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The Technical Basis for the NRC's Guidelines for External Risk Communication

WPI

U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Washington, DC 20555-0001

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The Technical Basis for the NRC's Guidelines for External Risk Communication

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ABSTRACT

This report provides the basis for NUREG/BR-0308, "Effective Risk Communications: The Nuclear Regulatory Commission's Guidelines for External Risk Communication." It presents a comparative analysis of NRC's risk communication needs and the state-of-the-art in risk communication practices, with a focus on external risk communications. In addition to providing a resource for the data collected during the formulation of the guidelines, this report provides recommendations for how the NRC can best incorporate risk communication principles throughout the agency. The Summary of Findings section contains the risk communication challenges and needs identified by NRC staff and management along with ideas, based on the state-of-the-art, for how NRC can improve in these areas. The Appendices contain survey instruments and results from the Needs Assessment Survey, which determined NRC risk communication needs, and the Best Practices Survey, which determined the state-of-the-art. Additionally, the appendices contain NRC and non-NRC (domestic and international) case studies, an annotated bibliography, and a risk message checklist.

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Executive Summary

Over the last several years, the Nuclear Regulatory Commission (NRC) has taken steps to improve communications with both internal and external stakeholders. Risk communication is a key element in these efforts. "Effective Risk Communication: The Nuclear Regulatory Commission's Guidelines for External Risk Communication" addresses specific communication topics and situations that deal with risk and that have been faced by NRC staff and management.

Risk communication principles and skills are still relatively new for many NRC staff members, although there are pockets of excellence within the organization. Continuing to improve effective risk communication practices within the agency is a priority supported by many staff who take pride in their contribution to ensuring public safety.

The NRC staff and their contractor, WPI, have developed guidance for NRC staff and management on the communication of risk insights and information. At the outset of the effort it was recognized that the guidance needed to be a practical tool, tailored to NRC staff and management needs. The first step in the process was to gather data from NRC staff and management, including the Commission, to assess agency needs. While collecting data, we developed case studies of issues involving public concern about NRC activities that required significant risk communication. WPI also investigated the state-of-the-art developments in risk communication by examining best practices used by risk communication researchers, practitioners, trainers, and at other organizations. WPI also updated the literature search done by the University of Wisconsin for a prior NRC effort. This report shares the results of this project and offers recommendations for the NRC to incorporate risk communication principles and practices throughout the organization.

The findings are structured around the following questions:

- What are the critical elements of a risk communication program?
- What can the NRC do to strengthen the agency's risk communication capabilities at the organizational and policy level?
- What risk communication skills and awareness do NRC staff and managers need?
- Who should be targeted within the agency for enhanced risk communication skills and awareness?

Findings: Effective risk communication programs are committed to open and objectives processes, use a flexible approach, identify proactive steps, are broadly supported within the organization, and emphasize two-way communication. At the organizational and policy level, the data indicate that the NRC needs to more proactively communicate with stakeholders and make a greater effort to listen to their concerns and perspectives. Despite the challenge of limited resources, the NRC also needs to consider some changes in its organizational structure and address organizational culture issues that run counter to effective risk communication practices.

At the individual level, the communication of risk requires an understanding of a broad range of communication skills that go beyond simply sharing technical data, risk analysis results, and probabilities. These skills include, but are not limited to, identifying stakeholders, building trust and credibility, crafting effective messages, handling confrontation, and communicating in a

crisis. The NRC should have a tiered approach targeting those who should learn risk communication skills. Staff who are directly involved with planning and implementing public meetings and other forums of interaction would realize the greatest benefit from additional risk communication training. However, all staff would benefit from an increased awareness of risk communication principles.

Recommendations: There are several specific actions that the NRC can take to address the communication needs raised through our research. The recommendations begin with instituting a communication policy that incorporates risk communication to help empower staff to more proactively engage the NRC's stakeholders. We also recommend specific resources and tools staff will need to follow through on the policy. First, we recommend that NRC publish guidelines for both internal and external risk communication as well as make sample outreach tools available to staff. The written guidelines should not stand alone, so risk communication training and coaching are also recommended. Finally, to help the organization succeed in its risk communication efforts, we recommend instituting a cohesive unit to champion risk communication at the top levels of the NRC. This group would have consultation capability to offer issue-specific support to other potential agencywide and regional issues requiring specific attentional to risk communication.

FOREWORD

The purpose of this report is to provide the technical basis for NUREG/BR-0308, "Effective Risk Communication: The Nuclear Regulatory Commission's Guidelines for External Risk Communication." While NUREG/BR-0308 serves as a basic, how-to, training tool for frequent use in NRC risk communication activities, this technical basis report advises how to incorporate risk communication practices across the agency. This report also includes: information regarding the NRC's risk communication needs collected through staff and management surveys and interviews; case studies of issues involving public concern about NRC activities that required significant risk communication; the best practices used by risk communication researchers, practitioners, trainers, and at other organizations; an annotated bibliography of risk communication literature and guidelines used at other federal agencies; and a risk message checklist.

Based on the state-of-the-art and the needs of the NRC, recommendations are made on how the NRC can strengthen risk communication capabilities at the organizational and policy level, on how the skills in the guidelines can be fostered within the agency, and on who to target for enhanced risk communication skills and awareness. Much of these recommendations focus on external risk communication. However, one facet of effectively communicating risk information to external stakeholders is effectively communicating with internal stakeholders. This report recognizes that connection and therefore also contains material regarding internal risk communication practices.

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We also are grateful to the more than 50 NRC staff members that we interviewed from all levels, offices, and regions of the organization, who provided essential insight into the agency and feedback on early drafts. Their involvement has been instrumental in shaping the content and structure of the final guide and the recommendations that are outlined in this report.

Finally, we thank the entire Risk Communication Steering Committee for their supportive guidance, steady commitment, and unwavering enthusiasm throughout the development of the guidelines and the preparation of this report.

1. History and Definition of Risk Communication at the NRC

Developmental Stages of Risk Management

All we have to do is get the numbers right.
All we have to do is tell them the numbers.
All we have to do is explain what we mean by the numbers.
All we have to do is show them that they have accepted similar risks in the past.
All we have to do is show them that it is a good deal for them.
All we have to do is treat them nice.
All we have to do is make them partners.
All of the above.

Baruch Fischhoff, *Risk Perceptions and Communication Unplugged: Twenty Years of Progress*

The public views the commercial nuclear industry and the NRC's role in regulating it within the context of safety. The public wants to know the risks to the community, the environment, and their families. How an individual feels about specific risks is determined by a variety of factors, including whether or not the risk is voluntarily assumed, the amount of control an individual can exercise over the risk, and the extent to which those who are exposed to the risks are the same people as those who receive the benefits. When communicating risk in this context, NRC needs to consider questions such as these: What perceptions of certain kind of risks do the receivers of the message hold? Is the information source credible? Is the appropriate channel of communication used for the audience? Is the message clear?

In the scientific community, risk is viewed as the likelihood of an event multiplied by a series of consequences ranging from mild to catastrophic: risk = probability x consequence. In addition to the broadening of risk domains, new methods for assessing risks have added complexity to the use of risk information. The growing acceptance of probabilistic risk assessment (PRA) has introduced new ways to conceptualize, manage, and talk about risks. PRAs have heightened the need for sharing assumptions and model robustness both internally and externally. The integration of risk analysis into NRC regulatory activities has increased the need for both external and internal stakeholders to be able to communicate about probabilities, uncertainties, consequences, and how they are being applied in decision making.

Many of today's veterans of risk communication started in community involvement programs geared toward understanding and responding to the needs of the community and garnering legitimacy for agency policies. Agencies with a history of community involvement view stakeholders, impacted communities, and the general public as partners involved in risk management. For these organizations, the legitimacy of risk-related decisions and the success of risk-informed policy making and implementation depend on input from key stakeholders, directly affected communities, and the public at large. Public involvement strategies and communication techniques have a place in the task of arriving at shared understanding. Risk communication has evolved to be viewed as an exchange of information and shared ownership in decision making for an agency and its stakeholders.

In keeping with the evolution of the practice of risk communication experienced by other agencies, the NRC defines risk communication as an interactive process used in talking or

writing about topics that cause concern about health, safety, security, or the environment.[1] The NRC's formal definition recognizes that risk communication should be a two-way process that includes multiple audiences, multiple types of information, and multiple purposes. As this definition implies, risk communication encompasses more then technical discussions of PRAs, risk insights, and their implications for NRC decision making. The research undertaken for this project and the findings presented in this report are consistent with a broad definition of risk communication that also considers the public's concept of risk.

Risk communication principles and skills are still relatively new for many NRC staff members, although there are pockets of excellence within the agency. During interviews, staff and managers agreed that the agency needs to have more effective interactions with stakeholders and that the staff needs to be given the training and the skills to be more effective communicators. Continuing to improve the capacity for effective risk communication within the agency is a priority that is supported by many staff who take pride in their contribution to ensuring public safety. They are frustrated when the agency is not able to convey this commitment. Knowing good risk communication practices will help them do their jobs even better.

2. Project Background

The NRC contracted with WPI to conduct research to help build the agency's understanding of risk communication and integrate risk communication practices across the organization as an integral part of its efforts to strengthen the NRC's ability to communicate with all stakeholders.

The primary objective of this project was to develop guidance that NRC employees could follow to communicate risk information within the agency and to the public more effectively. The NRC specified that the guidance should be in the form of guidelines and training for staff. Recognizing that the value of risk communication guidance for NRC employees would lie in tailoring the information to their specific situations, this research involved extensive data gathering from current NRC staff at all levels, from all offices, and from all regions. Because NRC can benefit from the experience and research of others, WPI also sought information from risk communication researchers, practitioners, and trainers working with a variety of topics and organizations. This report shares our research results and offers recommendations for NRC to incorporate risk communication principles throughout the agency.

This project is a follow-up to a risk communication study conducted in 1998 through a cooperative agreement between the NRC and the Center for Human Performance in Complex Systems, University of Wisconsin-Madison. That study focused on the risk communication challenges created by the advent of risk-informed regulation. It examined how to communicate risk analysis results effectively to regulatory decision makers, as well as how to explain the process of risk-informed regulation and risk-informed decisions to the public. Some of the observations and recommendations included in this report draw from the results of the University of Wisconsin study.

The goal of the additional research conducted in 2003 was to determine how best to integrate risk communication into the NRC based on the needs that agency employees identified, what other agencies are doing, and what is recommended by researchers and practitioners. A

[1] The NRC's definition of risk communication was developed by the Risk Communication Steering Committee and is based on a definition by the National Research Council.

steering committee with representatives from all NRC offices and one region ensured that the research direction remained closely aligned with NRC goals and helped ensure support for the project across the organization.

3. Methodology

Throughout the first half of 2003, WPI conducted research to assess NRC's risk communication needs, learn about what other organizations are doing, and digest new research and practices. The research team, including the NRC steering committee, placed strong emphasis on collecting data that would have practical application for the NRC.

To assess the NRC's risk communication needs, WPI conducted an online survey, focus groups, and interviews. WPI also developed case studies of issues involving public concern about NRC activities that required significant risk communication.

The online survey had 178 respondents from across the NRC. Questions covered both internal and external communication needs. A summary of the results and the original questions are shown in Appendix A. Answers to the four open-ended questions, in particular, provided insight into the types of issues and concerns NRC employees face that would benefit from increased risk communication proficiency. Survey responses also helped shape the questions for the focus groups and interviews.

As a follow-up to the online survey, WPI conducted seven focus groups with NRC employees both at headquarters and in Region I and approximately 50 individual interviews with senior managers, midlevel managers, and staff with significant risk communication experience. Interviews were also conducted with Chairman Nils J. Diaz, Commissioner Jeffrey S. Merrifield, Commissioner Edward McGaffigan, and former Commissioner Greta Joy Dicus. Focus group sizes ranged from six to eleven people. Interviews were conducted either in person or by phone. The interviews and focus groups enabled the research team to obtain more in-depth information about the internal and external risk communication needs as seen by NRC employees and managers. The focus group, interview questions and lists of participants are in Appendices B and C, respectively.

To complete the picture of NRC's present needs related to risk communication, WPI investigated several case studies of situations in which the NRC interacted with the public on controversial issues. Yucca Mountain licensing, the radiation release at Indian Point, and the "Tooth Fairy Projects" are well-known issues across the NRC. The case studies in Appendix D discuss the unique aspects of each case study, the outcome of the communication process, and lessons learned.

WPI also investigated state-of-the-art developments in risk communication by examining best practices at other organizations and through a literature search. To learn what other organizations are doing in the area of risk communication, WPI conducted 28 interviews with risk communication practitioners in state and federal agencies, industry, and with risk communication consultants and trainers who work with a variety of organizations. The interviews helped identify best practices in use at other organizations that could benefit the NRC. We asked about other risk communication programs, training efforts, and specific examples of situations where other organizations have worked well, and not as successfully, with the public on controversial issues. The best practices interview instrument and list of interviewees are presented in Appendix E.

Another method for calibrating the NRC against other organizations was the documentation of case studies both within and outside the United States. As with the NRC case studies, we examined and documented the unique aspects of each case, the outcome of the communication process, and lessons learned. The U.S. and international case study synopses are shown in Appendices F and G, respectively.

The literature search updated the annotated bibliographies created in 1999 by the Center for Human Performance in Complex Systems at the University of Wisconsin-Madison. WPI sought recent research articles in the areas of government risk communication, stakeholder involvement processes, technical communication, and science education. The report also added a listing of Web-based risk communication resources. The 2003 updated annotated bibliography containing the results of the literature search is Appendix H. During the course of our investigation of risk communication practices at other organizations, WPI identified several sets of risk communication guidelines or manuals being used by other agencies. Synopses of the risk communication guidelines collected are also in the annotated bibliography in Appendix H.

The information collected from NRC Commissioners, staff and management, coupled with the information from other risk communication practitioners, trainers, and academia, shows that many of the risk communication challenges faced by the NRC are typical of other organizations. It also is clear that many NRC employees already have a good understanding of how improving the risk communication proficiency of the NRC can help the agency improve its ability to fulfill its mission. The sections that follow combine the assessment of the NRC's risk communication needs, challenges, and successes with similar observations from other organizations. The combination results in practical recommendations for how the NRC can implement the practice of risk communication throughout its organization.

4. Summary of Findings

This section of the report highlights the risk communication challenges and needs identified by NRC employees. The Web-based survey and the interviews of NRC staff and management show the current state of risk communication understanding within the NRC as well as an interest among many employees to improve the agency's overall risk communication proficiency. Ideas for responding to the NRC's risk communication needs and challenges were raised by the agency's own employees.

This section also provided ideas from individuals in other organizations and academia that underscore the relevance and importance of the risk communication needs, challenges, and ideas for organizational improvement identified by NRC employees.

Our findings are structured around the following questions:

- What are the critical elements of a risk communication program?
- What can the NRC do to strengthen the agency's risk communication capabilities at the organizational and policy level?
- What risk communication skills and awareness do NRC staff and managers need?
- Who should be targeted for enhanced risk communication skills and awareness?

- How can risk communication skills and awareness be fostered within the agency?

As noted above, there are risk communication needs and approaches that relate to both internal and external stakeholders. The research described in this report focuses on risk communication with external stakeholders; however, some discussion of internal communication is also included since communication within the agency impacts interactions with external stakeholders.

4.1 What are the critical elements of an effective risk communication program?

The best practices interviews conducted for this project overwhelmingly reinforced the principles found in the extensive risk communication literature outlined in the annotated bibliography. We cannot state strongly enough that both empirical research and practical experience in the United States and abroad argue against providing a risk communication formula that technical staff can use to universally explain what radiation is, how risk assessment is done, or what risk-informed decision making is. Furthermore, using the "right" words does not produce agreement. Public understanding of the scientific aspects of a case does not necessarily guarantee public acceptance or support of the activity (Smith and Halliwell 1999). Even when you have the public's trust, you may still not get their agreement because they may not believe that the current scientific thinking has the final answer (Sjoberg 2001). Instead, risk communication researchers and practitioners alike emphasize that the most effective risk communication programs and initiatives follow these five principles:

- Be committed to an open and objective process that recognizes the validity of multiple perspectives in keeping with the NRC's principles of good regulation—independent, open, efficient, clear, and reliable (FY 2004–2009 Strategic Plan).

- Use a flexible, problem-solving approach to meet the needs of the agency, specific stakeholders, and situations.

- Identify proactive steps to develop trust and credibility, raise awareness, and build relationships.

- Be broadly supported within the organization (not a specialized function).

- Emphasize two-way communication between risk analysts, engineers, decision makers, and the public about data, assumptions, values, etc.

4.2 What can NRC do to strengthen the agency's risk communication capabilities at the organizational and policy level?

Effective risk communication requires implementation at the organizational and policy level to ensure a consistent approach and that adequate resources are available for staff to implement specific initiatives. A commitment to risk communication needs to be evident in each facet of risk management as well as in other activities that may influence the public's perception of risks. Policies need to clarify the need for and the use of input from external stakeholders (Sohn, Yang, and Kang 2001).

The information collected from NRC staff and managers identified several issues that need to be addressed at the organizational level.

4.2.1 Be more proactive

Many of the most experienced NRC staff in risk communication mentioned in their interviews that the NRC needs to be more proactive in communicating its messages and building relationships that facilitate productive interaction with stakeholders. In particular, respondents identified the following areas that would benefit from increased emphasis:

- Recognize issues that might be controversial and prepare for extra communication and involvement before a situation becomes a crisis in the full glare of public scrutiny. As the NRC makes risk management decisions, staff needs to consider how they will be viewed outside the insulated technical world of the NRC. If NRC policies and decisions are viewed as being disconnected from public perceptions about acceptable levels of risks related to the nuclear industry and exposure to radiation, the agency will come under fire from the public and representatives of the public.

- Be sensitive to technical terms and language that heighten fears and create misperceptions. Staff involved with drafting technical reports and other documents are often several degrees removed from direct interaction with public stakeholders. Respondents recommended raising overall sensitivity to how the language of NRC documents will be viewed when read by audiences outside of the nuclear industry. The NRC has an attentive public. Several respondents noted that many of the members of the public who attend public meetings invest a great deal of time in staying informed about the NRC and industry activities. They educate themselves about issues at other plants as well as overall NRC issues, such as the survey of the NRC's safety culture. Accessibility of NRC documents through the Web site will likely cause this attention to increase as the Web site improves and the public seeks more information from the Internet.

- Build long-term relationships. When recounting specific risk communication strategies that were effective, respondents often mentioned building relationships as being a key to success. External and internal respondents provided numerous examples of how reaching out to various stakeholders was useful. Examples included meeting with editorial boards of newspapers to provide background information to ensure more balanced news coverage, working with local or regional activists to identify where and when to hold public meetings to better reach the desired stakeholders, and going to local officials who can provide insight about the needs and interests of NRC public stakeholders.

- Provide general information about radiation, nuclear materials and nuclear power (Ziemer 1997). Respondents felt that the U.S. government has not done a good job of educating the public about nuclear materials and radiation and that this failure has allowed misperceptions reinforced by the popular media to stand unchallenged. While respondents felt that it is a challenge to be advocates for correct information without being advocates for nuclear power, they felt that the U.S. government needs to more proactively share the risks and benefits associated with nuclear applications. If the NRC does not take a proactive role in the education of the public about nuclear issues, then the public will be left to get information from the nuclear industry on one side and public interest groups on the other.

- Provide context to reports and documents available online, especially when new analysis or policies are available. Make it clear when old documents and policies have been superseded. The NRC makes many of its documents available to the public through the Web site. This level of openness can cause confusion when concerns are raised based on a document without realizing that the NRC has updated the information, analysis, or its

policy on that issue. When new information supersedes a previous report, the NRC should provide links or other notations to point Web users to the most current information on the issue. This type of proactive effort could help to avoid causing public concern over an issue that has already been resolved or because the context is not provided.

Note: Taking a proactive approach to risk communication requires up-front resources. Expectations that are placed on staff at headquarters and the regions need to be sensitive to what is possible and appropriate in different locations and for different topics. Staff members need to be given direction to be proactive and provided the time and resources necessary to be effective. In addition, expectations about the extent to which staff will be able to be proactive need to include the political and social realities of different NRC regions. Some regions have constituencies that are more active and concerned than others.

4.2.2 Address organizational culture issues

Risk communication best practices were relatively consistent between experienced NRC employees and external experts; however, many of the approaches that are considered to be most successful run counter to established NRC norms. Interview respondents described the cultural barriers to effective risk communication at the NRC. Some of the key elements are as follows:

- Listening to stakeholder needs. While most respondents expressed a desire to learn how they could get their ideas and points of view across to stakeholders in a way that will be better understood, few talked about the need to help NRC employees learn how to listen better to what stakeholders have to say. It is not well understood among NRC staff how public input can positively impact NRC actions and decision making. In general, NRC employees surveyed seemed to believe that if only they could choose the correct words, interactions between the NRC and the public would be more satisfying for both groups. The NRC needs to respond to stakeholder concerns and questions and explain how they were addressed in the decision-making process. (This issue is also discussed in Section 4.3.6)

- Fear and discomfort. Many NRC online survey respondents identified silence caused by fear and discomfort on the part of the staff as a barrier to effective risk communication. This sentiment was echoed in both the focus groups and interviews. The principal causes identified were concerns about causing an unforeseen reaction from stakeholders and management or appearing to be promoting nuclear power or other applications. Many staff members had a general discomfort with being placed in the communicator's role.

- Holding back information until the analysis is complete. Respondents pointed to a tendency to wait until final analysis is completed before communicating any information about an incident or an issue that has caught the public's attention. It is always tempting to avoid going public until you feel that you have the answers to all the questions that will be asked. There is concern that the preliminary conclusions may be contradicted by further analysis. The relatively new integration of risk analysis and insights into the NRC's regulatory processes exacerbates this problem because of the lack of familiarity with new policies and lack of a shared understanding of risk-informed regulation. Experienced risk communicators, on the other hand, recommend communicating early and often. It's better to explain something, even preliminarily, than to say nothing at all. Failure to communicate breeds mistrust and gives others an opportunity to frame the issues.

4.2.3 Provide clear management direction

The fact that many of the key principles of risk communication run counter to the current culture at the NRC means that they need to be reinforced through clear and consistent direction from management at the organizational level and through training and coaching at the individual level. Staff members need clear direction from management in the following areas:

- Clarify the role of staff members in the NRC's risk communication efforts. Currently there is a contradiction between the views that everyone has a part in external communication and that the communication function is a discrete area of responsibility. NRC respondents expressed a range of opinion about the level of communication skills needed by all technical staff and the extent to which internal communication impacts external risk communication. Overall, staff members need to be aware that good risk communication begins by following risk communication principles when briefing management, communicating with other staff members, and writing internal documents.

- Clarify the expectation of the role the public will play in risk management decisions. Moving beyond a "decide, announce, and defend" approach to public involvement related to commercial uses of nuclear materials requires guidance from management about how public input will be incorporated into decision making. Staff members need clear direction on when public involvement is appropriate (Wright 2000, Petts 1997). For example, is it ever appropriate to conduct additional testing or analysis to meet the requests of public stakeholders even if it would not be required under a strict technical justification? The NRC can also provide increased guidance to the staff and the public on public participation and notice activities.[2] When is it a requirement, and when is it the discretion of the NRC?

4.2.4 Modify the organizational structure

Several interview respondents believe that the NRC should consider making changes to how communication expertise is structured within the organization. The recent (August 2003) report from the Public Communications Task Force, chaired by Commissioner Jefferey S. Merrifield, made ten strategic-level recommendations, including advocating a third-party assessment of Office of Public Affairs' structure, policy, and practices and creating a Director of Communications position. The findings of this project support these recommendations. In particular, our study found that the NRC would benefit from having a communication function at the agency level that can

- promulgate consistent messages and approaches to risk communication challenges,

- assist with coordination of issues that span NRC offices, and

- share lessons learned within the NRC.

4.2.5 Commit resources

Many respondents stressed the need for management to acknowledge the importance of risk communication by committing the resources necessary for effective implementation. If

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[2] The Environmental Protection Agency provided five categories of public participation and notice activities, including public notification, public comment, public meetings, public access to information, decision-making influence, and public assistance/other (EPA 2000).

communication responsibilities are added to someone's job, there has to be an understanding that the resulting activities will take time. Additional resources would enable more effective risk communication by supporting the preparation needed to understand stakeholders' perceptions about specific risks and issues, increased access to facilitation resources, increased opportunities for informal communication, and time to follow up regarding the impact of public comment on decisions that are made. Respondents also reported the need to have flexibility in developing approaches and materials that meet the needs of specific situations. As policy and expectations regarding risk communication are developed and implemented, there also needs to be sensitivity that resource needs will vary depending on specific issues and breadth of activities.

4.2.6 Evaluate

Evaluation of risk communication is complicated, in part because defining what constitutes successful risk communication is difficult. Is success achieving stakeholder understanding of probabilities and uncertainties? Is it acceptance of NRC regulatory activities? Is it trust in the NRC to manage nuclear risks and to ensure public safety? Is it improved risk management decisions? The literature on risk communication evaluation provides risk communication performance indicators and metrics for formative, process, outcome, and impact evaluation (Lundgren and McMakin 1998, Chess 2000, Carnes et al. 1998, Tinker et al. 2000, Weinstein and Sandman 1993). However, effective evaluation at any of these levels requires the NRC to define its risk communication objectives. Because risk communication cannot be made distinct from general communication and public involvement, NRC's risk communication objectives need to be consistent and integrated with its overall communication and public involvement objectives. Based on the internal interviews conducted as part of this project and the review of other NRC reports, we have identified the following evaluation needs.

- Assess how well tools and policies are meeting the needs of staff and the public. Through formative evaluation, continue to explore and analyze the needs of the agency and its stakeholders as changes in the risk communication environment are made. Effective risk communication efforts are flexible and are regularly adjusted to meet the needs of all participants in the process. For longer-term initiatives, staff should be encouraged to gather feedback and update strategies on a regular basis. Reaching out to external stakeholders should not be overlooked in these evaluation efforts.

- Provide forums for sharing good practices, communication tools, and lessons learned. Currently, there are NRC employees who have developed strong risk communication skills through training and experience; however, this expertise has largely been built in isolation with some duplication of effort. Sharing these good practices, communication tools, and lessons learned would enhance the overall abilities of the NRC as well as promote efficiency.

- Establish a baseline from which to measure improvements. Determine risk communication objectives as part of developing overall communication performance indicators. These indicators can then be used to establish the baseline from which to measure improvements in communication activities for both internal and external stakeholders.

4.2.7 Provide consistent information

Risk communication experts stress the importance of providing consistent information to the public. Respondents identified problems with inconsistent information provided by different NRC

offices as well as discrepancies between information provided by the NRC and that of other federal agencies. Because these inconsistencies damage the credibility of the NRC, the agency needs to address information consistency issues at both the organizational and the individual levels. The NRC should handle information inconsistencies directly by being the first to explain what the differences are, why there are differences, and what is being done to resolve them. The following suggestions may assist in accomplishing this goal:

- Strive for consistency by building a common understanding. Many interview and focus group respondents attributed the NRC's problems with providing consistent information to the lack of a common understanding within the agency about how risk analyses are done and how risk insights are applied in decision making. They reported that the NRC has lost credibility with the public because it has heard different messages from different NRC representatives. While there was fairly uniform agreement that lack of a shared internal understanding is an issue, there was a mixed response about the extent to which it affects external risk communication effectiveness. It is worth noting, however, that the respondents who have the most direct contact with the public consider addressing internal issues as critical for improving NRC's external risk communication.

- Coordinate with other federal agencies. Another challenge that was raised in interviews and in several of the NRC case studies (see Appendix D) was that of communicating about issues that involved other federal and state agencies. At times, the NRC's standards and conclusions may differ from other agencies'. Some of the differences arise from the NRC and other agencies approaching risk analysis differently. The NRC uses an engineering risk paradigm, whereas many other federal agencies use a human health risk–based paradigm. Differences also arise when the NRC is asked at a public meeting to address stakeholder concerns about risks that are in the jurisdiction of another agency. The first step for avoiding these types of information consistencies is to recognize when an issue outside of the NRC's jurisdiction is likely to get significant interest at a public meeting. Once the issue is identified, decisions can be made about whom to invite to the meeting and what role each party should have. In some situations, other officials are given formal roles at the meeting. In other situations, other officials are simply invited so that they are available to answer any questions within their jurisdiction.

4.3 What risk communication skills and awareness do NRC staff and managers need?

At the interpersonal level, risk communication involves applying a variety of skills and tools to communicate in sensitive situations where people are concerned about health, safety, security, and the environment. This level of risk communication relies on a broad range of communication capabilities, including understanding NRC stakeholders, empathetic listening, letting others know you care about their health and safety, building trust and credibility, establishing long-term relationships, sharing expertise and insights, fostering understanding of risk analysis in all NRC employees, managing conflict, and effectively delivering NRC messages.

4.3.1 Identifying risk communication objectives

Many respondents discussed the need for setting clear objectives for risk communication efforts as the foundation for effective planning and implementation. Respondents identified the following possible objectives for NRC risk communication efforts: providing information to the public, gathering information about stakeholder concerns and risk perceptions, building trust and credibility, seeking involvement, and influencing behavior or perceptions about risk.

Lundgren (1994) argued that legal issues, organizational requirements, the nature of the risk, and audience requirements are all factors that will influence risk communication objectives.

4.3.2 Understanding the NRC's stakeholders

The foundation of effective risk communication—and communication in general—is a working understanding of stakeholders. There were mixed opinions about the extent to which the NRC understands each of its stakeholder groups.[3] To enhance the agency's understanding of its stakeholders, respondents identified the following areas that should be emphasized:

- Increase the agency's attention to personal impacts. Members of the public tend to be most concerned with the impacts on themselves, their families, and their environment (Lion and Meertens 2002). Staff need to be prepared to listen for and be responsive to these concerns as well as others that fall outside of the NRC's jurisdiction, such as economic impacts. While the NRC has a national perspective on safety and risk, the public will not be comforted by national averages and trends. They have concerns about a facility near them, and the NRC needs to be able to address those concerns.

- View risk from the public's perspective. The NRC staff need to consider how their analysis and decision making about risk will be viewed externally. Extensive research has been done to identify factors that affect public perceptions and tolerance of various risks (for a summary see Boholm 1998). The literature shows that the public may view a spokesperson as honest and competent but still not agree with what the spokesperson says. They are influenced by examples where something that was thought to pose little risk, such as Chernobyl, was later found to be hazardous. Nonexperts typically hear the statement "there is no risk" to actually mean "no risk has been found yet." They believe that risks tend to be denied or ignored until they are proven to exist (Sjoberg 2001).

- Build in time to learn the local perspective. When resources and issue warrant, time for staff to learn about local issues should be built into planning for public meetings, petition responses, or other activities. Staff should be encouraged to call local officials or other opinion leaders for input to agendas and identification of the communities key interests, for example.

- Establish clear expectations about the level of involvement. As new issues arise, NRC staff need to find out about the expectations that the public and local officials have about how they will be involved in the decision making. Are these expectations being met? Are they consistent with the NRC's expectations?

4.3.3 Building and maintaining trust and credibility

Survey and interview respondents shared personal experiences of when they were blindsided by trust issues when trying to present technical information and conclusions to the concerned public. They expressed frustration over a variety of organizational issues that contribute to the public's lack of trust in the NRC. These included a lack of resources to build relationships over time, lack of consistency in NRC information as the agency transitions to a risk-informed

[3] The report of the Task Force on External Communication includes an extensive list and descriptions of the NRC's stakeholders.

framework, uncertainty about how to address non-NRC issues, and the struggle between providing information in a timely manner versus completing the analysis before sharing information. (See Section 4.2 for discussion of the organizational issues that relate to trust and credibility.) At the individual level, NRC employees need to create an environment of trust and credibility because the public will not listen unless they trust the NRC employee speaking and view him or her as a credible source. NRC employees first need to be trained in the key components of trust (Peters, Covello, and McCallum 1997; Siegrist and Cvetkovich 2001; Sjoberg 2001):

Empathy	A sincere effort to understand how it would feel to be in the stakeholder's position. Empathy is not the same as sympathy or agreement.
Honesty	Truthfulness and openness about what you know and what you don't know. It is better to lean toward providing more information rather than less.
Commitment	Dedication to openly communicating with stakeholders to understand their perspectives and to help them understand yours.
Competence/ Expertise	Capability in your profession. When interacting with stakeholders who do not share your expertise, your technical competence makes only a small contribution to your credibility.

Staff should also learn about credibility: how to build it, how to avoid losing it, and how to rebuild it. They should be encouraged to involve other credible sources in delivering their message when appropriate.

4.3.4 Developing effective messages about risks and the NRC's role in managing them

The NRC's messages need to be responsive and in tune with the perspectives and information needs of the public. When developing messages, the NRC needs to involve a multidisciplinary team and test draft materials with different audiences such as co-workers, neighbors, or family. The meanings of words vary across disciplines and audiences, so getting input and feedback from a variety of sources can help ensure your message is understood as you intended. It is also a good idea to collect information on the risk perceptions people hold so that the message can be designed to both acknowledge these views and address any inaccuracies (Bier 1999).

In developing messages, there are three points in particular that need to be conveyed: the NRC mission, the context of processes and decisions, and information about safety redundancies (Kasperson et al. 1992).

- Communicate the NRC mission through words and actions. Underlying all NRC messages about risks is the message that the NRC is the right agency to ensure the safety of nuclear power, nuclear waste storage and transportation, and nuclear materials. In getting out the message that the NRC is dedicated to and capable of carrying out its mission, staff need to be trained to answer the public's most crucial questions regarding the agency:

    - Can I trust the NRC? The NRC must be able to articulate its expertise as well as its humanity when communicating and interacting with the public.

- Is the NRC committed to safety and security? The NRC must distinguish itself and educate the public on its goals and values. The NRC must prove its commitment to protecting individuals, communities, and the environment.

- Does the NRC care about me? The NRC must understand and value the public's concerns and articulate these concerns as well as, or better than, the public can. An empathetic approach using risk communication principles can reduce public skepticism.

Staff should also be trained to understand how their actions can reinforce these messages, for example, holding meetings in times and places that are convenient for the public and taking the time to listen to their concerns.

- Explain the decision-making process. Providing information about the decision-making process creates an environment that encourages meaningful participation. It is particularly important to share this information when faced with requests for information before the final analysis is available. Staff should be encouraged to communicate about what is being done to find answers even before there is an answer. Discuss how the decision will be made, who will be involved, the time line, and the role that feedback from the public will play in the decision. This information should be documented in a communication plan, which managers should encourage their staff to use and keep as a living document throughout the lifetime of the project/issue. Aspects of the plan (e.g., the key messages) can be shared in presentations, handouts, and posters.

- Communicate about safety redundancies. At public meetings, NRC employees tend to jump into the technical details of a specific issue. Even if they provide some context for the issue, they often fail to start out by presenting the big picture of the conservatism that underlies NRC regulations and the NRC's role in the regulatory process. This big picture message is an especially important context for risk-informed regulation. Risk analysis is being used to better align the NRC and licensee attention to those issues most important for safety, which involves both adding regulatory requirements and lifting them. While few members of the public are interested in the *process* of risk-informed regulation, members of the public living near plants that have petitioned for and received relaxed regulations are likely to have concerns regarding the *consequences* of risk-informed regulation (Bier 1999). Sharing the reality of safety redundancies can help alleviate those concerns.

See Appendix I for a checklist of risk messages.

4.3.5 Communicating technical information

Risk communication encompasses the full range of communication and public involvement activities that are discussed throughout this report. While communicating technical information is not the only skill required for effective risk communication, it is an important one and an area where most staff at the NRC recognize a need for improvement. Once the purpose for the communication has been established and the key messages have been identified, there are several specific considerations for technical communication.

- Speak in plain English. There is an overall awareness within the NRC that avoiding jargon and acronyms is important; however, the actual performance is not consistent. Based on specific experiences described in the interviews and focus groups, there are a couple of key areas that can be emphasized to improve the ability of the staff to speak plainly. One is to increase their recognition of what constitutes jargon. There are expressions, such as

"failure" and "risk significant," that are obscure or problematic from a public perspective. Another is to require staff to practice avoiding jargon internally. Through interviews with NRC employees, WPI learned that even staff are sometimes confused by the jargon used when talking to staff from other parts of the agency. Staff should not assume that there is a common understanding within the agency regarding risk-related terms, such as "risk significant," "risk informed," "uncertainty," and "variability."

- Use risk comparisons carefully. NRC staff have also requested that tools be made available on the NRC Web site that might help place risks associated with nuclear power and materials into context. Risk ladders that display a range of risk magnitudes such that increasing risk is placed higher up the ladder, for example, have been used to help people place risks within upper and lower bounds (Lipkus and Hollands 1999). These types of risk comparisons can be useful, but best practices in risk communication indicate that risk communicators should be careful about how and when to use them. Risk comparison tools provided for staff need to include guidance on how to best use them and the possible consequences for trust and credibility if they are used in the wrong context or manner.

- Provide tools to help staff communicate the technical and regulatory concepts that are most difficult to convey. In the online survey, focus groups, and interviews, respondents shared the areas of technical and regulatory information that are most challenging for them to communicate about. Samples of how staff have addressed these issues can be posted on the internal Web site and will be more useful to staff than generic rules for effective risk communication or examples from other industries. The staff identified the following concepts as being particularly difficult to convey:

  - Naturally occurring radiation. Where does it come from? How much is there?

  - The value and use of PRA as a safety evaluation tool for NRC and licensee. How are PRAs and other risk assessment tools being used in decision making about nuclear power plants and other civilian applications of radiological materials?

  - Uncertainty about knowledge of risk. How is risk analysis useful when there is uncertainty? (See below for specific guidance on this issue.)

  - Risk-informed, performance-based regulation. What is it? Why is being implemented? How will it ensure public safety?

  - The Significance Determination Process. What is it? How does it relate to actions taken by the NRC and the licensee?

  - Radiological releases and exposures that are below regulatory limits. Why can't there be zero risk?

  - Low-probability events with high consequences.

  - How to say that something is safe without saying that there is zero risk of an unsafe situation?

- Increase the ability of NRC staff to understand and communicate about uncertainty. Respondents emphasized that communicating about uncertainty is difficult both internally and externally because of the complexity of the information and the lack of understanding

about uncertainty and variability and how it should impact risk management decisions. See Appendix I for key questions that should be used in characterizing uncertainties. A related issue is the difficulty of communicating the impossibility of zero risk. The literature provides evidence that the NRC should be frank about zero risk being impossible but also should provide information about what is being done to minimize the risk (Nakayachi 1998).

- Increase managers' understanding of PRA and other risk analyses results. Several NRC staff members expressed frustration in discussing risk levels with managers who do not fully understand the concept. Because it is often the managers who pass information up the line to decision makers, the NRC needs to ensure that managers understand the implications of the data and are not focusing exclusively on the quantitative results of a risk analysis without understanding the margins of uncertainty surrounding the numbers.

- Use a range of verbal, numerical, and graphical methods to communicate probabilistic information. Bier recommended the following approaches (Bier 1999):

  - When communicating about small probabilities, use graphical representations to illustrate how small a probability actually is.

  - When using terms that are not well understood outside of the nuclear arena such as "release," "radionuclides," and "radioactive sources," give examples that illustrate both what the term means and what it does not mean.

  - Use a range of tools such as diagrams, outlines, and analogies when explaining complex phenomena so that audience members will develop accurate mental models of the phenomenon.

4.3.6 Engaging in two-way communication

As stated earlier in this report, the NRC's definition says that risk communication is "an interactive process used in talking or writing about topics that cause concern about health, safety, security, or the environment." The key points identified in this project for strengthening the two-way aspect of risk communication at the individual level include increasing emphasis on the need to listen to stakeholders and choosing the right mechanism for communication.

- Improve listening skills. Certainly an important aspect of risk communication involves presenting highly technical information about radiation, nuclear facility operation, and risk analysis data in a manner understandable to stakeholders. To do this effectively, the NRC staff need to be trained in active listening—how to do it and what to be listening for. What aspects of a risk are of most interest? What values about property, the environment, and government underlie the public perspective? What misperceptions about the decision-making process, the NRC, or radiation need to be addressed? Some would argue that listening to stakeholders is just as important as what an agency says to them. By listening to stakeholders with an open mind and sincere interest, the agency can first demonstrate its desire to hear what is on stakeholders' minds and then provide the information the stakeholders are seeking in a manner that is understandable to them. Taking time to listen is also a way to demonstrate that the NRC considers the public to have a legitimate role in decision making.

- Select communication mechanisms that match the situation. NRC's public meeting policy was implemented in 1999, and respondents indicated that it has been an

important and useful tool. Staff need additional guidance on how to make the meetings interactive within the framework laid out in the policy. The NRC can enhance its tiered approach to public meetings by coupling them with open houses, informally canvassing selected stakeholders before the meeting to get a preview of what concerns and issues may be raised, and having staff arrive early and stay late at meetings to interact with participants more informally.

Lundgren and McMakin offer the following guidelines for selecting methods for risk communication that are contingent on the organization's goals and the level of public interest:

If public interest is...	Methods of risk communication
...low, the goal should be to inform.	One-way method of communication: mass media (newspapers, radio, televisions), videos, mailing, public information booths at fairs and malls, news conferences, employee briefings
...moderate, the goal should be to get feedback.	Feedback method of communication: public meetings, telephone line, workshops, open houses, facility tours, community roundtables, surveys, focus groups
...high, the goal should be to engage.	Decision-based method of communication: citizen advisory groups

(Adapted from Lundgren and McMakin 1998.)

- Take steps to encourage one-on-one and informal interactions with stakeholders. When asked to identify the most successful risk communication they had been involved in, most respondents referred to instances when they were able to speak individually with stakeholders. Opportunities for direct interaction include before and after meetings, during breaks, and in via telephone.

4.3.7 Addressing security concerns

Security has become a concern that affects public perceptions about nuclear and radiological risks. The nature of public fear has changed in communities surrounding nuclear facilities. These facilities have been there for many years, so nearby residents have a level of familiarity with them, but now the possibility of a worst-case scenario has become more of a reality in the public eye. In addition, past NRC reports that mapped out "worst-case scenarios" were intended for very limited use were written prior to the September 11th event. Staff need to be sensitive to how this information will be perceived in the current environment and should take proactive steps to communicate its context. In the shadow of September 11th, communicating about low-probability, high-consequence risks has become even more challenging.

Effective risk communication about security issues requires understanding and valuing people's real worries about their safety and security. Security concerns are different and often more complex than concerns about safety. First, terrorist threats offer more unknowns. Second, safety systems are usually designed as protection from accidents. In contrast, security systems are designed to prevent intentional incidents. The public understands that distinction, is concerned that a terrorist is actually intent on breaching designed nuclear safety systems, and questions whether the security systems are adequate.

Employees need to be prepared to respond to questions about security both from other NRC employees and the public. The challenge related to risk communication about security is to create an environment of trust and confidence amongst all stakeholders in a situation where not all information can be disclosed. In some ways this situation is contrary to many basic and accepted risk communication principles.

NRC staff have taken steps to address the risk communication challenges related to heightened security concerns; these should continue to be implemented and refined. In the regions, the annual assessment meetings as part of the Reactor Oversight Process included proactive information about security at nuclear power plants through handouts and presentations. As NRC regional staff prepare to interact with the public on nonsecurity issues, they are cognizant that they need to be prepared to address general security issues as well as those related to the specified topic.

4.4 Who should be targeted for enhanced risk communication skills and awareness?

NRC respondents to our internal data collection had a range of perspectives on the extent to which improving NRC employee risk communication skills should be a broad initiative or more focused on those who have direct interaction with members of the public. Overall, respondents advocated a tiered approach that concentrated efforts on those that are directly involved with planning and implementing public meetings and other forms of interaction with the public. However, respondents also identified a need for all NRC employees to have increased awareness of the principles that underlie effective risk communication practices. Respondents believed that increasing the understanding of risk communication principles among all NRC staff would result in documents and technical reports that are easier for the public (and other NRC employees) to understand and would not trigger concerns unnecessarily. This need is echoed in the best practices interviews and the risk communication literature, which argue that the need for better interface between technical experts and the public over decisions that affect individual, societal, and environmental risks requires that public agencies view communication and public involvement skills as integral to their practices at both the organizational and the individual technical expert level (Grabill and Simmons 1999, Petts 1997, EPA 2000).

Respondents also focused on the need for managers to be part of a consistent vision for improving risk communication at the NRC. There are three vital roles that managers need to be prepared for to support improvements in risk communication: (a) managers need to reinforce the message that two-way risk communication is important; (b) as reviewers of reports, correspondence, and presentations, managers need to consider stakeholders' needs and perceptions about risk and risk management decisions; and (c) if staff are to follow the principles outlined in the guidance, they will need to be given the time and resources to do so. Managers need to be empowered to factor risk communication requirements into budget decisions.

5. Conclusions: How can risk communication skills and awareness be fostered within the agency?

The research points to several specific actions the NRC can take to foster risk communication skills and knowledge within the agency. These recommendations are similar to the suggestions and observations made by other groups examining the NRC's communication needs. They involve changes the NRC should make at both the organizational and individual levels. The recommendations begin with instituting a communication vision to help empower staff to more proactively engage the NRC's stakeholders. We also recommend specific resources and tools staff will need to follow through on the vision.

5.1 Communication policy

Instituting a shift in culture requires support from the top levels of the organization. The NRC currently has policies in place for communication plans, public meetings, and crisis communication plans, which have helped institutionalize their use.

We recommend that risk communication principles be incorporated into the overall communication policy. This is consistent with the report of the NRC's Public Communications Task Force, which has recommended that the agency develop a "communication vision for public communications that appropriately emphasizes the need to promote nuclear safety and actively engage the media and our stakeholders." By adopting an overall communication policy that includes risk communication, the NRC will demonstrate its commitment to improving interactions with and involvement of stakeholders.

The details of the overall communication policy should state the NRC's proactive stance in building relationships with stakeholders by fostering two-way communication. It should include the NRC's definition of risk communication and emphasize that risk communication is a much broader activity than simply sharing technical information. Risk communication involves a full range of communication activities that foster an environment for meaningful discussions about risk information, such as understanding stakeholders' perspectives, building trust and credibility, listening, and developing effective messages.

5.2 Internal and external risk communication guidelines

One of the objectives of the RES risk communications project includes the development of agencywide risk communication guidelines; therefore, part of the data collection included obtaining the NRC staff's views of their needs for guidelines and learning about the guidelines other agencies have developed for their own employees.

Several federal agencies have handbooks or guides that could serve as models for creating guidelines on how NRC employees can communicate with external stakeholders. In interviews with staff, however, they recognized a need to improve internal communication as a first step in improving risk communication with external stakeholders. They highlighted miscommunications and misunderstandings that occur within the organization that become compounded by interactions with external stakeholders. Internal communication guidelines should help the organization reach a common understanding, language, and process for sharing risk analysis results and associated probabilities internally. As the NRC becomes more successful at avoiding internal miscommunications, the organization will see clear improvements in its interactions with external stakeholders. Internal risk communication guidelines can assist with accomplishing these objectives.

External and internal guidelines should explain how to employ the full range of communication activities necessary to set the stage for communicating technical information. The guidelines should be designed to be a useful, practical how-to guide with summaries and practice tips for the skills encompassed in risk communication.

The guidelines should be enhanced by sample outreach tools, such as questions and answers, posters, and presentations that staff may use to communicate about a controversial issue. Other offices and regions of the NRC can learn from and build on these examples. The internal and external guidelines and sample outreach tools should be made available to staff and managers both in hard copy and electronically.

5.3 Training and coaching

The importance of training was reinforced during the internal data collection process. Many NRC respondents emphasized that written guidelines cannot stand alone. The content needs to be explained and reinforced in an interactive setting. Training in public meetings and media training are currently available at the NRC. To supplement this training, staff have been relying on non-NRC training for risk communication, public involvement, and dispute resolution, attending Harvard's risk communication courses, "Creating Informed Consent" from the Institute for Participatory Management and Planning and "Dealing with an Angry Public" from the Harvard-MIT Public Dispute Resolution Program. Staff have found this training to be useful and informative but express interest in training courses that are tailored to the NRC and the nuclear industry.

Many staff members expressed getting great benefit from one-on-one coaching, which is often obtained immediately before public meetings. NRC staff also have successfully coached each other. Their desire to be coached and trained underscores the importance of practicing risk communication skills. Without practice, staff will not be able to implement risk communication principles effectively.

NRC respondents were relatively consistent in advocating a tiered approach to risk communication training. The greater the level of communication about risk that public interaction a staff member's position requires, the greater amount of training he or she should receive. Because the NRC's documents are made available on the Internet, virtually every member of the staff plays a role in preparing information that will ultimately be available for public view and should receive some exposure to risk communication principles. As the NRC culture shifts towards endorsing proactive risk communication, staff are likely to see their public interactions increase, so they may need additional training.

Introductory risk communication training could be handled in a variety of ways. There could be interactive exercises available via Web that staff could take at their own pace. Introductory lectures could be presented in medium-sized or large auditoriums. A standing half-day course could be held monthly so staff could sign up at their convenience. This type of training could be either made mandatory or strongly encouraged as a career development or performance measure.

Training for staff who do much risk communication and/or have direct interaction with the public should be two to three days long, and it should reinforce the information provided in the internal and external risk communication guidelines. It should be presented through a mixture of short educational lectures followed by small-group exercises for practicing specific skills. The

exercises should be based on risk communication scenarios typical of the situations NRC staff face.

Rather than being treated exclusively as a stand-alone element, risk communication principles, such as good data presentation techniques, should be also be integrated into technical training courses such as risk analysis.

5.4 Consultation capability

Several recent reports related to communication needs at the NRC suggested variations on the idea of a communication "champion." Currently, it is not clear where the responsibility for risk communication lies. Risk communication should be viewed as a responsibility of all staff, backed by an agencywide communication policy, guidelines, and training.

To support the staff, however, we agree that NRC needs a communication "champion." We recommend this be a high-level office that offers consultation support to other NRC offices and regions. This office would serve as an internal source for advice and even resources to help other offices and regions work through specific issues on request. The office also would identify potential issues requiring specific attention to risk communication, alert those affected, and help work through the issue.

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APPENDIX A

NRC Risk Communication Needs Assessment Survey
Preliminary Report
3/19/03

Responses:
There were 178 respondents to the Risk Communication Needs Assessment Survey. The following table provides the representation by office.

Office	Number of Respondents
NRR	43
Regions	38
RES	26
NSIR	24
NMSS	22
EDO	5
OPA	4
OGC	4
Other	12
Total	**178**

Question 2: How experienced do you consider yourself in communicating risk information to external stakeholders? (1 = very experienced, 7 = no experience)

Average answer was 3.57.

Question 3: How often do you interact with these stakeholders with respect to risk considerations? (0 = never, 1 = less than monthly, 2 = monthly, 3 = weekly, 4 = daily)

	Never	Less than monthly	Monthly	Weekly	Daily
Licensees	16%	34%	25%	22%	3%
Congress	68%	26%	3%	2%	1%
Independent Groups	24%	50%	20%	6%	1%
NGOs	31%	51%	14%	5%	0%
States	45%	38%	13%	5%	1%
General Public	18%	53%	20%	6%	3%
Media	44%	42%	8%	3%	3%
Internal	5%	12%	22%	33%	29%

Question 4: Which stakeholder groups do you find most challenging to interact with? (1 = very challenging, 7 = not challenging)

Congress	2.63 (most challenging)
NGOs	2.67
Media	2.95
Public	3.18
Independent Groups	3.95
States	4.10
Licensees	4.42
Internal	4.73 (least challenging)

Question 5: Please rate the NRC's effectiveness for each of the following arenas for communicating with the public. (1 = excellent, 7 = poor)

One-on-one interaction	2.80 (most effective)
Web site	3.41
Public meetings (regions)	3.47
Printed materials	3.52
Public meetings (HQ)	3.70 (least effective)

Question 6: Please rate the usefulness of the following risk communication training topics for you. (1 = useful, 7 = not useful)

Message development	2.19
Communication skills	2.21
Risk comparisons	2.25
Understanding stakeholders	2.27
Evaluating risk communication	2.56
Using charts and graphs	2.81

Note: Less than one point difference in ranking

Question 7: Please share what specific issue(s), if any, you have recently been involved with that caused considerable controversy with the public.

<u>Davis-Besse Vessel Head Degradation</u>

- Significant stakeholder interaction involving multiple communication pathways.
- The risk significance of the reactor vessel head corrosion.
- Exposure of workers and off-site contamination when they left D-B and went to other nuclear plants. Questions from Congress: What different kinds of exposure are there, and why wouldn't one monitor find them all? The particles that were found elsewhere—do they pose a risk to the public, and if not, how does the risk compare with those chosen by people every day (e.g., cross-country airplane rides, X rays)?

- What was the likelihood that the corroded vessel head would have burst, and if it had, how catastrophic would the event have been?
- Mostly, these interactions [many opportunities to interact with stakeholders] went well, but there is definitely room for improvement. I highly recommend the NRC "Public Outreach Meetings" training—very appropriate for this topic.
- Reactor vessel head penetration cracks—how to say that cracks are likely although some may not be immediate serious safety problems.
- The Davis-Besse vessel head corrosion issue and the risk of that phenomenon caused considerable controversy.

Indian Point

- The Indian Point issue was a good case study. Although we assured the public there was no problem with their steam generator tube failure, we issued a red finding. The challenge was to convince the public that [it] did not pose an immediate safety risk.
- Tube failure at Indian Point 2—there was Congressional attention and much public concern. I'm not sure we did a good job conveying the actual risk to the public.
- The off-site consequences to be expected from a terrorist attach on the Indian Point spent fuel pool. . . .
- Indian Point—comment on the "draft" Witt Report on emergency preparedness.
- Ability to evacuate Indian Point—FEMA's reasonable assurance that the emergency plan is adequate.

Yucca Mountain/Transportation of High-Level Waste

- Trying to explain to Nevada citizens that Part 63 and the YMRP are risk-informed, performance-based.
- Proposed new transportation regulations in 10 CFR Part 71 include a new "exemption" level—materials below this level will not be regulated in transport. Public interest groups have a strong negative response to anything that appears to be a new way of releasing radioactive materials to the general public (i.e., renewing the "Below Regulatory Concern" concept).
- Yucca Mountain—first round of public meetings focused on what we thought was technically important (and risk significant); however, the public was concerned about transportation (the least risk-significant area of the program). Terrible press after meetings.
- Accidents involving spent fuel being transported.
- Control of solid materials, HLW repository and future licensing, site decontamination requirements, and federal agency regulations.
- New issues every month with Yucca Mountain. The latest deals with public mistrust of the NRC and a perception that the NRC and DOE are holding meetings without public presence.
- Other issues are waste disposal at PFS in Utah, Yucca Mountain in Nevada, and ISFSIs at various locations.

Spent Fuel Storage

- Leakage of the Salem Spent Fuel Pool, which resulted in some groundwater contamination on the site.

- Storage of spent fuel in significant quantities away from power plants.
- Private fuel storage.
- Discussion with NEI/industry concerning the recent orders and ICMs for decommissioning reactors and sites storing spent fuel in dry storage containers. This included the review and analysis of the guidance that NEI and industry submitted to the staff.
- Spent fuel pool risk study.
- I have been involved in assessment of the adequacy of cooling in spent fuel pools. I volunteered to go to a town meeting to discuss my findings. The town meeting was the site of the Millstone Site. This site had problems with their spent fuel pools that had been documented in a *Time* magazine article. I found it challenging to convey that the risk due to the spent fuel pool was minimal. This was before 9/11, so terrorist events were not considered in my study.
- Spent fuel pool expansion at Harris.

Security

- While working in OPA following 9/11, the issue of security at NPPs and how these and other NRC-regulated facilities and materials would hold up to terrorist attacks.
- Loss of licensed radioactive material that could potentially be used in a dirty bomb.
- Oyster Creek—public concern over security involving acceptability of trucks delivering goods and materials to an on-site warehouse.
- Risk assessments, or lack thereof, for emergency preparedness and security issues.
- Possible level of latent cancer fatalities following a postulated terrorist attack at a spent fuel pool.
- Terrorist public meetings and workshops on clearance.
- Terrorist attacks on spent fuel storage containers.
- Terrorist attacks on spent fuel transportation.
- Safeguards ICMs and CMs.
- Fatigue.
- DBT.
- Force-on-force.
- Training.
- Distribution of KI to the general public.
- Radiological dispersal devices.
- Giving the public access to information on security.
- Giving the public a real appreciation for risk in NRC space in relation to other critical areas of the [national] infrastructure.
- Emergency planning.
- Incident response.
- Coordinated federal response.
- The issues erupting after 9/11 are the most relevant. These include vulnerability of nuclear plants to terrorist attack, damage that might be caused by a successful terrorist attack, vulnerability of nuclear plants to impact of commercial aircraft, effectiveness of security measures.

Decommissioning

- Issues surrounding the former Apollo site (NUMEC, ARCO, and BWXT ownership) in Apollo Borough, PA, continue to challenge the agency. Some members of the local public are extremely distrustful of the NRC and our safety conclusions. Years after decommissioning the site, some vocal members of the local public continue to question activities there and the safety of the site. In addition, the local print media have actively written about the site within the past year.
- Cabot-Reading has generated controversy with the state. The public itself in Reading, PA, doesn't seem overly concerned about the site, but the state and NRC do not agree on the level of risk that the site presents.
- Maine Yankee decommissioning—differences between NRC and EPA requirements.
- What cleanup levels for radioactive materials are safe.

Other potential case studies that were mentioned by respondents were the South Texas Request for Multiple Exemptions, NOEDs, risk-informed regulation and the Reactor Oversight Program, effects of low doses of radiation, cancer, license renewal, and new licenses.

Question 8: In your experience, what are the most common concerns and questions that external stakeholders ask NRC staff?

Personal Fears and Impacts of Areas that the NRC Regulates

- Should I be concerned about the radiation I receive from...?
- Is the plant going to blow up? Is there going to be a release of radioactivity? Will I be able to get away safely? What should I do if something happens at the plant near me? How will I be kept informed if something does happen?
- Why do you want to poison my neighborhood?
- Would you live next door to one?
- What if there are leaks?
- Link between operating nuclear plants and cancer or other diseases.
- How would the construction [of a] future reactor affect them financially?
- The consequence question—how bad could it be, not the risk question, or the likelihood question.

Decision-Making Processes Used by the NRC

- The new ROP is confusing to congressional staffers (and me). A concern heard is, with the new ROP, do you get into a 9"can't see the forest for the trees" mentality? I.e., Davis-Besse again—congressional staff had a difficult time understanding all the time NRC staff spent on assessing risk and debating whether it was a red since the vessel head didn't actually burst, when the seriousness of the event seemed apparent to them without the drawn-out evaluation.
- Why does the NRC allow Indian Point to still operate?
- Why don't you just shut it down?
- We want you to be thorough, not only evaluate high-risk areas.

- If you can't assure us that the plants are safe, why do you let them run?
- What process is used to evaluate safety and are alternatives serious entertained?
- How are uncertainties identified and evaluated?
- Where do you get your information, data, and models, and are they publicly available?
- How are technical reviewers selected, and do they interact with other specialists outside the NRC?
- Why are there so many differences between EPA's environmental risk assessments and NRC's environmental assessments?
- How are differences in NRC staff evaluations vented, and are they communicated to the public?

Security

- How can you be sure a terrorist won't attack it?
- Are nuclear power plants safe from terrorists/sabotage?
- For security issues it is what is the basis for imposing new requirements on the licensees since security "only costs the site money"?
- That the NRC is not doing enough to protect against terrorist threats.
- How is the facility protected from a terrorist attack?
- The most common questions I received while working in OPA was "How can you be sure that NPPs/spent fuel pools/ISFSIs/nuclear waste shipments can withstand 9/11-type terrorist attacks? If the worst-case scenario accident occurred, what is the estimated loss of life and contamination? How far out would the devastation reach? What would have to be done to clean up and make the area safe?
- Evacuation feasibility (EP stuff)—physical security.
- How can this possibly withstand an attack by armed terrorists, an attack using an aircraft, an attack using modern weapons like RPGs, etc.?

The NRC's Relationship with the Industry

- Stakeholders ask about the environment and personal safety. The public is wise and knows that our licensees are businesses based on markets and profits. They understand and hope that we thoroughly regulate our licensees with a tough glove. The public understands our close ties to industry, NEI, and DOE, and they want to make sure we are not "in bed" with them. This case of intimate relations with those we regulate is too fine of a line. The NRC needs to reestablish a clear, lucid boundary between us and our licensees so that our stakeholders and public can regain confidence in effective regulation. These mothers and fathers at public meetings just want to ensure that their families will be protected from nuclear accidents, and they rely on us, the NRC, to make sure their families are protected. As the federal government, that is our legislative duty and we are failing. Let us change our apathetic responses to the public, our chummy relationships with licensees and industry, and become a trustworthy and respectable regulator for the American public.
- Their concerns related to who is holding licensees accountable. They look to NRC to be the cops. We often fail to understand their positions, perceptions, and attitudes before we engage

in discussions. The result is often that they do not understand because we don't understand their perceptions.

- Aren't you bought and controlled by industry? You are in bed with the licensee (DOE). Issues of trust, can't communicate if no trust, especially can't communicate on risk if no trust.

Question 9: What barriers does the NRC face in communicating with risk with external stakeholders?

How Much Detail?

- In addition, I believe one of the biggest barriers is understanding the tradeoff between oversimplifying an issue and potentially misleading our stakeholders (primarily the general public). That is, as regulators, we tend to focus on the exceptions, so when we try to communicate a complex issue, we frequently tend to "confuse" the overall message with all of the details. What is the appropriate level of detail?
- Ability of the public to understand complex technical topics. Not all of the issues are amenable to "sound bites," and it can be hard for the staff to reduce to simple terms.

Risk Comparisons

- Another possible barrier is knowing what are the NRC "accepted" values for frequencies/consequences of various events so that we can translate these into everyday terms (e.g., frequency of core melt compared to frequency of getting hit by lightning).
- Using comparative risk is sometimes a good idea but not always.

Knowing Stakeholders/Audience

- Knowing the various audiences and communicating in a way that is understandable and credible to each of those audiences.
- I think we have a lack of understanding of their main concerns.
- Discerning the degree to which the stakeholder posses technical knowledge and understanding of the subject/issue. And "stakeholders" is plural, so it's especially difficult to talk to a group with varying degrees of technical understanding.

Trust/Credibility

- Mutual distrust.
- The credibility shadow created by the Davis-Besse vessel head issue limits our ability to show we are an aggressive regulator interested in public safety.
- Public view that NRC is too close to the licensees (i.e., lacks real independence).
- Public view that NRC reviews are superficial (i.e., we never say no to the licensees).
- We are regulators. We are the government. We are working for industry.
- Distrust among some stakeholders. Some just won't listen—they've already made up their minds that we're lying to them and they won't believe us.
- Belief by many that all government agencies are the same and should be mistrusted, belief that NRC is a rubber-stamp agency with little backbone to face the industry.

- NRC is seen as part of the government and cannot be trusted.
- NRC needs to overcome the image that we are "in bed" with the industry. The only way that can be accomplished is to issue some stern and swift enforcement actions and close plants down when we believe there are safety issues that are serious. We also give the public false impressions with the 2.206 process. They can petition us to take action, but in fact we have rarely (if ever) done so. I think we need to stop worrying about "promoting" nuclear power and start educating the public about actual risks.
- Be honest with the stakeholders.
- Establishing credibility.
- Fear that the NRC is in bed with the applicants and industry groups.
- NRC is not always perceived as an independent regulator. People have indicated that our jobs as NRC employees are dependent on the existence of nuclear power; therefore, we can't be objective.
- History. WE are only one player and ultimately not the licensee. NRC is in bed with industry. WE are bureaucrats and are distant from the real effects of what we do.

Risk Perceptions

- Difficulty explaining risk in terms readily understandable to the public's wide range of education and experience.
- Prejudice against nuclear power.
- The public as a barrier. Because the public does not typically understand risk, placing them between the licensee and us is difficult. Another barrier is the ability to reach a common understanding of the risk between the licensee and us.
- The barrier is a common, simplistic definition of what "risk" is, what the understanding that what is a risk for one person is not necessarily risky for the next person.
- Public perception of risk.
- Lack of understanding of risk of nuclear power.
- Radioactivity is something that you cannot see/touch/smell, which makes it very difficult for external stakeholders to understand.
- External stakeholders usually have a preconceived notion of the relative risk of "things nuclear."
- NRC staff often assumes that our perceptions about risk are or should be the same ones that the public has. More often, the public's view of or definition of what risk is and what contributes to it are very different from the staff's.
- When it comes to nuclear materials, no amount of risk is tolerable for most.
- They have misconceptions about what we do and don't understand the hazards of radioactivity. For instance, they think the NRC is involved in nuclear weapons or that we work for DOE. They also think all types of radiation are a public health risk and believe nuclear power is unnecessary as an energy source.

Communicating Technical Information/Plain Language

- Inability of some staff to speak in lay terms.
- NRC does not communicate in people language, and the result is fear of the unknown.

- NRC has not done a good enough job of preparing its scientific and engineering experts to communicate with the public. The scientists and engineers are often "Myers-Briggs introverts."
- Difficulty in translating our excellent technical work into plain language.
- Limits on our communications ability with an average member of the public. With engineering and science backgrounds, our employees are almost incapable of saying, "It's safe" or "It's not safe" without adding caveats, conditions, etc.
- "Government speak," use of lingo/jargon, use of politically correct language, use of passive voice in conversations.
- The barriers which exist with regard to risk communication are, in principle, the same as those which exist with regard to the communication of anything else related to the nuclear power industry. The NRC has to find a way to communicate very complicated technical topics to a many stakeholders who may be "generally uninformed." So the challenge is to "simplify" the discussion so that is it understandable, yet maintain a high level of technical accuracy (i.e., not make the simplified discussion inherently incorrect in the process).

Other Agencies

- Other federal agencies may have other agendas that lead to confusion and are not consistent with NRC policies.

Format of Participation/Communication

- NRC still uses "a bunch of white guys in suits" at public meetings, instead of using more innovative approaches to reach the public.
- Assign the best staff to communicate the message
- Be proactive and reach out to stakeholders and communicate actively.
- NRC staff presentations tend to lack humor/pizzazz. Most are not crisp. At several public meetings I attended, I noticed that NRC management "punted" the question. This left stakeholders uneasy and did not convey safety. I suggest that every presenter have an evaluator assigned to them to provide objective/useful feedback.
- Being prepared with FAQs and message maps.
- For some reason, SES managers love sending out boring speakers. Everyone knows who is boring, everyone knows who excites and captures audiences, but we continue to perpetuate stoic presenters at our public meetings. Please start selecting "good" speakers and hire better public affairs writers. Develop more readable Yucca Mountain, Davis-Besse, Reactor Impact high-ticket item brochures for distribution on the Web site and at public meetings. Other agencies have communication brochures on their Web sites, but we do not. Also, a section on our Web site about nuclear education would be wonderful, and I think we have more than enough scientists and engineers at HQ to do this task. Many of the public need to know, in simple terms, what happens in a nuclear reactor and why nuclear waste is harmful. After learning about these simple nuclear reactions, then the brochures/Web pages regarding our big-ticket items would be excellent. Then, at public meetings, if our managers don't feel comfortable answering questions or do not know the answers, the public can be directed to the education section of our Web site.

- How to control/constrain interveners who want to seize and monopolize the discussion during meetings.
- How to have a respectful dialogue and be responsive to members of the public who, for years, have distrusted NRC.

Legal
- In contested cases, legal barriers prevent NRC from getting a message out.

Explaining NRC Roles and Responsibilities
- Limits on our jurisdiction (we don't regulate NARM or NORM, and the public doesn't understand that).
- The activities we regulate are technical and not easy to describe for a clear understanding by the general public. In transportation, the regulations are complex and not easily communicated to the public.

Emotional Issues
- Having to give technical answers to emotional questions.
- We speak a language different from the public. We speak about risk in technical terms, matter-of-factly. The public understands risk on an emotional level.
- We try to give technical answers to emotional questions. Some of the public have made up their minds and are not persuaded by our technical and bureaucratic answers. We need to be better storytellers to get our point across.
- Also, there is an "emotional" reaction by the public to all things nuclear.
- Fear—theirs and ours!

High Consequence/Low Occurrence
- Being able to down play the extremely unlikely but high-consequence scenarios.

Risk-Informed/Performance-Based Regulation
- Clarity on nexus among risk-based, risk-informed, and performance-based activities. Clarity among various risk-informed initiatives. Lack of common understanding among the NRC staff. Perception that either you are risk informed or you are deterministic. Confusion about risk informed and performance based and how it is being implemented at NRC.
- Having and sharing a clear and consistent understanding of how risk assessment results are being obtained and applied in the regulatory process.
- "Using a risk-informed approach is just another way of reducing regulatory burden on industry and will lead to less safety." Need to show examples where following risk-informed approach leads to increase in safety (not just maintaining safety).
- Understanding risk in real and potential terms rather than risk studies which always seem to conclude that less regulatory oversight is appropriate.
- Clearly defining and understanding its own regulatory framework dealing with risk, and not keep changing it to make special arrangements for "unique" cases all the time.

- I feel that the major barrier is the general lack of knowledge of PRA strengths and weaknesses by the NRC staff, particularly senior managers who often are called on to speak to external stakeholders.
- Our discussion of risk is centered around the concept of Probabilistic Risk Assessment when it comes to nuclear reactor safety. The general public is not well-versed in that concept. Our programs sometimes speak in terms of an event or issue's affect on "core damage probability." This "science" is not as exact and precise as its name implies. As such, we run into difficulty when trying to send messages that something has "very low safety significance" or has a certain color (as in ROP SDP space). It's all Greek to some of our external stakeholders, and all they want to know is, "Was there a problem, is it fixed, and if not, why not?"
- Uncertainties in the risk assessments.

Security

- Sometimes it is national security classification of information.
- Limited for people with the need to know.
- Sensitive/security restrictions on providing information.
- The limited availability of site-specific risk information for the public. This is increasingly more problematic when safeguards and security are factored in. The NRC needs to balance the public's need for the information with the need to limit access to information for security purposes.

Fear/Silence of Staff

- Concern among staff and management that speaking out in favor of safety (e.g., "It's a safe practice that's done all over the U.S.") will be perceived by the public as promotion of regulated activities, so they just don't say anything at all!
- Allowing an individual or group standing, just by acknowledging their ignorant, uninformed, or biased viewpoint.
- That we may overlook something of importance.
- Staff fear of saying something that could be misinterpreted, so better to say little or nothing.
- Reluctance of some management and staff to communicate with public interest groups.
- We tend to be too careful with our words, so we end up not saying a lot or even really addressing the issues.
- Management review and comment tends to restrict the message and narrow its meaning. It also could influence the timeliness of the information.

Internal Confusion/Lack of Coordination

- Being informed about and staying within Commission views on issues.
- There is lack of shared understanding and consensus on many important issues internally.
- Internal confusion on scope, objectives, expectations and the slow development of user-friendly risk tools translates into poor communications with all stakeholders.

- Inconsistent understanding and application of risk insights by NRC staff, supervisors, and management. We are not always effective at presenting a consistent front in discussions with external stakeholders.
- Inconsistency between HQ and different regions regarding the approach to discuss the risk message.
- Political aspects do enter into final considerations.

Lack of Training, Preparation by Staff
- Limited training for technical staff on making presentations.
- Not doing it well and not practicing the message prior to giving them.

Lack of Understanding by Stakeholders
- Too complicated.
- Public press and Congress can't put risk in context.
- The NRC is unknown unless there is a problem; then we are automatically on the defensive.
- The nuclear fear factor is about 100 times any risk that people can relate to.
- We try and change people's minds that are just against it—waste of time.
- The lack of knowledge by the general public on nuclear technology, the overall risks associated with this technology, and regulatory framework under which nuclear energy is used in this country.
- Public does not have a good understanding of nuclear energy. Their lack of knowledge adds to their concerns and makes communication risk of various scenarios more difficult.

Question 10: What information or specific issues have you found difficult to communicate effectively?

General
- It is difficult to convince people that NRC's #1 priority is safety when incidents like Davis-Besse occur and the public reaction is overwhelmingly negative. Once the media "lets loose," it's difficult to pull that train back. NRC needs to get "on message" earlier and more deeply throughout the agency in order to respond effectively. The entire NRC staff should know the facts, and they should be delivered from the top levels of the agency.
- I've tried to listen and engage in discussions without taking a definitive position so that a dialogue is created. Typically, the results are positive and often lead to follow-up discussions.

Risk Comparisons
- Comparison of sources of radiation to define risk. It is difficult for the public to compare exposure from the sun to exposure from radioactive material.
- Relative risk and acceptability of involuntary risk.
- Comparative risk without being allowed to educate the listener.
- Relative risk—we focus on worst-case or pessimistic analyses that tend to give results that are too conservative. Then later we try to say it's really not that bad, and we lose credibility.
- How the risk of operation of nuclear power plants compares to other acceptable societal risks.

- Comparable risk of health effects—auto fatalities are easy to count, but latent cancer isn't, and too many NRC staff are satisfied that reactors are safe because nobody (in the U.S.) has died from reactor operation, which isn't a valid risk claim.
- How to discuss risk and put it in context. What does it mean without sounding alarmist?

Risk-Informed/Performance-Based Regulation

- How certain requirements are risk informed/performance based, or why change from current safe practice is needed. HLW; control of solid materials.
- The value of PRA as an safety analysis tool for use by licensees and the NRC. How risk-informed decision making is supposed to work. What constitutes defense-in-depth? How do I consider it on a common scale with the results of risk assessments? The robustness of PRA data.
- How beneficial a well-done PRA can be to the licensee and the staff.
- Why regulations are difficult to change unless the change is minor/administrative.
- Explaining why using a risk-informed is the best approach (appears we disregard public issues).
- Risk-informed, performance-based rules and SRPs.
- Bases for regulations, guidance, and Commission decisions when SRMs aren't detailed.
- The technical issues regarding risk analysis.
- The following specific issue was difficult to communicate which was in the Indian Point 2 steam generator lessons learned task group report. The difficulty was that the steam generator tube failure was found to be a red finding in the significant determination process, but at the same time the message to the public was that the tube rupture did not pose a significant risk to members of the public.
- The concept that PRA and risk is best communicated in "orders of magnitude." As engineers, we often get too bogged down in the minutiae, which in the end, because of extreme uncertainty, are not that important. The main message we should be sending is the risk insights, not necessarily the risk number to the fifth significant digit.
- Limitations on the application of risk insights in the regulation of commercial nuclear power.
- To the general public or concerned citizen groups, it is sometimes difficult to communicate the strengths of using a risk-informed approach to regulation.
- That risk assessments and deterministic methods are not two separate concepts, but are complementary concepts, encompassing basic knowledge of phenomena, design/operation practices, and ability to look at them in an integrated fashion.
- Risk assessments provide much more useful insights beyond the actual "risk" numbers.
- Not a single issue—the problem is a lack of knowledge of the robustness of risk analysis.
- How quantitative results are arrived at. The relationship of changes in plant design or operation to changes in risk. Why change in regulatory approach is needed.
- The SDP process.
- Communicating about the ROP and the risk of specific issues to public was difficult because public didn't care and instead asked questions about their own pet issues having nothing to do with what we wanted to discuss.
- Timeliness of our decision-making processes and the objectivity of the ROP.

- PRAs that form the basis for white, yellow, or red findings under the Reactor Oversight Program's Significance Determination Process.
- The most difficult issue to communicate is when NRC levies fines and penalties for issues of minor safety significance, such as "white" findings and other events. The public and the media cannot understand why we take major actions when there is no health and safety issue to be concerned about. This raises credibility issues with the media and the public and gives antinuclear groups ammunition for criticism.

Exposure

- Why are there allowances for exposure in the medical arena that are not in other arenas?

Spent Fuel Storage and High-Level Waste

- Why a spent fuel storage facility can be safely operated for a period of time and then have the land returned to other uses.
- Why spent fuel casks won't "leak" radiation.
- Why transportation of spent fuel is safe.
- How disposal of radioactive wastes impacts the environment and how that factors into the overall risk of the commercial use of nuclear energy.
- Waste issues.

Severe Accident Mitigation

- I find it difficult to describe severe accident mitigation issues and defense in depth. It's hard to explain to people that had Davis-Besse's liner ruptured and a loss-of-coolant accident occurred, the containment building would have contained the radiation, and they would be safe. A nuclear accident is potentially so scary that people aren't able to comprehend after the accident part.

Complexity of Nuclear Power Plants

- Highly technical discussions on the workings of a nuclear power plant.
- How plants are still safe if they leave flaws in service.
- Complex technical issues, especially in the area of fire protection, that require many assumptions to get through an SDP are always challenging to justify or explain.
- Just explaining the technical aspects of a concern so a layperson can understand.
- Highly technical issues like the Davis-Besse upper head corrosion.

Absolutes

- Usually, it's the absolutes that I find difficult.
- "Can you guarantee me 100% that I won't get cancer because of activities you regulate?" You know, it is always difficult for engineers to answer "Will the sun come up tomorrow?" with the degree of certainty that is actually warranted because we know it is possible that the sun won't come up tomorrow.

Security

- The effectiveness of nuclear power plant response forces to defend against terrorist attack.
- Why the nation needs to be better prepared to address the current threat/risk environment.
- Any communications that deal with insider threat.
- Vulnerability of nuclear power plants to terrorist attacks.
- The cooling lake was closed to fishermen for security purposes.
- How effective is plant security?
- Security issues—the chairman keeps killing our press releases.
- Also, states very much want to know what their first responders should expect and prepare for in the event of a terrorist attack involving a radiological release. Given the sensitivity of the topic, NRC has not been forthcoming/willing to share this type of information with states.
- The ability to communicate risk issues to external stakeholders is an agencywide issue, not just an NRR, OPA, or NMSS issue. The risk associated with physical security events is not as quantifiable as those associated with reactor operation events.
- The significance of the HSAS threat levels related to power reactors.
- Security, terrorism, and emergency preparedness in post-9/11 awareness.
- How emergency plans are designed to deal with an accident resulting from a terrorist attack.

Perceptions and Understanding of Risk

- Probabilities as applied to accident analysis.
- Perspective on how to interpret a risk number.
- How do we say there is no risk when there is but the probability is rather small?
- Why the public should accept a risk CCDP of < E-06.
- Putting into the proper perspective very-low-probability events with very high consequences.
- Accept the fact that there is no zero risk.
- That there can be high costs to be completely safe.
- Acceptable risk.

Low Doses

- Convincing the public that 25 mrem/year is a very low dose and that no one ever suffered, let alone died, from such a dose.
- Dose vs effects.
- There is some risk in any industrial/power complex, and the law allows some risk and some exposure.
- It is also very difficult to talk about leakage and how some leakage is allowed and is OK. To the public, leakage is equivalent to imminent disaster. The concepts of "unidentified leakage," "pressure boundary leakage," and "identified leakage" are justifiable bases for thresholds established for requirements.
- That a small radioactive release is normal.
- Below regulatory concern/clearance.
- Radiological releases below regulatory limits, risk of plant events, and conditions.

Question 11: What form of guidelines for risk communication would be most useful to you? (1 = very useful, 7 = not useful)

Web page	2.67 (most useful)
Pocket guide	2.90
Brochure	2.94
NUREG	3.88 (least useful)

APPENDIX B. NRC FOCUS GROUPS INSTRUMENT, PARTICIPANTS, AND SUMMARIES

Objective: Discuss risk communication issues from the perspective of each office.

Questions:

1. What has surprised you the most about communicating about risk with external stakeholders? *[Round robin]*

2. How well do you think NRC staff understand external stakeholder concerns and perspectives? What do you think is important for staff to understand?

3. Respondents to the on-line survey identified several barriers that the NRC faces in communicating about risk effectively, these include (in no particular order):

   [Provided to focus groups via flipchart and handout]

   Knowing how much detail is appropriate
   Knowing how to use risk comparisons
   Understanding stakeholders/audience
   Trust/credibility
   Risk perceptions of external stakeholders
   Communicating technical information/plain language
   Method/venue of communication
   Lack of understanding by stakeholders of NRC roles and responsibilities
   Emotional issues in the context of stakeholder responses
   Risk-informed/performance-based regulation
   Security issues
   Fear/silence of the staff—don't say anything because of fear of saying the wrong thing
   Internal confusion/lack of coordination
   Lack of training/preparation by staff
   Lack of understanding by stakeholders of nuclear power or radiation

   a. Are there any other barriers that should be added to the list?

   b. Please identify the three most significant of these barriers and share what recommendations you have that the NRC can do to address them? *[Participants will each be asked to provide their top three, which will be tallied on the flipchart. The group will then discuss each of recommendations for each that received a vote.]*

4. Here is the ranked list of stakeholder groups. Why is it easier to communicate with certain groups than with others?

Congress	2.63 (most challenging)
NGOs	2.67
Media	2.95

Public	3.18
Independent groups	3.95
States	4.10
Licensee	4.42
Internal	4.73 (least challenging)

5. Respondents to the on-line survey ranked internal communication as the least challenging of all of the stakeholder groups mentioned; however, the rating was still 4.7 out of 7. Whom do you have to interact with internal to NRC, and how does that impact your communication external to the NRC? How can internal communication be improved?

6. What perceptions about NRC do you encounter when interacting with external stakeholders (industry, public, Congress)? How have these perceptions changed over the last couple of years? What do you think caused these changes?

7. Respondents rated NRC effectiveness for several arenas for communicating with the public. These were the results:

One-on-one interaction	2.80 (most effective)
Web site	3.41
Public meetings (regions)	3.47
Printed materials	3.52
Public meetings (HQ)	3.70 (least effective)

   a. What works well for each?
   b. What is problematic?

8. What skills do you think are important to have to effectively communicate about risk?

9. In evaluating NRC risk communication efforts, what do you think are the key criteria? What do you think indicates successful risk communication?

10. Risk communication training can cover a variety of topics. Which do you think would be most helpful for staff from your office?

11. Do you have any recommendations for us as we prepare agencywide risk communication guidelines and a training syllabus? *[Round robin]*

Participants: 6–12 staff from each office who communicate with external stakeholders through public meetings, the Web site, or other methods

Summaries:

March 24, 2003 NRR Focus Group
(4 participants)

Issues

- NRC is in a transition period and having difficulty communicating PRA internally. Staff even have trouble talking to the staff who understand risk concepts.
- NRC is not good at staying on message at public meetings, and often the script is thrown away.
- NRC staff need to factor emotion into stakeholder communication.
- NRC doesn't differentiate between external stakeholders. Everyone is given the same message.
- NRC staff need to be able to answer questions as broadly and simply as they can without using "tech talk."
- The public has high interest in security, but there is not much NRC can say about it. The current NSIR Q&A package is not in plain language.
- Part of the NRC's Achilles heel is that during crisis situations, its messages show up on the public's radar screen after there is a big hole in the reactor. NRC doesn't have a way to establish credibility before that.
- Staff who act as facilitators and spokespersons for the agency need training and qualifications for both controversial and run-of-the-mill daily business meetings.
- Staff are interested in taking training to develop skills to increase their comfort level with engaging the public.

Best Practices

- Knowing the audience is key. Once you understand to whom you're talking, you can make decisions about everything else.
- NRC residents are encouraged to talk to people in the local community—PTA, Lions' Club, etc, but this practice isn't consistently carried out.

March 25, 2003 NRR Focus Group
(5 participants)

Issues

- There should be consistency across NRC in message development. Many different internal agencies in NRC are communicating with the public. Each time a person goes out into the public, he/she represents the whole NRC.
- There should be a common language and common terminology. The language should be appropriate to the issue, e.g., general policy, licensing, or specific risk issue.
- Staff are not necessarily comfortable speaking with the public about numbers.
- One of the reasons internal communication is difficult is that NRC is a layered bureaucracy with multiple interests.
- Some level of fear leads to staff silence. There is a level of apprehension or hesitation to say something that differs with management's thought processes.
- Unprepared spokespersons lead to a loss in credibility.

- People are concerned about terrorism and want to believe NRC is doing all it can to protect them from the threat of terrorism.
- Lack of public speaking skills and poor body language are barriers to communicating with the public.
- NRC staff need to receive media training and develop the following understandings: different types of information; how to communicate about decision criteria; how to communicate about the whole process as opposed to just communicating about the individual pieces; use of terminology/common language; basic concepts and ideas for communicating with the public about risks; key messages—what's okay to say and what's not okay to say; factors that impact external stakeholders' perceptions and how to communicate in light of those perceptions; and information about resources available at NRC.
- NRC needs to agree on a platform that is applicable in nearly all situations. The training should include examples/case studies.

Best Practices

- Choose a group of NRC people to be spokespersons and ensure they receive all the training.
- When speaking with stakeholders, stick to the message and keep it simple.

March 31, 2003 General Focus Group
(11 participants from NSIR, RES, EDO, NMSS)

Issues

- There are various political barriers, including congressional members who are very hostile to nuclear power and the NRC.
- When communicating with stakeholders, the message gets "garbled" and the speakers do not "connect."
- NRC needs to do more homework on its stakeholders to find out what their issues are and what they want to talk about.
- There is a fear that response time to stakeholders' questions—sometimes up to a year—damages credibility.
- A core group of stakeholder communicators should be established.
- There are disagreements internally on security issues.
- Staff requested training in becoming active listeners, demonstrating compassionate understanding (empathy), and communicating in plain language.

Best Practices

- Leave business suits at home if the audience at a public meeting is rural.
- Touch base with licensees to gauge public interest.
- NRR media briefing papers and fact sheets on the Web were very well done.

April 2, 2003 RES Focus Group
(10 participants)

Issues

- There is no consistent definition within NRC of what risk is.
- Internal risk assessment communication needs to be made more understandable because NRC is making safety decisions that impact budget decisions.
- The big change in stakeholders is the rage factor. Staff need to learn how people in interviews see them through the lens of body language and then may get angry right away.
- There is a big difference between communicating internally and externally: the public is more emotional; NRC is more technical.
- NRC should speak with one voice.
- NRC doesn't do a good job communicating about uncertainty. The agency needs to be better able to communicate how NRC can say a plant is safe if there is uncertainty.

Best Practices

- When staff talk to the public, they put themselves in the stakeholders' shoes.
- It is important not to be defensive if something bad happens. NRC needs to get all the bad news out right away and tell the public what the agency is going to do to fix it. Admit when something went wrong, even when being attacked.
- Rehearse before public meetings with possible questions and responses.

April 8, 2003 SRA Focus Group
(8 participants)

Issues

- It is difficult to communicate the concept of PRA to both internal and external audiences. Staff would like tools for both audiences.
- There is a perception among staff that there is a lack of management support for risk communication.
- There needs to be honesty in the production of PRA internally. NRC staff say they have received requests for a predetermined answer.
- Look for ways to develop trust in PRA both internally and externally.

Best Practice

- Relations developed among competent NRC inspectors on site make people feel comfortable.

April 9, 2003 NMSS Focus Group
(7 participants)

Issues

- There is frustration when NRC can't communicate with stakeholders when it is involved in a legal issue; the NRC staff can't speak out, but opponents can.

- There is a perception among some NRC staff that if someone in Congress disagrees, then that person is antinuclear.
- It is still undecided in the industry whether risk comparisons should be used.
- Staff are surprised at how confusing NRC press releases are. They didn't know where to go within the agency to find clear answers.
- Staff appear confused on how to talk internally about risk on the NMSS side versus the NRR side. Discussing quantitative versus subjective information affects external communication.
- Every time NRC has a public meeting, staff meet new people. They have to realize they're starting over with many of the attendees.
- NRC should come up with some specific agency best practices for communicating risk to the public.
- Licensee needs to become an active participant in communicating with the public. It's a barrier to communication when the licensee doesn't reinforce the messages.

Best Practices

- Staff should think about a personal experience they have had to get a better idea of how stakeholders might feel.
- Being able to communicate information in a simple way is a key issue.
- Prepare for public meetings by having many different versions of an answer for questions likely to be asked.

April 17, 2003 Region 1 Focus Group
(8 participants)

Issues

- We're trying to build public trust in the NRC, not nuclear power. NRC finds that the public has preconceived perceptions from the media, which works against NRC.
- NRC staff don't relate to the public well because staff think in terms of numbers and the public thinks with emotion.
- NRC staff are not sympathetic to the public.
- NRC does not have a coherent internal message, and this impacts the message sent out to the public.
- The agency tends to do one-size-fits-all public outreach, and it hasn't worked.
- Public affairs should write articles for the newspaper.
- It's difficult to give security information without being attacked and accused of hiding or covering something up. NRC hasn't acknowledged that the challenge of talking with the public about security can be overcome.

Best Practices

- NRC has done well communicating with the media by providing them timely, accurate information in easy-to-understand terms. We need to continue to do this to build credibility with the press.
- Always engage the public at meetings even if there are only two people at a meeting.

APPENDIX C. NRC INTERVIEWS INSTRUMENT, INTERVIEWEES, AND SUMMARIES

Questions:

1. Overall, how would you assess the NRC's ability to communicate about risk?

2. Do you think that the way an organization communicates internally about risk information impacts how it externally communicates about risk? If so, how?

3. Share an example of particularly successful activities you've been involved with related to:

   - Risk communication with the general public
   - Building trust and credibility
   - Involving stakeholders
   - Risk communication among staff and decision makers within your organization

4. Share a not-so-successful example of risk communication. What made this situation so challenging?

5. What are the most common concerns and questions you hear from external stakeholders regarding risk?

6. What are the most common concerns and questions you hear from staff about communicating risk?

7. What specific risk information topics or issues have you found difficult to communicate about? Why?

8. How well do you think NRC staff understand external stakeholder concerns and perspectives? What do you think is important for staff to understand?

9. What barriers does the NRC face in communicating with external stakeholders? What can the NRC do to address them? What has worked/not worked? What are good practices we should capture?

10. In your experience, what are good ways for the NRC to reach its stakeholders? What techniques does your public respond to well?

11. Respondents to the on-line survey ranked internal communication as the least challenging of all of the stakeholder groups mentioned; however, the rating was still 4.7 out of 7. Why do you think it was so high? How can internal communication be improved/strengthened? *[Provide survey question and response as a handout]*

12. We are preparing risk communication guidelines as an outcome of this project. What suggestions do you have to make sure they are as useful and applicable to your staff as possible (format, print/online, with examples/without examples, etc.)?

13. What do you think indicates successful risk communication? In evaluating NRC risk communication efforts, what do you think are the key criteria? How would you know it was successful?

14. Risk communication training can cover a variety of topics. Which do you think would be most helpful for staff from your office? Who should receive this training?

15. What recommendations do you have on how to integrate risk communication skills and practices throughout your organization?

16. Whom else should we talk to?

Summaries:

COM Interviews
(4 respondents)

Issues

- The NRC needs to be able to make convincing statements, such as "The plant is safe" versus "The plant is not unsafe." The NRC cannot use ambiguous phrases.
- Understanding stakeholders is very different from office to office; this variability is a problem for the NRC.
- The licensee termination and clearance rules create communication challenges.
- EPA and the NRC speak different languages, and it is difficult to come to resolution. It creates a view in the public that there are battling agencies. When technical experts at the NRC and EPA disagree, it causes confusion for the public.
- Society doesn't understand radiation, but there are differing views on whether the NRC should engage in education about radiation and nuclear energy.
- Although there has been progress, there are still people in the NRC who do not believe in risk-informed regulation.
- The NRC's staff are highly qualified in the technical arena, but many are not good communicators.
- Many problems are communication problems, not specifically risk communication problems.
- Various elements within the NRC that have communication responsibilities, e.g., OPA and OCA, are not integrated.

Best Practices

- Practice helps staff learn how to communicate effectively.
- Stakeholder relations are much better when the NRC staff *listen* to stakeholders' concerns.
- In Europe, they do "safety assessments" not "risk assessments," and they don't talk about risk in terms of 10^{-6}.
- Meetings with a facilitator are more inclusive and more likely to get issues raised and addressed.

EDO Interviews
(3 respondents)

Issues

- When communicating, the NRC staff tend to go back to what they are comfortable with, raw numbers. Communicating in these terms isn't effective for stakeholders.
- The NRC staff have an excellent reputation technically but generally are not good communicators.
- The NRC staff want risk comparisons and analogies they can use when communicating about risk externally.
- People want to know they are safe, and the NRC needs to communicate this message in simple terms. When the conversation becomes overly technical, the public believes the NRC is trying to hide something.
- The NRC needs to communicate its role and mission to protect health and promote safety.
- The NRC staff struggle to communicate without appearing to promote nuclear power.
- All staff at the NRC need some level of communication training.
- If the NRC staff are not comfortable communicating internally, they can't communicate intelligently externally.
- The NRC offices are not budgeted to communicate well.
- The NRC's organizational structure may not be conducive to effective communication. The agency needs to move away from a hierarchal, controlled environment to be more open to communication up and down through the organization. The communication function is scattered among offices, and that may need to be modified.
- Risk communication needs to be viewed as an inherent part of everyone's job.
- Congress better understands what the NRC does, but there is still a need for improvement.

Best Practices

- Internal communication has improved with newsletters.
- When talking to the press, keep hammering on one point, keep coming back to the message.
- The best interactions at public meetings occur afterwards, speaking one-on-one with people when they express their fears.

NMSS Interviews
(3 respondents)

Issues

- The NRC is not communicating about the risk of terrorism well.
- People don't care about the overall risk—just how it will effect them personally.
- The NRC needs the right people to communicate with stakeholders. It may not be the engineers.
- People don't know much about the NRC and how it is different from DOE.
- There is the perception that managers say they support risk communication, but they don't provide resources, time, or a career path for people to do this in their work. The NRC needs management/leadership to say this is important.
- Throughout the agencies there are different levels of comfort with the use of risk. The NRC staff need a shared understanding of risk-informed approaches.

- Communicating about medical risks is difficult because human reliability has to be factored in.
- The NRC needs to engage in more prelicensing dialogue.

Best Practices
- Some offices are doing a better job of listening to their stakeholders.
- Existing risk communication training is helping staff better understand that stakeholders have fears and concerns.
- Having a facilitator for public meetings.
- Holding meetings in more locations so the NRC can reach more people.
- Avoiding the buildup of frustration and questions by allowing questions often during a public meeting.

NRR Interviews
(3 respondents)

Issues
- After public meetings, staff get feedback (such as in the media) that makes it clear that the public doesn't understand the NRC's meaning of risk.
- The NRC staff gets frustrated because they feel they have done a good job technically, but their message doesn't get through.
- The NRC should focus on building the public's confidence in the staff as regulators.
- The NRC needs to do research on regional perceptions of risk and how that affects public outreach in different parts of the country.
- When the NRC grants exemptions, it raises risk communication issues. It is hard for the public to understand why the NRC would grant an exemption.
- The NRC needs good communication internally to successfully communicate externally.
- The NRC needs a better relationship with EPA. The agencies are working toward different standards.
- Risk-informed regulation is easier in theory and process than in practice.
- The NRC needs to establish a consistent risk language.

Best Practices
- Use meeting facilitators.
- The NRC's credibility increases when an independent reviewer can verify and support what the agency is saying.

NSIR Interviews
(4 respondents)

Issues
- The NRC fails to devote the resources necessary to thoughtfully present and plan presentations.
- The NRC should be more deliberate in choosing who communicates with public.
- PRA models are insensitive to the factors that create the greatest risk.

- The NRC staff would like better analogies to help communicate risk.
- All staff should have basic training on risk communication. It could be through information on the Web or in a one-hour session.
- The NRC needs to coordinate with the Office of Homeland Security.
- The NRC staff are timid about communicating. The layers of management create fear of retribution.
- Training materials need to be consistent—use the same image, chart, concept, story over and over.
- The NRC lacks a consistent, clear, accepted message about risk internally. Various offices have their own definitions of risk and risk-informed versus deterministic regulation.
- The NRC needs to establish relationships with reporters both on a national level and locally.
- Although some improvements are necessary, ROP is an excellent program.

Best Practices
- Maintain a two-way dialogue with stakeholders.
- Work more closely with stakeholders to foster positive interactions. Personally invite them to meetings—both in writing and orally. Send a package of information in advance with background information on what the NRC does and the specific issue being discussed. Follow up with a phone call to ask if they have questions before the meeting.
- Establish ground rules at the beginning of a meeting.

OGC Interview
(1 respondent)

Issues
- The implementation of risk communication throughout agency is uneven.
- There are inconsistencies between and within programs regarding communication and public involvement.
- The NRC staff need to know what the key issues are for the relevant stakeholders.
- There typically is tension with licensees during the early site permitting process.
- The NRC needs a working definition of risk communication.
- There is no regulatory requirement to do public meetings.

Best Practices
- Meeting with local officials to discuss their concerns directly.
- Holding public meetings in different places to be more accessible.

Regional Interviews
(21 respondents)

Issues
- The NRC can't use a one-size-fits-all approach to risk communication. Each region faces different challenges, issues, and concerns.
- Building relationships requires work behind the scenes. It doesn't all happen at public meetings. It needs to be made clear that direct phone calls to stakeholders are okay.

- When talking to stakeholders, the NRC has to avoid jargon.
- It is difficult to communicate technical assessments simply. When speaking with licensees, it is appropriate and necessary to use technical terms.
- Lower level staff need to be allowed to communicate with stakeholders.
- All staff should have some risk communication training because it is part of everyone's job.
- The NRC staff use the risk language without truly understanding the concepts and principles. The language loses meaning when it is used improperly.
- The NRC discusses the results of an incident and explains that the likelihood of the incident is very small. The public focuses on the results and wants there to be no risk of the incident occurring.
- Public affairs and other staff need more freedom and flexibility in handling stakeholders. They need to be permitted to get away from bureaucratic answers.
- The NRC staff have difficulty being empathetic to stakeholders.
- The NRC staff need to put risk information and issues into context.
- The NRC lacks independent reviews of its risk assessments. Without peer review, NRC's assessments lack credibility.
- The NRC has a strong tendency to put weight on a finite number. The public and even people within the NRC don't understand the large uncertainties that surround risk assessment numbers.
- The regions do not have a lot of resources to do outreach.
- The NRC is reluctant to talk about weaknesses.
- Internally, the NRC talks in numeric terms. Externally, the public wants information in qualitative terms.
- It is difficult to communicate core damage probability.

Best Practices

- Some plants have been successful in interacting with the public through community advisory boards.
- Monthly public meetings.
- Preparing Qs and As before a public meeting.
- Having a new resident inspector introduce himself to various local leaders.
- The FAA and NTSB are effective risk communicators.
- Practicing and being coached before public meetings, including responding to mock questions.
- The e-risk newsletter: Risky Business is a good new initiative.
- The Web site does a good job of communicating emergent issues.

RES Interviews
(11 respondents)

Issues

- The NRC staff use terminology that may have a different meaning for the public.
- Using plain language is difficult for the NRC staff. It is an afterthought.
- Risk terminology needs to be standardized.
- Staff are self-censoring because they are aware of the messages they believe management doesn't want to hear.

- Staff feel pressure to avoid decisions that would have a financial impact on plants or put industry in a bad light.
- The numerical aspects of risk analyses cause people to oversimplify and misuse the results. It is a challenge to convey the uncertainties surrounding the numbers.
- The NRC staff tend to provide too much technical information, and the public gets lost.
- Staff need to be more succinct when providing information to decision makers. They often provide too much detail without an understanding of the decision makers' information needs.
- Staff think that the public perception is that NRC underestimates risk. The public perception is that the NRC is making life easier for licensees and has less concern for the public.
- The NRC needs to coordinate more with EPA. It is unsettling to the public when two federal agencies are at odds.
- External stakeholders have emotional ties to particular issues that go beyond the NRC's purview.
- It is a challenge to communicate about a decision that has led to a relaxation in requirements.
- Staff often don't have the time and resources necessary to communicate the right way. That forces the agency to be reactive.
- The NRC staff tend not to listen to stakeholders' underlying concerns.
- The NRC needs to better define the decision-making process.
- All staff should receive at least some risk communication training.

Best Practices

- Involve stakeholders at the beginning of the decision-making process.

APPENDIX D. NRC CASE STUDIES

Yucca Mountain

The Nuclear Waste Policy Act (NWPA) enacted in 1982 and amended in 1987 stipulated the obligation of the federal government "to provide permanent deep geologic repository for spent fuel and other high-level radioactive waste from commercial and defense activities." The NRC regulates the construction, operation, and closure of such facilities based on EPA standards. DOE is authorized to find sites and build and operate repositories. Since 1987 DOE has conducted feasibility studies on the Yucca Mountain site. In February 2002, DOE formally recommended Yucca Mountain as a deep geologic repository site and plans to apply for a license from the NRC by the end 2004.

Unique Aspects of Selected Case: This case highlights risk communication challenges created by multiple stakeholders as well as multiple issues. The list of direct stakeholders involved in Yucca Mountain includes the General Accounting Office and the NRC at the federal level. State and local governments involved directly with Yucca Mountain are the state of Nevada's Nuclear Waste Project Office and the Nye County Nuclear Waste Repository Office. Other parties that have influence are the Nuclear Waste Technical Review Board and the National Academy of Sciences. When waste is transported, state and local governments on the transportation route will also be involved in risk management. Risk communication also needs to address multiple issues such as the NIMBY syndrome related to transportation of material as well as the site itself and challenges of scientific assumptions made about the site.

Outcome of Communication Process: As a result of risk communication efforts at the local level, NRC representatives were invited by local communities to speak at public forums; the public followed up, sent e-mail, and called, indicating that the public believed that an answer would be given by NRC representatives. There was accurate and neutral local press coverage.

Lessons Learned:

- Introduce who the different parties are and explain the role of the NRC in the process.
- Address stakeholder concerns. Conduct expensive and extensive testing on casks above and beyond what is suggested by analytical models. Update and revise fact sheets, handouts, and posters, and tailor them to the needs of the audience.
- Communicate with and address the concerns of state and local government officials, which may differ from those of the public.
- Analyze and address the multiple issues involved: NIMBY, transportation, risk of earthquakes, etc.
- Identify issues that remain difficult to communicate, e.g., licensing at Yucca Mountain.
- Set up internal practices to support risk communication: management needs to tell staff that risk communication is important. Management needs to explain to staff how each piece fits into the overall picture. Staff need to understand what other NRC colleagues are doing and how their work fits into overall mission of the organization. Staff need to make time to interact and debrief each other about the substance of work as well as time for reflection about work. Successes and failures in the rest of the agency affect what goes on at Yucca Mountain. What one person says affects the credibility of the entire agency.
- Find ways to continue with public participation after the license application comes in.

- Train every speaker.

Indian Point

On February 15, 2000, at 7:17 p.m., an increased leakage was identified at Indian Point 2 nuclear power plant. The plant declared an "alert" based on the NRC's classification of emergency events. An alert phase indicates substantial safety problems and small release of radioactive materials within the limits allowed by the EPA. Steam Generator 24 had a leak, and radioactive water from the primary system contaminated the secondary system. There was a small release of radioactive steam into the atmosphere. An hour later the steam generator was isolated. The plant went into cold shutdown on February 16. The "alert" was terminated at 6:50 p.m. that day. The initial news release went out at midnight. Con Ed officials informed emergency officials of the shutdown, indicating that there was no release of steam material. They later retracted the statement. Local EMA officials felt they were misled. The media interest was intense the first day and became progressively negative. Four days after the event, the NRC formed a communications coordination team.

NRC created a Web site and answered public questions. However, key documents such as a statement of the safety assessment of the event (an alert is next to the lowest on the NRC four-level emergency notification system), and information on the tube condition was not available to the public. A later evaluation of the Indian Point incident revealed that the NRC did not follow the guidelines of its risk communication plan.

Communication Process Design and Management: The NRC's response was to form a communications team to help Indian Point 2 and PAO staff. The team represented all the major offices (RI, OPA, EDO, NRR). It built a Web site, coordinated Q&As and message mapping, developed graphic presentations, prepared responses to green candidates' arguments, and formulated strategies to deal with local officials.

Unique Aspects of Selected Case: This case underscores risk communication problems arising from the public's lack of understanding of internal safety processes as well as safety language used by the NRC and its licensees, e.g., the conservative measures and processes already in place to ensure safety and the different levels of emergency and types of emergency response required. This case also highlights the challenges of coordinating risk communication efforts by the NRC and its licensees. Con Ed was not prepared and adequately staffed to respond to media inquiries. As a result, it failed to provide updated information and did not returns calls from reporters. Con Ed was perceived as unresponsive. In addition, Con Ed contradicted NRC statements in the press. Furthermore, this case draws attention to the challenge of providing accurate information in a dynamic/in-discovery situation. Communicators have to make the right balance between when to communicate and what to communicate.

Outcome of Communication Process: The NRC was able to establish a communication process four days into the incident. Negative press progressively subsided. Risk communication continues to be an issue for all involved with Indian Point. Since September 11th, community groups have called for the decommissioning of the plant because of the security risks it poses to

the tristate area. Activists claim that, in addition to internal safety issues, Indian Point lacks an adequate emergency preparedness plan in case of a catastrophic event.

Lessons Learned:

- Inform the public about risk levels. Risk communication was unsuccessful because the public focused on evacuation, although evacuation was an unlikely event.
- Understand the stakes. Indian Point was caught in a high-stakes political game where elected officials tended to their constituents and their need for reelection rather than the scientific facts.
- Pay attention to technical communication. Use of simple graphics would have been helpful in understanding tube failure.
- Develop contact with local press. Teach industry to maintain contacts and leads with the press.
- Develop relationships with local officials. Precondition local officials for "less severe" accidents.
- Establish a communications team for significant events. Designate public affairs and technical briefers for such events and their aftermath. Also create a Web site with up-to-date information.
- The NRC needs to answer for itself the following questions: What is its risk communication role in such a case? Should it also review the risk communication practices of its licensees?

Tooth Fairy Project

In the late nineties, Jay Gould of the Radiation and Public Health Project (RPHP) began a nationwide initiative to study the level of radioactive strontium in baby teeth. Gould and RPHP asserted that after Three Mile Island, the cancer rate for children in the area increased at a faster rate than throughout the nation and that the cancer rate in children in San Luis Obispo jumped up after the opening of a nuclear power plant. RPHP claimed that Sr-90 released by nuclear power plants is transmitted to children through their mothers, possibly raising the cancer rate in children. They released findings of their data based on a sample of 86 baby teeth in Miami-Dade, Florida and 500 baby teeth in Long Island, New York. RPHP claimed that teeth from children born in Miami-Dade and other counties of South Florida have the highest concentrations of strontium and that Turkey Point and St. Lucie power plants may be the cause of high childhood cancer rates in south Florida.

Communication Process Design and Management: NRC scientists evaluated the claims leveled by Gould and RPHP. They wrote a rebuttal on the grounds that methodology of the study was inappropriate and led to false results. Then, the NRC held two public meetings in south Florida. Health physicists, state officials, and RPHP representatives as well as an independent and unsolicited scientist spoke at those meetings.

Unique Aspect of Selected Case: This was a proactive effort to respond to misinformation about nuclear risks.

Outcome of Communication Process: After the meetings, local and nationwide media outlets dismissed the findings of RPHP and said that the public did not need to worry about the "tooth fairy" findings.

Lessons Learned:

- Rebuttal of "bogus" science works. Counteract misinformation by reviewing science on which the claims are made.
- Message delivery is effective when a wide spectrum of people is discussing scientific claims. Invite other scientists to comment on the validity of claims.
- State and local regulatory agencies can be allies. Florida's Bureau of Environmental Epidemiology also reviewed cancer rates in south Florida, found some flaws in RPHP study, and reported its findings at the public meetings.

APPENDIX E. BEST PRACTICES INTERVIEWS INSTRUMENT AND INTERVIEWEES

General Questions:

1. Please describe your background in risk communication.

General Questions about Risk Communication:

2. Does your organization have a program that focuses on risk communication? If you are not aware of one, please direct us to someone who would know. *If yes,* please describe:

   - Who are the main audiences (internal and external stakeholders)?
   - How long has the program been in existence?
   - Who has access to risk information?
   - Please give us examples of typical tasks or activities that are part of risk communication program.
   - What, in your opinion, are the most important aspects of a risk communication program?

3. What are good ways to reach the public?
4. What role does risk communication play in your agency?
5. How does risk communication fit within the structure of your organization?
6. Is risk communication integrated, or is it an isolated function?
7. How is the risk communication program implemented?
8. Who implemented the program? Can we talk with them?
9. Did you use any criteria to evaluate or test your guidelines? If so, what?

Risk Communication Training:

10. What training do you provide your organization's staff on effective risk communication? Please describe the training program. *If you do not have a training program*, please go to question 17.

    - How is it distributed?
    - Is training voluntary or mandatory?
    - Have you gotten any feedback on how effective it has been?
    - Who provided feedback?
    - May we have a copy of your training program?

11. Have you evaluated training? If so, how?
12. Is there a difference in the kinds of training given to different levels of management? If so, what are the differences?
13. What recommendations do you have about risk communication training?
14. Who should receive training in risk communication?
15. What is the most important aspect of risk communication to cover in training?
16. How are the concepts reinforced back on the job?

Risk Communication Guidance:

17. Do you provide guidance to your organization's staff on effective risk communication? Please describe guidance. *If you do not have guidance*, please go to question 20.

    - What types of guidance do you have?
    - How is it distributed?
    - Have you received any feedback on how effective it has been?
    - Who provided feedback?
    - May we have a copy of the guidance?

18. What other tools do you provide to staff and managers to assist in the communication of risk information?
19. What recommendation(s) do you have on how to integrate risk communication skills and practices throughout your organization?

Best Practices:

20. Could you share examples of particularly successful activities you've done related to:

    - Risk communication with the general public?
    - Building trust and credibility?
    - Involving stakeholders?
    - Risk communication among staff and decision makers within your organization?

21. Could you share a disastrous activity? How did you overcome the barrier?

Barriers/Problems/Lessons Learned:

22. What are the challenges to implementation of the risk communication program?
23. What were the successes in the implementation of the program?
24. What failures did you experience, if any?
25. What barriers have you faced inside your organization?
26. What barriers have you faced outside your organization?
27. What other lessons learned can you share?

Wrap Up:

28. Whom else would you recommend that we talk to regarding risk communication?
29. Is there a best practice at another organization that you recommend we learn more about? *If yes*, whom can we call at that organization?
30. Could we call you again for a follow-up interview?

Interviewees:

The people who participated in the best practices interviews represented the following organizations:

- Alabama Emergency Management Agency
- Centers for Disease Control
- Creighton & Creighton
- Decision Partners
- Exelon
- Federal Emergency Management Agency
- Fulton Communications
- George Washington University
- JKR Associates
- Maine Yankee
- Maryland Department of Environment
- National Aeronautics and Space Administration
- National Transportation Safety Board
- New Jersey Department of Environmental Protection
- Nuclear Energy Institute
- Pennsylvania Department of Environmental Protection
- University of Colorado
- University of Pittsburgh, Graduate School of Public Health
- U.S. Air Force
- U.S. Army Center for Health Promotion and Preventive Medicine
- U.S. Department of Defense
- U.S. Environmental Protection Agency

Summaries:

The information gathered during the best practices interviews are organized around the following themes:

- organizational dimensions of risk communication,
- stakeholder involvement processes,
- trust and credibility,
- ways to involve the public,
- outreach mechanisms,
- crisis communication,
- risk communication guidance,
- risk communication training,
- evaluation, and
- risk communication among staff and decision makers.

Organizational Dimensions of Risk Communication

Challenges

- Risk communication is about building relationships, maintaining relationships, repairing relationships, and sometimes agreeing to disagree.
- Risk communication issues related to health and environment overlap with many other issues such as fairness, aesthetics, money, compensation, agendas (e.g., social, political, economic, resolution of history).

- Risk communication is grounded in the concepts that the public has power and knowledge. The goal is to get the support and understanding of the public. It is only possible through listening and negotiation.
- Often technical staff see risk communication as a way to talk about a risk number. They need to understand that it is more than just explaining a number. It is also about participation.
- Engineers often have trouble with the idea of involving people early in the process. It seems to be part of their professional training or their nature to have all the answers first before going to talk to others.
- Some of the toughest stakeholders are internal because they resist change. Only when they realize they can't work in a vacuum will they start to do things differently.
- It is difficult to get consensus among scientists.
- Organizations have trouble doing things that are instinctive in our personal lives. If you spill coffee on a table, you say I am sorry. If an organization causes an oil spill, it will not say I am sorry.
- Scientists, engineers, and decision makers often do not understand the need to integrate risk communication into decision making. They believe it is something a separate group does.
- A challenge to the implementation of the risk communication program is convincing senior management that it's important.
- The public is not interested in risk assessment. They are interested in risk management: the measures you are going to take to manage the risk.
- Instituting risk communication into an organization involves a culture change.
- It is important to have enough resources. Communication is resource intensive when you send people out to interact directly with the public.
- You can't afford to have employees with no people skills.

Best Practices

- Risk communication should be part of the agency's mission.
- Get top management involved. Someone has to say that it is important.
- Risk communication should be an integrated function within the organization and not isolated. However, technical staff should have others within the organization with risk communication expertise that they can draw from.
- Consult with outside risk communication experts.
- A key to becoming a good risk communicator is self-awareness and emotional intelligence. Anyone can become a good risk communicator.
- Have performance evaluations based on employees' abilities to execute what they learn in risk communication training.
- Set up a reward system for good risk communication and make sure that upper management gives recognition to good work.
- Infuse the organization with the idea that you can't make decisions that exclude. You need to make decisions that include.
- Risk communication needs to be seen as part of the regular cost of doing business. It has to be part of everyone's day-to-day job to have an impact.
- If you get early adopters and can demonstrate success with following risk communication practices, it helps to shift the whole organization's culture.

Stakeholder Involvement Process

Challenges

- Stakeholders can be anybody who has an interest or a stake in the issue. They can be internal, e.g., employees, or external, e.g., the public at large, other agencies, or the media. They may be involved in either internal or external issues. External issues can include safety, health, environment, fairness, or environmental justice. They may have a stated or an unstated agenda, e.g., politicians taking a stand.
- There has to be a willingness to hear both sides. Sometimes the public does not want to hear the agency's point of view.
- It is difficult to handle a vocal and well-organized opposition.
- Sometimes you have to deal with concerned citizens who are not from the local area.
- Communication and involvement are not one-time events. They need to be ongoing and sustained.
- It is difficult to gain consensus among stakeholders.

Best Practices

- Always deal in a transparent manner. Talk through the process with the community. The public does not always know the process. Right at the onset, be clear about the process you will follow and the expected outcomes of process.
- Communication is the ability to connect with people. There are several key aspects to risk communication. First, have a clear message/information to get across to people. Second, understand the audience.
- Get the public's input early in the process.
- Include all stakeholders.
- Determine and map both the experts' and community's perspectives. Then develop a strategy to bridge the gaps between them.
- Do focus group testing and conduct public opinion research on how best to word messages about security, waste disposal, and other issues.
- Messages need to address public outrage as well as present science and data.
- Consider issues in light of local circumstances. Every situation is different.
- Never put something on the table for public involvement if you have already made a decision.
- Work on building coalitions, and that will help lead to consensus. Gradually, you will move your project forward.
- You can't reach the public as a group. It is too large and ill-defined. You need to engage and build relationships with public opinion leaders (politicians, local environmentalist, newspaper editor, etc.).
- Tapping into existing community networks can be more effective than traditional outreach channels.
- Create an advisory committee that includes people from the affected community, industry representatives, organizations such as the League of Women Voters, etc.

Trust and Credibility

Challenges

- An important aspect of risk communication is building relationships with stakeholders.

- Risk communication in isolation from concrete actions to minimize risk doesn't amount to much. It isn't just a public relations job. If one person says, "There isn't a problem," and another says, "We have a problem, and here's what we'd like to do to fix it," the second person has more credibility.
- Experts within an agency are often resistant to using third-party information. These individuals are known for their technical expertise, so they have trouble accepting that others with less expertise have more credibility.
- Public affairs and public relations people are trained to put "spin" on information. They often want to manipulate the message to be more positive, but they don't realize that they lose credibility as a result.
- If the audience is very vocal on a contentious issue, you need to be careful about how you counter their opinion.
- It is difficult for a big organization to be trustworthy and credible because big organizations tend to change course and priorities before the process is over.
- Gaining trust and credibility requires work.

Best Practices

- Use empathy as a way to build trust.
- Establish credibility by listening to and acknowledging stakeholders' points of view.
- If you deal with classified information, be open and up front if you can't provide certain kinds of information and explain why. Some acceptable reasons for withholding information are national security, proprietary information, and litigation. Be genuine and sincere.
- Be willing to share what you know, what you don't know, and what you're thinking about.
- Use third parties as much as possible to avoid the "trust me" message.
- Have the public review documents before they're released.
- Check your science so you're not embarrassed by a mistake when presenting to the public (and lose credibility).
- Be aware of the difference between voluntary and involuntary and natural vs. manmade risks. Don't mix them up when talking to the public.
- Learn to attack the argument and not the person making the argument. If you don't, you will lose credibility.
- To build trust and credibility, you have to engage your audience: talk to them in terms they can understand. Never lie. If you don't know an answer, say so. These principles work for the general public and policymakers. If you lie, misrepresent an issue, or stretch the truth on the Hill, you will not be given another chance.
- To build trust and credibility, you have to demonstrate that the program is doing its planning together with stakeholders. Tell them what you will do, when you will do it, and then do it. It's not just talking at the stakeholders. It's following through.
- Tell the truth and tell it all the time. You can never overcome getting caught in a lie.
- Adopt a "no surprises" policy. Never surprise your stakeholders.

Ways to Involve the Public

Challenges

- People have great intentions, but they do not follow up on plans. They stay in panic mode, and at the next emergency no one looks at the plan. Panic mode blinds people to the resources they have available.

- It is difficult to put risks into perspectives when probabilities of bad consequences are low.
- Science and data typically are secondary to dealing with emotional concerns.
- The public and agencies go through a lot of anger when they feel a loss of control and respect. The way to handle it is to talk about it. Shutting down the dialogue worsens the situation.

Best Practices

- Identifying audiences is not done through massive surveys and focus groups. It is done by making informal contacts and networking. Ask your stakeholders for leads.
- Be there first, and be objective.
- Do 99% of the work before you go into a public meeting.
- When preparing to meet with stakeholders, anticipate their concerns and questions.
- Prepare for adversarial public reactions based both on scientific and emotional reasoning.
- Spend time predicting issues that will come up in public meetings.
- Be sensitive to cultural differences.
- Public dialogue is better in person that through brochures, e-mails, etc.
- Talk to the public informally. Have informal discussions.
- Listen to how the public talks about an issue when they are relaxed. Pay attention to the specific words they use and their emotions.
- Listen and do not attempt to counter emotion with hard facts.
- When choosing a spokesperson, select someone who knows how to monitor a group, understands group dynamics, is self-aware, is not focused on him/herself, does not take things personally, is not defensive, and knows how not to display negative emotions (anger, disgust, etc.).
- Use dry runs. Everybody hates them, but everyone improves as a result of them.
- Practice answering difficult questions.
- Let stakeholders air their concerns.
- Listen to the public to find out about their concerns.
- Remember that the public's point of view is legitimate whether or not you agree with it.
- When you receive comments, take them back and address them. The next time you meet, explain why some comments were not implemented. Some organizations train the public on how to offer meaningful comments. Be very careful on how you broach this topic with the public so that your are not condescending.
- It is essential to keep local officials in the loop if you are dealing with an issue that impacts a locality. Don't ambush local officials. Let them know about the issue in advance.
- Be accessible: by phone, with materials on hand at meetings, by sending information when asked.
- Avoid NRC lingo when talking with the public.

<u>Outreach Mechanisms</u>

Best Practices

- Use a wide variety of outreach mechanisms. No approach is effective for all stakeholders.
- Ask your stakeholders about the best ways to reach them. Prepackaged solutions will not work.
- To reach your target audience it is good to go through other groups that have direct relationships with the people you want to reach, e.g, first responders, local officials, media.

- Meet one-on-one with opinion leaders to get a broader understanding of the issues.
- Press conferences work well when you need to get information out quickly and uniformly.
- When addressing the media, send someone who speaks in sound bites.
- Meet with editorial boards of local newspapers to share information.
- Use press releases to get your message out.
- Inform opinion leaders about information in a press release before sending it to the media.
- Web sites are outreach tools. Keep your site constantly updated. Make it interactive in the sense that someone can e-mail a question and get an answer.
- Videotape a panel discussion on a topic and make the tape available to the public.
- The nuclear waste primer prepared by the League of Women Voters is a good example of providing technical information clearly and accurately in plain language.
- Set up booths at conferences.
- Have public meetings in an open house format that encourages one-on-one dialogue.
- Get information out in simple terms through the Web site, fact sheets, etc.
- If appropriate for your audience, provide information in Spanish or other languages.
- Give out things like Frisbees, coffee cups, pencils, and minifootballs with hotline numbers in case of an emergency.
- Consider nontraditional outreach channels, such as the local barber shop or church bulletins, based on the audience you are trying to reach.

Crisis Communication

Challenge

- It is difficult to get communities to take steps to reduce the impact of a disaster. You can't demand that people prepare for a disaster.

Best Practices

- When developing state-of-the-art warning systems, there is a public education process that goes hand-in-hand with it to make sure it is actually effective in saving lives. Here are two questions to address:
    - What do you want the public to do when there is a disaster? (Then work backwards from there.)
    - What do you want them to think during the disaster?
- Talk to the press early on and warn them if there is a bumpy road ahead.
- Keep repeating your message using a variety of communication channels.
- Deliver consistent messages constantly.
- Constantly reevaluate your messages and how they are perceived.
- Monitor the "person-on-the-street" interviews conducted by radio and television during a crisis to get a sense of the public's perception of the situation and determine if your message is reaching the public.

Risk Communication Guidance

Best Practices

- Slim handbooks in a Q&A format work well.
- Have a place (such as a Web site) where resources and information can be shared.

- Your handbook has to be written by someone who knows the organization inside and out and can draw on this insider knowledge. The handbook has to be written from the perspective of the organization. It cannot be generic.
- You need to have a way to reinforce that risk communication is important to the organization's success. In the agency's newsletter, have stories about what has worked, the successes, the lessons learned.
- EPA's Community Relations Superfund Handbook emphasizes cultural issues and adopts the philosophy that demands and a specific mind set cannot be imposed on the public.

Risk Communication Training

Challenges

- Senior managers often do not attend training because they can't find the time. Later, they don't understand and support what their staff is doing because they don't understand.
- Staff that receive risk communication training leave the workshop with new ideas, but then they confront managers who do not understand why things have to be done differently
- It is difficult to find time for training.
- Some managers do not understand the merits of training.
- Often those who get training are not the decision maker.
- Training is only meaningful an useful for those who have experienced a problem.
- If the attitude of the person you are trying to train is "we don't need help," having training materials is of no use.
- People have to see the value before they take the training. Otherwise, they won't learn as much.

Best Practices

- Tape mock interviews or other on-camera practice for critique.
- Role-playing and videos are good teaching tools.
- Show videotapes of public meetings and highlight what went right and wrong
- When training higher management, it is more effective to use someone else from higher management (at the same level as the participants or above) to report a success as a result of applying public involvement principles. That will carry more weight than a consultant hired to train and will show the practicality of the information.
- A preferred model for training is to offer a short lecture followed by small-group or individual exercises followed by a discussion period about the exercise.
- Share war stories.
- Topics to include: identifying your audiences, developing simple and concise messages, communicating at a technical level appropriate to the audience, translating public concerns for your internal technical audience, interacting with the media, dealing with different cultures.
- Teach people in the organization that risk communication is not one-way information about explaining risks. It is interactive dialogue and involvement.
- Reinforce the idea that the public is the boss—Staff and managers are familiar with the "boss" role. A big part of risk communication training is to address this new orientation toward the public.

- Remind people that practicing risk communication involves a culture change.
- Help people understand that there are more tools in the toolbox than just town hall meetings.
- Emphasize that risk communication starts at the very beginning of risk management. Train staff in the content area. They need to know well what they are going to be talking about.
- Policy makers and managers should receive risk communication training before staff.
- Anyone at any level involved in communicating should be provided at least minimal training. The information shouldn't be confined to a small group.
- Anyone who interacts with the media needs training.
- To have a high information retention rate, students need to use what they learn in training immediately.
- Reinforce concepts by practicing on the job, with coworkers, and with neighbors.

Evaluation

Challenges

- The risk communication process of identifying stakeholders, establishing messages, etc. is not linear. Situations constantly change and need to be reevaluated so your risk communication activities can be adjusted accordingly.
- To be understood is not the reward. The reward in risk communication is moving toward gaining trust.
- Often you don't hear about programs until they fail. They don't get much attention if they are done correctly.

Best Practices

- Include an evaluation component in risk communication plans that states who will conduct the evaluation and when.
- Go through the evaluative process with the community. Ask them what they still don't like. It is a different way to look at progress.
- When testing an audience don't make them work too hard. Have 2–3 people look at article or materials, and then talk to them about what they learned. Don't ask them to write comments.
- The evaluator should be familiar with risk communication, but it should not be the person implementing the plan.
- Use peer reviewers from the affected community.
- Use surveys to find out if people know what to do in an emergency or to test their knowledge level when preparing messages.
- Have debriefing sessions after a meeting or brown bag lunches following a communication campaign to discuss what went well and what could be done differently in the future.
- To evaluate training, conduct a follow-up evaluation six month after the training session as a way to measure trainees' retention of materials.
- The U.S. Department of Energy uses customer surveys. It sends out questionnaires and conducts phone interviews with its customers—the states, site program managers, and tribes—to evaluate its risk communication efforts related to transportation.
- Alabama's Emergency Assistance Agency (EMA) uses preset criteria and routinely solicits feedback from elected officials. It also monitors "man-on-the-street" media stories to be sure the public understands the information the EMA has distributed.
- The Federal Emergency Management Agency uses large-scale surveys to find out if the public knows how to act in the event of a particular emergency

- The Nuclear Energy Institute uses poll surveys as a barometer for changes in public acceptance of nuclear-related issues. When the poll results are negative, the organization knows to revisit its public information campaign.

Risk Communication Among Staff and Decision Makers

Challenges

- Managers have to recognize that risk communication is not easy. It is a learning process, and there will be mistakes.
- Security people, since 9/11, make it more difficult to release information. For example, it is hard to site a facility if you can't say where the facility might be due to concerns that it would be a target for bombing.
- Staff have to be skilled in addressing risk communication issues with their managers (particularly if their managers have not gone through training).
- The meanings of words vary with different technical disciplines.

Best Practices

- To help their managers consider risk communication ramifications, staff should ask questions such as, "What will happen if . . ." or "How will we be perceived if . . . ." The goal is to get the managers to articulate their concerns.
- Do not let internal bureaucratic fights be visible to the public. The public will sense that there is not a clear dedication from the agency.
- Make sure that staff have a common understanding of technical terms.
- For successful risk communication, there has to be a realistic understanding of risk among NRC employees.
- Employees are part of the community and have a lot of credibility. Internal communication involves training them about how to talk about the agency with other members of the community.
- How staff works with managers (their internal handling of risk communication) will parallel how the agency deals with the public.
- Coordinate communication efforts across divisions so they are delivering the same and not conflicting messages.

APPENDIX F. U.S. CASE STUDIES

1. Stakeholder Involvement and Public Participation at the U.S. EPA: Lessons Learned, Barriers, and Innovative Approaches

EPA Office of Policy, Economics and Innovation, January 2001,
http://www.epa.gov/publicinvolvement/pdf/sipp.pdf

This report is a synthesis and evaluation of U.S. EPA activities in the area of stakeholder involvement and public participation. It is a comprehensive attempt at summarizing lessons learned by the agency in including the public in environmental management decision making. This document is intended to facilitate organizational learning across departments, develop a broad perspective of organizational activities, and retain institutional memory.

Communication Process Design and Management: The goal of the EPA communication process is to involve the public in environmental decision making. Citizens, industry, environmental groups, and academics are groups included in EPA's process. A wide array of tools is used in public involvement: outreach programs, exchange of information, Web sites, opportunity for the public to make recommendations, development of consensus agreements, roundtables, constituency meetings, charrettes, and information gathering.

Unique Aspects of Selected Case: EPA programs are technically complex and difficult. EPA possesses a diverse and large stakeholder population. This document summarizes varied strategies used by the organization to engage its stakeholders.

Outcome of Communication Process: EPA has also created a host of programs to sustain public involvement activities, including Superfund Technical Assistance Grants, Superfund Job Training Initiative, Forum on State and Tribal Toxics Action, Consumer Labeling Initiative, Sector-Based Environmental Protection, Regulatory Negotiation, Watershed Partnerships, Environmental Justice Small Grants Program, Community-Based Environmental Protection, and National Community Involvement Conferences.

Lessons Learned:

- Establish trust—EPA recommends the following actions to establish trust at the community level: meet with community early, respond to community concerns, maintain a presence in the community, work with community on equal footing, share information openly, involve stakeholders in information gathering and decision making, link up with trusted local officials, and keep communication channels open.
- Use credible data and technical assistance in solving conflicts—EPA recommends the use of trustworthy and reliable data, especially in sensitive conflicts, as well as making independent experts available to groups that lack the technical knowledge to fully take part in the decision-making process.
- Recognize the links between environment, economy, and society—EPA advises to be prepared to go beyond the agency's primary mission. To establish trust with a community, an agency needs to understand the cultural, social, and economic impact of policy decisions. EPA recommends taking a holistic view of the community.
- Train agency staff or provide needed expert assistance in stakeholder involvement processes—EPA recommends training the staff in listening and communication, partnering,

process management, negotiation, consensus building, vision building, cross-cutting analysis, and multimedia approaches.

2. **Water-Related Health Risk Communication: Lessons Learned and Emerging Issues**
   R. T. Parkin, M. E. Embrey, and P. R. Hunter, 2002, *Public Health@Risk*, The Center for Risk Science and Public Health Newsletter, 2(1): 3–15, http://www.gwu.edu/~crsph/newsletter/5CRSPH.NEWSLETTER.pdf

This symposium convened researchers and practitioners to focus on water-related health risk communication. The goal of the workshop was to gather insights, identify best practices, and advance the field of water-related health risk communication.

Unique Aspects of Selected Case: Workshop dealt specifically with water-related health risk communication.

Outcome of Communication Process: There is a need for mixed methods in communicating with the public. Agencies should understand the impact of a particular medium on targeted groups. As a rule, the agency should not rely solely on print or Internet-based media but use a combination of methods including interactive events such as fairs and workshops.

Lessons Learned: The objectives of a risk communication strategy are to foster shared understanding among stakeholders, improve responsiveness, and increase credibility of the agency. The following issues need to be addressed in the communication strategies:
- congruence of language and concept among expert and lay persons,
- relevance and significance of risk information,
- role and impact of mass media,
- inherent uncertainty of risk models, and
- incompatible goals between advocacy groups, bureaucrats, and politicians.

Based on participants' experience, the following were presented as lessons learned:
- Communication processes influence communication products and stakeholders' assessments.
- Identify information needs of the public and other stakeholders. This task cannot be left to experts' opinions.
- Use multiple messages to respond to the needs of a diverse audience. One message will not satisfy the information needs of the entire population.
- Assess risk communication efforts.

3. **Stakeholder Participation: Experience from the Consortium for Risk Evaluation with Stakeholder Participation (CRESP) Program**
   Bernard Goldstein, et al., 2002, *Environmental Epidemiology and Toxicology* 2: 103–11.

The Consortium for Risk Evaluation with Stakeholder Participation (CRESP) is a consortium of university research centers that operate under the paradigm that stakeholder involvement is essential in risk management efforts. There are several reasons for such approaches. It "increases the relevance of research to stakeholders concerns, clarifies objectives of research agenda and enhances the public acceptance and understanding of research findings." (p. 104)

Communication Process Design and Management: CRESP programs advocate that community-based research and risk communication be based on the principles of honesty, openness, dedication, and commitment. There are three levels of interactions: informing the community, engaging the community, and setting the research agenda with the community.

Lessons Learned:

- Use a variety of communication methods. Communities are not monolithic. In general, communities are segmented in three groups. Some citizens are interested only in one-way communication in the forms of public announcements and notices. Other citizens would like to receive information but also want to express their values. For this second group, public meetings, workshops, phone lines are necessary methods. Lastly, some citizens want to be informed, express their opinion, and participate in decision making. Diversity in interest levels has to be met with a wide variety of communication methods.
- Build a "lessons learned" component into the risk communication program. Continuous evaluation of the program is necessary to ensure that information needs of population are met.

APPENDIX G. INTERNATIONAL CASE STUDIES

1. **Principles and Practices for Using Scientific Advice in Government Decision Making: International Best Practices**
   Report to the S&T Strategy Directorate, Canada, by W. Smith and J. Halliwell in support of the work of the Council of Science and Technology Advisers, January 1999, http://collection.nlc-bnc.ca/100/200/301/csta-cest/principles_practices_intl/bestprac1_e.pdf

This report presents ways to integrate scientific advice in governmental decision making in light of increasing uncertainty in the management of public health and natural resources. The report outlines the salient issues in dealing with scientific information and offers a collection of case studies based in Europe and New Zealand.

Communication Process Design and Management: The authors argue that risk communication involves openness in decision-making processes and understanding both the science and the choices and trade-offs. Three parties are involved in risk communication: scientists, risk analysts, and the public. The authors warn about assumptions in the merits of communicating. For example, one of the most common assumptions is that public assent increases with knowledge. However, experience suggests that public understanding of the scientific aspects of a case do not necessarily guarantee public acceptance or support of the activity. The authors' approach moves away from risk assessment based solely on technical information to assessment that incorporates social, economic, and political dimensions. The best risk assessment acknowledges multiple sources of knowledge; considers social, ethical, and political values; and incorporate cost-effectiveness. The report suggests that risk communication be integrated into risk management.

Unique Aspects of Selected Case: This report looks at the use of science in public policy in cases outside the United States. Case studies highlight *dos* and *don'ts* and identify weak spots in the ways scientific information is used. Cases include the *E. coli* 0157 outbreak of infection in central Scotland; disposal of the Brent Spar in the United Kingdom; white spotted tussock moth in Auckland, New Zealand; an integrated transport policy in the United Kingdom; and the use of antibiotics in animal feed in the European Union.

Lessons Learned:
- Distinguish scientific advice from value judgments.
- Contentious areas should be identified and publicized as such to maintain openness.
- Set up institutional arrangements that promote openness and coordination. Examples include consensual conferences, ethics committee, and use of Internet and traditional publications for disseminating scientific data and analyses.

2. **Risk: Improving Government's Capability to Handle Risk and Uncertainty**
   The U.K. Prime Minister's Strategy Unit, 2002, http://www.strategy.gov.uk/2002/risk/risk/report/index.html

This report, mandated by Prime Minister Tony Blair in July 2001, assesses risk management and communication in British public agencies and offers research-based recommendations. The Strategy Unit surveyed existing practices and procedures in public and private sectors, held

seminars with risk experts, and interviewed civil servants and internal and external stakeholders. Two premises underlie this report. First, in cases where risks are unknown, poorly understood, or cannot be regulated, the role of government is to provide information so that people can control their exposure to such risks as well as assess governmental actions. Second, broadcast media are important partners in communicating risk with the public.

Communication Process Design and Management: The communication process rests on the principles of openness, transparency, and participation. It is integrated in the risk management process. The following measures are part of the risk communication process:

- Providing open access to research used to inform decision making.
- Organizing risk communication seminars with stakeholders and being open about past challenges and mistakes as well as principles guiding current decision-making process.
- Establishing procedures and tools to gain stakeholders' opinions and advice on risk issues.
- Offering up-to-date and continuing information about ongoing risks.

Unique Aspects of Selected Case: This case looks at governmentwide risk communication practices. As such, the report presents principles and protocols that can be applied in a wide range of situations.

Outcome of Communication Process:

- Laws for fairness and accuracy in reporting.
- Creation of a risk Web site serving as a clearinghouse of information on continuing or event-based risks.
- Creation of best practice database in risk management accessible to civil servants (http://www.benchmarking.gov.uk/site/risksiteinfo.asp).

Lessons Learned:

- Start early in the decision-making process.
- Communicate about risks and listen to concerns of the public. Communication with the public is a two-way process.
- Do not restrict communication to the "usual suspects" to prevent "group think." Involvement with the public needs to be widespread.
- Invest in training in communication and develop the capacities to contact "hard-to-reach" populations and translate complex scientific information to the general public. Risk communication is a "resource-intensive" activity.
- Plan risk communication carefully and strategically to avoid stakeholder "consultation fatigue."
- Develop a "toolkit" with and for broadcast news media for working jointly in times of crises. The toolkit should include factual information as well as a model for joint collaboration during emergencies.
- Organize a media emergency forum.

APPENDIX H

RISK COMMUNICATION FOR GOVERNMENT PRACTITIONERS:
An Annotated Bibliography

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INTRODUCTION

This annotated bibliography contains more than 60 references on the topic of risk communication, with a particular emphasis on those that may assist practitioners. The focus on risk communications programs and applied risk communication issues includes references that bridge the gap between theory and practical application of risk analysis and risk communication programs.

This bibliography is a supplement to an earlier bibliography: *Risk Communication for Government Practitioners: An Annotated Bibliography*, prepared by V. Bier of the University of Wisconsin-Madison's Center for Human Performance in Complex Systems, February 1999. The list of references is not comprehensive but rather an update covering material similar to that in the University of Wisconsin bibliography.

References reviewed, generally published in or since 1998[1], are grouped in six sections:

1. General Risk Communication Literature contains both review articles and discussions of new risk communication techniques that can be applied by field practitioners.
2. Credibility and Trust in Risk Communication is a somewhat larger section in this bibliography than in the predecessor, reflecting the expansion of references on this topic, particularly on how trust is gained and maintained. The issues covered in this section range from citizens' concerns to discussions of governments' and agencies' roles in publicizing information regarding possible risks.
3. Government Risk Communication focuses more specifically on government risk communication, with subsections on risk communication to government decision makers and government risk communication to the public. The articles focus on the importance of integrating technical analysis and public values, as well as questions about probabilistic risk analysis and the public/expert interface.
4. Stakeholder Involvement Processes articles focus on topics such as the importance of rules and negotiations around the role of the stakeholder, the major reasons for the increased use of the stakeholder process, and the importance of greater public involvement in the development of government policy.
5. Technical Communication and Science Education references focus on both the process and the results of communicating technical information. This section contains subsections on the mental models of environmental risks, risk communication programs, evaluation, and terrorism.
6. Risk Communication Guideline Samples is a new category.
7. Reference Web Sites is another new category added to assist in the research process, since an increasing number of reports and information regarding risk communication topics are available electronically.

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[1] Since this bibliography builds on the early effort by the University of Wisconsin, most of the references are from 1998 or later. However, a few earlier works were selected because they were considered relevant but had not been included in the previous bibliography.

References are listed alphabetically by author within each section or subsection.

The research findings for this annotated bibliography were found in a variety of journals covering fields from risk analysis to environmental policy, such as *Risk Analysis*, *Social Science and Medicine*, *Reliability Engineering and System Safety*, and *Public Relations Quarterly*). Articles were searched through the use of Infotrac, various governmental agency Web pages (e.g., EPA and NRC), search engines such as Google, and also in published journals. To be as inclusive as possible, a number of key words, in various combinations, were used for the Internet search: risk analysis, risk communication, risk perception, risk assessment, risk and terrorism, risk and trust, risk and credibility, risk and stakeholder perception, and best practices and risk communication. The annotations were compiled through summarizing references in combination with the authors' abstracts.

1. GENERAL RISK COMMUNICATION LITERATURE

Boholm, A. 1998. Comparative Studies of Risk Perception: A Review of Twenty Years of Research. *Journal of Risk Research*. 1(2): 135–64.
Provides a critical review of a number of cross-national studies of perceptions of risks, which have been conducted in accordance with the psychometric paradigms developed by the Oregon research group in the 1970s. The author offers theoretical and methodological approaches to study risk perception comparatively. Various issues relating to the comparative framework are discussed, such as the distinctions between objectives and perceived risk, the role of communication and the media, the political system, and various societal determinants, such as marginality, gender, and ethnicity. The author notes that comparative theoretical and methodological studies regarding risk perception need to be further refined.

Grabill, J.T., W.M. Simmons. 1999. Toward a Critical Rhetoric of Risk Communication: Producing Citizens and the Role of Technical Communicators. *Technical Communication*. 46(2): 272.
Focuses on arguments in risk communication that the predominant linear risk communication models fail to consider, such as audience and other contextual issues. The authors note that some scholars have argued that failures of these risk communication models have led to a number of ethical and communicative problems. The authors attempt to extend the critique by arguing that "risk" is socially constructed. They further note that the claim for the social construction of risk has significant implications for both risk communication and the roles of technical communicators in risk situations. The implications are then framed as a "critical rhetoric" of risk communication that dissolves the separation of risk assessment from risk communication to locate epistemology within communicative processes, brings power in risk communication to the foreground as a way to frame ethical audience involvement, and argues for the technical communicator as one possessing the research and writing skills necessary for the complex process of constructing and communicating risk.

Johnson, B. 1999. Ethical Issues in Risk Communication: Continuing the Discussion. *Risk Analysis*. 19(3): 335–48.
Proposes a possible framework for classifying multiple types of ethical issues in risk communication research and practice to help continue a discussion initiated in 1990 by Morgan and Lave. Johnson poses some of the questions at each stage of the process for planning risk communication strategies to be discussed (e.g., selecting issues to be communicated, knowing the issue, dealing with the constraints). The conclusion notes, "The ethical and other normative issues of risk communication . . . will never disappear. They are inherent in the enterprise, and no advice . . . will resolve them completely."

Kuhn, K.M., D.V. Budescu. 1996. The Relative Importance of Probabilities, Outcomes, and Vagueness in Hazard Risk Decisions. *Organizational Behavior and Human Decision Processes*. 68(3): 301–18.

Investigates the joint effects of vagueness on both the probability and the outcome dimensions of hazard risk, using both pairwise choice and rating response tasks. The authors present the findings of a study in which 72 subjects evaluated risk stimuli (concerning either environmental or health hazards) that varied in the level of probability of loss, the amount of loss, and the precision with which each dimension was specified. The authors further noted strong evidence of a consistent individual attitude toward vagueness on both risk dimensions and an almost equal number of vagueness-seeking and precision-seeking subjects. The authors found that the choices were consistent with a decision rule based on dimension preference but that attitude toward vagueness significantly predicted choice in cases where a dimension preference rule was not appropriate.

Lion, R., R.M. Meertens, I. Bot. 2002. Priorities in Information Desire about Unknown Risks. *Risk Analysis*. 22(4): 765–75.
Discusses how people perceive risks and how to best communicate about them. The researchers used nine Dutch focus groups to determine what kinds of risk information people desire when confronted with an unknown risk and how those desires for information relate to the main dimensions underlying risk perception. Overall, the researchers found that people desire information with which they can determine the personal relevance of the risks confronting them. The authors note that their findings are similar to appraisal steps described by health behavior models. They further note that the results provide a dynamic picture of the way risk aspects might interact to create a final risk judgment.

Lipkus, I.M., J.G. Hollands. 1999. The Visual Communication of Risk. *Journal of National Cancer Institute Monographs*. 25: 149–63.
Discusses the various uses of graphics as tools for communicating risks. The authors discuss reasons that graphics should be effective aids to communicate risk, point to the effectiveness of the Risk Ladder as a communication tool regarding absolute and relative risks, and also provide evidence suggesting that people understand risk information presented in histograms and pie charts. The authors also review the uses of visuals such as graphical displays in communicating risk. They discuss issues to consider when designing graphs, such as which displays should be applied to different risk communication tasks. Finally, they provide suggestions for future research in this area, such as the application of theoretical models to the visual communication of risk, how to effectively communicate risk uncertainty, and whether the lay person's perception of risk varies by the type of graphical format, and if so, by how much. The authors provide nine suggestions that address these issues.

Mertz, C.K., P. Slovic, I.F. Purchase. 1998. Judgments of Chemical Risks: Comparisons among Senior Managers, Toxicologists, and the Public. *Risk Analysis*. 18(4): 391–404.
Describes the results of a survey to determine attitudes, beliefs, and perceptions regarding risks from chemicals of 19 senior managers for a major chemical company in the United Kingdom. The authors note that similar surveys had previously been conducted with toxicologists and members of the general public in the United States and Canada. The results indicated that, in general, senior managers tended to judge risks to be quite small for most chemicals. In addition,

they had lower risk perceptions than did members of the British Toxicological Society and a comparison group from the Canadian public. The results further showed that the managers held views that were similar to British toxicologists working in industry and government and dissimilar to the views of toxicologists working in academia. The authors note that the observed differences between views of managers, toxicologists, and the public must be recognized and understood to facilitate communication and constructive efforts to manage chemical risks.

Mileti, D.S., L. Peek. 2000. The Social Psychology of Public Response to Warnings of a Nuclear Power Plant Accident. *Journal of Hazardous Materials*. 75(2/3): 181–94.
Reviews the process that must be undertaken by the public in response to warnings of an impending nuclear power plant emergency. The authors define the three basic components of emergency warning systems and summarize the elements of public responses to warnings. Research is also presented that dispels many popular myths regarding the public's response to emergencies, and the conclusion provides an overview of the warning response process.

Sjoberg, L. 2000. Factors in Risk Perception. *Risk Analysis*. 20(1): 1–13.
Discusses several approaches to searching for answers regarding the phenomenon of risk perception. The author notes that technical risk estimates are sometimes a potent factor in accounting for perceived risk but that in many important applications they are not. One example lies in availability, which accounts for a minor portion of risk perception. The author presents the psychometric model as the leading contender in the field but notes that its explanatory value is only around 20 percent of the variance of raw data. He notes, however, that the addition of "unnatural risk" to the psychometric model greatly improves its percentages. To improve the percentage of variance, the author proposes a model that uses attitude, risk sensitivity, and specific fear as explanatory variables. This model seems more promising than previous approaches as it explains 30–40 percent of the variance. This model is also unique in offering a different psychological explanation of risk perception.

Smith, D., J. McCloskey. 1998. Risk Communication and the Social Amplification of Public Sector Risk. *Public Money and Management*. 18(4): 41–51.
Explores the process of risk communication and risk amplification and suggests a number of perspectives on policy development. The authors note that concerns exist within the public sector about the ability of organizations to communicate issues of risk. These concerns include the nature and magnitude of risks, the vulnerability of those who may bear the consequences associated with an event, and the sense of helplessness felt by victim groups. The authors further note that during catastrophic events, the public sector also has responsibilities in dealing with agencies, such as health care and emergency services. Managers in charge of dealing with such risks are growing concerned that risk issues could escalate beyond expected levels; thus, the authors place effective communication of risk and uncertainty as integral parts of public sector activities.

Tanaka, Y. 1998. Psychological Dimensions of Risk Assessment: Risk Perception and Risk Communication. *Progress in Nuclear Energy*. 32(3/4): 243–53.
Discusses how modern science and technology serve for predicting risks and lend themselves to increasing protection for humans. The author notes how perception and communications gaps seem to be sharpening between scientists and the lay public as to what is safe and how safe is safe enough. An attempt is made to illustrate the causes of such perception and communication gaps and present some empirical evidence to understand the psychological foundation of fears in the lay public.

2. CREDIBILITY AND TRUST IN RISK COMMUNICATION

Budd, Jr., J.F. 2000. The Incredible Credibility Dilemma. *Public Relations Quarterly*. Fall: 22–26.
Discusses the components of credibility, how the public perceives it, and how it varies from issue to issue and person to person. Using a national credibility index survey, Budd had 2500 individuals rank the credibility level of as many as 44 different public leaders and public figures, from a Supreme Court justice to a talk show host. Results show that the public is very discerning on how it bestows its confidence in its leaders or in other public figures and that each case is different. The public's judgments are influenced by personal and political views, by age and experience, and by the level of personal involvement in national affairs of the nation. The author concludes that issues must be developed and presented, on their own merits, with varying sources of information deployed judiciously for maximum effectiveness.

Cvetkovich, G., M. Siegrist, R. Murray, S. Tragesser. 2002. New Information and Social Trust: Asymmetry and Perseverance of Attributions about Hazard Managers. *Risk Analysis*. 22(2): 359–67.
Focuses on the asymmetry principle of trust and how it was investigated in two surveys that also investigated the perseverance of trust. The two studies yielded evidence that both type of news (good versus bad) and initial general trust in the nuclear power industry or the food supply industry affect level of trust. Individuals distrusting the industry exhibit less trust following both bad and good news events. One study also found that judged informativeness and judged positiveness of news events are affected by type of news and general trust of the industry. Individuals low in general trust of the nuclear power industry judge both bad news and good news as less positive than did those high in general trust. Those low in general trust also judged bad news as more informative than good news, unlike those high in general trust. The authors suggest that the Salient Value Similarity Model is one way of accounting for the varying psychological processes.

Jungermann, H., H.R. Pfister, K. Fischer. 1996. Credibility, Information Preferences, and Information Interests. *Risk Analysis*. 16(2): 251–61.
Reports the results of the German portion of a study financed by the Commission of the European Communities regarding the credibility of various information sources. Run in five European countries, the study focused on the Seveso Directive of the European Union and its demands that information be provided to the public by companies and authorities regarding facts, risks, and behaviors related to hazardous facilities, particularly chemical facilities. The study found that credibility plays only a minor role with regard to the respondents' information preferences and interests and that they prefer specific types of information from specific information sources. The study further noted that there is a difference between men and women regarding perceptions and evaluations of risks. Women are more concerned than men about technical risks; they evaluate the chemical plants more negatively, favor environmentalists and critical groups more strongly, and show a greater interest in learning about risks.

McBeth, M.K., A.S. Oakes. 1996. Citizen Perceptions of Risks Associated with Moving Radiological Waste. *Risk Analysis*. 16(3): 421–27.
Reviews the existing literature in the area of the perceived risks of citizens concerned about the transportation of radiological waste to temporary or permanent sites and presents new data on the subject from a southern Idaho survey. The new data bring three points to light: (a) age, gender, and knowledge are the key variables predicting opposition to the transportation of such waste; (b) the primary concern among the opposing and unsure public is the planned use of trucks to move the transuranic (TRU) waste, since "transportation puts hazardous materials in relatively close contact with the public"; and (c) respondents have high degrees of trust in officials who make decisions based on technical knowledge, are charged with the safety of transporting TRU waste, and respond to mishaps. The authors note, "These attitudes need to be understood by policymakers and administrators when designing and implementing waste transportation programs."

McComas, K.A., C.W. Trumbo. 2001. Source Credibility in Environmental Health-Risk Controversies: Application of Meyer's Credibility Index. *Risk Analysis*. 21(3): 467–80.
Applies an existing five-item index for measuring source credibility in the context of environmental health-risk controversy. The survey data were gathered from five upstate New York communities facing environmental health-risk issues. An analysis of the case studies and a combined data set showed that the credibility index was consistently reliable across all applications. The credibility index was used to predict risk judgments in a structural equation model. Overall, the analysis demonstrated that the credibility index performed consistently well across the five cases and illuminated important differences in each. The analysis and index could be a useful addition to environmental health and risk communication studies.

Peters, R.G., V.T. Covello, D.B. McCallum. 1997. The Determinants of Trust and Credibility in Environmental Risk Communication: An Empirical Study. *Risk Analysis*. 17(1): 43–54.
Examines a study conducted on trust and credibility as related to environmental risk communications. The study was conducted in two parts. In the first part, six hypotheses regarding the perceptions and determinants of trust and credibility were tested against survey data. The most important hypothesis was that trust and credibility are dependent on three factors: perceptions of knowledge and expertise, perceptions of openness and honesty, and perceptions of concern and care. In the second part, models were constructed with perceptions of trust and credibility as dependent variables. The goal was to examine the data for findings with direct policy implications. One such finding was that defying a negative stereotype is key to improving perceptions of trust and credibility.

Siegrist, M.G., G. Cvetkovich. 2000. Perceptions of Hazards: The Role of Social Trust and Knowledge. *Risk Analysis*. 20(5): 713–19.
Discusses the role of social trust and its correlation to the public's judgments about a hazard's potential risks and benefits. The authors determined that when an individual lacks knowledge about a hazard, social trust of authorities managing the hazard determines perceived risks and benefits. The study was divided into two parts: the role of social trust on individuals who have personal knowledge about a hazard and the role of social trust on individuals who have no personal knowledge about a hazard. For those individuals who have personal knowledge, social trust is unrelated to judged risks and benefits; for those who have no personal knowledge, strong correlations between social trust and judged risks and benefits were observed for hazards. The public relies on social trust in making judgments when personal knowledge about a hazard is lacking.

Siegrist, M., G. Cvetkovich, C. Roth. 2000. Salient Value Similarity, Social Trust, and Risk/Benefit Perception. *Risk Analysis*. 20(3): 353.
Discusses the theory that people trust others who hold similar salient values and that social trust has a positive influence on perceived benefits and a negative impact on perceived risks. Findings are based on the results of a survey of University of Zurich students, which indicated that the proposed causal model explains perception of pesticides, nuclear power, and artificial sweetener. The study also found that when social trust is controlled, the relation between risks and benefits perceived diminish. Results indicate that social trust is a key predictive factor of the perceived risks and benefits of a technology and provide support for the salient values similarity theory of social trust.

Sjoberg, L. 2001. Limits of Knowledge and the Limited Importance of Trust. *Risk Analysis*. 21(1): 189–98.
Discusses how perceived risk and related attitudes have been implicated as major factors in many of the difficult problems that face modern society. Despite the fact that most experts argue that no or very small risks are involved, the public is still concerned. The author notes that the public's lack of trust is the main reason for their concern. The results are presented from studies

of risk perception of the public, experts, and politicians. Politicians and members of the public believe that there are many unknown effects of technology, and such beliefs are strongly related to their perceived risk, whereas experts on nuclear waste seem to believe that little is unknown in their field of expertise.

Thomas, C.W. 1998. Maintaining and Restoring Public Trust in Government Agencies and Their Employees. *Administration and Society*. 30(2): 166–94.
Attempts to advance the understanding of trust in government by addressing a relatively narrow question: How can we create, maintain, or restore public trust in government agencies and their employees? The article reviews several conceptions of trust and lays out a series of hypotheses regarding means for building and maintaining public trust. The author notes that, although the hypotheses have not been empirically tested, they are grounded in well-established social science theories and suggests several avenues for future research. The author further notes that government agencies can build and maintain the public's trust in a variety of ways extrapolated from social interactions: the avoidance of lying, misuse of power, incompetence and complacency, and the establishment of organizational stability and internal monitoring and accountability procedures. Although political exchanges differ from social ones, Thomas adds that these methods can provide useful general guidelines.

3. GOVERNMENT RISK COMMUNICATION

3.1 Risk Communication to Government Decision Makers

Arvai, J.L., R. Gregory, T.L. McDaniels. 2001. Testing a Structured Decision Approach: Value-Focused Thinking for Deliberative Risk Communication. *Risk Analysis*. 21(6): 1065–77.
Describes a test of a strategy to improve the quality of public input by combining themes from risk communication with the prescriptive decision process of value-focused thinking. The authors provide the results of a study that was conducted to test the validity of two hypotheses. The first hypothesis centers on the theory that participating in a structured, value-focused risk communication approach leads people to make more-thoughtful, better-informed, and hence higher-quality decisions by helping them consider and discuss a wider array of decision-relevant issues and address key value trade-offs. The second hypothesis centers on the theory that utilizing a value-focused decision structure makes participants feel more comfortable with their decisions, more satisfied that their selected alternative reflects their key concerns, and more satisfied with their decisions in the end. The study consisted of six groups of 7–10 people who participated in conventional "alternative-focused" risk communication workshops and eight groups that participated in similar "value-focused" workshops. All workshops dealt with the management of risks to riverine salmon habitat from hydroelectric electricity generation. The results supported the hypotheses: the value-focused decision structure leads to more-thoughtful and better-informed risk management decisions.

Barnes, P. 2001. Regulating Safety in an Unsafe World (Risk Reduction for and with Communities). *Journal of Hazardous Materials*. 86(1): 25–38.
Discusses how fire services are beginning to seek closer links with communities by defining clear regulatory frameworks for conventional safety assessments and conceptual frameworks that allow a redefinition of their role towards establishing partnerships with communities to promote sustained safety. The roles of safety regulators and the public are discussed, as is how contrasting their views are regarding risk perception and the estimates that institutions place on risks and harm. The author notes that the distrust between the two groups is primarily due to the lack of public involvement in decision making regarding safety issues and differences in professional training.

Bier, V.M. 1999. Challenges to the Acceptance of Probabilistic Risk Analysis. *Risk Analysis*. 19(4): 703–10.
Discusses some of the key challenges to the acceptance and application of probabilistic risk analysis (PRA), including (a) the extensive reliance on subjective judgment in PRA, requiring the development of guidance for the use of PRA in risk-informed regulation, and possibly the development of "robust" or "reference" prior distributions to minimize the reliance on judgment and (b) the treatment of human performance in PRA, including not only human error *per se* but also management and organizational factors more broadly. The author notes that all of these areas are seen as presenting interesting research challenges at the interface between engineering and other disciplines.

Bohnenblust, H., P. Slovic. 1998. Integrating Technical Analysis and Public Values in Risk-Based Decision Making. *Reliability Engineering and System Safety*. 59(1): 151–60.
Describes a policy framework that incorporates both technical analysis and aspects of public values. The framework can be used as a decision-supporting tool and helps government decision makers to make more informed and transparent decisions about safety issues. Simple technical analysis cannot capture the complex scope of preferences or values of society and individuals. However, the authors note that decision making needs to be sustained by formal analysis.

De Marchi, B., J.R. Ravetz. 1999. Risk Management and Governance: A Post-Normal Science Approach. *Futures*. 31(7): 743–58.
Discusses the problems of risks and governance by providing three examples: the "Seveso" accident involving dioxin, the bovine spongiform encephalopathy ("mad cow disease") epidemic, and the licensing of genetically modified maize. The authors note how the erosions of trust in established institutions could lead to serious declines or paralysis of innovations and also of government, due to both the history of manmade hazards and the unpredictability of untested toxic chemicals.

Koehler, J.J. 1993. The Influence of Prior Beliefs on Scientific Judgments of Evidence Quality. *Organizational Behavior and Human Decision Processes*. 56(1): 28–55.
Focuses on the influence of scientists' prior beliefs on their judgments of evidence quality. Studies conducted on a group of graduate students in the sciences and a group of practicing

scientists on opposite sides of a controversial issue revealed agreement effects. Research reports that agree with scientists' prior beliefs are judged to be of higher quality than those that disagree. In the first study, a prior belief strength × agreement interaction was found, indicating that the agreement effect is larger among scientists who hold strong prior beliefs. In both studies, the agreement effect was larger for general, evaluative judgments (e.g., relevance, methodological quality, results clarity) than for more specific, analytical judgments (e.g., adequacy of randomization procedures). A Bayesian analysis indicated that the pattern of agreement effects found in these studies may be normatively defensible, although arguments against implementing a Bayesian approach to scientific judgment are also indicated.

O'Connor, M., S. van den Hove. 2001. Prospects for Public Participation on Nuclear Risks and Policy Options: Innovations in Governance Practices for Sustainable Development in the European Union. *Journal of Hazardous Materials*. 86(1): 77–100.
Outlines the potential of participative governance and risk management in application to technological choices in the nuclear sector within the European Union (EU). The authors list several of the key nuclear issues facing EU member states, such as public concern with large-scale environmental and health issues; the Chernobyl accident (and others less catastrophic) whose effect has been to erode public confidence and trust in the nuclear sector; the maturity of the nuclear plant, hence the emerging prominence of waste transportation, reprocessing, and disposal issues as part of historical liability within the EU; and the nuclear energy heritage of central and eastern European candidate countries to EU accession. The importance and usefulness of public participation, stakeholder consultation, and deliberation procedures are discussed as ways to enhance and improve the policy process regarding the risk management challenges that the EU member states currently face.

Sohn, K.Y., J.W. Yang, C.S. Kang. 2001. Assimilation of Public Opinions in Nuclear Decision-Making Using Risk Perception. *Annals of Nuclear Energy*. 28(6): 553–64.
Proposes a method of assimilating public opinions in the decision-making process intended to resolve the major shortcomings of existing models, which are deficient in or missing public participation. The authors note the public's concern regarding nuclear safety, which is numerically characterized by risk. To help quantify those risks, the authors introduce the psychometric model. The first step of the psychometric model is the assessment of psychological risk dimensions by using factor analysis and a set of identified factors for optimized computation. The next step is combining the opinions of the public with those of a selected group of professionals, whose opinions were gathered from separate polls conducted for this study. The methods used for testing consisted of the analytic hierarchy process, the multiattribute utility analysis, and—for uncertainty analysis—a fuzzy set-based approach. Results show that public perceptions are an important element in nuclear-related decision-making processes.

Thompson, K.M., D.L. Bloom. 2000. Communication of Risk Assessment Information to Risk Managers. *Journal of Risk Research*. 3(4): 333–52.
Discusses the results of a two-phase study of risk communication between risk assessors and risk managers (including policy makers). The first phase consisted of telephone interviews with 30 air

quality risk managers from all levels (18 from local, state, and regional offices and 12 from national offices). The second phase involved a focus group with 11 senior EPA risk managers representing a broad range of national offices and programs. The focus group, which lasted for two hours, was meant to elicit responses from the risk managers to specific examples of videotaped risk information created by agency risk assessors. The risk managers indicated their interests in hearing both qualitative and quantitative information about risk and also emphasized the importance of discussing other information about the decision context. A similar test was conducted involving a class of students from the Harvard School of Public Health, in which similar responses were given to the videotapes. The authors note that the results from this study suggest that, to better inform risk managers, risk assessors must also appreciate and present the broader context of the decision and convey how uncertainties and weaknesses in the assessment may influence stakeholder perceptions of risk and the effectiveness of different risk management options.

3.2 Government Risk Communication to the Public

Davies, M.F. 1997. Belief Persistence after Evidential Discrediting: The Impact of Generated versus Provided Explanations on the Likelihood of Discredited Outcomes. *Journal of Experimental Social Psychology*. 33(6): 561–78.
Belief persistence after evidential discrediting is examined as a function of generated versus provided explanations. The author provides the results of three experiment groups. Experiment 1 consisted of subjects who generated explanations for event outcomes. Experiment 2 examined belief persistence using high-quality provided explanations. Experiment 3 replicated the findings using hypothetical outcomes. Results show that fewer contrary reasons are produced after generating explanations than after reading provided explanations for both hypothetical and discredited outcomes.

McComas, A., C.W. Scherer. 1999. Providing Balanced Risk Information in Surveys Used as Citizen Participation Mechanisms. *Society and Natural Resources*. 12(2): 107–20.
Discusses the fact that, although surveys provide a good method of obtaining a representative sample of opinions, one drawback to using them as mechanisms for citizen participation in environmental policy making is that citizens who respond may be unfamiliar with the issues. This study investigates whether providing balanced information in the survey impacts responses to a series of questions on waste management. The authors randomly selected residents in five New York counties to receive one of two survey versions, one containing information sidebars adjacent to a series of questions on waste management. While respondent groups gave similar answers to demographic, behavior, and media usage questions, they responded quite differently to questions about waste management. Recipients of the information sidebars were more certain of their opinions and generally more positive toward the waste management options. The results suggest that providing balanced information in citizen surveys can sometimes lead to more deliberative responses.

Meara, Jill. 2002. Getting the message across: is communicating risk to the public worth it? Journal of Radiological Protection. 22(2002): 79–85.

This article describes obstacles to presenting risk alternatives to the public. The author emphasizes that one must build public trust and confidence by being open. One must also learn what people know and what they need to know, and then develop and test appropriate messages. Risk communicators should not be overly concerned with the public's level of education, perceived values and fear factors. The author also suggests that it is important to set a risk in the context of the benefits of undertaking it, then the alternative. The article summarizes that communicating risk and uncertainty is worth it and provides suggestions for how to improve communication with the public about risk.

O'Connor, R.E., R.J. Bord, A. Fisher. 1998. Rating Threat Mitigators: Faith in Experts, Governments, and Individuals Themselves to Create a Safer World. *Risk Analysis*. 18(5): 547–56.

Explores public judgments about the threat-reducing potential of experts, individual behavior, and government spending. The data are responses of a national sample of 1225 to mail surveys that included measures of several dimensions of public judgments about violent crime, automobile accidents, hazardous chemical waste, air pollution, water pollution, global warming, AIDS, heart disease, and cancer. The findings from the surveys expressed a seemingly similar train of beliefs on the issues. The authors found that the respondents held little faith in experts' ability to curb violent crime and automobile accidents; they showed moderate faith in the experts' ability to deal with global warming, and they had high expectations that the experts would eventually find solutions for the remaining threats. Rather than relying on the experts, the respondents believed that individual behavior would be most effective in dealing with violent crime, AIDS, heart disease, and automobile accidents. Regarding government spending on the issues, the respondents placed AIDS first, followed by heart disease and cancer, with violent crime, automobile accidents, and global warming at the bottom. The authors believe that the relative lack of sharp demographic cleavages and the generally moderate opinions indicate a good opportunity for public education and risk communication.

Petts, J. 1997. The Public-Expert Interface in Local Waste Management Decisions: Expertise, Credibility and Process. *Public Understanding of Science*. 6(4): 359–82.
Discusses how decision-making strategies that favor the top-down model do not recognize expertise as a communication and learning process and have been seen to fail in many risk management contexts, in particular in local waste management decision making. The author examines a novel public involvement program in the development of a local waste strategy to provide an opportunity to understand expertise as a process. Particularly noted are how expert knowledge is selected at the technical/democratic interface, how information is shaped and balanced, and whether knowledge shifts during processes of exposure to expertise. This research provides evidence that counters expert views that the public are irrational, uninterested, and concerned only about zero-risk options. It also provides evidence that expertise is linked to its source and that perceptions that expertise is not independent have a significant impact on public responses. The author also discusses means to optimize the process of expertise.

Stakeholder Involvement and Public Participation at the EPA. Lessons Learned, Barriers, and Innovative Approaches. 2001. www.epa.gov/opei/pubsinfo.htm
Focuses on EPA efforts to involve the public by reviewing formal evaluations and informal summaries from across the agency that identify, describe, and/or evaluate agency stakeholder involvement and public participation activities. The review identifies key cross-cutting lessons learned, pinpoints unique barriers and ways to overcome them, and highlights innovative approaches to stakeholder involvement and public participation. Results suggest that EPA has worked hard to involve the public; however, it is not clear how effective the initiatives have been. The lack of evidence suggests a need to develop standard evaluation criteria and performance measures that evaluators can draw upon.

Wright, J.W. A Structured Approach to Risk Communications between Government and Public Stakeholders. Canadian Standards Association's Risk Management Technical Committee. A report from the Society for Risk Analysis 2000 Annual Meeting. http://www.riskworld.com/200/SRAam00/ab0ac395.htm
Focuses on the growing acceptance of the need for greater public involvement in the development of government policy, particularly those policies related to risk, and a growing recognition of the need to improve communications between decision makers and public stakeholders regarding risk issues. The report describes the objectives for risk communication throughout the risk management decision process and offers methods for implementing effective communications and consultations with public stakeholders.

Ziemer, P.L. 1997. Radiation Protection Information: Can You Trust the Government's Risks or Risk the Government's Trust? *Health Physics*. 77(1): 9–15.
Discusses the fact that the public's trust in agencies such as the Atomic Energy Commission and the Department of Energy has drastically declined over the years as it relates to the hazards and effects of radiation. The author points to the use of negative images, pictures, and symbols produced by the mass media, as reasons for the decline. The author notes that evidence suggests that the public's perception of radiation risks is due more to agency mistrust and negative images than it is to actual technical information that is presented by experts in the field of radiation. Further evidence suggests that attempts to regain the public's trust have been largely unsuccessful. The author suggests that, to regain success in this arena, experts should focus their efforts on educating the next generation of citizens (elementary/secondary schools) regarding the true risks and hazards of radiation.

4. STAKEHOLDER INVOLVEMENT PROCESSES

Elsasser, P. 2002. Rules for Participation and Negotiation and Their Possible Influence on the Content of a National Forest Program. *Forest Policy and Economics*. 4(4): 291–300.
Focuses on the importance of rules for participation and negotiation regarding the role of stakeholders in National Forest Programs (NFPs). The author notes that, when rules for participation and negotiation are absent, unclear, or unsuitable, substantive stakeholder involvement may be impeded. Regarding stakeholder participation, the author further discusses how NFP results may be influenced by the selection of participants; their self-organizations; their possible involvement in hierarchies, coordination and decision rules within NFP discussion groups; and the interrelation of these issues with participants' bargaining power. The article further discusses how negotiations can be organized to surmount the obstacles to achieving a substantive participatory NFP.

EPA Public Participation Policy Review Workgroup. 2000. Engaging the American People: A Review of EPA's Public Participation Policy and Regulations with Recommendations for Action. http://www.epa.gov/opei/pubsinfo.htm
This product of a cross-program EPA work group creates a framework for a strategic plan for public participation. The work group evaluated existing public participation policies and provided recommendations. During its review of EPA's former public participation policies, the work group reached five conclusions: (a) The 1981 public participation policy was still valid but did not incorporate new statutes or public participation innovations. (b) The 1981 policy had not been adequately publicized internally or externally, and EPA and its coregulators had not consistently implemented them. (c) New participation techniques and information technologies provide the agency with opportunities to involve the public and challenges to reach both those who have and those who lack Internet access. (d) Few centralized tools or resources are available to aid EPA staff and agency partners in engaging the public. (e) Streamlining decision making should not preclude meaningful public participation. Based on these conclusions, the work group

established a set of recommendations to address the issues on a short-term (3–12 month) and a long-term (1–3 year) range.

Executive Summary of AIHC Stakeholder Report. 1998. Using Stakeholder Processes in Environmental Desionmaking. An Evaluation of Lessons Learned, Key Issues, and Future Challenges.
http://www.riskworld.com/Nreports/1998/STAKEHOLD/HTML/nr98aa03.htm
Examines the major reasons for the increased use of stakeholder processes, identifies some of the key issues and challenges associated with managing them, and analyzes factors shaping the future use of stakeholder involvement. The report is divided into ten chapters ranging from matching stakeholder processes to problems to the future of stakeholder processes and how they relate to environmental decision making.

Wakefield, S., S.J. Elliot. 2000. Environmental Risk Perception and Well-Being: Effects of the Landfill Siting Process in Two Southern Ontario Communities. *Social Science and Medicine*. 50: 1139–54.
Focuses on the results of a case study of the impact of two proposed landfill sites on an Ontario, Canada community. The research suggested that the well-being of individuals and communities was impacted as much by the decision-making process as by the outcome itself. The authors conducted qualitative interviews across a variety of stakeholder groups, which were then used to address the nature of concerns experienced by individuals faced with a local landfill site proposal, to explore the effects of the siting process on individuals and communities, and to examine the coping strategies employed by individuals in response to impacts experienced. The researchers found that the experience of psychological impacts and effectiveness of coping strategies was shaped by certain factors associated with the site and siting process. The authors noted that the findings have implications for environmental decision making, suggesting a need to locate a balance point between community involvement and an expedient decision-making process within variable community contexts.

5. TECHNICAL COMMUNICATION AND SCIENCE EDUCATION

Adelsward, V., L. Sachs. 1996. The Meaning of 6.8: Numeracy and Normality in Health Information Talks. *Social Science Medicine*. 43(8):1179–87.
Addresses what is known about how people involved in mathematical tests understand them and how the results are used in the construction of ideas about risk and normalcy. The authors draw on an empirical study of the use of numbers as metaphors in talks between a nurse and her potential patients in a directed health survey. They note the ambiguities of risk that stem from translation from epidemiological findings, to clinical practice, and then to lay experiences of health and illness. The authors then pose the question "How are risks expressed statistically, or otherwise mathematically, to be interpreted and communicated within the discourse of medico-science, and how within the discourse of an individual's everyday life?" To answer this question, they address the importance of testing and test results as tools in risk discourse and preventive

practices. They further note that test results, when presented in mathematical terms as numbers or points on a scale, are fundamental to preventive practice.

Alsop, S. 1999. Understanding Understanding: A Model for the Public Learning of Radioactivity. *Public Understanding of Science*. 8(4): 267–85.
Documents a study of how particular members of the public learn about radiation and radioactivity and proposes a model to describe their learning called the informal conceptual change model (ICCM). The author describes ICCM as a multidimensional framework that incorporates three theoretical dimensions: the cognitive, conative, and affective. The paper describes each of the dimensions and then draws upon case study data to illustrate the model. The focus of the study was how the members of the public living in an area with high levels of background radiation learn about the science of the potential health threat. In the conclusion, the author examines the need for a greater awareness of the complexities of informal learning.

Blake, E.R. 1995. Understanding Outrage: How Scientists Can Help Bridge the Risk Perception Gap. *Environmental Health Perspectives*. 103(6): 123–25.
Describes a widely used approach to understanding how the views of scientists and the public differ and gives an example of how the gap between these views can be bridged. The author notes that the popular press often portrays environmental health risks as scarier than most scientists would portray them. The press tends to present these risks from the general public's perspective. Because the media's presentation of environmental health issues is key in establishing the terms of public discourse, such an approach can further dialogue in the policy-making process. The mission of the media is to help define a research agenda for protecting the communities from environmental health hazards. The author notes that, because this agenda will ultimately be some combination of the ideas put forward by scientists, public health officials, and the public, the role of the media is critical in this policy-development process.

Dusenbury, R., M.G. Fennema. 1996. Linguistic-Numeric Presentation Mode Effects on Risky Option Preferences. *Organizational Behavior and Human Decision Processes*. 68(2): 109–23.
Examines preferences between lotteries with chances presented either numerically or linguistically. Presentation mode is predicted to affect preferences due to the perception of linguistic chance as skewed distributions of risk. Based on weighting functions incorporating risk/uncertainty aversion from ambiguity theory and cumulative prospect theory, the authors predicted that presentation mode effects on risky choices would be detectable in very small risks and in large risks. In two experiments, subjects chose between both gain and loss lotteries with constant payoffs and equivalent numeric and linguistic chances. The results showed that presentation mode affected choices when chances were above 50 percent. Lotteries with numeric chances were more frequently preferred in gains, while lotteries with linguistic chances were more often preferred in losses. The effect of presentation mode for low-chance lotteries (5 percent and less) also affected choices such that numeric choices were generally preferred more frequently in losses and linguistically expressed choices were generally preferred more often in gains. The authors conclude that the results suggest that theories of the effects of second-order

uncertainty on risky choice may be used to model decisions involving linguistic risk and that the study of the perception of linguistic risk assessments can provide insight into the cognitive processing behind the weighting functions proposed to depict decision under risk uncertainty. The authors further note that the results have practical implications since information providers can affect decision makers' choices by controlling presentation mode in such a way that it can alter the relative attractiveness of uncertain events.

Finkel, A.M. 1995. Toward Less Misleading Comparisons of Unclear Risks: The Example of Aflatoxin and Alar. *Environmental Health Perspectives*. 103(4): 376–85.
Looks at comparative risk assessment (CRA) and how previous attempts at CRA have yielded uncertain calculations in accommodating the qualitative differences among risks. The author attempts to show that the fact that environmental and health risks differ in unknown quantitative respects is at least as important a caution to CRA as the fact that risks differ in known qualitative ways. To prove how misleading CRA can be when uncertainty is ignored, Finkel revisits the claim that Aflatoxin contamination of peanut butter was "18 times worse" than Alar contamination of apple juice. By using the Monte Carlo simulation, the author showed that the best estimates of the relative risk of Aflatoxin to Alar are much closer to 1:1 than to 18:1. The implications of these findings for risk communication and individual and societal decision making are discussed, with an eye on improving the practice of CRA while also acknowledging that its outputs are uncertain.

Fox, C.R., J.R. Irwin. 1998. The Role of Context in the Communication of Uncertain Beliefs. *Basic and Applied Social Psychology*. 20(1): 57–71.
Discusses some of the many factors—social, informational, and motivational—that influence what is expressed by speakers and what is understood by listeners regarding the communication of uncertainty. The authors examine six sources of information on which listeners rely: (a) the listener's prior beliefs and assumptions about the world, (b) the listener's interpretation of the social and informational context in which the speaker's beliefs were formed, (c) the listener's evaluation of the speaker's credibility and judgmental tendencies, (d) the listener's interpretation of the social and motivational context in which the statement was made, (e) the listener's understanding of information conveyed directly and indirectly by the speaker, and (f) the listener's interpretation of the social and discourse context in which the statement was embedded. The authors cite other research from decision making and social psychology, as well as examples from the risk communication literature.

Siegrist, M., G. Cvetkovich. 2001. Better Negative than Positive? Evidence of a Bias for Negative Information about Possible Health Dangers. *Risk Analysis*. 21(1): 199–206.
Measures whether the results of a scientific study influence confidence in the study's validity and the magnitude of change in the resulting perceived danger of the health risk investigated. The study consisted of three investigations, which reported that scientific results that confirm a danger (negative results) affect confidence in a study's validity and resulting risk assessments differently than do results indicating low risk (positive results). The authors conclude that the observed asymmetry between positive and negative research results might be one reason that people are afraid of many of the hazards they are faced with in modern society.

5.1 Mental Models of Environmental Risks

Gregory, R., T.A. Satterfield. 2002. Beyond Perception: The Experience of Risk and Stigma in Community Contexts. *Risk Analysis*. 22(2): 347–57.
Discusses concerns regarding stigmatization and its importance as an influence on the development of risk management and communication policies for a wide range of technologies and products, such as those associated with hazardous waste storage, nuclear power, and genetic engineering of plants or foods. The authors assert that, although much attention has been placed on the adverse economic effects of stigma, the social, psychological, and cultural impacts are sometimes at least as significant and should merit more attention from policy makers and researchers. They base their argument on the findings of recent studies of resource-based communities, whose residents may be shunned by local and nonlocal publics and whose products may suffer a loss of markets, creating social and economic hardships for the community. The authors then examine the various aspects of stigma and link descriptions of the problem and prescriptions of recommended policies to five underlying characteristics of stigma, focusing on the possible insights and contributions from trade-off analysis and narrative approaches.

Nakayachi, K. 1998. How Do People Evaluate Risk Reduction When They Are Told Zero Risk Is Impossible? *Risk Analysis*. 18(3): 235–42.
This article focuses on the results of two Japanese studies that examined how people evaluate risk reduction when they believe zero risk is impossible to achieve. The measures collected included willingness to pay for risk reduction and degree of trust in the risk management agency. The findings showed that participants were more willing to pay a higher amount for the same reduction in risk in the "zero risk possible" than the "zero risk impossible" condition but that people's trust in the risk management agency did not differ between the two conditions. The results suggest that it may be viable for agencies to accurately communicate the unattainability of zero risk without suffering a loss in public faith or trust.

5.2 Risk Communication Programs

Davis, S.C., A.D. Gilman. 2002. Communications Coordination. *Risk Management*. August: 38-42.
Discusses the proper steps to be taken and certain rules to be followed to develop an effective crisis communication program. In particular, the author notes three stages of crisis communications: before, during, and after a crisis, with each stage having a particular protocol to be followed, including public relations and media *dos* and *don'ts*. The author concludes by noting, "Communication allows those who are affected to know what is happening and that it is being managed effectively."

Ng, K.L., D.M. Hamby. 1997. Fundamentals for Establishing a Risk Communication Program. *Health Physics Society*. 73(3): 473–82.
Discusses an outline for understanding and designing an effective risk communication organizational plan that could be used by a variety of federal, state, or private agencies. The suggestions, a mixture of various techniques derived from literature and the authors' insights, provide a template for formulating and conveying risk messages. The paper first outlines the fundamentals of risk communication, including definitions, informing vs. influencing, the importance of public participation in risk management, and the building of trust and credibility. The authors then discuss their 13-step method to developing a risk communication program, which is based on the premise that the risk communication program should be dynamic and flexible and involve interaction with the public.

5.3 Evaluation

Carnes, S.A., M. Schweitzer, E.B. Peelle, A.K. Wolfe, J.F. Munro. 1998. Measuring the Success of Public Participation on Environmental Restoration and Waste Management Activities in the U.S. Department of Energy. *Technology in Society*. 20(4): 385–407.
Looks at how the implementation of public participation in its decision making can greatly enhance the Office of Environmental Management (EM) in the Department of Energy (DOE) by helping to define problems, to identify and evaluate decision alternatives, and to develop mission. The primary hurdle to overcome before such public participation can be implemented is convincing decision makers that such an activity will be a sensible and worthwhile investment. The article summarizes research conducted to expand those savings and improvements and facilitate other improvements by developing a set of performance-based indicators, based on discrete attributes of successful public involvement, for use in evaluating public participation programs and activities in EM, with special emphasis on activities implemented in DOE field offices.

Chess, C. 2000. Evaluating Environmental Public Participation: Methodological Questions. *Journal of Environmental Planning and Management*. 43(6): 769–85.
Discusses some of the basic issues raised by evaluators of social programs (e.g., unemployment and housing, etc.) that have served as methodological proving grounds for evaluation to encourage further thinking about the evaluation of environmental public participation programs.

The author notes an increasing effort by environmental agencies to engage in public policy activities. Despite this trend, the lack of a proper evaluation program has made steps towards improvement more difficult. The author poses questions such as why evaluate, what should be evaluated and how, and what is the role of the evaluator. Examples of different methods are provided to assist in answering those questions, as well as some recommendations, such as increasing evaluation aimed at making midcourse corrections, which includes involving participants in evaluation and assessing a variety of participatory goals.

Fisher, A., Y. Chen. 1996. Customer Perceptions of Agency Risk Communication. *Risk Analysis*. 16(2): 177–84.
Discusses the findings of a commissioned baseline study of how United States Department of Agriculture's Animal and Plant Health Inspection Services customers viewed its risk information. The article notes that, although the agency in question has traditionally been responsible for ensuring the plant and animal health of exported and imported products, the responses emphasized emerging customer concerns about the environment and human health. Many of its customers responded that risk communication is important but that the agency was not very effective in communicating potential risks. The customers further reported that they were moderately satisfied with the communication they received, although they had little contact or interaction with the agency. This study provides a baseline for measuring change in the agency's risk communication effectiveness and can be used as a model for other organizations that are planning to evaluate their own risk communication effectiveness.

Grunig, J.E., L.A. Grunig. 2001. Guidelines for Formative and Evaluative Research in Public Affairs. A report for the Department of Energy Office of Science. www.instituteforpr.com.
Provides a narrative description of what the best public affairs programs within and beyond the Department of Energy are doing to formulate and assess their operations. The authors also focus on appropriate procedures for formative and evaluative research rather than suggesting specific outcomes, organizing the paper along the levels suggested by theoretical literature in the field: program, function, organization, and society. The authors concentrate on three publics or stakeholder groups that emerged during a 2000 workshop on public affairs metrics for energy research. The suggestions provided emphasize the importance of employee communication, community relations, and media relations, while also advising that public affairs personnel must go beyond media placement as a method of measuring their effectiveness. The authors acknowledge that what works at one site may not be effective in another. Instead, they endorse standards that are helpful for all public affairs people concerned with doing their jobs better. They also emphasize the importance of the peer review process, as it helps laboratory directors and other top-level decision makers understand the potential and the limitations of public affairs practice.

Rogers, P.J., G. Hough. 1995. Improving the Effectiveness of Evaluations: Making the Link to Organizational Theory. *Evaluation and Program Planning*. 18(4): 321–32.

Explores the implications for evaluation practice of using five different perspectives on organizations, drawn from the four models of social program implementation developed by R.F. Elmore (1978). The paper illustrates how many popular approaches to evaluation—including utilization-focused, performance indicators, and fourth-generation evaluation—and key approaches to meta-evaluation assume that organizations operate exclusively in a particular way. It also argues that evaluation will really be effective only when its focus, methods, and management reflect realistic assumptions about how organizations work.

Tinker, T.L., C.M. Collins, H.S. King, M.D. Hoover. 2000. Assessing Risk Communication Effectiveness: Perspectives of Agency Practitioners. *Journal of Hazard Material.* 73(2): 117–27.
Describes a study conducted by the Agency for Toxic Substances and Disease Registry, a U.S. public health agency, to evaluate its risk communication process, specifically the roles and responsibilities, planning, implementation, and coordination of activities in response to illegal indoor spraying of methyl parathion, a hazardous pesticide, in Pascagoula, Mississippi. Interviews of staff members involved in the program were conducted and to find its strengths and the areas in need of improvement. The areas in need of improvement included (a) developing a clear strategy for planning and conducting communication activities; (b) determining staff roles and responsibilities for coordination; (c) and developing clear and consistent health messages, a dissemination strategy, and training in the delivery and evaluation of messages, effects, and outcomes.

Weinstein, N.D. 1999. What Does It Mean to Understand a Risk? Evaluating Risk Comprehension. *Journal of National Cancer Institute Monographs.* 25: 15–20.
Looks at risk communication and how it is frequently intended to help people understand hazards they face with the hope that understanding will help them make better decisions about the need for action or help them choose among alternative actions. The author first expresses the need to define "understanding" before any successful communications effort can be mounted. Once that is achieved, the author points to three essential issues that need to be addressed before people can make quality decisions regarding personal risks: information about the nature and likelihood of potential ill effects, about the risk factors that modify one's susceptibility, and about the ease or difficulty of avoiding harm. The author notes that even when this information is accepted as information required for understanding, it is still difficult to measure what people really know or believe. Examples for this article are drawn from research conducted on public perceptions of the risks from smoking. The results indicate that the public has a limited understanding of the hazards and risks of smoking.

5.4 Terrorism

Deisler, P.F. Jr. 2002. A Perspective: Risk Analysis as a Tool for Reducing the Risks of Terrorism. *Risk Analysis.* 22(3): 405–13.

Discusses the potential uses of risk analysis as a combative tool against terrorist attacks. After first reviewing the multifaceted nature of terrorism and the reasons it is likely to become endemic in world society in the long term, just as other areas of crime are endemic, this article surveys several fields of risk analysis, finding possible short- and long-term uses of risk analysis. The primary areas covered are risk communication and chemical, biological, and technological risk analysis. Broad policy and other uses are also considered. The author notes that risk analysis had already played some role, perhaps informally, but he also sees the possibility of a much larger, formal role in the future.

Garrick, B.J. 2002. Perspectives on the Use of Risk Assessment to Address Terrorism. *Risk Analysis*. 22(3): 421–23.
Discusses the applicability of the principles of quantitative risk assessment (QRA) to analyzing the threat of terrorist acts on a facility. The traditional theories of QRA are rooted in answering three questions: What can go wrong? What is the likelihood of that happening? What are the consequences if it does happen? The new methodology is primarily related to taking a perspective of "How can something be made to go wrong?" The essence of the theory is to adopt an approach to scenario structuring that parallels the thought processes of the terrorists, rather than just analyzing a system for accident scenarios. The author notes that the key to the successful use of QRA lies in inventive problem solving and in the development of models that map the logic between events of interest for which there was no direct experience to events for which some experience existed, while including the event uncertainties.

6. RISK COMMUNICATION GUIDELINE SAMPLES

Project XL Stakeholder Involvement: A Guide for Project Sponsors and Stakeholders, EPA Office of Reinvention, March 1999, EPA 100-F-99-001, http://www.epa.gov/ProjectXL
Project XL is a collaborative planning process created by the U.S. Environmental Protection Agency to find innovative solutions to environmental problems. Sponsors and stakeholders get together to conduct, create, implement, and test pilot strategies that can then be presented to the EPA for nationwide application. The guide offers clear steps to engage the public in decision making. Stakeholders are divided into groups (sponsors, direct participants, commentators, and members of general public). These groups have clear responsibilities at each stage of a Project XL.

Process/Tools: Project XL starts with an agreement on the following norms: transparency, full access to information, everyone having a chance to influence outcome, and every party being treated with respect and having full ownership of project. Then, ground rules are established on membership conditions, methods of decision making, lines of responsibility, accountability, the role of the facilitator, methods of communication, and the handling of confidential information. Project XL recommends looking at each phase of a project and identifying the stage at which a particular kind of public input is needed (e.g., impact assessment in the planning phase, support in the implementation phase, etc.). Some useful

tools included in this report are "Self-Assessment of Existing Relationships" and "How to Set up a Stakeholder Group."

Public Participation in the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS), U.S. Army Corps of Engineers, 1999, http://www.usace.army.mil/inet/usace-docs

The U.S. Army Corps of Engineers (USACE) has established a formal process to include communities in policy decision making for the restoration of formerly used defense sites. The underlying premise is that a community relations program is essential to the success of the restoration of a formerly used defense site. USACE believes it is central to maintain trust and credibility to the process. The first step is a needs assessment of the community. Then, the community relations programs addresses community concerns and assesses the extent to which a restoration advisory board is needed. The public is involved in the creation and examination of administrative records.

Process/Tools: This is a manual for field officers. The emphasis is on a legal and mandated administrative procedure. Although heavy in administrative procedures, the manual has a collection of sample letters, community surveys, and documentation requirements that could be useful to any public involvement process.

Best Practice Report for Contaminated Site Assessment, Remediation and Management, Prepared for the Olympic Coordination Authority by Egis Consulting Australia, June 2001, http://www.oca.nsw.gov.au/ecology/BinaryData/ Best_Practice_R001_final.pdf

Although this guideline focuses on the assessment of contaminated sites, best practices in risk communication are also included. Risk communication guidelines are heavily based on a 1999 document issued by Australia's National Environment Council: *Schedule B(8) Guideline on Community Consultation and Risk Communication.*

This report recommends engaging in active community involvement only in three situations: the site is a nuisance, contamination may spill over to adjacent area and impact community, or the site itself is the subject of controversy. Once one of these conditions is met, a community consultation program is drafted. Assessment of the site contamination begins only after an assessment for community involvement is completed. The communication plan should have at least the following four sets of goals:

- information goal: inform the community of what the agency plans to do and why,
- organizational goal: maintain credibility of the agency in eyes of the community,
- legal goal: follow existing laws and procedures, and
- process goal: allow for input from community including in evaluation and decision making.

The communication plan is also guided by the following principles: consider the community a legitimate partner, expect the process to take time, listen to concerns, practice honesty and openness, collaborate with credible sources, meet the needs of the community, empathize with

the community, and evaluate the effort. Planning involves gathering information about demographic profile, media report, data collection, identification of issues, contact with key leaders, and development of a communication protocol.

The report assumes that not all contamination will be remediated and that public involvement may not be necessary in all cases. A communication plan should be drafted before site assessment begins, and the agency should engage in extensive prior planning.

Process:

- Establish the need for, nature, and extent of public participation at the onset of the program.
- Involve community in data gathering and decision-making process. Community involvement requires more than one-way exchange of technical information. It is a two-way process requiring listening and communicating.
- Discuss and agree on goals of risk communication plan: Goals may include gathering and distribution of information about the site, maintenance of organizational credibility, meeting legal requirements, and providing opportunity for citizens to get involved.

Tools:

- A list of questions that may arise when designing a risk communication plan
- A summary of the advantages and disadvantages of various involvement techniques, such as public meetings, on-site meetings, conference, charrettes, workshops, seminars, advisory groups, public forums, individual discussions, survey, open houses, displays and exhibitions, observations, information brochures, hot line, Web sites, and media

Risk Communication Primer: A Guide for Conveying Controversial or Sensitive Environmental, Health, and Safety Information to a Concerned Audience, Navy Environmental Health Center, Environmental Programs Directorate, http://www-nehc.med.navy.mil, http://www-nech.med.navy.mil/ep/index.htm

This quick reference guide contains risk communication principles and associated tools to prepare Navy remedial project managers to explain environmental, health, or safety risks to the public. The guide offers tips for developing messages, establishing trust, and presenting messages. Among the topics covered are crafting simple and concise messages, organizing information, avoiding pitfalls, handling angry people, selecting credible spokespersons, organizing open houses, anticipating questions, working with the media, and preparing for interviews.

Tools:

- Questions to initiate the development of appropriate messages
- Rules for maximizing the amount of information the audience hears, understands, and remembers
- Traps to avoid when creating and delivering messages
- Tips for simplifying language
- Guidelines for communicating empathy and competence

- Advantages of the open-house format for presenting information
- Tips for staying on message during interviews with the media

Communicating with the Public: A Guide for DOE Employees, U.S. Department of Energy, Office of Intergovernmental and Public Accountability, September 2001 draft
This simple and practical guide was written to help DOE staff and contractors improve communication with the public. It covers five main topics: writing for the public, speaking to the public, communicating with the public about risk, communicating with minority audiences, and handling controversy in public meetings. The guide discusses general principles of effective writing, including targeting different audiences; defines the purposes of writing; offers examples of jargon fog; and illustrates how to simplify and "punch up" writing. The guide emphasizes the importance of good openers and closers when speaking to the public and suggests ways to add human interest and deliver a high-energy presentation.

The guide summarizes findings from risk communication research and presents guidelines for DOE to use in responding more effectively to community concerns about risk. The guide discusses how to avoid offensive risk comparisons, improve communication with minority audiences, recognize culturally defined ways of responding to controversial issues, and understand and cope with controversy. The guide discusses the role of the facilitator in easing controversial meetings, keeping the meeting on track, clarifying communication, accepting feelings, and summarizing and clarifying direction.

Tools:

- A start-up sheet of questions to remind a writer to consider the audience, purpose of the document, and readers' motivations for reading the document
- Alternatives to traditional outlining as a means of organizing writing, including the use of sticky notes, free writing, decision trees, and process maps/guides
- Writing headlines as a means of defining the key points to emphasize
- Suggestions for writing more simply and with more emotional impact
- Summaries, sidebars, appendices, labeling of information, and effective graphics as techniques for presenting information at various levels to satisfy different audiences
- A primer on the use of charts, diagrams, and tables
- Ways to add human interest to presentations: stories and analogies
- Ways to engage an audience: polling, recording responses, small-group assignments
- Tips for delivering a high-energy presentation
- Pitfalls of using risk comparisons
- Suggestions for communicating with minority audiences and for involving minority communities in decision making
- Meeting formats as alternatives to public hearings: large group/small group, workshop, open house, Samoan Circle/fishbowl, coffee klatsch

Communicating in a Crisis: Risk Communication Guidelines for Public Officials, U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, 2002, http://www.samhsa.gov, http://www.mentalhealth.org

The purpose of this primer is to be a resource for public officials on the basic tenets of effective communications generally and on working with the news media specifically. It is intended as an easy-to-use pocket guide on the basic skills and techniques needed for clear, effective communications; information dissemination; and message delivery. After determining the goal of communication and corresponding messages, the next step is staying on message. The guide presents examples of the use of "artful repetition" in staying on message and suggests regular briefings with the media as a means of balancing accurate information with timely information.

The guide recommends acknowledging uncertainty and understanding the public's risk perceptions; tackles risk communication myths, principles, and pitfalls; discusses ways to earn trust and build credibility with audiences; and recommends building support through alliances with other officials and experts to ensure all issues are addressed. The guide suggests ways to work with reporters to help them do their jobs and ensure the agency's key messages are disseminated, appropriate ways to correct errors and control rumors, and methods to assess personal strengths and weaknesses affecting communication performance.

Process:

- Prepare a risk communication strategy and materials.
- Prepare for a public meeting.
- Find other opportunities to get the message out to the public.

Tools:

- Tips for holding regular briefings with the media
- Guidance for communicating technical information
- An alphabetized list of pitfalls and how to avoid them when communicating with the public
- Ways to diffuse anger and hostility
- *Dos* and *don'ts* of interviews
- List of sample questions to help prepare for public meetings
- Suggestions of other channels of communication

7. REFERENCE WEB SITES

http://odphp.osophs.dhhs.gov/pubs/prevrpt/Archives/95fm1.htm
Risk Communication: Working with Communities to Weigh the Odds, U.S. Public Health Service

http://www.cresp.org/
Consortium for Risk Evaluation with Stakeholder Participation (CRESP), academic research Web site on stakeholder involvement

http://www.depts.washington.edu/irarc/index.html
University of Washington's Institute for Risk Analysis and Risk Communication (academic research on risk communication)

http://www.epa.gov/iriswebp/iris/index.html
Integrated Risk Information System (IRIS), U.S. Environmental Protection Agency

http://www.epa.gov/opei/pubsinfo.htm
EPA site that contains a number of reports and workshop findings

http://www.google.com/search?q=%22best+practices%22%2B%22risk+communication%22&hl=en&lr=&ie=ISO-8859-1
Google search of "best practices + risk communication"

http://www.nlm.nih.gov/pubs/cbm/health_risk_communication.html
Health Risk Communication (CBM 2000-7)

http://www.napawash.org/pc_economy_environment/recent_publications.html#2000
The National Academy of Public Administration has some reports about citizen participation and risk on this site.

http://www.psandman.com/
Peter Sandman Risk Communication Web site has some interesting background articles on risk. Sandman is a "guru" of risk communication.

http://www.rand.org
The Rand Environmental Science Policy Center has some reports on risk assessment and risk communication.

http://www.riskworld.com/Abstract/AB5ME001.htm
Risk Abstracts Library abstracts of papers on risk analysis, assessment, and management

http://www.riskworld.com/websites/webfiles/ws5aa014.htm
Risk communication Web sites

http://www.sra.org/
Society for Risk Analysis Risk Assessment, Characterization, Management, Communication, and Policy

APPENDIX I. RISK MESSAGE CHECKLIST

Adapted from *Improving Risk Communication,* U.S. Committee on Risk Perception and Communication, National Research Council, Washington, D.C.: National Academy Press, 1989.

Information on the nature of risks
- What are the hazards of concern?
- What is the probability of exposure to the hazards?
- What is the distribution of exposure?
- What is the probability of each type of harm from a given exposure to each hazard?
- What are the sensitivities of different subpopulations to each hazard?
- What are the qualities of the hazard?
- What is the total population risk?

Information about the nature of benefits
- What are the benefits associated with the hazard?
- Ware the qualities of the benefits?
- Who benefits and in what ways?
- How many people benefit and how long do the benefits last?
- Which groups get the disproportionate share of the benefits?
- What is the total benefit?

Information on alternatives
- What are the alternatives of the hazard?
- What is the effectiveness of each alternative?
- What are the risks and benefits of alternative actions and not acting?
- What are the costs of the alternatives and how are they distributed?

Information on the control of the risks
- What controls do you intend to use?
- How reliable are these controls?
- What input does the public have in selecting the controls?
- What are the risks after implementing the controls?
- What happens if the controls fail?

Uncertainties in knowledge about risks
- What are the weaknesses of available data?
- What are the assumptions on which the estimates are based?
- How sensitive are the estimates to changes in assumptions?
- How sensitive is the decision to changes in the estimates?

Information on management
- Who is responsible for the decision?
- What issues have legal importance?
- What constrains the decision?
- What resources are available?
- How to find further information and whom to contact

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11. ABSTRACT *(200 words or less)*

This report provides the basis for NUREG/BR-0308, "Effective Risk Communications: The Nuclear Regulatory Commission's Guidelines for External Risk Communication." It presents a comparative analysis of NRC's risk communication needs and the state-of-the-art in risk communication practices, with a focus on external risk communications. In addition to providing a resource for the data collected during the formulation of the guidelines, this report provides recommendations for how the NRC can best incorporate risk communication principles throughout the agency. The Summary of Findings section contains the risk communication challenges and needs identified by NRC staff and management along with ideas, based on the state-of-the-art, for how NRC can improve in these areas. The Appendices contain survey instruments and results from the Needs Assessment Survey, which determined NRC risk communication needs, and the Best Practices Survey, which determined the state-of-the-art. Additionally, the appendices contain NRC and non-NRC (domestic and international) case studies, an annotated bibliography, and a risk message checklist.

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