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Risk Communication

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THEMES AND TASKS OF RISK COMMUNICATION

Proceedings of the International Workshop on Risk Communication
held at the KFA Jülich, October 17–21, 1988

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Foreword

This volume presents a set of papers from an international workshop on "Risk Communication". Participants were about 20 researchers from the U.S. and about 20 researchers from Europe, in particular from the FRG. Although they represented a wide range of disciplines and nationalities, their common interest were the problems of communicating about risks, particularly for health and environment, resulting from the development and application of modern technological systems and procedures.

Why has risk communication research become so important? Modern societies have great difficulties in coping socially and politically with new technologies and their consequences. The debates between experts and laypeople, between scientists and politicians, between advocates and critics, between political parties, and even within scientific communities and political parties are "hot": One argues, and sometimes fights, about the probability of accidents in power plants, about the consequences of increased (or reduced) car traffic, about the possibility of the creation of genetically dangerous material through the combination of genetically harmless material, and about the ill-defined consequences of potential global climatic change.

Whereas most people today have come to realize that in a democratic political system there is simply no alternative to open, honest, and extensive information and communication, most people also have come to realize that this is an extremely difficult, and sometimes dangerous, task. As has been said before, informing about risk has itself a high risk of failure. A well-known example is the presentation of information about extreme low probabilities of an accident (e.g., in a nuclear plant) or about effects which cannot be perceived with our senses (e.g., radiation).

The workshop presented, for the first time in the FRG, the theoretical concepts, empirical findings, practical experiences, and some conclusions of a scientific community which explicitly focusses on "risk communication". The scientists met at the Research Center in Jülich for a particular reason: Within the Program Group Technology and Society there is one research group founded a few years ago under the direction of Ortwin Renn to examine the social compatability of energy supply systems. Recently, this group shifted its attention to the study of risk communication problems in a national and international context. The workshop provided an important opportunity to learn and discuss about the present state-of-the-art of risk communication research.

The objectives of the workshop were

- to discuss examples of risk communication problems (e.g., radon, transport of hazardous waste, energy production),
- to document the state of the art of risk communication research (e.g., presentation of risk information in the media),
- to identify research needs and promising research areas and strategies (e.g., implementation of the right-to-know), and
- to formulate recommendations for strategies of risk communication (e.g., procedures for involving citizens in decisions about waste disposal sites).

These objectives were pursued with respect to five topics:

- how do the media cope with the variety of information about risks for health and environment?
- how do trust and credibility affect the effectiveness of risk communication attempts?
- how can individuals and society improve their preparations for emergencies and their management of disasters?
- how can the right of communities to be informed about potential risks be implemented?
- how can risk communication strategies be evaluated, and on on the basis of which criteria?

On the first day of the workshop, invited papers were presented that reviewed the state-of-the-art for each topic. During the next two days, working groups identified research needs and formulated policy recommendations. This volume contains, for each topic, the state-of-the-art paper(s) together with a summary of the conclusions reached by the respective working group.

The final day of the workshop broadened the discussion of risk communication in two respects: First, the concept of risk, its emergence and significance in modern society, was discussed in an invited lecture by Prof. Niklas Luhmann from a historical and sociological perspective. In particular, a distinction was be made between risk and danger that might help to explain some of society's current concern about risks and its difficulties in coping with them.

Secondly, a different type of risk, global environmental (particularly climatic) change, was discussed in a panel consisting of Prof. Wolf Häfele, Prof. Roger E. Kasperson, Prof. Helmut Jungermann (chair), Prof. Niklas Luhmann, William Long, Dr. Steve Raynor and Prof. Ernst Ulrich von Weizsäcker. Two contributions are included in this volume.

The risk of global environmental change differs from other risks in that it is not determined by one specific technology but by a variety of often diffuse activities like, e.g., burning of rain forests, use of aerosoles, and energy production with coal and oil. Meanwhile, the consequences occur in place or times distant from their genesis, raising serious inequity problems. The problems, particularly of climatic change, have become apparent, research efforts have been increased, national and international cooperation has begun - and the public has become concerned. There is broad consensus that "something has to be done", and fast. However, opinions differ about what to do and how to do it, and human institutions have their apparent limits. The topic represents a new challenge to risk communication research:

- scientific assessments regarding potential risks have a high degree of uncertainty and hypotheticality,
- potential negative effects will incur beyond the lifespan of our generation,
- any changes would happen in such a slow motion that hardly any generation will observe dramatic events,
- nobody (or rather, too many people) can directly be blamed as causing global environmental change,
- any measures will require international cooperation between countries that have completely different interests,
- and there are a host of other factors creating impediments, particularly for involving "the public", - the many "publics" - into the process of "doing something".

But involving the public is an inevitable condition for success. The task cannot be solved by experts or by politicians. If the public does not perceive the problem as "its" problem, actions will be difficult to implement - one might even argue to justify. Therefore, the topic deserves special attention from researchers on risk communication.

Helmut Jungermann, Roger E. Kasperson, Peter M. Wiedemann

Editors

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Introductory Remarks

Helmut Jungermann

The International Workshop on Risk Communication at the KFA Jülich is probably the first conference on risk communication in Europe, very probably the first one in the FRG, and definitely the first one in Jülich. There have been many meetings on risk issues over the last 10 years, of course, and many of the participants present have attended many of them. But to my knowledge no conference yet has made communicating about risks its focal subject. Why not?

One reason may be simply the usual time lag that characterizes so many research efforts in Europe; risk analysis, technology assessment, environmental impact and social impact assessment, studies of risk perception and concepts like informed consent - all these topics came over the ocean with a lag of roughly five years. The same may now have happened with "risk communication". Europeans simply may be a little behind, slow in receiving and decoding transatlantic messages.

A second reason, more favorable for the European self image, may be that European science is more reluctant than American science to pour old wine into new bottles, i.e., to create new headings for the same old (though good, of course) research. This is partly due to the difference in research funding policies between Europe and the US. American, more so than European researchers, must fight for funds by continuously stimulating the interest of funding agents and agencies. And, as we all know, sensitivity decreases with the duration of a stimulus, i.e., when stimuli are not changed.

A third, more fundamental reason may be that the political context in which risk research is embedded differs between Europe and the U.S. in a way that makes risk communication a less appropriate subject or concept here than there. The American system has a strong need for reaching consensus, for "getting to yes". European systems, on the other hand, operate more by ideological battles that do not allow compromises. Therefore, whereas communicating, and even more so negotiating, are natural and accepted strategies in the American system, they are often viewed with suspicion in Europe because they might weaken one's troops and their outcome will be a betrayal of the only right ideology (i.e., one's own).

Related to this is a fourth reason. As has been the case with previous risk research transferred from the U.S. to Europe, the risk communication message has met skepticism. Some felt and feel that the approach does not fit the real problem: the basic conflicts are not about risk (but rather social values, etc.), and the conflict cannot be solved by improving communication (but by political arguments, campaigns, and decisions). Or, to put it differently, focussing on risk communication does not address the actual problems; on the contrary, it masks or even dodges the actual problem - maybe unintentionally, maybe intentionally.

Whatever the reasons for the late and slow arrival of "risk communication," problems exist in Europe that deserve efforts to improve the management of technologies on the technical, social, and political levels. "Risk communication" may be a useful concept for such an improvement - as long as we do not forget the context from which the concept was taken and the context in which we apply it.

From this perspective, the conference should be particularly interesting. It might help to clarify differences as well as commonalities of American and European political cultures and to identify which findings and efforts can be used under which conditions, and which should be adjusted to their respective culture. This seems particularly important in view of the increasing number of problems (e.g., greenhouse effects), requiring global international strategies and joint efforts within the European Community, between East and West, between Europe and the U.S., and between the industrialized countries and the Third World.

Media Reporting of Risk Information: Uncertainties and the Future

Malcolm Peltu, London

"Truth lies in the nuances" - Anatole France

1. Introduction

The mass media, particularly television and newspapers, play an important role in communicating information about the nature, extent, and priority of risk issues. Media reporting of risk information, however, is generally subject to inaccuracies and imbalances which can misrepresent important factors.

Little more can be said with certainty about media impact in risk communication.

Research evidence fleshes out some of the ways in which the media influence, and are influenced. Facets of the nature of media bias have also been analysed. Yet there is a considerable degree of uncertainty about current 'answers' to most key questions. Many nuances are still to be explored in the search for truth.

The extent of the uncertainties is likely to grow because more use will be made of new telecommunications channels, like satellite and cable television, new print and publishing methods; and other new information technologies. These changes will be especially significant in Western Europe because they are being accompanied by widespread deregulation of broadcast media.

This paper aims to highlight areas which should be the focus of future research effort. It does this by examining media reporting of risk information along four dimensions:

- existing research evidence, emphasising major uncertainties (Sections 2 and 3);
- international aspects (Section 4);
- new developments that could radically alter the media environment in many countries (Section 5);
- actions that could be taken to modify risk communication in the media (Section 6).

An extensive bibliography is provided to assist future risk communication research and discussion.

2. How the media influence

2.1 Direct or indirect?

Initial interest in the role of the media in risk management derived largely from risk perception studies, such as those carried out by the Decision Research Group in the USA. After comparing measures of actual statistics, public perceptions, and the amount of media coverage for various risks, a Decision Research team (1) concluded that the media have important effects on people's judgements on risk levels "not only because of what they don't report (successful plane trips or reactor operations), but because of what they do report to a disproportionate extent."

Media studies going back over 50 years have moved away strongly from the 'magic bullet' or 'hypodermic' model of media impact which assumes a direct causal relationship between what the media say and how audiences are influenced. Lowry and DeFleur (2) argue that most researchers in media studies now generally accept that impacts are *mediated* through social interactions and personal beliefs, and *diversified* in the types of impacts among different audiences.

Cozzens and Contractor (3) suggest that people who are regularly exposed to media are not inclined to accept the reality portrayed in them when it conflicts with information obtained from a personal source. They say audiences actively interpret, and are often highly sceptical about, information received from the media.

Risk communication in the context of this complex mediated model has many more unknown variables than in the simplistic magic-bullet theory. Research into interactions between media and risk will, therefore, have to address the variety of contexts and social relationships that are involved in risk management processes.

2.2 Diverse and evolving impacts

Media effects may change over time. Accumulating, mediated, diverse, and long-term media influences are difficult to assess "within the format of an experiment, a one-shot survey, or even a content analysis of media messages," according to Lowry and DeFleur.

A number of research projects relevant to risk communication have attempted to take these factors into account. For example, the agenda-setting hypothesis (4) is one of the most commonly agreed theories in media studies. It states that the way information is selected and presented in the media plays an important part in shaping people's perceptions of what issues are important, and with what level of priority.

A series of research studies in the USA at the Centre for Urban Affairs and Policy Research (CUAPR), Northwestern University, examined this hypothesis by looking at how news reports affected the views of the general public, policy makers, and interest groups.

Most agenda-setting studies, such as those on risk perception by Lichtenstein et al (5), fail to take account of the views of participants before and after media exposure. The CUAPR researchers worked closely with journalists so they could test opinions before a story was published, then afterwards. After four studies, which included topics such

as toxic waste disposal and health-care fraud, CUAPR findings clearly point to different impacts on different groups.

The health-care story raised the topic's priority rating among the public. However, it remained a low priority for policy makers, although they raised their perception of the public's view of the issue's importance and the need for action. The views of interest groups did not change (6).

Stories about faulty toxic waste disposal at a local university, on the other hand, led to relatively little impact on the public or policy makers. This may have been because the problem was well on the way to being 'solved' by the time the story broke (7).

Research (8) into public attitudes to firearms and drunk driving were also carried out at Northwestern University using similar pre- and post-publication interviewing techniques. These found the media had a greater impact on judgements about societal risks rather than at a personal level: people changed their beliefs about the importance of these risks to the community at large, but not their own estimated risk of being personally affected.

These findings are important to risk communication. They indicate how difficult it is to draw universally-applicable conclusions, even from apparently uncontroversial statements about media effects like: 'The media helps to set the public and policy-making agenda.'

2.3 The significance of media quantity

One of the main problems in media studies is finding realistic metrics for evaluating media content. Most studies rely on measuring the volume of print media coverage given to various topics.

Content analysis, however, has many limitations. It is much easier to do for print media than television, although television could have a more powerful effect in many circumstances. Volume of coverage may not take account of varying impacts, for example between a short front-page story and a longer article tucked away on an inside page. It also does not indicate how much attention, if at all, has been paid to the coverage by different people.

Content analysis, however, provides important risk communication evidence when used to examine public attitudes to the same subject over a long period.

For instance, Mazur (9) concludes that the quantity of coverage, rather than its quality or content, has the greatest effect on public attitudes to nuclear and other technological controversies. He believes high levels of media coverage stimulate latent attitudes and emotions. According to this view, people with a negative attitude to nuclear energy will increase their 'anti' attitude when media volume on the subject increases, irrespective of whether the coverage is about nuclear power or bombs, or highlights benefits more than disadvantages.

MacKuen and Coombs (10) have studied the media in relation to broader political issues. They confirm Mazur's view that people generally have their views reinforced by

media coverage. But they believe the character of events and their portrayal in the media, not just the quantity of coverage, are important ingredients in the accretion of data, images, and opinions over time. This could contribute to the creation of the underlying attitudes which, Mazur says, are stimulated when media coverage increases.

Such evidence raises important questions which need to be further investigated in risk communication studies.

Most studies of media reporting of risk focus on the aftermaths of crises, such as those at Chernobyl (11) and Three Mile Island (12) nuclear plants. If it is true that the mere reporting of such events will increase 'anti-nuclear' attitudes, should the prime focus of attention be on determining ways of getting the right information to the right people in the right timescales? Are analyses of whether reporting is 'pro' or 'anti' the technology of secondary significance?

In addition, a great deal of work still needs to be done in understanding how diverse media affect diverse audiences in the development of deeply held, and hard to change, opinions.

2.4 Multiple sources, multiple impacts

Just as audiences should not be viewed as a unified mass, so the media should not be seen as a single entity. The media are highly diversified both in the technologies used and the nature of their content. Even sections within the same medium can vary significantly. For example, Peters (13) found articles on nuclear energy in newspapers from twelve countries were generally more 'pro' the technology in *Business* and *Science* than those in *General News* and *Politics* sections.

Evaluations of media reporting of risk and the environment have tended to focus almost exclusively on news reporting. Yet the mediated, evolving model of media impacts stresses the importance of accumulated effects. Many of these come from fiction or 'features', not just news; from films, books, videos, theatre, radio, comics, and other media.

Works like Mary Shelley's *Frankenstein* or Aldous Huxley's *Brave New World* have become strong metaphors which provide a subtext to what many people feel about the dangers of science. A spate of 'horror' films in the 1950s, like *The Incredible Shrinking Man*, warned of genetic damage that could be caused by radiation. The films appeared at a crucial time when views of nuclear power were being formed.

Ryder's study (14) of the responses of young adolescents in the UK to a news item about Three Mile Island, three days after the crisis occurred, shows that semiotic and fictional impacts may linger longer than news reports. Although the young people showed relatively little response to the detailed content of the news item, they later spoke about the dangers of deformed babies, hair falling out, and other images and terminology that have been prevalent in fictional and documentary films and television programmes.

Gerbner et al (15) found that science coverage on television in the USA increased more in entertainment than news programmes in the 1970s. They discovered heavy viewers

of entertainment programmes were more negative to science than light viewers. In general, they say scientists were usually stereotyped as being more dangerous, less rational and stable, and much more violent than other characters in entertainment presentations.

General media studies, say on the effects of sex and violence in television, usually include news reporting as an integral part of the broad spectrum of media. Risk communication studies must also become interested in a wider variety of media. In news reporting, this should embrace more fully the popular end of the market. Many studies concentrate mainly on 'serious' newspapers.

Factual books should also be considered. Rachel Carson's *Silent Spring*, for instance, had an enormous influence on attitudes to environmental pollution in the 1960s. This was amplified by the poetic resonances of its title.

2.5 Media as risk management actors

Whatever the precise nature of their impact, media are undoubtedly influential actors in modern risk management processes, together with policy makers, regulators, industry, public interest groups, and experts (16).

Public opinion influences, and is influenced by, all the actors in the process. Journalists and editors take account of the opinions of their audiences when establishing the criteria used to select and present information (17).

People in the media also influence other risk management actors through social processes other than the impact of the information they broadcast and publish. For example, Protess et al (18) at CUAPR found strong evidence that active collaboration between journalists and policy makers in the ongoing process of media investigation had a greater policy impact than the actual reports in the health care and toxic waste disposal cases.

As Cook et al (19) comment, a "symbiotic relationship" may often exist between journalists and policy makers. "Journalists in search of story credibility and personal recognition (e.g. journalistic rewards related to the 'achievements' of their work) may increasingly build policy 'solutions' into their stories, while government officials seeking to obtain media access may be increasingly willing to comply," they suggest.

2.6 When silence matters

When Lichtenstein et al (20) pointed out that media influence comes as much from what is not reported as what is, they highlighted the media's failure to report routine technological 'successes'. The media are also often silent, or slow, in reporting 'negative' events - or warnings made long before the events occur.

Eggington (21) believes the accidental contamination of animal feed with polybrominated biphenal (PBB) in Michigan in 1973 was "probably the most widespread, and the least reported, chemical disaster ever to happen in the Western world." She said the media had failed to function as a public watchdog because "not until the

results of contamination were glaringly obvious" did they stop "accepting the explanations of the bureaucrats and start investigating farmers' complaints."

Similarly, Swan (22) says the media, even local newspapers, "underreacted to the point of silence" for a long time in reporting the pollution from a waste dump at Love Canal, near Niagra Falls in the mid 1970s. Eventually, the pollution was prominently reported; a state of emergency was declared; and many people were evacuated.

During 1987 and 1988 there were three major disasters affecting UK citizens: the sinking of a P&O ferry in Zeebrugge harbour; a fire at Kings Cross Underground station; and a fire on the Piper Alpha oil rig in the North Sea (23). In each case, as soon as the disasters happened, the media found experts who had warned about hazards that contributed to the accidents (24). The media had, however, given little, or no, attention to these warnings before the accidents.

Turner's model (25) of the phases that lead up to man-made disasters illuminates the institutional and psychological pressures which cause journalists, like many other people, to respond slowly to indicators of likely future accidents.

After analysing a number of disasters, he found that each went through an initial 'incubation' period during which warning signals accumulated. Deeply-rooted institutional and psychological factors caused a tendency to accept the *status quo* as 'reality'. Evidence to the contrary is generally ignored in this phase, particularly if it comes from non-experts, or non-establishment experts, and if its acceptance implies horrendous and/or highly costly cnsequences.

Turner's model is significant to a wide spectrum of risk communication activities. It helps to explain why it can be difficult to get the media to provide advanced warnings of potential dangers with sufficient 'agenda-setting' priority to encourage preventive action to be taken.

Advertisers can sometimes use their commercial influence to cause stories to be suppressed or emasculated. Weis and Burke (26) report how tobacco advertisers deleted anti-smoking text from health supplements in *Newsweek* and *Time*. Rubin and Sachs (27) cite examples of how journalists self-censor copy to avoid confrontations with editors who are under pressure from major advertisers on particular stories.

'Whistle-swallowing' - where media fail to 'blow the whistle' early enough to alert audiences to a hazard - also relates to the status of the media involved. Frequently, as in the Michigan and Love Canal cases, serious attention is given to a problem only when national media get involved, although local media may report the issue months or years before.

3. Influences on the media

The media are channels for carrying the messages of other risk management actors, as well as being actors in their own right. The nature of what appears in the media reflects the relative effectiveness with which different actors influence journalists and editors.

A key risk communication goal is to find how to get the media to convey what different actors feel are appropriate data and messages. Yet most of the literature on media reporting of risk looks at what is presented, and how that may affect audiences. More priority needs to be given to examining the forces which determine what appears.

3.1 Risk communication requirements

Risk communication requirements as such have negligible influence on media reporting, outside the context of a particular dramatic event. Sandman et al (28) discovered there was a paucity of information about risk in environmental reporting in New Jersey, USA. Risk becomes a major media topic only after there has been a disaster. Then, attempts are made to make 'acceptable risk levels' and comparative risk statistics intelligible to a lay audience.

According to Otway et al (29), media reports in seven European countries regarding the emergency at Chernobyl used a huge variety of units to measure radiation effects. In some cases, different units were specified in the same article. This made most reports confusing or meaningless in terms of quantified radiation data. Friedman et al (30) also found press and television in the USA did not provide enough radiation or risk information in their coverage of Chernobyl.

Otway et al say attempts to explain raw radiation numbers after Chernobyl in understandable terms of likely health effects were often inappropriate. For example, references to allowable limits frequently failed to say in what situations the limits apply, or what the limits meant to health.

They point out, however, that the source of many media-related risk communication problems were the officials and experts quoted by the media. In some cases, ministries within a country gave the media different radiation units, which were quoted verbatim. Otway et al also comment that "public confidence was not helped by overly technocratic efforts to put Chernobyl risks 'in perspective' by comparisons with natural death rates or the risks of dissimilar activities ..... people were concerned to hear their own public health authorities essentially say that it (Chernobyl) didn't matter because so many people die of cancer anyway."

Singer and Endreny (31) suggest that the media do not report on risks; they report on *harms*. Sandman (32) believes the media are more interested in *outrages* than hazards, just as the public's concerns and fears are more a product of outrage than of hazard. The characteristics of 'harms' and 'outrages' discussed by these researchers closely match many of the criteria used to decide that a story is 'newsworthy', as discussed in Section 3.6.

3.2 The importance of sources

Journalists rely to a great extent on the information provided to them by various sources. For example, the difficulties of gathering accurate information from official sources in the immediate aftermath of the accidents at Three Mile Island and Chernobyl were a major cause of initial errors and exaggerations (33). In the Chernobyl case, information gathering was exacerbated by the general lack of openness in Soviet society and deliberate attempts by Western governments to score political points (34).

Sandman et al (35) have concluded that where bias occurred in their analyses of environmental reporting in New Jersey, it was usually "a product of the reporter relying too heavily on a particular source in a particular article, rather than his or her intentional bias." They also found that, "when reporters want risk information, they want it chiefly from official - preferably government - sources."

The importance of sources makes the extra weight given to official views from government and other 'establishment' officials a major public relations (PR) barrier to be overcome by people wishing to put alternative views.

Ken Rowe, who has been an environmental reporter in the US, has been quoted as saying "The Federal Trade Commission is a source. The Friends of the Earth is a rumour" (36). Lawrence McGinty, a TV news reporter in the UK specialising in science and technology, comments (37) that most statements from officials, such as those at a regulatory authority, are intrinsically 'newsworthy': "What the establishment says is news, so environmental activists must work harder to establish the credibility of any story they want the media to cover."

Environmental groups have, indeed, worked hard at their PR activities. Organisations like Greenpeace and Friends of the Earth have deliberately used PR activities, including the provision of 'alternative' experts and what McGinty calls *stuntism*, to gain and keep media interest in various topics (38).

Much of the growth in the coverage of environmental stories, many of which are concerned with risk management, can be attributed to the PR activities of special interest groups (39). This is reinforced by dramatic disasters, like Chernobyl and the death of seals in the North Sea in mid-1988.

3.3 The role of experts

Experts are a vital media source in reporting risks based on scientific and technological developments. Specialists in a particular topic are looked to for 'objective' opinions, facts, and comments. Many biases and inaccuracies in reporting result either from over-reliance on particular expert sources or the unfair 'balancing' of expert views.

Rip (40) describes how the increasing involvement of experts in public-arena debates has changed how advice is provided. In the past, experts generally advised in confidence to decision makers who were their "masters". Experts are now more independent, but their role is often ambiguous because of their dual loyalties to those they are advising and to their own discipline.

When communicating with the public, scientists are often reluctant to express doubts, and their organisational role may encourage them to support official positions more firmly than the probabilities indicate. Wynne et al (41), for instance, found Cumbrian hill-farmers in the UK felt they were "the victims of scientific conceit and official deceit" because experts from local government departments were over-confident and frequently incorrect in the advice provided about the effects of radiation fallout from Chernobyl.

In an era where research investment is often scarce, experts may be tempted to over-promote their work publicly as a means of gaining funding for themselves or the

organisations in which they work. Many experts also work for, or are funded by, organisations with a vested interest in underplaying, or exaggerating, certain risks.

Experts in the public arena are often in conflict with each other. According to Rip, experts are faced by counter-experts and the lay public who attempt to deconstruct the fundamental principles, assumptions, and techniques used to build the advice. This challenge, he says, exposes "limitations, gaps, errors, and failings in a way that poses questions, not only in relation to specific problems, but also concerning the general confidence placed in the 'hardness' of scientific 'facts'."

Experts often criticise the media for being inaccurate, over-simplified, and biased (42). They should also be aware of the role played by experts in creating or reinforcing these problems.

3.4 Public Relations

Industry and public organisations spend vast amounts of money every year on PR because it helps them to get the media to portray their views to the public.

PR is one of the most important influences on journalists. A variety of proven techniques are available to achieve PR aims, from press releases and press conferences, to deliberate 'leaks' and extensive background lobbying.

In October 1987, a body called the Influenza Monitoring and Information Bureau held a press conference in the UK about the likelihood of a flu epidemic hitting the country. It resulted in a lot of coverage, including headlines like 'Nine million at risk of killer flu', which caused a rush for flu vaccinations.

Later, three pharmaceutical companies which had set up this bureau were reproved by the British Pharmaceutical Industry for breaking its code of conduct on promoting products through the media (43). Despite this reprimand, the PR exercise had achieved the objective of selling more vaccine.

Mazur (44) explains how staff at the US Environmental Protection Agency leaked an internal report to a *New York Times* reporter in 1985 which estimated that 5,000 to 20,000 lung cancer deaths a year in the country were caused by natural radon emissions in homes. Although the figures were five years old, they were related to current concerns about radon in Pennsylvania, thereby helping to boost the credibility of the story - and the EPA's policy of inreasing its work on indoor radon.

PR activities of environmental groups include the creation of events, such as a ship sailing into a nuclear test area, or 'pseudo-events', like staging protests, to get media coverage. As a BBC television reporter comments (45): "It has always been the aim of Greenpeace not merely to confront their chosen enemy, but to make sure the whole world can watch the confrontation."

Sachsman (46) estimates that between 25 and 50 percent of environmental reporting in the San Francisco Bay area in the 1970s were influenced significantly by PR efforts. Peters (47) reports PR officers in research establishments in the Federal Republic of

Germany (FRG) estimating that between 60 and 90 percent of articles about their organisations had appeared after some involvement by the PR office.

These figures, from my experience of the media, give a realistic impression of the strong influence of PR on what appears in the media. In some media, like technical and trade publications, the proportion is probably higher. In others, particularly well- funded 'investigative' newspapers and TV current affairs programmes, the proportion will be lower.

The value of PR is confirmed by its substantial use in organisations that continue to do so only because they gain significant returns on their investment. Yet communications studies, including those on risk communication, pay relatively little attention to the effects of PR on the media and their audiences.

3.5 Advertising

Advertising is a vital part of the media, both in terms of media content and the influence advertisers may exert on journalists.

Like PR, a great deal of money is spent on advertising because it is an effective way of influencing audiences. Clarke et al (48) suggest that advertising could be the basis for a communication strategy to modify environment-related behaviour by targeting audiences on the basis of their knowledge, emotional response, verbal commitment, and ecology-related behaviour.

Advertising is being used in a number of risk communication projects.

British Nuclear Fuels (BNF), for instance, has encouraged people to visit the Sellafield nuclear power station as part of its effort to "gain credibility with the public" so that people would "really start listening" to what it had to say about nuclear energy risks (49).

As a result of a nationwide press and television campaign started in 1986 to promote this objective, over 100,000 people went to Sellafield in 1987, compared to only about 30,000 in 1986. A new £5 million Visitors' Centre was opened by the Duke of Edinburgh in 1988. Generally, visitors go away from the Centre "feeling better" about Sellafield, according to a BNF spokesman (50).

Advertising in the mass media is being widely used by governments around the world to inform the public about risks from AIDS, and what can be done to limit its spread. In the UK, for example, the Health Education Authority (HEA) has conducted a multi-million pound AIDS advertising campaign since 1986 aimed at target audiences, like young people.

This advertising has had to overcome distortions and myths highlighted in media reports on the subject (51). Regular tracking of public perceptions and behaviour shows the advertising increases informed awareness, but misconceptions grow again when public education activities are in abeyance.

Some of the ways in which advertisers can cause the suppression of stories has been discussed in Section 2.5. In addition, there is an overall pressure on advertising-funded media to be 'commercial' and attract large audiences. This has a fundamental impact on the format, content, and style of what appears.

Advertising and PR have an important role in risk communication beyond the effects of specific campaigns. People's value judgements can be strongly influenced by the way choices are framed (52). One of the main purposes of advertising and PR is to frame the attributes of its subject matter in the most favourable light: emphasising positive aspects and minimising negative ones. The use of these techniques can, therefore, be of major significance to risk communication activities.

3.6 Institutional and professional factors

Many organisational factors and professional practices decide what finally appears in the media.

The aims of media owners determine the overall ethos, objectives, style and bias of a particular television or cable channel, programme, newspaper, magazine, film, or book. The amount of money available for editorial resources determines the number and quality of media professionals employed; risk communication is often hampered because editorial budgets do not allow for the employment of a sufficient number of appropriately qualified journalists.

Technical factors can also be important constraints in risk reporting, such as having to prepare material quickly to short deadlines and, in television, to find appropriate visual material.

The selection and presentation of information depends crucially on media professionals' concepts of what makes a 'good news story' (53). Singer and Endreny (54) point out that journalistic news values lead to an emphasis on hazards that are rare, new, and dramatic - ones that kill many people are more newsworthy than long-familiar illnesses.

Sandman (55) lists the characteristics of outrage, which he says are of more concern to people than hazards. This list consists of key elements that comprise a 'good' journalistic story: something exotic, memorable, dreaded, unfair, and highly focused in time and space, which has been imposed on people against their will, often by 'treacherous' officials.

Vacor (56), a television reporter in the USA points out that media reporting of risk generally consists of following up big, dramatic incidents. "We look primarily for victims. Victims make good television, good print .... we also often look for officials because we want to affix blame," he says. That is also the scenario for Sandman's generation of public outrage.

Scientists search for 'objective' truth; journalists generally look for 'balance'. Such balance helps to correct biases that come from failing to check with more than one source. On the other hand, it can mean the views of an unrepresentative minority are given equal weight to a better-founded opinion.

The majority report of the Twentieth Century Fund Task Force on the Communication of Scientific Risk (57) felt that "given the constraints under which they work", journalists do a good job of reporting complicated scientific matters with a reasonable degree of accuracy, comprehensiveness, and impartiality.

Within an aggregate balance, however, there may be significant distortions. Some views gain more prominence because of the way stories highlighting them are positioned within a medium, or appear in a medium with a very large audience.

For example, widespread coverage was given to evidence given in July 1988 to a US Senate Committee by Dr. James Hansen, Director of NASA's Institute for Space Studies. He said the current drought in the USA was almost definitely caused by the 'greenhouse effect' resulting from man-made pollution. His comments received high priority initially in many UK newspapers under front page headlines like '2025 .... Year Earth Will Be Too Hot To Live On' and 'Pollution Threat Of Scorched Earth'.

Over the following weeks, this was balanced by many reports which quoted other scientists who said it was too early to say whether or not the drought was actually part of a long-term cyclical weather pattern, rather than being caused by the greenhouse effect. Such reports, however, were usually in more specialist media, or had less prominence than the original reports (58).

4. The international dimension

Hazards are often trans-national and trans-regional. Media, however, generally are not.

Within a country or region, media tend to concentrate parochially on issues they believe are of local interest to their audiences. Sabatier (59), of the Earthscan international information service on environmental issues, says, "There are no international media issues, only local interest in problems with an international dimension."

Adams (60) found that television news coverage in America of natural disasters prioritised attention given to specific incidents outside the USA on the basis that the "death of one West European equalled three East Europeans, equalled nine Latin Americans, equalled eleven Middle Easterners, equalled twelve Asians". Higher priority was also given to disasters in areas which Americans visited on holiday most often.

The media are attracted to international issues that stimulate national 'outrage' at being a victim of a hazard caused mainly by 'foreigners'. Acid rain, for instance, was a prominent media issue in the early 1980s in Scandinavia and the FRG, where forestry damage was extensive and highly visible. It remained a relatively low media priority in the UK, which is a prime source of the problem, but has been relatively unaffected by the consequences (61).

Toxic waste disposal became a prominent news item in the UK in August 1988 because the ship Karin B, containing dangerous waste, was moored off the British coast while a waste disposal outlet was sought. Much of the coverage, and the government's response, focused on the fact that it came from Italy, which did not want to dispose of it in its own country (62).

Varying government regulations and approaches can cause difficulties in reporting international issues. For example, different ways of aggregating radiation contamination data in Italy and Switzerland led to confusing media reports about how fallout from Chernobyl affected neighbouring areas. The differing attitudes taken by national and local governments to the level of risk posed by Chernobyl, and what to do about it, also affected media reports (63).

The growing use of satellite and cable television will increase the number of television channels with a true international market. The ownership and content of these outlets will be controlled mainly by commercial organisations seeking to maximise audience sizes. This is likely to lead to more entertainment- dominated programmes, originated mainly in English in the USA or aimed at blandly homogeneous multinational audiences.

5. The future

Innovations in media regulation, technology, and ownership will create many new forces that fundamentally alter the nature, and effects, of key media.

5.1 Deregulation and the dominance of entertainment

Traditionally, broadcast media in Europe have been regulated by governments to include 'public service' principles that emphasise educational and cultural values. Many of these regulations are being dismantled to give private enterprise the opportunity to exploit the potential for a greater number of satellite, cable, and radio channels.

At the 1988 Edinburgh International Television Festival (EIFT), Christine Ockrent, former Deputy Director-General of the French public service TF1 television channel, commented that France had swung from being the most to the least regulated system "in an astoundingly short time" (64).

This, she said, has led to television channels being run primarily as part of business concerns where "programmes are discussed not in terms of quality, but in terms of commodities and figures." As a result, she adds, "what is interesting has over-run what is important" in news programmes. Increasingly, the same presenters are being used for news and entertainment programmes.

At the same EIFT, Jane Hewland, Controller of Features and Current Affairs at LWT, the commercial television channel for the London region, said she will be willing in future "to use every trick in the drama and entertainment book; current affairs have been too slow in using them."

In the USA, greater competition is being introduced into traditional commercially-dominated television structures. Postman (65) sees this also leading to news being treated essentially as a vehicle for entertainment.

Postman quotes Robert MacNeil, executive editor and co-anchor of the American MacNeil-Lehrer Newshour, stating these requirements for television news in this competitive environment:

"The idea is to keep everything brief, not to strain the attention of anyone, but instead to provide constant stimulation through variety, novelty, action, and movement. You are required .... to pay attention to no concept, no character, no problem for more than a few seconds at a time. Bite-sized is best, complexity must be avoided, nuances are dispensible, qualifications impede the simple message, visual stimulation is a substitute for thought, and verbal precision is an anachronism."

Risk communication without complexity, nuance, qualification, thought, and precision is extremely difficult, if not impossible. The ratings-chasing pressures which eliminate these essential characteristics are, however, likely to become more entrenched and widespread in the future.

Chester and Montgomery (66) report the emergence of sponsored programme-length commercials (PLCs), about half-an-hour long, that promote products in the guise of 'objective' entertaining current affairs programmes. For example, a PLC called *Consumer Challenge* starts by asking questions like: 'Can a pair of sunglasses actually make you see further, clearer, and sharper?. The programme was funded by the maker of the sunglasses, so the eventual answer is 'yes'.

PLCs are being taken up initially on cable television in the USA. They have two important qualities for companies trying to fill air time and also make a profit: they do not cost anything and keep audiences entertained. The need to keep audiences high and costs low could shape more of what appears in the mass media in the future.

5.2 New information technologies: diversity or conformity?

The combination of computers and telecommunications has opened up many new channels of communication. Fears have been expressed, however, that this could lead to greater conformity in media content, and a reduction in the quality of information reaching many people.

Peters (67) reports that studies into nationwide cable and videotext systems in the FRG found the increased number of channels led to political programmes being avoided and the consumption of entertainment programmes increasing. Programmes which allow greater 'open access' to community groups and individuals found very few viewers.

Overall, Peters comments that new information technologies tend to polarise audience information levels. "Those who are already well informed profit most from the new information sources, while those with a low information level profit least," he says.

Smith (68) also comments that, "new information technologies could mean that those sections of the audience which do not demand to be informed will be more completely cut off than they were in the past". Traditionally, non-specialist media, such as national newspapers and television broadcast channels, were what Smith calls a "complete social presence". They included a broad spectrum of information and ideas, including items individuals in the audience may not have pre-selected.

New information technologies offer greater refinements in pre-selecting what an individual reads, or sees. By exacerbating the knowledge gap between information 'haves'

and 'have nots', this could splinter the public into discrete grouping which lack a common media fount of information refreshment.

The result, according to Smith, is that new information technologies, and the perceptions surrounding them, "are preparing mass society for important, and perhaps undesirable, internal partitions, which may place great strains upon the self-image of democratic societies."

New information technologies, however, do offer a variety of techniques that have the potential to enhance democratic processes. More television, cable, and radio channels, together with cheaper print and publishing technologies, give the opportunity for more communications routes containing a wider range of opinions. It is also possible for viewers to use interactive technologies to 'vote' instantaneously on various issues via their television sets (69).

Increasing commercial competitiveness, in all forms of the mass media, could lead to greater entertainment-oriented conformity of content and opinion. Quicker means of gathering public opinion could militate against experimentation and diversity because high audience ratings are regarded as being so important.

There will also be many more minority programmes, including those with open access to 'alternative' views. But they will attract only small audiences of people with an existing interest in the topic.

The growing use of new communications methods could make it harder to get serious risk-communication messages through to mass audiences. At the same time, more effective communication could be possible with some well-targeted audiences.

6. Risk communication recommendations

A number of possible routes are available for changing risk communication in the media.

6.1 External controls on the media

Few people argue for the undemocratic imposition of official views on the media in a democracy. However, those who feel the media are irresponsible in their reporting of risk often suggest, or imply, that external controls are needed.

For example, the Chairman of the Twentieth Century Task Force on the communication of scientific risk, Harrison E. Schmitt, provided a dissenting report which recommended that the media should accept 'guidelines'. These aim to get news reports to avoid contentrating on "controversy or possible cover-up", and for entertainment to be "more representative of real life".

Proposals like these will never be accepted voluntarily because they contradict with traditional journalistic principles and practices. Freedom of expression in the media may lead to many problems, but is fundamental to democratic processes that can help to raise safety levels.

Many years before the Chernobyl crisis, a former Director of Oak Ridge National Laboratory in Tennessee, Alvin Weinberg (70), attributed higher nuclear-plant safety standards in the West to the "greater degree of access of the public to technological debate". He also said he believed imbalances and sensationalism in media reporting in the West has led to an over-emphasis on safety.

External controls on the media are, therefore, not only undemocratic, but could lead to more lax safety controls.

6.2 Education to improve communication

One of the most common recommendations relating to risk communication and the media is to improve the education of media professionals in risk, and of experts in how to deal with the media.

More education is a worthy objective. It is unlikely, however, to make more than a peripheral impact on the way media work. The methods used by media professionals are far too ingrained to be altered in any significant way just by education.

The Rutgers University Environmental Risk Reporting Project (71) recommends a variety of ideals for journalists and editors reporting risk. These include the desirability of having risk information in the first few paragraphs of hard news stories; being sensitive to misleading headlines; avoiding over-reliance on biased sources; seeking out 'uninvolved experts'; and giving more weight to sources who support their opinions with 'hard evidence'.

These types of goals may be acceptable in theory. However, journalistic news values, competitive pressures, deadlines, and the difficulties in deciding which experts are unbiased and what facts are hard, make them ineffective in practice.

6.3 Practical support for the media

The Rutgers project explores options for improving the provision of risk information in a form, and within timescales, which could be practically useful to reporters. The main support mechanisms considered were:

- *a mobile environmental risk information team* to respond a few times a year to environmental emergencies, providing reporters with access to necessary background information and expertise;
- *a 24-hour hotline* to offer continuous access to expert information and libraries;
- *a networked information service*, like the 'wire' services run by news agencies, which would provide fact sheets, press releases, background articles, and other aids to assist journalists when a story breaks;
- *an environmental library* for each newsroom, containing a comprehensive range of risk information;
- *an environmental press kit* consisting of information relevant to a breaking story, such as a list of expert contacts and glossary of technical terms.

Experiments in these activities are to be encouraged. They must have the active participation of working journalists to check how they meet journalistic realities. For exam-

ple, competition between journalists to get 'better' stories than their rivals may make journalists reluctant to use facilities shared with other journalists, such as a common source of experts.

These types of support for journalists may be of more practical value than education. But they will still probably make only a relatively small overall impact in the face of more powerful professional and commercial forces.

6.4 Understanding/manipulating the media

For most participants in the risk management process, the bottom line of risk communication is to see their own views prevail in the media. This means that an appreciation of what influences the media is of crucial significance, as PR experts have been aware for many years.

Vacor (72) says that improvements in risk communication will come if all those involved in the process "understand how the media work and demand a higher degree of participation in the system." There are two ways of perceiving such participation: as an essential part of democratic processes - or as means of manipulating what the media say. It is, actually, a bit of both.

Media that are open to a variety of influences have more freedom than those subject to strict control by a narrow group. In reflecting the variety of messages being fed to them, media display the diversity of opinions and ideas that exist in society, provided a reasonable balance is maintained.

However, where particular forces become too dominant, such as certain commercial or political groups and ideologies, the media can become a tool for deliberate, biased manipulation of audiences. In a totalitarian state, audiences tend to be aware of the overt objectives of those directing the media. In democracies, such manipulation may be more covert - and therefore more effective.

7. Conclusion

This paper argues that very little is known with a reasonable degree of certainty about how the media influence their audiences.

Media effects are mediated through diverse, subtle social interactions and processes. Future changes in the regulatory and technological media environment will create even more uncertainty by changing basic parameters of media/audience interaction.

More research is needed to help shed light on these uncertainties and future changes. If this research is to be of relevance to real communicators of real risk, it must fully address the issues of how the media are influenced, not just media impacts. In this context, the role of experts, PR, advertising, and media professionals' motivations are key priorities.

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The Role of the Media in Risk Communication[1]

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1. The origins of risk communication

"Risk communication" names both a practice and an area of research. The practice - which encompasses warnings, reassurances, predictions, threats, disclaimers, explanations, excuses, and many other activities - is very old. But the research area is new.

So we may wonder why after thousands of years of risk communication it has suddenly seemed important to study risk communication. The new field of study does not, of course, emerge ex nihilo. It grows directly out of work in risk analysis and risk perception. Why the current focus on communication? There are several reasons. First, everyone working in risk management agrees that technological risks to life, health, and the environment cannot be eliminated; they can only be reduced, usually at marginally increasing costs. Trade-offs must therefore be made, and these inevitably require value judgments. Such value judgments involve political decisions, and in democratic societies the public must participate in the decisionmaking process. It is important, therefore, that the public understands the risks involved and the costs of reducing them. Risk managers need to know how to communicate the often technical data and the uncertainties surrounding them so that ordinary people can play an appropriate role in the decisionmaking process.

A second reason for recent interest in risk communication is that risk managers appreciate the limits and inefficiencies of managing risks solely through engineering controls. They - and we - have lost some of the technological optimism of a few decades ago. Users of technology can often do much more to reduce risks than engineers of technological systems, and frequently only small adjustments or changes in behavior are required. It is well known that more early deaths would be avoided if people stopped smoking or used seatbelts than by all the billions of dollars spent on regulating technology and the environment. So the question is how we can frame messages most effectively to change behavior.

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Another reason for the rise of risk communication is the disclosure and information laws - principally the Seveso Directive in Europe and the Emergency Planning and Community Right to Know Act (Title III of Superfund) in the United States - which require industrial sources of technological risks to communicate the nature and level of these risks to the public. Firms wanting to know how to do this effectively but without causing undue alarm have generated much of the interest in risk communication research.

A fourth reason concerns the history of social science risk analysis research in the United States. Around 1970, many engineers and scientists, especially those involved in nuclear power, began to grow frustrated by negative public attitudes toward technologies like nuclear power and by the success of the environmental movement in forcing tough and costly regulations governing them. Why, they wondered, were people more disturbed by the risks of nuclear power than by other risks that were similar in magnitude, more likely, or both? Why had they failed to convince the public that nuclear power was socially beneficial?

These experts opened the door for psychologists, sociologists, and anthropologists to explain lay attitudes about risk and technology. What emerged were many different explanations, but especially noteworthy was a theory about risk perception. The theory established some very interesting findings about how badly people - including experts - make judgments about risks; the extent to which attitudes are determined by how messages are framed; and how people are often selective or biased in their concerns because they care about other features of technologies besides their risks. Many of the findings were confirmed by some remarkable surveys and simple experiments about human judgment and decisionmaking.(1)

As interesting as this work in risk perception was, it seemed of limited use to risk managers and technological experts. To succeed in bridging the gap between expert and public attitudes (which, as the experts saw it, meant getting the public to think "correctly" about these matters), they needed to know how to apply these findings. Driven by this pressure, and aided by laws like the Seveso Directive and Title III of Superfund, risk perception researchers began to think about risk communication.

An interest in risk communication inevitably draws our attention to the contemporary mass media, because the media constitute the source of much if not most of the public's information about risks and technologies. Experts and industry representatives can talk as long and as well as they like, but to a very great extent the messages from them that reach the public are mediated by newspapers, television, radio, and news magazines. A chemical company may, of course, send a spokesperson to a town meeting to explain the risks its products impose on the local community, but principally in contemporary society risk communication is mass communication.

Once we recognize this fact, it becomes evident that risk communication is not so new a research area after all. For much of the territory of interest has been worked over for half a century or more by scholars in the area of mass communications research.(2) Work in this area encompasses more than risk communication, but its findings often bear upon risk issues. And, on the other side, risk issues are increasingly broad, encompassing political, psychological, cultural and moral questions -- some of which are

illuminated by work in mass communications research. Like le bourgeois gentilhomme who has been speaking prose all his life without knowing it, many will be surprised to discover they have been engaging in or studying risk communication for years.

2. Why the role of the media is difficult to study

How do European and American news media report on technological and other health risks? And how should they report on such matters? To a great extent our interest in the latter question drives our interest in the former: it is because we hold views about what the press ought to be doing that we want to know what in fact it is doing.

But let us begin with the factual question. As one might expect, the answer to it is complicated, for several reasons. First, news organizations operate within a political culture, and the political cultures of the United States, West Germany, the Netherlands, and Great Britain vary significantly.(3) Second, "the news media" is not a monolith; the term stands for a large variety or organizations and institutions -- newspapers and television, daily and weekly publications, tabloids and "serious" newspapers -- which differ greatly in their practices. One could hardly compare the elite New York Times, for example, with the sensational tabloid National Enquirer; even among respectable news organizations, significant differences exist.

But these are only the most obvious complications. There are also great difficulties in designing empirical studies that tell us what we want to know about media reporting of risk information. We originally hoped in writing this paper to find for each of the countries we looked at neat and relatively conclusive studies of media coverage of risk issues and to compare them. We imagined lining them up and being able to report that in England the press covered AIDS or Chernobyl this way, while in Germany, by contrast, the press did it that way. This proved to be an idle hope. Few studies exist, and even fewer are comprehensive or conclusive. The subject of one study in one country rarely matches the subject of another in another country, making straightforward comparisons impossible.

So it is more necessary than usual, at this stage in the development of research on media coverage of risk issues, to rely heavily on a general knowledge of the history and political culture of the relevant countries for an understanding of the role of the media. Our own knowledge here leaves much to be desired. We have been aided by the insights of many of our informants, but we find nonetheless that comparative judgments remain at this point a risky venture.

This is not to deny that interesting work has been done on media coverage of risk and environmental issues. It is rather that what we want to know is extraordinarily complex. Essentially, we want to know how different kinds of news coverage of risk issues affect people's understanding of and beliefs about these issues. We can attempt to enhance our understanding of the processes involved in various ways. Informal studies and anecdotal accounts have been done of Chernobyl and Three Mile Island,(4) EDB and other chemicals,(5) and radon(6); there are also more general studies of media coverage of health risks and of science and technology.(7) But -- especially in the face of widespread assertions about the power of the press to shape the political agenda and public con-

sciousness -- we may still hope for a more systematic understanding of these matters. Such an understanding seems to call for more rigorous methods.

Mass communications research offers two tools: content analysis and media effects studies. Content analysis attempts to capture the character of media coverage. We often have firm opinions about the way the press covers an issue: that coverage is biased, or fair, or sensational; that it is liberal or conservative, right-wing or left-wing. Content analysis attempts to test these opinions, to make reasonably objective judgments possible about the sprawling mass of print and broadcast messages. The method is clearly described in the Report of the Public's Right to Information Task Force of the President's Commission on the Accident at Three Mile Island, the only comprehensive content analysis of a single event relevant to our subject that we know of.

> The researcher must devise a method by which a trained individual can reduce the words printed in a newspaper or spoken over the air to sets of statistics that can be compared. For example, a content analysis might determine how much space a variety of newspapers devoted to the accident; or how many times a news source was quoted throughout the week; or whether specific information on a given topic appeared, and if so, how often.(8)

Without context, background, comparison, and interpretation, such quantitative measures do not tell us very much. Bad content analyses are easy to ridicule. But when done well (as in the Three Mile Island report) content analysis can be a useful aid to understanding the interplay of media coverage and public opinion.

Even when done well, however, content analysis takes us only so far toward our ultimate goal, which is to understand how media coverage influences public perceptions of risk issues. For this we also need studies of media effects. If content analyses often seem insignificant, the trouble with media effects studies is very different. No one disputes that demonstrations of the impact of news stories on public perceptions and attitudes are significant; the problem is rather to establish convincingly that it is the media and not something else that have had the impact supposed. In experimental contexts it is possible to control for effects other than the media's on beliefs and attitudes.(9) But media effect studies focusing on real-world cases are inevitably inconclusive (which is not to say valueless). Countless studies of the effects of violence on television prove the same point: it is never possible to be certain, and rarely possible to be even confident, that an effect was caused by media coverage rather than something else. Often, an equally plausible conclusion is that heightened media coverage of an issue (say, nuclear power) was not the cause of an effect (say, increasing opposition to nuclear power) but was rather itself an effect of some third cause.

To understand adequately the interplay between controversial risk issues, media coverage, and public opinion, we would need in-depth content analyses and studies of media effects of the same risk issue.(10) For we want to know not only to what extent news coverage affects public opinion but how the particular content of news messages affect it. Needless to say, such comprehensive studies are extremely labor-intensive and difficult to carry out.

3. On the relationship between media coverage and public opinion

By far the most ambitious, impressive, and provocative research project in this area is the twenty-year study by Hans Mathias Kepplinger of coverage of technology in the German print media.[11] Kepplinger is among the few scholars who dares to draw far-reaching conclusions about what might be considered the three fundamental elements in media coverage of an issue -- the content of media coverage, the "reality" that media coverage presumably aims to capture, and public opinion -- and the relations between them. Whatever criticisms can be raised against his conclusions, we must be grateful that he has robust and interesting conclusions. His work has stimulated much of the discussion that follows.

Kepplinger's view, for which he has amassed a great deal of evidence, is that media coverage of a variety of technological issues -- in particular air, water, and forest pollution, radioactive fallout, and fatal traffic accidents - - has become increasingly negative over the last twenty years, while the objective indicators for these issues have shown improvement or at least have not declined. For example:

> The press hardly reported water pollution at all during the period of the greatest pollution of the Rhine in the late 1960s and early 1970s.. . .The press only emphasized water pollution when the pollution of the Rhine had receded and the regeneration ability of the river in terms of bio-chemical oxygen requirements had increased considerably. In relation to the Rhine there is a contradictory development between the real pollution and reported pollution.[12]

Thus, Kepplinger concludes, the media do not convey an accurate picture of reality. And, furthermore, "this new portrayal of reality by the media leads to a fundamental change in the public's views."[13]

Kepplinger's work is of interest not only in its own right, but also because he argues for a view that many others hold, often without benefit of evidence. His view involves two claims: one about media content, and one about media effects. Let us examine each of these, beginning with the second.

Kepplinger's evidence for the view that the media's (inaccurate) portrayal of reality changes public opinion is unclear. Part of the evidence seems to be that public opinion lags behind media coverage by about a year; that is, negative coverage of an environmental or technological risk is followed by negative public opinion about it. But this may be a case of *post hoc, ergo propter hoc* reasoning. Journalists and the public may both be responding to some third factor, with journalists quicker to react to events. In that case journalists would appear to be in the vanguard of opinion change, without actually wielding much influence themselves.

Another possible explanation, suggested by Allan Mazur's work, is that as media coverage of a controversy increases, public opposition to it also increases -- irrespective of whether the coverage is predominantly negative or not.[14] Mazur surmises that exposure to the disagreements among experts in the press makes a technology seem dangerous; even if pro- and anti-technology sentiments are well-balanced, the public is inclined to conclude that it's better to be safe than sorry. If this is so, then it is not the

negativity of coverage that contributes to negative public opinion; the mere increase in coverage (such as Kepplinger documents), whether negative or positive, will bring about this effect.

Mazur's view is supported by the conclusions of the Report of the Public's Right to Information Task Force of the President's Commission on the Accident at Three Mile Island. At least part of the impetus for the task force's content analysis was the belief among many critics that American press coverage of Three Mile Island had been unduly alarmist or sensationalist. The content analysis found that overall, reassuring statements reported by the press far exceeded alarming ones (56 to 39 percent).[15] One way to reconcile the impression of alarmism with this finding is via Mazur's view that the mere increase in press coverage of an event or technology contributes to intensifying the sense of danger, even if coverage is not particularly negative. Perhaps people believe that those who speak on behalf of a technology "doth protest too much."

The idea that the public tends to react negatively to media coverage of environmental and technological risks even where coverage is not predominantly negative suggests that people process negative and positive messages differently. This suggestion is confirmed by the findings of psychologists studying risk perception. They have examined both how people make judgments about risks or probabilities, and how people evaluate technologies, policies, or choices that appear to combine risks and expected benefits.[16] Regarding judgments, two points are relevant. First, people rely on a few heuristics or rules of thumb in estimating risks or probability. Among these is the availability to recall instances: people judge risks in which examples are more easily imagined or recalled to be more likely than similar risks that do not call up examples so easily. Press coverage of small risks, of course, makes instances more salient or vivid and thus more available to recall, which causes people to judge them more likely than they are.

The second point is that people are concerned not only about the magnitude of risks (i.e. their probability-weighted outcomes) but also about other of their qualities. The clearest example is whether a risk appears to be voluntarily accepted or involuntarily imposed. But some other risk qualities are especially relevant to environmental and technological issues: whether a risk is potentially catastrophic in its outcome rather than chronic; dread rather than common; and new rather than old or familiar. People perceive technologies embodying risks that are catastrophic, dread, and new as riskier than other technologies with risks "comparable" in magnitude, and news reports emphasizing these kinds of risks will send different signals than other negative messages.

Psychological research on decisionmaking confirms the view that positive and negative messages are processed differently. This work shows the importance of how people frame their options in drawing conclusions or making decisions. People adopt a reference point from which outcomes or choices are seen as positive or negative, but this reference point is influenced by how a choice is presented or described. Moreover, people tend to react more strongly to options that are negative relative to their reference point than to options that are positive. We tend to be more eager to avoid losses than to secure comparable gains. Thus, if people see a technology as possibly saving lives but also as risking some loss of life, they will weigh the losses more heavily than the gains in their decisions about whether to support or oppose the technology. If they frame the expected consequences of a technology as possible gains, say from imagining

the benefits it will bring, they will weigh these consequences less heavily than if they had framed them as possible losses from foregoing the technology.(17)

These findings are reinforced by work done by Elisabeth Noelle-Neumann and Wolfgang Donsbach on what factors influence the selection or retention of information by the newspaper reader. The flood of information grows continually, and the question arises: what filters do we use to let some of this information in and leave some out? Noelle-Neumann and Donsbach tested the hypothesis that mechanisms of selective attention, perception, and memory shield people from information that is incompatible with their predispositions. But they found that the process and effects of exposure to information are far more complex than this view -- essentially the theory of cognitive dissonance -- allows. They too concluded that people are more receptive to negative information in the press than positive. Supporters of a technology, for instance, are more likely to be affected by critical information about it than are critics likely to be affected by positive coverage.(18)

These findings -- which come from a variety of social scientists in different fields and research areas -- all support the view that people process negative and positive information differently. What follows from this? An important conclusion is that, even where people's views are formed largely on the basis of news coverage, it is a large leap from the claim that people have predominantly negative views about an environmental or technological issue, or are unduly alarmed about a given risk, to the view that the media have covered the issue in a sensational or predominantly negative way.

4. On the relationship between media coverage and "reality"

What of Kepplinger's view that the media do not portray an accurate picture of reality because press coverage is unrealistically negative? Kepplinger here echoes Spiro Agnew's famous description of journalists in 1969 as "nattering nabobs of negativism." This view invites very difficult questions about the proper role of the media. We began by distinguishing two tasks: discovering how the media do cover risk issues, and deciding how they ought to. We move here from the first to the second, because Kepplinger's claim contains an implicit accusation: it suggests that the media ought to be attempting to reflect reality. But this assumption needs to be examined critically.

Indeed, looking at what the media do in communicating risks reveals a deep tension in our expectations of what the media ought to do. Looked at in one way, the criticism that the media do not accurately reflect reality seems a perfectly legitimate and natural one. Of course the media should reflect reality! What, after all, is the alternative? Bias. Distortion. One side of the story. Things out there in the world are a certain way, we believe, and an unrealistic news story does not capture the way they are because of the personal biases of the reporter or the ideological commitments or structural constraints of the news organization. The ideal, from this point of view, is to get as close to "reality" as possible; for the press it is to mirror "the way things are."

Of course we are all sophisticated enough to realize that the ideal is unattainable, that every person and every organization is constrained in ways that prevent them from capturing reality even if they sincerely aim to do so. The question here is not whether or to what extent reflecting reality is possible. We may admit that we will always fall

short, and yet take the reflection of reality as the ideal. That is a very natural and commonsensical course.

But this view of what the media ought to be doing conflicts with much of what we know about how the news media do in fact operate. More important, it neglects how they must necessarily operate. It would be absurd to expect your daily newspaper to give an accurate picture of "reality" full-stop. There is altogether too much reality: subatomic reality, chemical reality, astronomical reality, psychological reality, political reality, economic reality, and lots of other realities too. At the very most a newspaper can select from among these -- omitting, say, subatomic reality as irrelevant to its readers concerns (most of the time, though we can always imagine exceptions) -- and concentrating on political and economic reality. But even this is too vast an area. Journalists must find further ways of lopping off large chunks of reality. Well, we may say, that's not mysterious. Large chunks of reality are unimportant, from the point of view of journalists and their audience, because they remain constant over time and can be taken for granted. We are interested in what's new, unusual, changing, likely to affect us in ways we need to know about. This begins to bring us close to the standard criteria for what's newsworthy familiar to students of journalism. What's news is what's new, unusual, interesting, important, dangerous, controversial, a change from the norm.

Seen in this way, news coverage is inherently "unrealistic"; it gives us a "distorted" picture of the world; it aims, and should aim, at nothing else. (We put these words in scare-quotes, of course, because we mean to disavow their typical negative connotations.) Reality is not as interesting as the press makes it seem, and a newspaper that produced even a representative slice of reality would be excruciatingly dull.[19]

Yet it is difficult to reconcile these necessary functions of the news media with our interests in truth, objectivity, and fidelity to reality. How do you select a small sample of things and events and trends in the world from the teeming multiplicity without distorting their significance?

Often you don't. Journalists can always be criticized for the criteria they employ in choosing news stories. We may well object to the prevailing practice summarized by a memo (now in need of a rewrite) that is said to have hung in the newsroom of a British daily: "One Englishman is a story. Ten Frenchmen is a story. One hundred Germans is a story. And nothing ever happens in Chile."[20] Similarly, there is something disturbing in the idea that the news must be "new," if that means that a people suffering malnutrition for decades is not a story, even if their plight remains unknown to most of the news audience.

But our objection in such cases can only be to the particular principles implicit in these cases, and not to the wider principle that *some* criteria must be employed to select from the mass of possible news stories. To bring our discussion back to the issue of risk communication, the question is whether the media's presumed emphasis on negative aspects of risk issues is justified.

To take Kepplinger's example, let us assume that water pollution in the Rhine has declined over the last fifteen years, while media coverage of the pollution has increased. Does this indicate a defect in press coverage that ought to be remedied? Not necessarily.

First of all, people (journalists or the general public or both) may not have been aware of the Rhine pollution at its peak. What you don't know can hurt you, but it can't scare you. Since the environmental movement only began to gather momentum in the late sixties it is perfectly plausible that water pollution was greater before people were disturbed by it.

Even if people were aware of the pollution before extensive media coverage (surely they saw it and smelled it), they may not have viewed it as an alterable part of the environment. It is a commonplace that people rebel against their circumstances when they begin to see the possibility of something better, and that this happens not when their circumstances are most dire but when they have begun to improve. So it is very plausible that those who lived near the Rhine in the early sixties saw its filth as one of the unfortunate but inevitable consequences of civilization.

These points go some way toward explaining and justifying negative media coverage of pollution even in the face of improving conditions. Pollution may still be excessive, even if there is less today than twenty years ago. We may appreciate its risks more now than when they were greater. And we may hold different values because of previous successes in pollution control, which lead us to demand further improvements in the future. Just as people's desires change with increased economic welfare, so their social and political values may alter with improvements in the environment. There is nothing obviously irrational about this process. In covering such issues, journalists can be registering dissatisfaction with a state of affairs despite its improvement over some previous state. They may be reflecting social values, engendering them, or both, but this need not indicate a failure to see "reality" as it is. For the reality at issue here includes people's values and expectations, and so is partly beyond the reach of even the most sensitive scientific indicators of environmental harm or risk.

Life expectancy is greater than ever before, and many of the risks previous generations endured have been eliminated. But we are highly sensitive to every whisper of danger. One clear example: the risks of conceiving a child with birth defects have been greatly reduced in the last decades as a result of amniocentesis, sonograms, knowledge of the ill effects of drugs, alcohol, and cigarettes on the unborn, etc.; but we daresay expectant parents worry more about the risk of bearing a child with birth defects than did their parents. In part at least this is because they have more control over the course of events.

How should we characterize this change of values? Is it the spoiled attitude of those who haven't suffered enough -- those children of the affluent postwar period who think they can have everything, never suffer, and live in a perfect environnment? A kinder interpretation of some of the same facts is that the human psyche abhors a vacuum; when it need no longer worry about how it will put breakfast on the table it worries about what (additives, preservatives, pesticides) is in that breakfast. When your life expectancy is thirty-five, or even fifty-five, you don't worry about the risks of diseases that are likely to strike forty years hence. So it is natural for people to worry more about pollution than they used to, even if pollution has declined.

Of course the question remains just what the journalist's role is here. Are journalists partly responsible for increased awareness of pollution and changing values among the

public, or are they simply responding to popular trends? No doubt more research in this area can shed some light on this question, but like other chicken-and-egg questions it remains largely unanswerable. Common sense suggests that both factors play a part: journalists, as members of the larger society, respond to social trends (although perhaps more quickly than the typical citizen); at the same time they act as catalysts, speeding up these trends.

5. Some dilemmas for journalists

We have been examining the claim made by Kepplinger and others that there is something wrong with media coverage of risk issues when negative coverage of an issue increases while the objective indicators of "negativity" (pollution or other damage) remain the same or even improve. It is rare, of course, that we have a clear indicator of "reality" with which to compare media coverage. Risk issues are controversial: they involve uncertain claims about the future, and usually significant disagreement exists about the facts of the matter -- about how bad things really are now or how bad future consequences will be of present conditions about which there is consensus.

This can be true even where we have reliable statistics. Consider two examples. The accident at Three Mile Island showed that certain kinds of accidents previously thought impossible or highly unlikely by experts were in fact quite likely. At the same time, in that accident the containment mechanisms succeeded in preventing the release of hazardous radioactive materials. Both supporters and opponents of nuclear power took these ambiguous events to support their side. Who was right? Similarly, several years ago the number of commercial airline accidents in the United States declined, while the number of near misses increased. Was air travel getting more safe or less?

But statistics, even when accurate as far as they go, often mask important questions. Opponents of a technology are likely to worry about risks with properties not always captured by the numbers: risks that are catastrophic -- of low probability but fatal or very injurious to large numbers of people -- and risks like cancer with long latency periods between exposure to a hazard and the onset of effects. That our fears have not yet been confirmed is not necessarily to the point.

Because of such uncertainties, ambiguities, and limitations in our knowledge it is often argued that news coverage should be balanced -- should give both the "pro" and the "anti" side of risk issues -- and that the media show bias if coverage is not so balanced.[21] It is quite natural and in many ways appropriate to take such a view. Nevertheless, the conception of balance and objectivity implied in this view raises serious questions.

(1) Is balance always desirable? No. We demand balance only where we already take both sides of an issue somewhat seriously. We don't think the cannibal or the Nazi deserve equal time.[22] These, obviously, are extreme cases; but the issue remains in less extreme cases as well. The decision to seek balance implies a value judgment on the part of the journalist or the news organization that there are (at least) two minimally respectable sides to the story.

(2) Is balance a simple arithmetic matter of giving an equal number of pro and anti statements or points of view? Several dangers lurk in this view of balance. One is trivialization: the idea that for each position there is an equal and opposite counter-position. A natural consequence of this view is sheer agnosticism or skepticism: if a news story is totally balanced, there is nothing to choose between the two positions.[23] Another danger is oversimplification: the idea that each issue can be divided neatly into two and only two sides: pro and anti. Thus journalists generally want to put the question in risk communication as "Risky or not risky?," while scientists insist that the question is rather "How risky?"[24]

(3) How does the journalist's choice of sources affect the overall slant of his or her news story?[25] To what extent do journalists rely on "official" sources or "experts" whose credibility is not questioned? To what extent do they rely on fringe group sources or extreme opinions that spice up their stories but mislead about the nature of a controversy?[26] (A likely consequence of the "two sides to every story" approach just described.)

(4) To what extent does or should the journalist's or the news organization's own judgment about the merits of a particular issue influence the way in which a story is told? Partly this is a question of whether or to what extent pro and anti statements in a news story are simply statements attributed to sources, or whether the journalist herself makes such statements. This in turn depends partly on how pro and anti statements are understood. If we think of them as explicitly evaluative judgments ("Nuclear power is a disastrous idea," "Radon poses a grave danger"), then journalists (at least or especially in the American tradition) are not likely to make them in a news story, thus contributing to the problem of skepticism described in (2). But if we understand them to include factual judgments with negative implications ("Smoking caused x number of deaths in 1987") then presumably even staunch defenders of the distinction between news and opinion must allow the journalist to make such statements.[27]

6. The politics of risk communication

We began by noting that our interest in how the media report on technological and other health risks is driven by our beliefs about what their role ought to be. In this paper we have been exploring some fundamental reasons why both the empirical and the normative issues are complex.

Deciding what is newsworthy and what the "reality" is that news reporting ought to capture is intrinsically difficult and controversial. Reporting about technological and environmental risks, no less than the risks themselves, is politically fraught. The media are part of the social and political processes they cover and not simply detached transmitters of messages. Sources of risk information who regret that their messages do not reach the public as they intended should realize that, ironically, to the extent that the media are simply transmitters they easily become the tools of politically interested parties.

This is not to say that the press should never adopt the role of neutral transmitter, but rather that when it does it should do so self-consciously. Journalists may, for example, decide to cooperate in government-sponsored information drives to help stop the spread

of AIDS. In so doing, they are at once acting to change behavior (a very active and political role) and transmitting others' messages (a seemingly passive role).

Where risk issues are embroiled in social and political controversies, those controversies themselves form an essential part of the "reality" that news media must cover. When the media report on these disputes, they are more likely to fuel them than to resolve them, giving comfort and encouragement to some interested parties and angering others, while further polarizing and perhaps confusing the ordinary public.

> We thus agree, but only in part, with William Cannell and Harry Otway, who argue that the perceived inadequacies of risk communication arise not because it is intrinsically difficult to inform people about the nature and consequences of technological hazards. . .the most important reason behind the apparent inadequacy of risk communications is the fact that they are judged against criteria which are inappropriate. Risk communications cannot be expected to resolve the conflicts which inevitably arise in society over the choice and implementation of technologies.(28)

Cannell and Otway are right to emphasize the political nature of risk issues and the fact that it is unreasonable to expect, as some interested in risk communication do, that to communicate adequately and accurately ought to suffice for achieving social consensus on risk issues. But that is partly because what is adequate and accurate is itself hotly contested,(29) and because the substance of disagreement cannot be wholly separated from the process by which that disagreement is communicated (as, for example, in decisions about which sources to use, how prominently, and the like). One can maintain that there are no intrinsic problems in informing people about the nature and consequences of technological hazards only on an exceedingly narrow conception of "the nature and consequences of technological hazards." So, for example, estimates of the risk of a certain chemical accident might converge on one in a billion, but whether that is high or low, what it ought to be compared to -- in other words, the meaning of that statistic -- is highly contestable. This is as much a question of the nature of a hazard as anything is.(30)

Beneath all these normative issues lies a further layer of empirical complexity. For even if we could somehow resolve the normative issues, there remains the fact, as confirmed by evidence from a variety of quarters, that there is a gap between the content of news coverage and public perceptions and understanding of risk issues. Our discussion focussed on the idea that people process negative and positive information differently. In so doing it ignored a further complication: namely, that risk communication aims to reach not a single audience but a variety of audiences with different interests (in both senses), values, and levels of intelligence, education and understanding. We may suppose, furthermore, in keeping with the findings on risk perception, that these audiences -- the lay public, members of environmental groups, politicians, policymakers and government bureaucrats, industrialists, scientists -- will frame the information presented to them differently. Is it possible to communicate intelligibly and accurately to all of them at once (or even to some subset of these groups)? This is an important question about which there is much dispute and little evidence. Some people claim, for example, that anything clear enough for the ordinary citizen to understand will do violence to the facts as seen by a scientist. We hope this is an overly pessimistic view; we see no reason why people able to manage in the world of mortgage rates, baseball statistics, and the stock

market cannot be made to see, for example, that risk is not an either/or concept but a matter of degree.

More research needs to be done on this issue, as well as on the other empirical and normative issues we have explored. Because of the complexities we have described, advances will depend partly on cooperation among risk analysts, communications experts, political theorists and philosophers; in any case, progress is likely to be slow and the research costly. Journalists, moreover, may be resistant to assimilating any lessons of this research to their own practice, on the grounds (which they have been known to articulate) that to do their job well they must let the consequences of reporting be damned. Such an attitude betrays either misunderstanding or irresponsibility (or both) about the journalistic enterprise. We hope to have demonstrated at least this: it matters greatly that journalists and the rest of us understand the context and the consequences of press coverage of risk issues.

References

(1) For a fuller discussion of these findings, see below, in the 1st section .

(2) Other sources of information are also relevant. One (no doubt distasteful to many) is market research, done principally by or on behalf of businesses selling products or services to find out how best to reach consumers. Another is the work of those in public health directed toward public communication and education; this is obviously related to risk communication but seems to have a distinct history. We have not yet been able to pursue these paths to see what of relevance to risk communication can be extracted.

(3) The selection of countries we chose to examine is somewhat arbitrary -- based on contacts we had in those countries, work we knew was being done, time constraints, and the like. A regrettable omission (perhaps rectifiable in later versions of this paper) is France, which appears to present a significantly different model from the countries we examined.

(4) See H. Otway et al., An Analysis of the Print Media in Europe Following the Chernobyl Accident (Luxembourg: Office for Official Publications of the European Communities, 1987); Hans Peter Peters et al., Reactions of the German Population to the Chernobyl Accident (Julich: Nuclear Research Center, 1987); M. Deicher et al., The Accident at Chernobyl: A Report on Risk Management at a Local Hot Spot in West Germany, paper delivered to the Society for Risk Analysis, Boston, November, 1986; David Rubin, "How the News Media Reported on Three Mile Island and Chernobyl," Journal of Communication 37 (1987); Mark Stephens, Three Mile Island (New York: Random House, 1980).

(5) Harold Sharlin, "EDB: A Case Study in Communicating Risk," Risk Analysis 6 (1986); Media Institute, Chemical Risks: Fears, Facts and the Media (Washington: Media Institute, 1985).

(6) Allan Mazur, "Putting Radon on the Public's Risk Agenda," Science, Technology & Human Values (issue).

(7) See, e.g., Twentieth Century Fund Task Force on the Communication of Scientific Risk, Science in the Streets (New York: Priority Press, 1984); Dorothy Nelkin, Selling Science: How the Press Covers Science and Technology (New York: W.

H. Freeman, 1987); Edward J. Burger, Jr., Health Risks: The Challenge of Informing the Public (Washington: Media Institute, 1984).

(8) Washington: U.S. Government Printing Office, 1979, p. 182.

(9) See, e.g., Sharon Dunwoody, Marian Freistad and Michael Shapiro, "Conveying Risk Information in the Mass Media," presented to the International Coomunication Association meeting, May 1987, Montreal, whose experiments suggest that the content of headlines and the vividness of a news story (operationalized in terms of whether a story's lead was personalized or not) can influence risk judgments. They found, however, that behavioral intentions were not affected. For a more general experimental treatment not concerning risk issues per se see Shanto Iyengar and Donald R. Kinder, News That Matters: Television and American Opinion (Chicago: University of Chicago Press, 1987).

(10) And to make reliable comparative judgments between countries we would need similar studies carried out in different countries.

(11) Most of this work is untranslated, and we rely here on the English paper "Artificial Horizons," unpublished, as well as on an interview with Hans Kepplinger on August 10, 1988. "Artificial Horizons" summarizes the work of H. M. Kepplinger and R. Mathes, Kunstliche Horizonte: Die Darstellung von Technik in Zeitungen und Zeitschriften der Bundesrepublik Deutschland von 1965 bis 1986, forthcoming.

(12) Artificial Horizons, p. 8.

(13) Ibid., p. 16.

(14) The Dynamics of Technical Controversy (Washington: Communications Press, 1981), ch. 8.

(15) The content analysis seems to have limited its investigation of reassuring and alarming statements to those directly (through quotes) or indirectly attributable to sources; it did not, it appears, examine statements made by the reporter in the ordinary course of a news story. Kepplinger's study, as we understand it, did not limit its analysis to statements by sources. The difference in approach here may reflect a different understanding of the reporter's role in Germany and the United States; more specifically, the American study may reflect the American view that insofar as the reporter is speaking in her own voice her statements are value-neutral, while the German study may reflect the belief that all statements are value- laden. For more on this point, see the 5th section.
For a full discussion of the media outlets covered, how "reassuring" and "alarming" were understood, and other important details of the content analysis, see the Report, pp. 182-214.

(16) For work in judgment, see D. Kahneman, P. Slovic, and A. Tversky, Judgment Under Uncertainty: Heuristics and Biases (Cambridge: Cambridge University Press, 1982), and P. Slovic, B. Fischhoff, and S. Lichtenstein, "Rating the Risks," Environment 21 (1979). For work on decisionmaking, see D. Kahneman and A. Tversky, "Prospect Theory: An Analysis of Decisions Under Risk," Econometrica 47 (1979), and A. Tversky and D. Kahneman, "The Framing of Decisions and the Psychology of Choice," Science 211 (1981).

(17) Whether our judgments and decisions are distorted or not, rational or irrational, is an important but different question. Although the psychologists who have done this research have been careful to avoid drawing normative conclusions of this sort, others are often quick to come down on one side or the other: to conclude

either that people are easily manipulated, not trustworthy, and irrational because they misjudge risks; or else that "the people are always right," that whatever affects people's judgments is necessarily legitimate. It is important to examine the reasons for opposing some technology or risk carefully; it is likely that the psychological bases for opposing a risk will be mixed. It may be reasonable to worry about catastrophic risks differently from others, and it may be reasonable to frame a choice one way rather than another. But our estimations about magnitudes of risk may be erroneous, and we may have to admit although we are subject to certain framing effects we cannot defend this tendency.

(18) "Selective Exposure to Newspaper Content," presented at the International Communication Association Conference, May 21- 25, 1987, Montreal. Their findings are especially significant since they do not seem to be aware of the risk perception literature.

(19) Here we find a parallel between the psychological processes uncovered by research in risk perception and the professional norms of journalism. Just as people assimilate information in a way that does not fully reflect the facts, the norms of journalism select for stories that do not mirror "reality."

(20) Carlin Romano, "The Grisly Truth About Bare Facts," in Reading the News, edited by Robert Karl Manoff and Michael Schudson (New York: Pantheon, 1986), p. 47. Similarly, the British paper Today of July 19, 1988 carried a huge headline on page 1: "Poison Cloud Sprays 5,000 Britons"; one had to read several paragraphs down to learn that in addition to the British tourists the fallout from a chemical factory explosion in Italy also affected 145,000 other people. We are grateful to Malcolm Peltu for showing us this story.

(21) See William Rankin and Stanley Nealey, A Comparative Analysis of Network News Coverage of Nuclear Power, Coal and Solar Stories (Seattle: Battelle Research Center, 1979), which argues that news coverage, which increased greatly in the years from 1972 to 1977, was biased in favor of the antinuclear side because neutral and critical stories increased at a faster rate than promotional ones (cited in Twentieth Century Fund Task Force on the Communication of Scientific Risk, Science in the Streets).

(22) See Alexander Cockburn, "The Tedium Twins," Harper's, August 1982, for a caustic demonstration of this point.

(23) An example (not from risk communication): a recent segment of the CBS magazine series West 57th examined the new biography of John Lennon by Albert Goldman, which argues that Lennon was a crazed degenerate drug addict and a rotten human being. The reporter presented both sides: the view that Goldman was right, and the view that the book did Lennon a grave injustice. But there was little attempt to evaluate the book's charges, only to state them and their denials, and to undermine Goldman's motives by emphasizing the big advance he got from the publisher. The viewer was left with no way of deciding whether the book was simply sensational or worth taking seriously.

(24) See Peter Sandman, "Explaining Environmental Risk: Some Notes on Environmental Risk Communication."

(25) See Russell Spears, Joop van der Pligt, and J. Richard Eiser, "Sources of Evaluation of Nuclear and Renewable Energy Contained in the Local Press," Journal of Environmental Psychology 7 (1987).

(26) We were recently told this story: the head of a think-tank was asked by a reporter for the name of someone who could talk about a certain controversial subject. The think-tank head asked if the reporter wanted someone with sensible views or crazy views. The reporter preferred the latter.
But see Sandman, "Explaining Environmental Risk," who argues persuasively that on a scale of 0 to 10 representing possible positions on an issue reporters are interested in 2s and 3s and 7s and 8s: positions neither too wishy-washy nor too far-out.

(27) We gather from discussion with Hans Kepplinger that his coding of positive and negative statements about technology took the latter tack: it distinguished explicit and implicit positive and negative statements (weighting the former more heavily) and counted factual judgments with negative implications (statements about death or injury) as implicit value judgments.
Our work so far suggests a difference between Continental European and Anglo-American norms of journalism in this respect: journalists in the Anglo-American tradition uphold the distinction between news and opinion and the "fact-value gap," while European journalists reject these distinctions and see themselves much more as involved in value-laden political activity. For confirmation of this difference see Renate Kocher, "Bloodhounds or Missionaries: Role Definitions of German and British Journalists," European Journal of Communication 1 (1986), pp. 43-64. This is an issue very much worth pursuing.

(28) "Audience Perspectives in the Communication of Technological Risks," Futures (1988).

(29) For an illuminating example see Brian Wynne, Peter Williams, and Jean Williams, "Cumbrian Hill-Farmers Views of Scientific Advice," Evidence to the House of Commons Select Committee on Agriculture Investigating the Chernobyl Disaster and the effect of Radioactive Fallout on the U.K., May 1988.

(30) For a good discussion of risk comparisons and the context of risk estimates, see Vincent Covello, Peter Sandman, and Paul Slovic, Risk Communication, Risk Statistics, and Risk Comparisons: A Manual for Plant Managers (Washington: Chemical Manufacturers Association, 1988).

Results of the Working Group "Media Reporting of Risk Information"

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Risks are covered in many contexts and different media types. The working group limited its focus to mass media like newspapers, television and radio (excluding, e.g. fiction), and to institutional risk controversies (those related to institutional decisions on risk sources), excluding information on health risks, for example. Although many of the general findings of mass communication research are also relevant to risk communication, we emphasized aspects particularly important for the communication of risks. The paper is divided into two sections. The first describes how the mass media in fact communicate risks. The second part suggests improvements in the current situation and how to bring them about.

How do the mass media report on technological risks?

1. In keeping with professional norms of newsworthiness, mass media do not focus mainly on risk as statistically defined. They rather emphasize other (qualitative) aspects of risk, such as conflict, human interest, personal victims, institutional blame or innocence and guilt. This is true for the selection of topics to be reported as well as for the way in which they are reported.
2. When mass media report on statistically defined risks they sometimes fail to present them accurately and clearly. For example, they often report risks without a context, failing to put them in perspective or to provide appropriate comparisons.
3. There is some evidence that minority positions may be over-emphasized by the mass media, since journalists try to report in a way that is "balanced" and to give different views on a topic. Such an approach may (in most cases but not always) lead to a more alarming view of a risk than the majority of experts would assert.
4. There are important differences between different types of media and between, e.g., different sections of a newspaper. For example, the reporting on risks in the busi-

ness section of a newspaper is usually more positive than in the "news" or political section.

5. Given journalistic norms and the boundary conditions of journalists' job, sources determine the content of news reports to a much larger extent than is publicly recognized. Their credibility, their accessibility and their readiness to cooperate with journalists (among other factors, like the political power or status of the source) have a great influence on which sources are selected. Other relevant factors are, for example, time, space and the limited expertise of journalists, the political orientation of the particular news organization and advertisers' implicit or explicit pressures.
6. The "risk emphasis" (whether a risk is covered in a more alarming or a more reassuring way) varies over time, place and issue, depending, e.g., on the availability of alternative sources, and the anticipated beliefs and expectations of the mass media audience.
7. Although we have no uncontroversial theory of mass media effects, we can rule out a simple "magic bullet" model according to which mass media content is transferred directly into beliefs and attitudes of the audience.

How should risk communication in mass media change?

1. There is no real chance to radically change journalistic behavior. However, some moderate changes in the ways technical risks are reported would be useful. The best hope for change, however, may be for potential sources to improve their ability to communicate through the mass media.
2. Although it is legitimate for journalists in their risk reporting to focus on risk aspects other than the statistical risk figures, they should not completely ignore the latter. They should be aware that their and their audience's concept of "risk" differs from that of the experts and that both concepts are legitimate and useful.
3. Journalists should seek and use a wider range of sources of risk information. A data base of technical experts in several technical fields, as, e.g., provided by the Media Resource Service in the United States and comparable institutions in some other countries, might assist journalists in finding the "best" rather than the "next" source.
4. Institutional as well as individual sources of risk information should learn how to be more effective communicators, by, e.g., avoiding jargon and being accessible to and cooperative with journalists. All efforts should be made to identify and eliminate barriers for effective communication. This might include trying to better understand and respect journalistic norms, values and needs; understanding that the media have a legitimate "alarming function"; and overcoming professional or organizational norms that prohibit communication with the public.

Trust and Credibility in Risk Communication

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1. Introduction

Better knowledge about the potential impacts of human actions and behavior and the deliberate use of technologies with high catas trophic potential have encouraged modern societies to develop institu tional responses to manage and regulate risks. Initiated by the heated debate about nuclear power, the political agenda has slowly moved from the paradigm of distributing wealth and income to a new paradigm focussing on the legitima tion of major risk sources that have the potential to threaten human health and environmental quality. The question of how society copes with risk management has become a major topic of new sociological investigations (e.g., Beck 1986; Luhmann 1986; Perrow 1984). The traditional power struggle between left and right, which had dominated social processes and changes in the last decades, may gradually be replaced by a new confrontation between the industrial versus the environmental fraction, although right and left positions still cluster within the two new groupings (Huber 1984). In general a shift in political paradigms is accompanied by new social changes with respect to the distribution of social resources, in particular power, prestige, and trustworthiness, and social structures.

Risk communication occurs in a specific social and political arena characterized by high public interest in the subject as such (but not necessarily in every single risk), by political polarization for the special class of high-consequence, low-probability risks and by a strong symbolic representation of risk management for different value systems and lifestyles. In addition, the stochastic nature of the risk concept and a multitude of scientific conventions and models that are used in risk analysis and risk management, but are rather remote from common sense reasoning, have created a gap between the professional understanding of what risk and risk management imply and the intuitive perception of most lay persons.

Communication in such an arena faces many serious problems: How can a communicator justify the application of professional standards if these are hardly intelligible for most people and trigger anti-elitist resentments? How can a communicator deal with the typical condition of dissent in technical, social, and political communities about the seriousness of different risks? How can a communicator cope with the intuitive heuristics that govern people's processing of probabilistic information? How can a communicator establish an aura of credibility if s/he has a vested interest in the proposed acceptance of his or her message?

The following paper attempts to summarize the major findings of the psychological and sociological literature on trust and credibility, and to apply these finding to the specific arena of risk communication. We will present a few guidelines for risk communication that are supported by the basic literature and that appear appropriate for the social and institutional context in which the risk debate takes place.

2. A conceptual framework of trust and credibility

Before presenting the major findings of scientific research on trust and credibility, some of the terms used in this paper need to be explained. First, we like to specify what we mean by "risk communication", then we will discuss the various definitions of trust, confidence, and credibility, and finally we are going to introduce an analytical framework for studying trust in risk communication.

We adopted the definition of risk communication by Covello, von Winterfeldt and Slovic (1986). According to these authors risk communication can be defined "as any purposeful exchange of information about health or environmental risks between interested parties. More specifically, risk communication is the act of conveying or transmitting information between parties about

a) levels of health or environmental risks;

b) the significance or meaning of health or environmental risks; or

c) decisions, actions, or policies aimed at managing or controlling health or environmental risks.

Interested parties include government, agencies, corporations, and industry groups, unions, the media, scientists, professional organizations, public interest groups, and individual citizens" (Covello, von Winterfeldt, and Slovic 1986, p. 172).

The definition limits the scope of risk communication topics to health and environmental aspects. This does not exclude the study of secondary and tertiary effects triggered by the communication process on health and environmental risks. On the contrary, the consequences of the communication effort in terms of psychological, social, and political repercussions are vital elements of the analysis of risk communication (Kasperson et al. 1988). The limitation refers to what is being communicated and not to the effects that the communication will initiate on social and psychological processes.

Among the stated purposes of risk communication, gaining or sustaining trust is one of the most frequently mentioned objectives (Kasperson and Palmlund 1987; Covello et al. 1986; Zimmermann 1987; Renn 1988). But most articles on risk communication do not elaborate what they mean by trust and which elements constitute a trustful relationship. We need therefore a better understanding of the meaning and implications of the term trust. If we consult the literature, we can find the following definitions:

a) "the confidence that one will find what is desired from another, rather than what is feared " (Deutsch 1973);

b) an "Actor's willingness to arrange and repose his or her activities on Other because of confidence that Other will provide expected gratifications" (Scanzoni 1979);

c) "a generalized expectancy held by an individual that the word, promise, oral or written statement of another individual or group can be relied on" (Rotter 1980);

d) "a generalized expectation related to the subjective probability an individual assigns to the occurrence of some set of future events" (Rempel, Holmes, and Zanna 1985);

e) "assured reliance on a person or thing" (Webster's Third International Dictionary).

Apparently all definitions emphasize the reliability of information and the conviction by the receiver that the source of a message has given truthful and complete information. For our purpose of defining trust in the context of communication, we would like to suggest the following definition: *Trust refers to the generalized expectancy that a message received is true and reliable and that the communicator demonstrates competence and honesty by conveying accurate, objective, and complete information.* Although trust and confidence are often used interchangeable, confidence in a source can be distinguished from trust as a more enduring experience of trustworthiness over time. Accordingly *confidence denotes the subjective expectation of receiving trustworthy information from a person or an institution.* People have confidence in a source if their prior investment of trust in that source has not been disappointing over a longer period of time. If many persons share such a confidence in a communication source, they assign credibility to this source. So we can define *credibility as the degree of shared and generalized confidence in a person or institution based on their perceived performance record of trustworthiness.* All three terms imply a judgment of others about the quality of a message or a source. So they are all based on perceptions (Midden 1988). These perceptions, however, can be linked to special structural and performance characteristics of institutions.

To make these terms more operational, it makes sense to identify the major attributes that constitute trust, confidence, and credibility. The literature includes several approaches (Garfinkel 1967, McGuire 1985, Barber 1983, Lee 1986, Sheridan 1987). We decided to amalgamate some of the proposed suggestions from the literature and developed the following classification scheme.

Trust can be substructured in the following five components:

a) Perceived *competence* (degree of technical expertise assigned to a message or a source);

b) *Objectivity* (lack of biases in information as perceived by others);

c) *Fairness* (acknowledgement and adequate representation of all relevant points of view);

d) *Consistency* (predictability of arguments and behavior based on past experience and previous communication efforts);

e) *Faith* (perception of "good will" in composing information).

Trust relies on all five components, but a lack of compliance in one attribute can be compensated for by a surplus of goal attainment in another attribute. If objectivity or disinterestedness is impossible to accomplish, fairness of the message and faith in the good intention of the source may serve as substitutes. Competence may also be compensated by faith and vice versa. Consistency is not always essential in gaining trust, but persistent inconsistencies destroy the common expectations and role models for behavioral responses. Trust cannot evolve if social actors experience inconsistent responses from others in similar or even identical situations.

Confidence is based on a good past record of trust-building communication. In addition, the performance of the source and its image with respect to its fulfillment of tasks and communicative functions are major attributes that constitute confidence. High social support for a source can serve as a reinforcement for generating and sustaining confidence. In addition, congruence of its goals and values with those of the targeted audience may enhance confidence (Luhmann 1973).

Both, trust and confidence, are necessary conditions for the assignment of credibility to a source. Credibility is a product of long term evidence and commonly shared experience that a source is competent, fair, flexible to new demands, and consistent in its task performance and communication efforts. Judgments about these criteria are based on social perceptions. These perceptions, however, are at least partially governed by structural factors, such as the success or failure in meeting the socially assigned roles and expectations and the institutional openness for public demands and requests. Thus it makes sense to distinguish between genuine perception factors (Image aspects) and structural factors (characteristics or properties of institutions that affect the social perceptions). All three, trust, confidence, and credibility, are also subject to the macro-sociological climate in a society vis-a-vis social institutions and their role for social cohesion (Lipset and Schneider 1983). This influence is independent from the actual performance or communication record of the source.

For analytical purposes it seems appropriate to differentiate between different levels of trust, confidence and credibility depending on the source and the situation. We developed therefore a classification scheme that is composed of five distinctive levels of analysis:

a) *trust in a message*,

b) confidence in a communicator (*personal appeal*),

c) confidence and credibility as a result of source perception (*institutional* image and prestige)

d) confidence and credibility as a result of *institutional performance* (structural variables)

e) the *macro-social* climate in which trust-building takes place.

Each level of analysis is embedded in the next higher level. Consistent violation of trust building efforts on one of the lower levels will eventually impact the next higher level. Distrust on a high level sets the conditions and determines the latitude of options for

gaining or sustaining trust on a lower level. The order of levels is also associated with an ascending order of complexity and abstraction.

The levels of analysis enable us to identify the elements within each level that may contribute to trust, confidence, or credibility. Table 1 illustrates the key variables in each of the levels and shows their interrelatedness. The "message" rubric includes all the variables that influence the perception of competence, fairness, consistency, and faith. Personal variables, such as appearance, appeal, style, and responsiveness, affect the trust and confidence that a person conveys to his or her audience. Furthermore, institutional performance and image color the acceptance and evaluation of a message and influence the reception of the communicator by the targeted audience.

All variables that we identified as relevant on this level are summarized in the two rubrics representing image and performance of institutions. Last, the social political climate shapes the readiness of receivers to give credit in terms of prior confidence to a communicator. In times of predominant distrust in institutions, the expectation that communicators are trying to betray their audience is the default option in receivers' attitudes toward a communication source. Under such conditions, active trust management is certainly required. In times of a positive climate of confidence in institutions, trust is given as an initial investment or credit to new sources, but may easily be lost if abused.

3. Insights from psychological studies

3.1. Trust as prerequisite for social orientation

Interaction among individuals relies on a minimum of trust between the actors involved, at least to the point that they share a common meaning of the elements of the communication process. Thus trust is a prerequisite for any social interaction and at the same time a major mechanism to provide orientation in uncertain situations and to make the outcome of a communication more predictable. In this sense, trust is a medium to reduce complexity by limiting the scope of behavioral responses, but it is also a medium to enhance complexity because it entails a higher degree of freedom for behavioral actions without implying an extensive debate between the interaction partners about the legitimation or appropriateness of each other's actions (Barber 1983; Luhmann 1980).

By shortcutting normal control mechanisms, trust and later on confidence (based on positive experience with granting trust to a specific social actor) can be a powerful agent for efficient and economical performance of social tasks. Durkheim's analysis of organic solidarity as a major structural variable of modern societies focussed on trust as one of the the predominant media that helped to shape the division of labor and to differentiate societal functions (Durkheim 1933; Luhmann 1973). But trust provides also ample opportunities for misuse. Thus trust is permanently tested in social situations. If one set of actors feel that they have granted trust to another set of actors who misused this valuable social resource, a return to tighter control and explicit step-by-step management of task performance is likely to occur. The major factor of building confidence in a social actor is therefore experience of trustworthiness in the past.

The more people feel that their investment in the trustworthiness of a specific institution served them well, the more credibility this institution will gain over time and the more degrees of freedom it will have in planning and performing tasks, even if these are not immediately intelligible to the audience. In this respect, credibility helps institutions to develop and carry out their agenda without being forced to legitimate each step of action.

3.2 Psychological factors of trust and credibility

Psychological research about attitude and attitude change has shed some light on the conditions under which receivers of information assign trust or one of its building blocks, such as competence, to a communicator. These research results are usually discussed in the framework of persuasion: What elements of a message or a communication context is likely to enhance or diminish the persuasive effect of a message? What elements of the message are remembered and which trigger changes in opinions or attitudes?

Before reporting on some results of these studies, we should mention the restrictions and limitations of these studies to avoid misinterpretation (McGuire 1985; Anderson 1983; Meinefeld 1977). Most of the research in attitude change has been performed in laboratory settings with student populations. Most experiments were done with a limited set of issues or topics so that it is not clear whether the revealed relationships can be extended to other topics or audiences. Many experiments were conducted in the 1950ies and 1960ies, both time periods in which the social climate for trust and credibility differed considerably from today's climate. For example, experiments involving experts as communicators resulted usually in considerable persuasion effects in the early 1960ies while more recent experiments demonstrate more ambiguous results depending on the existence of a social controversy over the issue and the social perception of the expert's own interests (Eagly et al. 1981; Heesacker, Petty and Cacioppo 1983). But at the same time many of the research findings are consistent over long time periods and have been tested with a variety of subjects and topics (Chaiken and Stangor 1986; Eagly and Chaiken 1984). So they can be regarded at least as well founded hypotheses for application in risk communication until more specific research studies are conducted in this area.

The following review of research results is based on such experiments. For the purpose of this article, we will only present the conclusions and omit the methodology or design of these studies. Readers interested in a more detailed review should consult the respective review articles (McGuire 1985; Chaiken and Stangor 1987; Eagly and Chaiken 1984; specifically for risk communication Lee 1986). Among the factors that have been found to enhance the persuasiveness of a communication are:

a) Attractiveness of information source: Attractiveness is composed of similarity of positions between source and receiver; likability of source; and physical attraction (Lee 1986; McGuire 1985; Chaiken and Stangor 1987).

b) Sympathy or empathy of the receiver with the source: This refers to the possibility of a receiver to identify with the source or its motivations (Mc Guire 1985; Eagly and Chaiken 1984).

c) Credibility of source: Among the components tested are perceived competence, expertise, objectivity, impartiality, and fairness (Lee 1987; Tyler 1984; Rempel and Holmes 1986).

d) Suspicion of honest motives: Receivers do not detect any hidden agendas or motives behind the communication effort (Rosnov and Robinson 1967; Eagly et al. 1981).

dd.High social status or power of communication source: The effect of these two variables depend heavily on the issue and the composition of the audience (Mc Guire 1985; Chaiken and Stangor 1987; Lee 1986).

These factors seem almost intuitively plausible. A communicator is likely to leave a more lasting impression on the audience if the message appears honest, accurate, and fair and if the communicator is a likable person with whom the audience can easily identify. The more difficult question, however, is how a communicator can accomplish to impart these impressions on the audience under real life conditions. What do we know about the effectiveness of message composition and personal appeal that would allow us to tailor information programs to seek more persuasive power?

3.3 Message composition and personal appeal

(Un)fortunately, we do not have any recipes to enhance credibility or to increase the persuasiveness of a message. But psychological research in the past two decades have yielded some interesting, sometimes even counter-intuitive, findings that link specific aspects of message composition or personal style of communication with persuasive effect. These findings are summarized in Table 1 under the two rubrics of "message" and "personal factors". Some of the more counter-intuitive factors deserve special mentioning:

a) High credibility sources, such as scientists or opinion leaders, produce more opinion change, but no difference in message learning. The learning of a message is more related to the similarity of the message than to existing attitudes and beliefs (Hovland and Weiss 1967; McGuire 1985).

b) Perceived expertise depends on many factors. Among them are status, education, perception of technical authority, age, and social class. If expertise of a communicator is challenged in public, people tend to focus on substitutes for expertise, suchas suspected interests or reliance on reference group judgments (Heesacker et al. 1983; Renn 1984).

c) Stating explicitly the persuasive intent is usually more convincing than hiding such an intent and leaving it to the audience to make their own inferences. People like to know what the communicator wants them to believe. If it is not openly stated, they will suspect a hidden agenda (Lee 1986; McGuire 1985).

d) Fairness and social status are both variables that can compensate lack of objectivity. Even if people are aware that the communicator has a vested interest in the issue and that s/he argues from a specific viewpoint, they may trust the message or develop confidence in the communicator provided that the information presented

appears to be fair to potential counterarguments and that it is presented with technical authority (Lee 1986; McGuire 1985).

e) Being explicit in the conclusions and presenting counter-arguments to potential objections has been proven more effective than operating with implicit conclusions or presenting only one side of the story. The two, often conflicting goals, of fairness to the opponents of the communicator's view and of honesty about one's own motives have to be reconciled in each communication effort in order to be most persuasive (Lee 1986; McGuire 1985).

f) The perception that the goals and motives of the source serve a common interest or refer to highly esteemed social values, such as protection of the environment or public health, enhances public confidence in the communicator, but reinforces distrust if the task performance of the communicator is perceived as weak. People invest more trust in these institutions in the beginning, but tend to be more disappointed if the outcome did not match their expectations (Tetlock 1986).

g) The agreement to listen to disliked sources increases the probability of attitude change. Although likableness of a source usually enhances the persuasive effect, the mere acceptance of listening to a non-likable source may motivate the audience to focus on the message instead of the source of communication. The psychological mechanism involved here is called avoidance of cognitive dissonance (Festinger 1957). One can only justify to spend time with a disliked source if at least the message is worth the effort. However, the motivation to engage in communication with a disliked person may also serve as a reassurance of how bad the source and the message are. Which of the two reactions is likely to emerge as a result of a communication with a disliked source? This depends on the degree of commitment to one's previous attitude, the strength and salience of the attitude with respect to other beliefs and values, and the perception of vested interests of the source (Fazio et al. 1977; Chaiken and Stangor 1987).

All these insights are helpful to design communication programs and to train communicators for their task. But it should be kept in mind that most of these results were accomplished in rather artificial laboratory environments and may not be valid for the specific risk communication arena. Risk communicators who are familiar with the persuasion literature have assured us, however, that many of the findings from persuasion research match very well their personal experience with risk communication. So these studies can provide some helpful clues of how to design a more effective communication program and may serve as a starting point to conduct more specific research projects on trust in risk communication. In the chapter on risk communication we will return to these findings and develop some guidelines for risk communicators.

3.4 The elaboration-likelihood model of persuasion

In addition to the "clinical" experiments that test the influence of different communication variables on persuasiveness, several theoretical models have been proposed to provide a conceptual framework for interpreting these results. In this context, we would like to present one model, the "elaboration-likelihood model of persuasion", developed by Petty and Cacioppo in the late 1970ies (overview in Petty and Cacioppo 1986). In

spite of its recency, this model has been extensively reviewed by social psychologists and received many favorable comments (Chaiken and Stangor 1987; Eagly and Chaiken 1984). In addition, C. Middenhas explicitly recommended this model for application in risk communication (Midden 1988).

The major component of the model is the distinction between the central or peripheral route of persuasion. The central route refers to a communication process in which the receiver examines each argument carefully and balances the pros and cons in order to form a well-structured attitude. The peripheral route refers to a faster and less laborious strategy to form an attitude by using specific cues or simple heuristics

When is a receiver likely to take the central route and when the peripheral route? According to the two authors, route selection depends on two factors: ability and motivation. Ability refers to the physical availability of the receiver to follow the message without distraction, motivation to the readiness and interest of the receiver to process the message. The central route is taken when the receiver is able and highly motivated to deal with the issue. The peripheral route is taken when the issue is less relevant for the receiver and/or the communication context is inadequate to get the message across. In this case, the receiver is less inclined to deal with each argument, but forms an opinion or even an attitude on the basis of simple cues and heuristics. Such cues may be related only to the circumstances of the communication, such as physical attractiveness of the communicator, overall credibility of the source, or perception of a consensual or majority opinion. They may also refer to specific clues or keywords in the message, such as "pollution" or "dump", or to formal criteria, such as the length of the message, the number of arguments, or the number and prestige of people mentioned in the message.

Within each route, the mental process of forming an attitude follows a different procedure. The central route is characterized by a systematic procedure of selecting arguments, evaluating their content, balancing the pros and cons, and forming an attitude. The peripheral route, however, bypasses the systematic approach and assigns credibility to a message by referring to the presence of cues. To be an effective risk communicator, the model would suggest that you test first your audience whether the issue is central or peripheral to them and then develop your message either as systematic and rational essay or as an appealing text with lots of positive clues.

Unfortunately the communication process is more complex than the model suggests. First, the audience of a communicator may be mixed and consist of persons with central and peripheral interests in the subject. Many cues that are deliberately used to stir peripheral interest can be offensive for people with a central interest in the subject (e.g. using advertising methods for risk communication). Second, most people are not predisposed to exercise a central or peripheral interest in a subject. Rather it may depend on the message itself whether it can trigger central interest or not. Third, and most important, the two routes are prototypes of attitude formation and change, and therefore only analytically separable. In reality, the two routes are intertwined: Persons may tend to respond primarily to the cues or primarily to the arguments presented, but they will not exclusively pursue one route or the other (Eagly and Chaiken 1984; or Eagle et al. 1981)

4. Sociological factors of trust and credibility

4.1 Trust in sociological perspective

The discussion of trust, confidence, and credibility focussed so far on the subjective processing of information and the assignment of credibility to a message or a source. The studies on persuasion revealed a complex network of factors that influence the formation of attitudes. Credibility of an institution and trust in the message were both relevant aspects in shaping people's readiness to accept information and to believe its content.

In this chapter, we will adopt a broader perspective and try to analyze what role credibility and trust are playing in the context of social structures and processes. Beyond the individual judgment of assigning trustworthiness to a source of information, confidence in the institutional management of social tasks and trust in the communication between subsystems of society constitute aggregate conditions that determine the overall climate of trust in a society and are related to the perceived performance of institutions and their flexibility to cope with new demands.

Trust on a personal level is a subjective expectancy that a person will refrain from behavioral options that may harm the trusting person. In the first chapter we translated this general concept of trust into the communication context. Trust necessarily entails risk-taking, but in contrast to the scientific endeavor of predicting the probability of potential outcomes, trust implies that the selection of options is left to the entrusted person or institution. Due to the perceived competency and honesty of the entrusted entity, one does not need to bother with assessing the outcomes of actions and with controlling the decision making process of that entity (Luhmann 1980; Luhmann 1973). This saves time and effort.

On a more aggregate level, trust denotes a generalized medium of social differentiation and division of labor (Parsons 1960). The performance of specialized institutions in economy and government relies on a prior investment of trust by those who are served by this institution or finance its functioning. Total control would imply that the control agencies would need the same expertise and the same time allocation as the performing institution. Such an arrangement would neutralize the desired effect of social differentiation and ultimately lead to a society of intimate clans performing all necessary social, economic, and political functions simultaneously. Such an intimate framework based on familiarity with each individual in the clan may be able to operate within a closed egalitarian community (cf. the group-grid distinction in anthropology; Thompson 1983), but a modern, functionally divided society could not function without trust as general medium of social communication.

Trust as a generalized medium is characterized by a diffuse and unspecified relationship between the involved actors (Parsons 1960; Parsons and Shils 1951). Similar to another generalized medium, such as money or prestige, its existence and functioning is independent from individual consent, but it can inflate or deflate as a result of the commonly expressed "trust in trust" (Luhmann 1973). The relative value of trust varies over time as empirical surveys clearly indicate (Lipset and Schneider 1983). In some periods, people tend to invest a large amount of trust in institutions and it takes many disap-

pointments before they withdraw this investment; in other periods, people tend to be extremely cautious with the investment of trust, but put more emphasis on functional equivalents, such as more organized control or increase of participation. Trust can partially substituted by other generalized media, but not totally replaced.

As we focus on trust in communication, we are only interested in which ways the general climate of trust and the structural performance of institutions set the stage for confidence in communication source and their credibility. The assignment of credibility is obviously related to the perception of the past performance of the communicator. This record does not only include the experiences of the audience with earlier communication efforts, but also their evaluation of the institutional task performance. If an institution does not meet the demands of the public, they are likely to face a credibility crisis even if they are absolutely honest about their failures. Specifically, risk communication is only regarded as trustworthy if the communicator is able to convey the message that s/he has met the public expectations in managing risks. Risk management and risk communication are closely linked and a bad management record cannot be compensated by an excellent communication effort. Communication may help to change public expectations or to correct misperceptions of the actual record, but it will not cover the gaps between expectations and perceived performance.

4.2 Trust and institutional performance

In analogy to the description of research results in psychological experiments, this subchapter comprises some of the interesting findings of sociological and organizational research with respect to trust and credibility of institutions. In contrast to the laboratory experiments in psychology, these findings are derived from surveys and other statistical data. On one hand, they are more applicable to "real" world situations, on the other hand they are usually verbal reflections of respondents in surveys and may be influenced by other factors than the proposed verbal stimulus. In addition, survey results leave more room for subjective interpretation of data compared to laboratory results. Caution is also advised in translating these results from the arena in which they were observed to the arena of risk management.

Again we will focus on the results of various studies and omit the description of the methodology and their specific design. For a more detailed review, we suggest to consult the respective literature (e.g. Lipset and Schneider 1983; Rourke et al. 1976; Katz et al. 1975):

a) Researchers found a low correlation between the perception of institutional competence and the desirability of the tasks and goals that the institutions were performing. The institutions people like most received low ratings on competence and vice versa. Although sympathy helps to attain credibility, perceived competence alone may be sufficient for gaining trust, but the lack of sympathy makes people more critical towards the actual performance of the institution. Mistakes are more likely to be forgiven if the communicator can count on a sympathetic audience (Lipset and Schneider 1983).

b) Perceived competence of institutions were most likely associated with the perception of a successful task performance and the perceived cost-benefit ratio in meeting

these tasks. In addition, the public image and the social prestige assigned to an institution serve as preliminary heuristic strategies to assign credibility (Matejko 1988).

c) Perceived fairness and openness, the second prerequisite for institutional credibility, is closely linked to the transparency of the decision making process, the opportunities for public scrutiny and institutional control (check and balances), and the degree of personal satisfaction with the rationale and procedures for decision making in the respective institution. Surprisingly, the amount of actual opportunities for public involvement and participation was hardly correlated to perceived openness (Lipset and Schneider 1983; cf. theoretical concept Luhmann 1980).

d) Institutional case studies demonstrated that the erosion of credibility was often linked to: incompetence, poor performance, incomplete or dishonest information, withholding of information, obscure and hidden decision making processes, denial of obvious problems, and denial of vested interests (Midden 1988; Matejko 1988; Lipset and Schneider 1983; Bergesen and Warr 1979) .

e) Credibility can be enforced by: good performance, fast responses to public requests, consonance with highly esteemed social values, availability for communication with outsiders, unequivocal and highly focussed information transfer, flexibility to respond to crisis situations or new public demands, and demonstration of public control over performance and money allocation (Lipset and Schneider 1983; Rourke et al. 1976; Pinsdorf 1987) .

Success stories of communication efforts in the pharmaceutical and chemical industry demonstrate clearly that overreacting to public requests never hurts (Pinsdorf 1987). Taking off a product from the market even if only a tiny fraction of the product is contaminated or poisoned has helped companies in the past to manage a credibility crisis and regain public confidence. Private institutions were more often able to show such flexibility and immediacy in their response compared to governmental institutions. But the involvement of tax money in public institutions adds a potential risk factor in the trust building effort. If too much money is spent for communication, the intended effect may be counteracted by the outrage over the spending of public money.

The major lesson to learn from these studies is that most people invest initially in trust to institutions, but keep a close eye on their performance to assure that their investment earns return in terms of actual performance. The less these institutions are liked, the more they rely on a good record of past performance and flexibility to respond to public demands and claims. The general climate towards institutions in general and the socio-economic conditions are additional external factors that make people more inclined to invest in trust, but the most relevant factors are competence and openness.

4.3 A model of issue organization in risk debates

The results of organizational studies on credibility emphasize the close relationship between perceived performance and credibility. Many risk management institutions face the problem, however, that their specific task is not well understood and that public expectations do not match the mandate or the scope of management options of the in-

stitution. Risk communication in this situation has to address public expectations and public knowledge about the risk management rationale first before it can deal with actual management results and before it can ask for trust in the management effort. Such an educating approach is only acceptable to most people if the education process is mutual and if the essence of public concerns is adequately addressed.

The first criterion that risk managers have to learn from the public as much as the public can learn from them has become almost a truism in communication theory, but is still missing in the communication praxis (Covello et al. 1986; Zimmermann 1987; Renn 1988). Two-way communication is clearly a prerequisite of successful information campaigns, but it is often hard to implement and requires flexibility and the willingness to adapt to public concerns on the side of the communicating institution.

The second criterion of matching communication with public concerns is more complex and requires additional theoretical elaboration. Although two-way communication helps to identify these concerns, it is helpful to know what kind of concerns are usually expressed in the risk arena and in which way these different classes of concerns can be addressed. To classify these different classes of concerns, S. Rayner and R. Cantor have proposed a division into three levels of risk debates based on previous work of Ravetz on different knowledge classes (Rayner and Cantor 1987). The risk debate involves a factual level about probabilities and extent of potential damage, a clinical mode about institutional arrangements and experience to deal with these risks, and a word view perspective that is focussed on values and lifestyles in dealing with risks in general. The system uncertainty and the decision stakes increase with the order of the three levels.

We have modified this model slightly and substituted decision stakes with "intensity of conflict" and system uncertainty with "degree of complexity". We felt that even on the lowest level of factual evidence the decision stakes might be considerable, but the conflict level is lower due to the consensus on methodological rules of scientific inquiry. System uncertainty is also related to all three levels: depending on the society, world views may encompass hardly any uncertainty while probabilistic reasoning in science explicitly address the uncertainties involved. Again we felt that degree of complexity was a more adequate term. Even simple world views are more complex than personal or institutional judgments or factual evidence.

If the risk debate is mainly focused on technical issues, trust can be obtained by referring to data and scientific findings. Communication in this debate serves the purpose of convincing the audience that the factual knowledge compiled by independent scientists support the case of the communicator. Although scientists and many risk management agencies are most comfortable with technical debates, they are rare in real conflicts. More probable is that the focus of the debate is on vested interests, distribution of risks and benefits, and the adequacy of the proposed solution in terms of economic and social compatibility.

This type of debate does not rely on technical expertise, but on personal and institutional judgments and experience (second level). A debate on this level requires input from stakeholder groups and affected populations. The issue of conflict is not so much the magnitude of the risk, but the distribution of risk and the tolerability of such a risk vis-a-vis the potential benefits that the risk source is able to provide. Trust in this situ-

ation cannot be accumulated by demonstrating technical skills and expertise, but by compiling evidence that the communicator has been cost-effective in the allocation of resources and has been open to public demands and requests. Competent management and openness towards social demands are the two major factors in providing credibility to an institution in the context of a risk debate on the second level.

If the participants in a risk debate focus on values and future directions of societal development (third level), neither technical expertise, nor institutional competence and openness are sufficient conditions for conveying trust. Trust in this situation can only be a result of a more fundamental consensus on the issues that underlie the risk debate. The referendum on nuclear energy in Sweden can be used as an example to illustrate that point. The nuclear debate was as heated in Sweden as it was anywhere else in Europe. But through the referendum a consensus was accomplished. This consensus specified the limits for the growth of nuclear power, but also defined the legitimate range of nuclear power utilization in Sweden. This prior agreement helped to move the issue from the third to the second level where technical and organizational solutions could be discussed without expanding the debate into a fundamental conflict over lifestyles and basic values.

Most research on the effectiveness of building trust and confidence on the institutional level pertains to the second and first level of the risk debate (von Winterfeldt and Edwards 1984). The third level involves a macro-sociological framework that is hard to test empirically and that exhibits a degree of uniqueness of each single debate that it is difficult to draw generalizable conclusions. One of the common lessons learned from the study of the different risk debates is that technical and organizational solutions to a risk conflict can only be implemented if the debate never reached the third level or could successfully removed from the third to the second level, at least for the majority of the interested audience. As long as value issues remain unresolved, even the best expertise and the most profound competence cannot overcome the distrust that people will have in the task performance of the acting institution.

4.4 The influence of the institutional and social context

The social context in which risk communication takes place is an important factor for gaining credibility. Although the primary variables are related to the performance of the institution and its perception in the public, the overall climate towards institutions in general has a definite impact on the trust that people have in specific institutions. Research in the last two decades has produced some of the factors that influence the social climate of trust:

a) Confidence in business and economic organizations depends on the perceived quality of their services, but also on the employment situation, the perception of power monopolies in business, the observation of allegedly unethical behavior, and the confidence in other institutions, such as government or press (inverse relationship; cf. Lipset and Schneider 1983)).

b) Confidence in political institutions depends on their performance record and openness, but in addition on the perception of a political crisis, the belief that government is treating everyone fair and equally, the belief in the functioning of

checks and balances, the perception of hidden agendas, and the confidence in other institutions, such as business or press (inverse relationship; cf Rourke et al. 1976)

c) The more educated people are, the more they express confidence in the system, but they more they are also disappointed about the performance of the people representing the system. Less educated people express more confidence in leadership, but show less trust with respect to the system or institutions in general (Lipset and Schneider 1983).

   Political conservatism correlates positively with confidence in business and private enterprise, and negatively with confidence in government and public service (this may be US -specific). Liberal positions are correlated with lack of confidence in both, business and government (Lipset and Schneider 1983).

In summary, social climate prestructures the conditions under which an institution has to operate for gaining or sustaining trust. In a positive social climate people tend to invest more trust in institutions from the beginning and may be more forgiving if part of this trust is abused. In a negative social climate people tend to be very cautious in investing trust in any institution and request to have more control over the performance of the affected institution. If trust is misused, it takes much time and effort to encourage people to start investing in the trustworthiness of the institution.

The social climate for trust seems to be a function of widely publicized events of misperformance or trust abuse, the perception of an economic recession, the general level of public education, and the degree of controversy over public issues. For the U.S. political culture, distrust in large institutions is the rule, rather than the exception (Rourke et al. 1976; Katz et al. 1975; Lipset and Schneider 1983). The more people feel that institution are controlled by countervailing forces and the more these institutions are atomized and fragmented, the more they find them trustworthy (Lipset and Schneider 1983). But as will be shown in the next chapter, the social climate for trust in institutions has been steadily declining over the last two decades in the United States.

5. Revealed trends of public confidence in U.S. institutions

5.1 Institutional credibility

The influence of macro-sociological and economic factors on the societal level of trust, confidence, and credibility can be illustrated by survey results in the United States. In general, public confidence in all major institutions, including business, government, and labor, has declined in recent years (Lipset and Schneider 1983). The basic institutional structures of society are still supported, but may be threatened if trust continues to decline (Betz and O'Connell 1983). These trends seem to be universal for the western world, including Japan.

The statistical data on institutional confidence exhibit two interesting features: First, the decline in trust is universal for all selected institutions and second, common interest institutions, such as churches, medical institutions, and colleges, top the list of trustworthy institutions while large political institutions and big business are at the end of the scale (Lipset and Schneider 1983). Similar results were found in a survey by Renn (1984) for a West-German sample about credibility of sources in the nuclear debate.

Scientific and other competent institutions received high ratings compared to more general political institutions and private business. The special distinction between small business (being more trustworthy) versus big business (being less trustworthy) in the U.S.-survey seems to be typical for the United States, since international surveys could not reveal similar attitudes of "smaller is more trustworthy" in the United Kingdom, West Germany, Australia, and Japan (Louis Harris 1981 in Lipset and Schneider 1983).

Survey results over longer time periods demonstrate significant variations in the average assignment of confidence in institutions. In the 1930ies, surveys revealed a low confidence in institutions. After the war institutional confidence improved steadily to reach a peak in the Mid-1960ies. During the next two decades, the confidence level dropped dramatically, but oscillated around significant events (Lipset and Schneider 1983). The Vietnam war, the awareness of the ecological crisis, and the tremendous political turmoil in the late 1960ies probably caused the significant drop in public confidence in the early 1970ies. The Watergate scandal obviously improved the level of public confidence in institutions because the political institutions in the United States were able to handle and overcome a serious political crisis (very positive results for the congress and the media at that time). The following economic recession, however, started a new malaise which was shortly interrupted by a more optimistic attitude at the beginning of the Carter administration. But this administration apparently failed to meet public expectations and so the public confidence index dropped again. Although the beginning of the Reagan era revitalized economic prosperity and optimism, the confidence in institutions did hardly change as more recent survey data suggest (University of Maryland 1984).

Most sociologists believe that the decline of confidence in public institutions is partially a function of better education and the increase of public aspirations with respect to their share of public resources and welfare (Lipset and Schneider 1983; Katz et al. 1975). In addition, the complexity of social issues and the pluralization of values and lifestyles may have contributed to a growing dissatisfaction with the actual performance of institutions (Renn 1986). But at the same time, people are confident in the governmental and economic system and do not support fundamental changes in the organizational structure of society. Therefore, the confidence crisis is less a systems than a performance or competence crisis.

This is being reflected by Lipset and Schneider: "We suggest that the increase in political dissatisfaction was not a cognitive or ideological change; it was rather a response to events, and to the perception of events, primarily in the political sphere. The vast majority of the population was not unhappy because government policy did not correspond to their ideological predispositions. They were unhappy because political leadership was proving ineffective in dealing with massive social and political problems, like war, race relations, and the economy." (1983, p. 399).

The less the public showed confidence in one class of institutions, the more they were inclined to assign more trust to those institutions that were either functional equivalents or control institutions for this specific institution (Lipset and Schneider 1983). The more people distrusted the government, the more they trusted private business and vice versa. Although trust is definitely not a zero sum game, people feel more comfortable to invest a fixed minimal amount of overall trust to different institutions and distribute this

amount according to their preferences. This mutual compensation scheme can also serve as evidence for the strong commitment of the American public to the idea of check and balances.

Public confidence in institutions was more negative if the institutions were listed in general terms. The general label "public utilities" triggered more negative responses than more concrete options, such as "Your local public utility company", or any utility company's name (Lipset and Schneider 1983). This result may be an artifact since many respondents might have no recollection of negative events with respect to their local company, but plenty of memories on public utilities in general (Availability effect). But this result could also be an indication that most people are actually satisfied with the personal service they receive from these organizations, but that they get a picture of the outside world through the media and personal networks that suggest more negative experiences and abuses of trust for people outside of the community. If this interpretation is valid, the affected institutions may all perform perfectly, but still face a credibility crisis due to the perception that the more abstract notion of an institutional type or class to which the specific institutions belong is associated with a negative image. The change of such an image may require a time consuming effort to demonstrate positive performance and to link the specific accomplishments of one organization to the pool of organizations which it is associated with.

5.2. Credibility in science and technology

Risk management can be associated with economic or political institutions and is therefore subject to the same social forces of growing distrust that other institutions face in the contemporary U.S. society. Since distrust is not directed towards the structure or the system of the institutions, but rather to their performance and leadership, some authors have proposed that the crisis is caused by a deep distrust of the American public toward professionals and cultural elites (Betz and O'Connell 1983).

Risk communication may face this resentment in particular because risk analysis and risk management rely on highly professionalized rules and run often counter to common sense. Peripherally interested persons are probably more susceptible to such an resentment because it offers a readily available cue to dismiss the information offered by risk management institutions. But even an elaborate processing of each argument presented may activate an unfavorable response if the language and the reasoning appear too technical and remote from everyday-life experiences.

But in spite of this opposition to professionalism, people's trust in science and technology is higher than in most other professional institutions. While opinion polls show a decline of confidence in Congress from 42 to 13 percent; in colleges, from 61 to 36 per cent; and in medicine from 72 to 43 percent, science suffered only a loss of nine percent (from 46 to 37) during the decade from 1966 to 1976 (Betz and O'Connell 1983). More recent data, compiled by the Academy of Sciences, indicate that professional institutions in general lost credibility over the last decade, but that the scientific community remained almost stable in spite some dramatic fluctuations from one year to the next (cf. Table 2)

But this overall impression of a favorable and rather stable credibility of scientific institutions has to be further qualified. "The attitudes of the general public toward science and technology are over whelmingly favorable. At the same time, science did suffer from the general disillusion ment experienced by all major social institutions during the late 1960ies and early 1970ies. Furthermore the minority voicing negative opinions of science and technology, though still small, does seem to have grown during the last 20 years. Coupled with this is the evidence that persons of the typically supportive middle class also are disproportionately more aware and concerned about such technological hazards, as pollution and nuclear arms. We might conclude that the seeds of disenchantment with science and technology are present, and in recent years perhaps a few have even sprouted" (Pion and Lipsey 1981, p. 313).

The reasons for a more skeptical or at least ambiguous perception of science and technology are routed in at least three different developments (Renn 1984): First, after two decades of astonishing successes in scientific accomplishments, aspirations in the future applications of science exploded and led to expectations that problems such as cancer or world hunger could be resolved by science within a short time period. As these expectations remained unfulfilled, people became more skeptical and disencha nted. Second, the rise of the environmental movement and the awareness of the environmental crisis acted as reinforcers to the disappointment over the slow scientific progress and revealed the ambiguity of technical development. Third, the shift from qua ntitative to qualitative goals, a typical development in most western nations, induced a fuzzier perception of the merits and objectives of scientific and technological activities. The definition of what constitutes a good quality of life entailed a variety of often conflicting interests and goals that were often in opposition to the implicit values and interests of the scientific and technological community.

In addition to these more fundamental factors, other influences and developments have been suggested as caused for the increased skepticism toward science: the alignment of science to big business and government, anxiety about the ethical implications of further technological advances in some areas of medicine and the biological sciences, and the growing awareness that much scientific research lacks social relevance (La Porte and Metlay 1975). Lack of confidence in science is more pronounced among those who are young and who identify themselves as "liberal" and "conservationist" (Lipset and Schneider 1983; La Porte and Metlay 1975).

The decline of confidence in science and technology has major impacts on risk communication. Even within technical debates that require expertise as a means to provide trust, people have no means to study or review the evidence presented. They do not possess a lab and cannot afford to employ a scientist to investigate the various claims. Even scientific reputation or evidence of peer review may not be sufficient to convince the audience that an information is technically correct, let alone that it is relevant for the issue in question. One of the solution in this dilemma is either to lift the debate on the second or third level, where common sense and prior experience provides enough knowledge to take part in the debate, or to initiate a sophisticated institutional framework of check and balances that assures scientific scrutiny and control.

In spite of this difficulty, risk communication should emphasize the scientific roots of risk analysis and risk management and refer to scientific conventions as a means to reconcile conflicts about facts. Among the professional standards that guide risk management efforts, scientific standards are more likely to be accepted by a lay audience than for example institutional rules. If these standards can be expressed in common sense concepts and applied to everyday experience (not just a translation into everyday language), the probability of trust in the message will further increase.

6. Lessons for risk communication

What advice can we give to risk communicators of how to design and implement a risk communication program that incorporates the findings of past research and includes the more anecdotal evidence of risk communication efforts in the past. The first lesson is to distinguish between the three levels of the debate. Nothing is more detrimental and frustrating for all participants involved than addressing an audience who expects a third level debate and is confronted with a detailed technical analysis of t he issue. The risk communicator should investigate the level of debate beforehand and design different communication programs for each level.

Debates change frequently in nature and it is good to have the means available to switch from a technical, to an institutional, and to a moral debate. While technical expertise is vital on the first level, and evidence for institutional competence and openness on the second, there is no clear medium of communication available for the third level. A more general discourse focused on value issues may be the appropriate tool. Is the objective of such a debate to reconcile existing conflicts, the involvement of an outside mediator may be helpful to set the agenda and to identify the concerns and values that the communicator is supposed to address.

Using our analytical model of distinguishing between message, person, institution, and social climate, we developed a set of conditions and prerequisites for gaining trust in communicating with others (cf. also Table 1). These refer to general principles of risk communication and provide orientations for analyzing and designing communication programs.

a) To improve the *trust in a message* we recommend to explain the rationale of risk analysis and its role for risk management so that the audience is better prepared of what to expect. In addition, the decision making process and the past record of the institution should be included in the message so that people can assign competence to the actors and get a better feeling of the trade-offs that had to be made in meeting the specific risk management task. Evidence of competence, fairness towards other viewpoints, and references to commonly shared values

   and beliefs will make a message more attractive and could help to address the centrally and peripherally interested audience at the same time. Conclusions should be made explicit and vested interests should not only admitted, but justified in terms of public mandate or economic function.

b) To improve *trust in a personal communicator*, the major goal is to develop a communication climate that enables the audience to identify with the communicator

and share his or her experiences and beliefs. The more a communicator manages to avoid the mask of an institutional spokesperson and the more he or she can express compassion and empathy for the audience, the more likely the audience will identify with the speaker and feel compelled to the arguments. Conveying probabilistic information is a real challenge, but can be done in reference to everyday experience of budget constraints and consumer products. Furthermore, evidence of successful use of risk analyses in hazard management can serve as demonstration to define the role and limitations of risk analysis in improving public health and the environment. Peripheral cues should be confined to commonly shared symbols, appealing formats, and surprises in openness and honesty and should definitely avoid negative labelling of potential opponents, swiping generalizations, or typical advertising gimmicks. Peripheral cues are important for successful communication, but cues have to be selected carefully to please the peripherally and centrally interested audience.

c) To improve the *credibility of an institution* the vital factor is performance, not public relations. Confidence has to be gained by meeting the institutional goals and objectives. In addition, credibility is linked to the evidence of being cost-effective and open to public demands. These two goals are often in conflict with each other (Kasperson 1987), but they have to be treated as complimentary, and not as substitutional goals. Fairness and flexibility are major elements of openness. In addition to assuring sufficient external control and supervision, public participation may be implemented as a means to demonstrate the compliance with the political mandate and to avoid the impression of hidden agendas. On the premises of good performance, communication programs can be designed that reflect these accomplishments. Such programs should provide honest, complete, and accurate information which is responsive to the needs and demands of the prospective audience. This can only be done if the source engages in an organized effort to collect feedback from the audience and establish a two-way communication process. Involvement of citizens, open house policies, discussion forums, open TV channels, or other means should be explored to assure the functioning of the two-way communication structure.

d) To *improve the social climate* is not within the realm of possibilities for a single communicator. But large-scale organizations or association of organizations can affect the overall climate. One way to improve the climate is to accept and even endorse checks and balances in the control of the organization. The other obvious solution is to demonstrate the flexibility and foresight of the organization in meeting and anticipating new public claims and values. The impersonal nature of institutions may be mitigated by providing special local services and by engaging in community activities and programs. Governmental institutions will receive more credibility if they do not leave the impression of permanent crisis management, but of competence and preparedness for long-term threats and challenges (in particular pertaining to environment and technology).

Many different factors affect credibility. On the personal level, appearance, communication style, honesty, and creating an atmosphere of identification of the audience with the communicator are major variables that influence credibility; on the institutional

level the actual performance in terms of role fulfillment, cost-effectiveness and public expectations as well as communication style in terms of readiness to respond immediately to public concerns or openness to new claims and demands constitute confidence and help to build credibility. Furthermore, the social climate and the level of controversy associated with the issue affect the assignment of credibility independent of the performance of the actors involved.

7. Conclusions

The objective of this report has been to review the relevant psychological and sociological literature on trust and credibility in communication and apply the findings of our search to the new area of risk communication. What are the major insights that we gained from our review and how can they be practically applied to risk communication programs?

The most important conclusion is that psychological and sociological research cannot provide a laundry list with proper solutions for all kinds of communication problems. A communicator who expects recipes or fool-prove guidelines for dealing with the public will certainly not find them in the literature on persuasion or institutional credibility. The major finding of all the experiments and surveys conducted so far is that individuals as well as social units make use of a complex variety of internal and external cues to process messages and that the variation of one or two factors may only lead to marginal changes in the outcome. As hard as it is to make predictions from existing cues to attitude changes or from attitudes to actual behavioral responses (Wicker 1979), the more difficult it is to create an communicative environment that guarantees the desired persuasive effect.

With this reservation in mind, studies about persuasion and institutional credibility provide a considerable amount of interesting findings that are relevant for risk communication. First, credibility of a communication source is closely linked to the perceived past performance record and its openness for public demands. The more institutions comply with the expectations of the public, the more confidence people will have in these institutions and the more trust they will assign to their messages. Communication efforts may be successful to change excessive aspirations or to correct misperceptions of the actual performance record, but it is more than unlikely that communication can compensate poor performance.

Furthermore, in a climate of general distrust toward social organizations, it is helpful to accept countervailing powers and public control and to provide public access to all relevant information. The organization of open houses, the invitation of representatives of public groups to board meetings, the automatic and uncensored publication of relevant pollution data in newspapers or in public displays (i.e. air pollutants, radioactivity, or other substances), the involvement of the organizational staff in community projects, and the provision of opportunities for citizens to participate in control or emergency planning boards are some examples of structural measures that counteract the public suspicion of "hidden" agendas and dishonesty. They create a microclimate of trust and credibility amidst a macro-climate of skepticism and lack of confidence. Survey data already revealed that most people have more favorable views about the trustworthiness of their local institutions compared to the institutions in general.

On the basis of these structural opportunities for public involvement and control, specific communication programs can be designed that include elements of successful persuasion. Again these elements will not work if the message is untrue, biased, or in complete. In contrast to advertising where people feel that nothing important is at stake, the risk issue is too sensitive for most audiences to be lured into accepting a message by the mere presence of peripheral attractors. To make messages attractive is an important factor for a successful risk communication, but if the message is weak or even false, the best package is not worth a dime.

How can one make a message attractive provided that the information given is accurate, complete, and honest? The major recommendation that comes from our analysis is to assess the concerns of the targeted audience before drafting the message. Are the concerns related to technical matters, such as emissions or potential health effects, or to institutional performance and judgments, such as the decision to ban a substance from the market and tolerate another, or to values and world views, such as the tolerability of large-scale technologies or the inequities involved in centralized production or waste disposal facilities? Depending on the level of concerns in the actual risk debate, the communication program has to be designed and implemented in a different way. Technical debates need the input from technical experts and scientists and rely on clear evidence that the risk assessment of the communicator reflects the best available estimate. Institutional debates need the input of senior management staff and outside control agencies who can give testimony about the past record of the institution and independent reviews of its performance. Value-driven debates are most difficult to handle and most institutions avoid to deal with them. But credibility is easily lost if third level concerns are ignored or -even worse- addressed with technical or legal arguments. It seems rather advisable to open a discourse with different stakeholder groups, social scientists, moral authorities, and public opinion leaders as a means to clarify one's own values and document their legitimation and validity in a value-pluralistic society.

Finally, the message and the personal appeal of the communicator can be improved by following some of the principles developed in Chapter 6. The major thrust of these guidelines refer to the inclusion of verbal clues and elements of personal appearance that make the audience identify with the message or a communicator and relate to their personal experience and shared values. Technical jargon (even in technically oriented debates), reference to professional wisdom (versus common sense), emphasis on common practice, and impersonal approach are some of the cues that communicators should avoid. The more the audience feels that the message means something to them or that the communicator is "one of them", the more they will be inclined to listen to the message and process its content.

The order in which these conclusions were presented reflect the order of importance and effectiveness. A good communication program should not start with communication at all, but with a critical review of the organizational structure and the potentials within this structure to meet the demand for openness and public involvement. Then a thorough analysis of the issues is needed to identify public concerns and characterize the risk debate. As late as then comes the design of the communication program with the formulation of the message, its proper packaging, channeling, sending, and testing in terms of communicative feedback. Even if all these recommendations are followed, the success

is never guaranteed. In an open society, messages compete with each other for public support. The better the quality of the message and its appeal, the better is its chance to reach the desired audience. To give every group in society a fair chance to express an opinion and to provide the platform for a rational discourse on the different views expressed is the ultimate goal of communication in a democratic society. Risk communication can certainly contribute to that goal.

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MESSAGE	
Positive	*Negative*
Timely Disclosure of Relevant Information[1)]	Stalled or Delayed Reporting[1)]
Regular Updating With Accurate Information[1)]	Inconsistent Updating[1)]
Clear and Concise	Full of Jargon[2)]
Unbiased[3)]	Biased[3)]
Sensitive to Values, Fears and Concerns of Public[4), 5)]	Inconsiderate of Public Perception[3)]
Admits Uncertainty[1)]	The Absolute Truth
From a Legitimate Reputable Source[3), 4)]	From a Questionable Source
Organized Message[5)]	
Use of Metaphors[5)]	Too Literal[5)]
Explicit Conclusions[5)]	Receiver Derive Own Conclusion[5)]
Positive Information Recorded in Early Part of Message[5)]	
Forceful and Intense[6)]	Dull[6)]

PERSON	
Positive	*Negative*
Admits Uncertainty[1), 3)]	Cockiness
Responds to Emotions of Public[3)]	Indifference
Appears Competent[1), 6)]	
Similarity with Receiver[5), 6)]	Perceived as Outsider[3)]
Has Some Personal Stake in the Issue[3)]	
Clear and Concise[1)]	Too Technical[2)]
Perceived as 'Expert'[5), 6)]	
Perceived as 'Attractive'[5)]	
Charismatic[5)]	
Trustworthy-Honest, Altruistic, and Objective[6)]	

Table 1. Factors of credibility for different levels of Analysis

INSTITUTIONS			
a) abstract		*b) concrete*	
Positive	***Negative***	***Positive***	***Negative***
Healthy Economy Low Inflation, Unemployment[7]	Recession[7]	Postivie Personal Experience[7]	Negative Personal
	High Inflation High Unemployment[7]	Strong,Competent Leadership[7]	Incompetence[7]
New Administration - New Ideas[7]	Corruption[7]	Positive P.R.[7]	Layoffs/Hiring Freeze Strikes[7]
	Domestic Violence or Unrest[7]	Sound Environmental Policy[7]	Irresponsible Environmental Policy
Period of Relative Tranquility[7]		Produces Safe and Good/Services[7]	Poor Quality Goods/Services[7]
Perception of Competent Leadership[7]	Poor Leadership[7]	Positive Past Record of Performance[7]	Negative Past Record of Performance[7]
Perception of Altruistic Motivation[7],[8],[9]	Image of Self-Serving Motivation[7],[8],[9]	Reasonable Rates[8]	Exhorbitant Prices[8]
Peace[7]	War[7]	Undertakes Socially Relevant Tasks[9]	
		Practical Contributions to Every Day Life[10]	
		Benefits Outweigh Costs[11]	Magnitude of Risk Taking Greater than Benefits[11]

POLITICAL/CULTURAL CONTEXT	
Positive	***Negative***
Faith in Institutional Structures[7]	Perception of Structural Decline[7]
Checks and Balance System Functioning Well[7]	Poor Leadership/Incompetence[7]
	Corruption/Scandal[7]
	Energy Crisis
	Perception of Unfair Taxation
New and Innovative Ideas[7]	
	Perception of Worsening Financial Situation[7]
	Social Unrest[7]
	Terrorism[7]

Table 1: Factors of credibility for different levels of Analysis (continued)

Institution	1973	1974	1975	1976	1977	1978	1980	1982	1983	1984	1986
	Percent										
Medicine	54	60	50	54	51	46	52	46	51	50	46
Scientific community	37	45	38	43	41	36	41	38	41	44	39
Education	37	49	31	37	41	28	30	33	29	28	28
Organized religion	35	44	24	30	40	31	35	32	28	31	25
Military	32	40	35	39	36	29	28	31	29	36	31
Major companies	29	31	19	22	27	22	27	23	24	30	24
Press	23	26	24	28	25	20	22	18	13	17	18
TV	19	23	18	19	17	14	16	14	12	14	15
Organized labor	15	18	10	12	15	11	15	12	8	8	8
Executive branch of the federal government	29	14	13	13	28	12	12	19	13	18	21
Congress	23	17	13	14	19	13	9	13	10	12	16
U.S. Supreme Court	31	33	31	35	35	28	25	30	28	33	30
Banks and financial institutions	NA	NA	32	39	42	33	32	25	24	31	21
N =	1,504	1,484	1,490	1,499	1,530	1,532	1,468	1,506	1,599	989	1,470

SOURCES: James A. Davis, Tom W. Smith, General Social Surveys Cumulative Codebook, 1972-1985, Roper Center, pp. 166-169; unpublished 1986 data provided by Tom W. Smith

Table 2: Public indicating "a great deal of confidence" in the people running selected institutions: 1973-86

Results of the Working Group "Trust and Credibility in Risk Communication".

George Cvetkovich, Western Washington University, Bellingham
Peter M. Wiedemann, Nuclear Research Centre, Jülich
(Chairmen)

There is a growing skepticism about wether the proper consideration is beeing given to environmental and health related issues in the industrialized countries. Disasters such as Chernobyl, the Rhine accident, and Seveso have eroded the public confidence in the capability to control large scale technologies. Attempts to inform the public about the risks and benefits of these technolgies have failed. One of the factors causing this failure of information policies is the growing distrust by the public. In general, trust in science, governmental agencies and in industry has declined.

Trust includes a perception that the communication is technically competent, fair, honest, consistent and benevolent. Research reveals that trust can be eroded by factors such as incompentence and poor performance, incomplete information, withholding of information, denial of obvoius problems, denial of vested interests.

On the other hand trust can be enhanced by good management performance, comprehensive information, acknowledgement of the other party's problems and concerns, and involvement of all stakeholders into the risk assessment and decision making process.

There is one important point to stress: these components of trust represent expectations of the recipients. Whether or not a communicator is trustworthy depends on the point of view of his audience.

This is where social science comes into play. Social science is often asked to design strategies for creating trust: How should one present a message in such a way that the public believes it? How to enhance the acceptability of the information or of a decision considered risky? How to enhance the credibility of the communicator? In short, social sciences are often asked to provide means for a better impression management or, to put it more strongly, means to manipulate public opinion.

Trust cannot be restored or enhanced by impression management. On the contrary, attempts to manipulate public opinion or perception results in distrust, at least in the long run. It should also be noted that trust is not just the product of a successful communication process - something that will be achieved when you behave in a certain correct

way. Trust is also a quality of the process itself. What, then, can be done to gain or restore trust and credibility?

The answer depends on the nature of the problem you have to deal with. There are three classes of problems in risk communication which can be located along two dimensions, i.e.

- systems uncertainty
- decision stakes

Risk communication strategies must be tailored according to the specific problem class (see Table 1).

Table 1: Problem levels and related dimensions

level		example	issue	criterion for decision making	application procedures	type of discourse
(1)	technical problem	safety engineering	confidence	evidence	rules	information transmission
(2)	clinical problem level	medicine site selection	credibility	experience	skills	mixed
(3)	worldview problem level	societal choice of energy supply systems	trust	argument	ethical standards	creating shared meaning

Level 1: Low decision stake, low uncertainty. The problems in this class are of a technical nature and can be solved by the transmission of information. The issue the risk communicator is facing is public's confidence in the given information. He has to demonstrate that he applied the proper rules (e.g., the proper rules in gathering the information). The criterion that determines the audience's confidence is evidence. Examples of such problems are driving without seat belt usage, smoking, engineering component choices (safety systems).

Level 2: Medium decision stake, medium uncertainty. Prototypical for this class are medical problems. Transmission of information is not sufficient here since it is not only confidence whch is at stake here but also credibility. Therefore, shared meanings, i.e. a mutual understanding has to be created in the communication process as well. The credibility issue should be addressed by demonstrating professional experience which can be done by giving examples or proof of professional skills. Examples of such problems are medical problems, e.g. the treatment of cancer, or facility siting decisions.

Level 3: High decision stakes, high uncertainty. Problems in this class involve world view issues, i.e. value considerations and ethical and moral questions which can be dealt with by means of ethical debates and arguments to create shared meanings or convergence of meaning. The application of ethical standards by the parties involved enables the building of mutual trust. Examples of such problems are the greenhouse effect, choices between energy supply systems, management of hazardous waste.

Implications:

1. Different stakeholders may - and usually do - locate the same problem on different levels, e.g., what is seen as a technical problem by a governmental agency might be perceived as a "world view" problem by an environmentalist group. Genetic engineering, for instance, can be conceptualized as a pure technical problem, but it might also be conceptualized as a clinical problem or even as a problem which concerns ethical standards.

2. Before deciding about a risk communication strategy one should identify the level on which the audience locates the problem. This requires careful listening to the other parties' interests, needs, values, complaints and concerns. The discourse type should be selected to fit the problem conceptualization of the audience.

3. When in doubt about the audience's problem conceptualization one should choose the higher level. Thus the risk communicator should be prepared to address not only technical problems but also questions of ethical standards.

4. Lack of confidence in the given information might be a sign that the audience does not perceive the issue as a technical problem but as a clinical or world view problem. Here, giving more information is the wrong strategy and will not resolve the conflict. Instead, one should move up to a higher level and change the type of discourse.

5. The best way to deal with uncertainty concerning the audience's level of problem representation might be a top-down approach, i.e. start with the highest level, establish a shared understanding, and work your way down through the lower levels. This might be a somewhat tedious and certainly time-consuming way, but the alternative, i.e., starting at the bottom and moving to the top, might prove to be even lenghtier and is a rather risky strategy: It might obstruct further communication efforts. A good example is the comparison of genetic engineering with nuclear power. In the case of genetic engineering the problem was addressed in a very early stage as a world view problem: The scientists themselves developed ethical standards for conducting research in this area. In communicating on nuclear power, however, the problem was first approached as an information transmission issue, i.e., on the technical problem level. Questions of social values were not considered. The ethical questions were raised by the opponents. This might be one reason why this debate is so heated.

The Right To Know and Community Dynamics

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1. Introductory note

My aim was to produce a state of the art paper based upon responses by researchers with empirical evidence to share. In the event only four colleagues replied with relevant material. This suggests that the state of high quality field research on risk communication in Europe may be poorer than it ought to be. I am pleased that the Risk and Pollution Initiative, funded by the British Economic and Social Research Council, has just launched two major studies into risk communication, one dealing with multiple pollutants on the Severn Estuary and one looking at responses to migrating landfall gas near residential areas. But a network of coordinated case studies in various European countries, based on principles arising from this workshop, needs to be established as a matter of some urgency.

2. Rights to know, community dynamics and tolerable risk

In his lengthy report on the Sizewell B Inquiry into the safety, economics and local environmental aspects of the pressurised water reactor, the Inquiry inspector, Sir Frank Layfield QC (1987, §12.13) introduced the term *tolerable risk*. He regarded this as a more faithful representation of what is often referred to as "acceptable risk". He correctly pointed out that the term acceptable risk "does not adequately convey the reluctance with which possibly substantial risks and benefits may be tolerated".

The application of tolerable risk implies that, even after formal regulation and even assuming a competent and genuinely public spirited risk creator, elements of the public, as well as doubtless all honest experts, will still feel that there is a *residual risk*. They may tolerate, but they do not accept. They will only tolerate if the process through which safety is assessed and delivered incorporates issues raised by the right to know and community political, social and economic dynamics which form the basis of this review presentation.

Tolerable risk can never be a stable or final concept. Indeed, the fact that people feel that safety levels can be subjected to regular open and fair review is part of tolerability. The tolerable zone for safety, whether in pre-product assessment, product design and manufacturing, or residuals disposal, is the outcome of *procedures* which establish and subsequently build upon *mutual trust*. The safety determination process needs to be even more participatory and creative than it is today, at least for those areas of risk

where there are genuine doubts over the reliability of management and the credibility of technical prognoses and judgements.

2.1 Establishing a risk dialogue

Tolerable risk assessment is therefore a scientific art form. This should specifically lock in the experience and understanding of non-technical assessors who are experts in their own field, to the judgements and calculations of the technical and scientific community. Brian Wynn and two colleagues (1988a) illustrate this point in their study of Cumbrian farmers in northwestern England, whose hill land was contaminated by ceasium fallout from the Chernobyl explosion. The farmers are faced with a future of indeterminate length during which they can neither sell their sheep nor their land because of radiation blight. Admittedly they receive some financial compensation from the government, but this does not cover all the associated pecuniary losses.

What the farmers objected to most was the attempt by government scientists to frame assessments of the health danger in probabilities that conveyed a sense of rigidity and authority on what in reality was complete guesswork. Because the initial phase of communication took place through formal channels well removed from the day to day life of the farmer, the risks that were communicated took place in a false context of abstract certainty. The hardy hill farmer negotiates with all manner of environmental uncertainty, through adaptable devices such as moving stock and feed around and selling short when the price is right. The communication of risk should have been handed in the context of a *dialogue* between the adaptable strategies of day to day farming and the adjustable scientific uncertainties of measurement, monitoring and prediction. This would have resulted in a communication that would have fused two potentially very complementary strategies of environmental negotiation.

Wynne reports that when the farmers met the scientists face to face, they realised that they could do business through a common language. But the structure of communication prior to that, via ill- prepared reports, misleading ministerial statments, and unexperienced interlocutors such as agricultural union and ministry officials, widened the gulf between scientific and farming experience. This created resentment, and ultimately, lack of faith in official scientific prognoses. Unless connected by more informal means, that mistrust would have carried over into other areas of communication, tainting even well meaning and innovative programmes in subsequent years.

2.2 Risk dialogue, the exercise of power, and community dynamics

This notion of a *risk dialogue* is now becoming better established in research analysis and design. For example Sally Macgill (1987), looked at how various groups and individuals living around the nuclear fuel reprocessing plant at Sellafield also in Cumbria, in northwestern England, responded to the findings of an independent, and supposedly authoritative report on the possible connection between radioactive releases from the plant and childhood leukemia (Black, 1984). Macgill found that response to the report, which was largely inconclusive but purported to be reassuring, dependent on five factors:

(i) whether or not the individual had any direct or indirect economic dependence on the company involved (British Nuclear Fuels - BNF)
(ii) whether the individual was actually employed by the firm
(iii) the degree to which social networks within which an individual moved were economically associated with the industry.
(iv) the personal relationship between married partners and their belief in each other's views.
(v) the extent to which British Nuclear Fuels defined its position and demonstrated that it was genuinely interested in being a "good neighbour" and a positive economic force in the community.

Macgill believes that risk communication is less about rights to know as it is about domination and persuasion. It is a game to bring about conditions of public responsiveness which generate tolerance. Thus communication is not aimed at reaching some idealised "truth". It is geared to creating a "right atmosphere", by establishing a set of economic and social relationships that will create tolerability.

The risk dialogue, therefore, is set in the context of political, economic and social relations in such a manner as to manipulate public responsiveness to safety and good neighbour management. British Nuclear Fuels have successfully launched a three-pronged attack to reinforce its dominant position in northwest Cumbria.

(i) It has established a "workforce ombudsman" who will take any complaints or observations regarding safety considerations from any member of the workforce direct to management. This is a confidential hot line that can be used to by-pass union officials and middle management. It is not used much because of the obvious dangers of recrimination, but its very presence reassures many in the workforce that their rights can be protected. The actual effectiveness of this arrangement in terms of right to know, and right to inform is less significant than the image of caring responsiveness.
(ii) BNF has opened up an expensive and elaborate visitor centre. This has become a local tourist attraction handling around 100,000 visitors per year. The centre is run via local people, all personable and articulate, who are trained to explain the workings of the plant and its purportedly benign environmental effects in a language that is reassuring, non-scientific, and carefully cultivated to avoid controversy. Critics get frustrated at the "cotton wool" responses, but the vast majority of local people and visitors appear to enjoy the experience. The "fun" element is reinforced by plenty of "hands on" games including computer graphics and reactor models. Children have a wonderful time, but the message and the graphics are very carefully manipulated.
(iii) BNF has also placed money in a community economic trust which is designed to pump prime new local enterprise. The trust is connected to governmental and local authority job training and job creation schemes. The company is not only investing in a nuclear connected economy. It is also building the basis from a non- nuclear dependent future economy of what it could well become a part over the next twenty years, as British nuclear fortunes wane and as BNF expands into other areas of scientific innovation.

Yet as Macgill points out, all this violates Habermasian concepts of ideal discourse. These conditions are (a) motive-free communicaton; (b) equal chance of initiating discussion and perpetuating criticisms, and (c) equal opportunity to participate. BNF has created a permanent structure of economic dependency in the local community. It effectively controls what information is made available and what is discussed under a generalisable right to know label.

Information is synthesised into simplistic patterns to aid credibility. Anyone asking for more specifics can readily become swamped in scientific complexities. Even social relationships in the home and elsewhere are influenced by attitudes created by the BNF publicity machine. Risk communication therefore becomes lost in a whelter of other communicative and social relationships in which power is exercised so as to create an appropriate atmosphere of trustworthiness, reliability, responsiveness and well meaning community relations.

There need not be anything sinister about this. A responsible company in a friendly community could well regulate itself in everybody's interests. The point is simply that a genuine right to know cannot exist because of information overload, the distortions inherent in any synthesis of contentious evidence, and the manipulating effect of using informational and structural power to create a supportive community that, for the most part, accepts what it is told. Just as mistrust breeds suspicion irrespective of how much information is provided, so trust creates acceptance even when information remains privileged.

Figure 1:

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1. *Ignorance* dictates what dangers are known about and which are not. How far a right to know is actually exercised and how open our official and inhouse regulatory procedures become is clearly very important. Equally significant is a need to establish a common language that sets risk concepts not only in the vernacular, but in the context of a community's hopes and fears.

2. *The de minimis principle* suggests that residual dangers will be tolerated if there is no better safety technology, and if the processes through which this position is accepted are transparent, accessible and accountable. *de minimis* also presumes that the risk product or service is deemed worthwhile in the national interest - another area in which power bias can manipulate perceptions.

3. *The comparison test* indicates dangers will be tolerated if they are seen to appear to be less threatening than other, more familiar perils, so can be regarded by the majority as being of no real concern. This is the approach adopted by the British Health and Safety Executive (1988) in its recent statement on the tolerability of risks from nuclear power reactors. But it is a test that is proving very awkward to put into effect, unless, as reported in the largely successful BNF case, management is seen to be "community friendly".

4. *The justification test* is used to relate benefits to dangers so that the public can feel that the final product is not only in the national interest but also a force for their own good. This last test includes measures for adequate health and financial (including property value) protection in the event of accident, including insurance cover and various forms of community compensation. This test is particularly relevant to the issues of right to know and community dynamics.

Figure 1 illustrates how in theory risk tolerability can be arrived at. How far people appear to tolerate risk depends on four basic principles.

Figure 1 illustrates why a "right to know" is more than mere disclosure of information on a guaranteed or statutory basis. The key to establishing tolerability is to move the lay and technically minded risk assessors from a state of "ignorance" to a state of "knowledge". Wynne's Cumbrian sheep-farmer study cited earlier shows all too clearly that experts rapidly cross the boundaries of their specialisms when communicating with the public. Even the most sophisticated assessor can claim access to only a narrow zone of "knowedge".

Ignorance in this context does not necessarily mean a state of "unknowingness". It applies to any condition where relevant and legitimate viewponts are not fully understood and appreciated. This suggests that the community and the experts need to establish what Wynne calls *cultural risk translators, or mediators* who provide a lexicological and intelligible bridge between the different parties. Macgill's work warns that this will not be easy to put into practice. The risk translator, or communicator, is not acting either with perfect knowledge and understanding, or in a world of Habermasian equal power relationships.

2.3 Empowering the community to be its own risk appraiser and risk mediator

What follows is a proposal specifically designed for communities faced with a decision to have a "stigma-linked" risk-laden facility in its locality, namely a nuclear installation or hazardous chemical dump. The notion, however, could also apply in a regional context to toxification of groundwater or to the use of chemical pesticides or genetically engineered organisms over a large area. In such cases we are considering an environmental hazard whose perilous characteristics are almost unknowable, and where the consequences of uncontrolled exposure to toxic substances could be lethal and widespread with huge implications for medical insurance and house prices.

In such cases there is a need to establish some kind of community control over the manner in which risks are understood and communicated, bearing in mind the points raised in Figure 1. The generic concept is a *community safety service* that gives the people access to equivalent levels of understanding over the technical assessment of safety, under accidental and normal conditions. The service would have three vital roles to play.

(i) It would provide the community *with its own assessment of possible dangers and safety requirements.* The service would become the focal point of community bargaining over appropriate safety levels both before and after siting or during the management of chemical residuals in the regional environment.

(ii) The source would provide a *point of translation of risk principles and risk management* for the risky facility or phenomenon in an intelligible language set in a comparative context that was seen to be independently prepared.

(iii) The service would also act as a *trouble shooter and mediator* in the event of a near accident or a real disaster. It would help to provide information on the scale of the damage and advise on what precautions should be taken. It would also act

as a mediator for appropriate compensation claims so that local people can feel that they have an authoritative negotiator on their side.

The aim, therefore, would be to provide a forum for interchange between the risk creating phenonemon and its neighbouring community. A number of models for undertaking this task can be examined.

1. *The local liaison committee* is the most popular, least threatening and generally least effective version. It usually has no power to do anything, it is mostly a talkshop, and it rarely carries any influence on post disaster compensatory dealings. Local liaison committees can nevertheless play an important role in acting as a communicative bridge between risk creation and reception. In the right hands, and following the principles of information openness and transparency via the vernacular, the local liaison committee can, and does, provide a low budget forum for risk dialogue.

2. *The independent advisory committee* composed of academics, industrial representatives and knowledgeable lay people is another well-established mechanism. In Britain, for example, there are dozens of such bodies, many of which are highly respected. For the most part these committees are established to advise, not to mediate. As such they have no power, though they may carry authority. However, some are executive regulatory agencies in setting standards and enforceable codes of practice. These usually consist of representatives of key itnerest groups with a record of knowledgeable impartiality. A study currently being carried out at the University of East Anglia shows that their influence is tremendously dependent on their composition, their research back- up, the degree of scientific dispute, and the political context of their advice. In power terms, such committees are weak so cannot be relied upon as good risk communicators.

3. *An office of technology assessment* located in the legislature is also a relatively common development. The US Office is well known for its robust and forthright analysis but its effective influence on risk dialogue is variable. An embryonic European Community version in Strasbourg has just begun to take its first faltering steps over an assessment of fusion technology. Both the European Office and various national institutions are viewed with suspicion by powerful governments that dislike meddling legislature. It is unlikely that such an office will do more than provide another basis for judgement. Certainly it will not provide the kind of "people's empowerment" implied in the structure of such an institution.

4. *A local environmental risk ombudsman's office* is another possibility. This would be a nascent version of a full blown community risk communication office, but has the advantage of being potentially nimble footed procedurally, and capable of tackling a variety of risk analysis through contract consultants. Ombudsman's powers are usually somewhat limited by statute and convention, so even a well organised office may not be able to probe or mediate as much as might be desired. Yet this is a promising arrangement as a non-threatening precursor to a community office, and deserves to be experimented with.

5. *A community risk communication office* is the "rolls royce" model, though not necessarily the ideal solution. So far as is known no such office yet exists, though the concept is being examined for the disposal of radioactive and other chemically hazardous wastes.

This could be a tailor-made office, but its powers would still be fettered by the lack of a general right to know as statutorily defined, by legal restrictions on class action in the event of initiating a compensatory claim, and by community- risk creator power relationships as discussed above.

The logic implicit in Figure l, regarding a free flow of information, and the case for some sort of independent, but authoritative risk communication service, may not result in a better approach to the establishment of tolerable risk strategies. The little empirical analysis that exists of such schemes suggests that subtle and not so subtle power relationships define what information is made available, how it is packaged or framed, and how it is received and responded to. The effectiveness of any such service cannot be separated from the legal status of rights to know, the willingness of risk creators and official regulators to expose their dealings and judgements honestly and openly, and the recognition by community groups that such a forum is designed to be used rather than abused to promote sectional of self-serving interests. All to easily these stumbling blocks jeopardise the best of intentions.

3. On the state of a right to know

In Europe, a statutorily comprehensive right to know is a rare commodity. Elements of so-called "sunshine legislation" exist in Sweden, Denmark and Norway, the Netherlands, France and West Germany. Elsewhere the record is patchy, campaigning groups fight a slow but persistent battle to allow greater openness in the assessment of public danger. In general, the trend is towards more liberal policies with a steady, if slow, extension of statutory rights. The reasons for this trend are reasonably obvious:

(i) Major disasters such as thalidomide, opren, Seveso, Flexborough and Chernobyl have brought in their wake demands for better advance information on precautionary measures and in emergency preparedness in the event of accident.

(ii) The increasing controversy over the siting of any hazardous substances dump has created a political recognition that better public relations through more information are essential if such substances are ever to be disposed of through acceptable democratic means.

(iii) More scientifically aggressive pressure groups, prompted by the well-funded tactics of international environmental organisations such as Greenpeace, Friends of the Earth and the bird lobby, have begun to win major political battles over opening up information of chemical and other pollutants. These groups have been successfully joined by a number of freedom of information campaigns which challenge secrecy on all fronts.

(iv) The European Community has begun to pass directives which require information to be made publicly available in member states. Foremost amongst these is the so-called "Seveso Directive" (82/501/EEC) on major accidents associated with certain industrial activities. But others relating to the formal publication of registers of effluent discharges are becoming more widely followed in specific member state legislation.

(v) Minority groups, with swing vote power in coalition governments, are pressing for more rights of knowledge as part of their general political bargaining. And in general, the principle of a right to know, is being accepted as part of a mature democracy. This is manifesting itself in a much greater willingness on the part of

official regulators and industrial safety managers to accept a greater degree of public scrutiny to upgrade public trust in their work and their profession.

(vi) Industry, too, now recognises that greater openness could be an asset. It should help to improve community relationships, it can warn of possible danger of public disapproval, it can result in more comprehensive environmental protection, and it can stimulate improved management practices.

For example in the UK, which has long been notorious for its impracticable approach to almost comprehensive official secrecy, a number of developments have occurred which have improved rights to know.

(a) Under the Control of Pollution Act 1974 and the Food and Environment Protection Act 1986 registers of all authorised and actual discharges into air, water and onto land must now be provided for public scrutiny, and information associated with the review of chemical pesticides in advance of registration must be made public. In practice these registers are not readily accessible. Furthermore it is not at all easy to relate actual to authorised discharges because much can be hidden in sampling statistics. In addition, information on pesticide formulations is rarely complete. Pressure groups often have to use the US Freedom of Information Acts 1966, 1974 to obtain US data for comparison.

(b) Under the Health and Safety at Work Act 1984 and subsequent regulations an employer must inform employees of any dangers they face. But there is no similar requirement to inform the general public. This "need to know" philosophy sometimes extends to including nearby residents in the "knowledge net", but in general, wider public information is still not readily available with regard to work place risks that may cross the boundary fence.

(c) The Local Government (Access to Information) Act 1985 opens up for the first time all local authority committees to public scrutiny. It is possible for the environmental health departments to create special working groups whose discussions are not included under the legislation. For contentious hazardous themes, such as asbestos dismantling, standards and procedures, this can be a common ploy, legally to keep the public ignorant.

(d) The Environment and Safety Information Act 1988 provides that all enforcement notices applied by government regulators for a wide array of potential public dangers on recalcitrant industry must now be made public. The degree of compliance with such orders has not yet been opened up, but the fact that an establishment is known to be subject to an order, and why, is a salutory experience for safety management.

In addition the Confederation of British Industry (1987) has published guidelines for its members indicating that the public should be informed when standards of good practice are not observed (see Table 1). And the government's White Paper on Official Secrecy published earlier this year proposes that it will not longer be a criminal offence to disclose unauthorised information that does not apply to national security, and intelligence, defence, law enforcement and international relations. Personal and commercial information, including cabinet documents would not be covered by the criminal law sanction. This means that whistle-blowers, who form the lifeline of leakage in the UK at present, if caught, releasing priviledged material, will only be subject to disciplinary

procedures. This softens considerably the penality for confiding, so a healthy state of leakage should be maintained in UK risk politics.

Table 1: *CBI principles for disclosure of safety, health and environmental information*

• Firms should establish policies to secure openness in safety, health and environmental information, and should make adequate arrangements for their application in practice
• Firms should provide the local public with sufficient information appropriate to the circumstances to enable them to understand the nature of the potential risks and the arrangements that exist for their safety
• Firms should, wherever possible, agree to requests from regulatory authorities to consent to disclose to the public information previously supplied to such authorities
• Firms should support the disclosure of information to the general public sufficient to enable them to be well informed and reassured about the extent and efficiency of the controls which regulatory authorities operate on their behalf
• Firms should handle all specific requests for information quickly and politely and, in the event that information cannot be disclosed, reasons should be given
• Information necessary to protect the safety or health of the public or an individual should always be disclosed
• Firms should withhold safety, health and environmental information on grounds of confidentiality only if they are genuinely satisfied that confidentiality is justified for commercial or personal privacy reasons
• Firms should keep representatives and spokesmen for the local community - local councillors and officials, Members of Parliament and the European Community and the media - regularily informed of site activities and proposed developments or future events that concern the public

However, a statutorily guaranteed right to know still does not effectively exist in most Member States of the European Community. For most of the key risk issues information is either deliberately or unintentionally distorted or withheld to protect those in whose interests information should not become freely available. An equally common reason is the sheer difficulty of coping with a fully open information flow, especially in a multi-lingual political Community where regulations within and between countries are highly complex and extraordinarily varied.

A number of European Community Directives do contain provisions for mandating a right to know. These cover product labelling, worker safety, environmental impact analysis, chemicals evaluation and major accidents from large industrial installations. In every case, however, the actual enactment of national laws around the provision of right to know is highly variable and rarely complete or effective.

In a study of the European Community response to Article 8 of the Seveso Directive, which requires member states to inform people about measures taken to mitigate hazards and what to do in the event of an emergency, Wynne (1988b) and his co-workers found a willingness to meet the intent, but a surprising degree of failure to establish an effective public information service. Where sincere efforts were being made to meet the requirements of the Directive local people were generally tolerant of the state of information provided. Only where foot-dragging was suspected was there resentment and

suspicion. In addition, because many of the plants covered by the Directive already existed in a community, public interest in safety and emergency procedures was low where the industry was a prominent and respected local employer. Wynne suggests that the workforce can provide a kind of social bridge between management and the public in such circumstances. This is an intriguing idea that is worth pursuing.

The Wynne study also pointed to a confusion of understanding between "active" and "passive" information dissemination. In the active mode, information is provided even if the public do not request it. The passive approach is simply to make information available and force the interested minority to seek it out. Only in the UK is there any comprehensive attempt to meet the "active" requirements of Article 8, and even then, this applies to the Large Inventory Top Tier Sites. The smaller inventory sites are, as yet, barely covered. Despite the passage of Article 8, a great majority of industrial major accident hazard sites in the European Community do not benefit from public information processes as mandated by that legislation. Even where this material is available, it is often devoid of any reference to any scientific uncertainty in the expert knowledge used to determine and to manage the plant's safety. Any accident or near miss that triggers public alarm would create a demand from specific information that would very rapidly exceed the scope of the information currently available.

In any case as Baran points out in an accompanying paper, the Seveso Directive is couched in language to leave to the deviation of the risk creators just who should be told about the possibility of hazard or provisions for emergency evacuation. The European Commission is currently in the process of tightening up these laws with a view to insisting that the provision of active information is more formalised.

In a special analysis of the response to the Seveso Directive in the UK, Walker (1988) argues that industry is essentially controlly information flows and the character of dissemination, but that the legality of the requirements for disclosure are forcing industry to give more than ideally it would like. Yet official safety audits, crucial to the industrial safety case, still remain closed to public scrutiny. The European Community may well require such audits to be made public. This would expose an important aspect of confidentiality that should not remain secret.

Wynne and his colleagues conclude that more onus should be placed on the shoulders of industry, and not upon the regulatory agencies, to disseminate information, even though the local authorities may provide the conduit. Emergency procedures should be handled by one agency so as to avoid duplication and confusion in responsibility and publicity. Yet this rarely is the case, often there is no single authoritative source of information regarding post disaster protection and evacuation. Wynne also suggests that studies should be undertaken to find out how much people remember about the material provided for them. It is likely that such studies will reveal what Macgill and others have already suggested, namely that the culture of risk tolerance is set in a much more diverse risk dialogue that extends across many strands of social and economic life. This reinforces the main theme of this paper, namely that a right to know is only a precursor to good risk management, which should ideally be structured so as not to depend upon a statutorily enshrined right to know.

4. Right to know, community dynamics and radioactive waste siting strategies

The political problems of how to deal with communities likely to face an unwanted hazardous waste dump are so well covered that I shall not dwell on them here (see for example Blowers and Pepper, 1987). The main point to stress is the difficulty of deciding

(a) how much information to disseminate in advance of any particular community being selected,
(b) when to tell the community, and by what means, when a decision to select has been taken,
(c) at what point in the decision process over the whole siting strategy should the commitment to dump permanently or temporarily be taken.

These are not easy questions to answer, and no-one has come up with a workable solution. In general governments prefer the secrecy route, only informing communities at the point of decision that they are short listed or selected. This invariably not only creates extremely hostile reaction even amongst sympathisers. It also ensures that many non-NIMBY groups are also activated in defence of fairness of treament. This was the experience in the UK (see Kemp and O'Riordan, 1988) and appears to have been the case in the Netherlands (Vlek, personal communication).

Figure 2: *Radioactive waste siting failures in the UK*

	"Site first" approach
1979	Decision to undertake geological tests in two sites for high level waste disposal rejected by government because of constituency pressures
1984-7	Decision to undertake geological tests in two sites for low level and intermediate level waste
	intermediate level site abandoned because corporate landowner refused to sell land due to local public protest
	low level site became a possibility for intermediate level disposal
	three more test drill sites chosen to give appearance of real choice. Test drilling begins following special parliamentary order; no local public inquiry
	all three sites abandoned in run up to 1987
	general election. All in Conservative constituencies where local antagonism threatened sitting MPs.
1987-1990	"Strategy-first" approach
	Outline of three disposal routes for a single "superdump" of LLW and ILW below ground; coastal entry but below seabed disposal; below seabed
	Nine months of public response, but vagueness as to possible sites. Rumour of potential candidates activates local protest groups.
	Ill-considered determination of site selection criteria heading for second best approach on most politically feasible site.

What is particularly problematic is the deep sense of mistrust that pervades all future government- community dealings, even when a much more open policy is pursued. For example, the Nuclear Industry Radioactive Waste Executive (NIREX 1988) in Britain has embarked on a massive public consultation exercise to find out what people think of different options for disposing of intermediate and low level waste (s. Fig. 2).

One option deliberately *not* included is on-site permanent or temporary at nuclear installations - an option most favoured by the coalition of anti-nuclear groups. So whatever NIREX determines is the best way of disposing (deep under land, land to sea, below seabed) there will be howls of opposition over whatever site is selected with as much aggro as ever before. This is partly because the anti-nuclear lobby is manipulating the failure to canvas an on- site storage outcome, but mostly because a majority feel that neither the government nor NIREX can be trusted to act in the public interest. Rights to know and to negotiate mean nothing if the political dynamics are hostile. NIREX will be compelled by government pressure to site a suitable long term depository for the government wants a "superdump" to allow it to fulfill its nuclear energy politics. Also its own technical advisers believe that a "final solution" must be followed. NIREX will be forced to go for a site adjacent to either Sellafield or Dounreay, the site of the ailing fast reactor programme, or in the empty northern highlands where the local authority, still partly feudal in character, is willing to take the waste. If a Scottish site is selected, and Dounreay looks the most promising, there will still be an enormous problem over transportation of the waste, an issue that has been given less prominence in the public debate.

The point here is that national and community politics, not geology or waste management strategy, will dictate the British choice. No matter how sincerely "open" the reformed NIREX has become, it is still labelled by the vast majority as dictatorial, incompetent and insensitive. Public relations over radioactive waste management are well and truly soured in the UK, because of the ten year history of political mismanagement. Rights to know and honest community dialogue will do nothing to overcome this inbuilt suspicion.

5. A future research strategy

I am convinced that a right to know has no value for risk communication (though much value for freedom of information campaigners) if

(i) it is not related to a genuine commitment to protect the public interest on the part of the risk creator;
(ii) official regulation is not fully open and legally accountable;
(iii) there are no powerful self policing safeguards in place (such as in-house liability insurance schemes and trade association safety procedures linked to insurance premia and official regulatory authorisations) and
(iv) unless there is in place some kind of community risk communication service that bridges technical and lay expertise and provides an independent basis for effective community control over its risk future.

Having said all that, I am also of the view that such conditions do not exist today, and may still not be enough to guarantee a harmonious strategy for tolerable risk manage-

ment. Maybe tension and a degree of energising suspicion is necessary to ensure that the best standards are maintained. Maybe, too, accidents, or preferably, near accidents, have to occur from time to time to ensure that there is regular and comprehensive review of risk communication procedures.

As to future research, let me suggest the following:

(1) Assessment of mediating mechanisms

We should embark on a carefully monitored comparative assessment of the effectiveness of various approaches to community risk communication servicing in a number of settings and in a number of countries. These would include ombudsmen-type arrangements, liaison committees, community networks, including specialist panels, and technology assessment devices. The criteria for effectiveness would be

(i) establishment of mutual trust,
(ii) capacity to build bridges between various parties in developing a sense of mutual understanding,
(iii) alleviation of formality in requirements for information and for justification of in-house regulation,
(iv) evidence of mediation in standard setting, near miss occurrences, and post accident compensation. Mediation success would be defined in terms of diffusing hostility, resolving disputes, and re-establishing trust,
(v) evidence of overall reduction and cost minimisation of the risk management process. It may not be possible to get a precise "feel" for these criteria, but a well-designed research project ought to be able to obtain informed comment.

(2) Assessment of the significance of right to know legislation in reducing information demands.

An interesting hypothesis is that the more information can be made available, the more risk communication strategies will have to be adopted in order to reduce the demand for information overload. Again the roles of *trust and power* will influence the outcome of this hypothesis which essentially argues that a *framework of access to knowledge* may be more significant in building dialogue than the transfer of information itself.

(3) Analysis of the factors which influence the retention and the usefulness of information provided for risk avoiding behaviour or emergency procedure behaviour.

Evidence from the Seveso Directive study is that retention of information relates to the "risk friendliness" or "risk unfriendliness" of the atmosphere between the source of potential danger and the community. The kind of multi- pronged approach to community relations followed by BNF in Cumbria is worth analysing in a comparative context.

(4) Assessment of risk communication strategies in novel risk situations.

Figure 3 outlines four relationships between different communities and regulatory agencies with regard to landfill gas migration in the UK. In each case risk dialogue should be handled with different skills taking into account points raised in this Work-

shop. The fact that this particular category of danger is unusual but that dialogue with the public is beginning to be successfully managed in an atmopshere of calm cooperation, suggests that a carefully controlled comparative study would produce valuable results.

Figure 3: *Risk communication possibilities for migrating landfill gas.*

Prime Facia there are 1000 landfill sites in the UK which pursue a landfill gas problem. Following preliminary discussions with HMIP a matrix of four types of landfill sites is envisaged for detailed study:

	Public not informed	Public informed
Existing Site	1	2
Proposed Site	3	4

Category 1 is when the problem exists but consultation with the neighbouring community has not been established. Risk assessments, however, have been and are being made, and there are proposals to establish a risk communication programme.

Category 2 is when the knowledge of the hazard is well established and where public involvement has been developed through a number of means. In addition, specific measures (venting, collection for energy conversion) have already been put into effect.

Category 3 is when a new landfill or an extension of an existing landfill is being proposed but where there is the likelihood of a NIMBY-type reaction based on possible gas hazard. Here is where a programme of faithful and trustworthy risk communication is most urgently sought.

Category 4 is where an explosion, causing injury, has already generated local publicity. What is being proposed are new hazard reduction measures yet to be presented to the local public. It is arguable that a different approach will be required in comparison with category 2, but the hypothesis needs to be tested.

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(5) Risk communication strategies within industry.

Risk management will only prove to be successful if the risk creator undertakes the bulk of the burden of regulation and public communication. We need to examine in more detail what institutional devices make this more likely, and what options various industries and industrial associations adopt. On institutional devices, a study needs to be undertaken of the effects of external compared to internal regulation, namely the role played by official agencies on the one hand and that played by in-house health and safety officials, research and development teams, and in-house or cooperative liability arrangements. Since the insurance industry is steadily abandoning liability cover for pollution and risk, industry itself is steadily taking on its own insurance arrangements. How these work and how they influence internal and external risk communication and information dissemination procedures is a new area, ripe for analysis.

6. Conclusions

On the right to know

1. A right to know is essential in any democracy that believes in openness, fairness and reasonable treatment of its citizens. Undue limitations on a right to know encourage abuse of power, nurture suspicion and distrust in scientific expertise and in risk man-

agement, corrode well meaning procedures for arriving at acceptance of tolerated risk, and inevitably result in unjust treatment of individuals or communities.

2. A statutorily sanctioned and legally enforceable right to know over likely dangers to health or property is a rare phenomenon even in well functioning democracies. Its absence weakens the basis for adequate accountability in environmental regulation to the point where public trust in unscrutinised regulation is severely undermined. It also places too much dependence on policing the public interest via those whose motives can never be entirely relied upon to be public spirited, namely the risk creators themselves. This is a fundamentally unsatisfactory state of affairs if acceptance of tolerated risk is to be achieved, especially as a high degree of self-policing is essential if environmental risks are to be managed effectively and efficiently.

3. Right to know really ought to be used in two senses.

3.1 An enforceable right to access to existing documents or information.

3.2 A right to unbiased and authoritative accounts of the riskiness of a particular product or process.

The freedom of information campaigners prefer to keep these two ideas separate. They are right to do so. But for the purposes of this analysis the two concepts will need to be combined.

4. Despite its importance for risk communication and management, a complete right to know can never be put into practice for six reasons.

4.1 *Information overload.* On any risk issue nowadays all relevent information is too voluminous and indigestable to be presented in a manageable format for non specialists. This problem is getting worse, to the point of becoming unmanageable.

4.2 *Bias in synthesis.* Any attempt to synthesise or summarise complex and often disputed information will fail because

4.2.1. No single person has the authority or the knowledge to do this job to the satisfaction of all interested parties.

4.2.2. Any synopsis is bound to reflect bias, no matter how unintended.

4.2.3 The wider scientific and institutional context in which a summary has to be placed cannot meaningfully be provided. Even if faithfully summarised, such syntheses would still be misleading in actual implementation.

The very act of synthesis raises expectations about accuracy, independence and completeness that cannot be fulfilled, and creates fears of bias or doubts over misinterpretation of value positions that falsify the integrity of the task, no matter how faithfully and honestly undertaken.

4.3 *Grounding expert uncertainty.* Experts are expected to deliver authoritative views even when their techniques are suspect and their undertstanding limited, variable, or in dispute. First-hand evidence of expert fallibility can corrode faith in any "external au-

thority". The expert has to find ways of admitting limited understanding in such a manner as to inspire confidence that the best information is being given. Everyone copes with uncertainty and ambiguity in their lives: we need to extend this experience across the unnecessary barriers between "professional", "institutional" and "lay" expertise. Technical experts need to be knowledgeable of community dynamics.

4.4 *Disturbing harmonies.* Opening up a complete right to know will expose relationships and contexts in the management, regulation and reception of risk that often are best be left covered up. More information alters the basis of power relations between all kinds of parties - client and regulator, manager and worker, company and community, employees and workmates, employer and family - that maybe at ease in a state of stutus quo. Risk management cannot be separated from a whole host of institutional and social relationships which can become vulnerable and brittle should a comprehensive and unfettered right to know requirement exist.

4.5 *The realities of power and capital.* Power relations within capital and government dictate that there can never be a complete right to know. Sunshine regulation will always be manipulated in order to maintain control over events. An incomplete right to know masquerading under false pretences as a total right to know may damage the integrity of risk communication and reinforce power in established hands.

5. A distinction is sometimes made between a *right to know* and a *need to know.* The latter is a watered down version of the former. Under the need to know doctrine, only that information necessary to assist those positively in potential danger would be disseminated. The scope of the material and the degree of distribution would be limited, and decisions as to what would be distributed would be made by the risk creators. Need to know is a dangerously misleading approach to risk communication, and its application could be damaging to the cause of establishing tolerable risk.

On community dynamics

6. Risk management cannot avoid incorporating community opinion, community receptivity and community compensation. Determining tolerable risk is an art form, not a science: it involves community political dynamics at the very heart of its operation.

7. It is therefore misleading to talk of an "expert" and a "lay" perception of risk as if to imply that the first is superior to the other. Both must be seen as parts of a whole process of risk assessment. This false dichotomy must be deleted from risk communication studies.

8. There is no ideal method of communicating information on risks to the community and faithfully responding to community values and concerns. Too much depends on factors that are peculiar to a given problem.

8.1 Community political preferences vis a vis those of the government in power.

8.2 History of community government relationships.

8.3 History of community risk-creator relationships and the role played by the risk creator in the economic and social life of the community.

8.4 The character of community based politics via its social structure, economic relationships and the activities of particular pressure groups.

8.5 The general mood regarding unfairness of treatment and injustice of risk burdens elsewhere, but whose relevance applies to a particular issue facing a particular community.

9. The most promising developments to assist in the dynamics of community acceptance of tolerable risk include:

9.1 The use of respected local people as community risk translators, lubricating relationships between the risk creator and the local public.

9.2 The use of networks of respected and representative community leaders to act as channels of two-way communications regarding tolerable levels of residual wastes.

9.3 The establishment of an authoritative and independent community safety service to ensure that the community has an element of effective power over the assessment of the risks it receives.

9.4 The development of "safety nets" of compensatory funding in the unlikely event that health and/or property values are actually damaged. These "safety sets" need to be sufficiently robust as to be reasonably impregnable to manipulation and procrastination in any post-disaster litigation.

9.5 The creation of a community investment fund, linked to a liaison committee, on the part of the risk creator, designed to supply a flow of benefits, both economic and social, to the local people. This should not be seen as a bribe, but should be provided on the basis of "good neighbour" principles.

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Rights and Duties Concerning the Availability of Environmental Risk Information to the Public

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1. American environmental law and the practical importance of environmental information.

The legal framework for protecting human health and the environment in the United States can be divided into two main sectors: (1) regulatory law which consists of legislation and detailed regulatory programs carried out by federal and state agencies to prevent harmful uses of technology; and (2) common law which contains tort liability doctrines for use by injured parties to secure compensation and other remedies in the courts.

Citizens participate in the regulatory law sector by various means. They express views which influence the enactment of legislation. They provide factual information to agencies to influence the setting of standards, and participate in agency hearings. They also bring "citizen suits" in the courts against agencies or companies which are not meeting regulatory requirements to force compliance. And they also seek judicial review of standards, licensing actions and other agency decisions. Obviously, the more information that citizens have on environmental matters and agency and industrial activities, the more fully and effectively they participate in the regulatory law sector to prevent or reduce environmental risks.(1)

Citizens also use common law tort doctrines in the courts to secure remedies for harms they have suffered as a result of industrial wrongdoing. In addition to compensation, they also seek punitive damages and court orders to stop further wrongdoing by firms. To prevail in such actions, they must provide sufficient evidence of industrial negligence or of the unreasonably risky nature of industrial activities, and must also establish causation linking their harm to a particular firm or group of firms. Again, it is obvious that the more information that citizens have on environmental matters and industrial activities, the more likely they are to be successful in securing remedies, since the information may provide them with needed evidence of industrial wrongdoing and causation.(2)

Thus, in the context of American environmental law with its adversarial methods of problem-solving, citizens need information on various environmental matters and the activities of agencies and companies in order to effectively assert their rights.

2. Citizen access to environmental information

The information on industrial hazards and their risk consequences that citizens need to act effectively in the American legal framework is usually quite technical, for example: studies of environmental systems, the potential or actual impacts of a new activity, health risk analyses, pollution and public health data, models of disease causation, and information about industrial discharges and emissions. This information is usually developed at considerable cost by experts for agencies, industrial firms and trade associations, which then hold the information for their own use or release it at their discretion.

Individuals and citizen groups do not have sufficient economic resources to independently develop this information, and even if they did, they could not acquire the intimate knowledge of these matters that, in most instances, is possessed by agencies and firms.

Therefore, two types of laws have been enacted by federal and state governments in the United States which provide citizens with rights to environmental and industrial information held by agencies and firms. These are the *Freedom of Information* laws, which establish citizen rights of access to agency-held information, and the recent *Right to Know* laws, which provide for citizen access to certain types of information held by industry. (3)

These laws which expansively provide for public rights to risk information were nurtured in the American context, with its unique mixture of traditions, values and institutions. In this context, one finds, for example, deep anxieties about technological risks, traditional mistrust of government and industry, historical commitment to town meetings and other forms of participatory government, and reliance on litigation and other adversarial methods for resolving disputes. Such factors, working in combination, support new rights to risk information.

The common law tradition also provides strong historical support for industry's duty to warn persons about their exposure to certain technological risks. Thus, under product liability theory, a manufacturer is liable for injury to a user of its product if the product caused the injury, and the manufacturer's failure to warn the user of the product risk made the product defective or unreasonably hazardous. (4) Companies which have failed to warn have produced significant harms to product users and consequently incurred ruinous liability, as the recent flood of asbestos cases demonstrates. As a result, strong public support has arisen for codification of duty to warn theory and this has led to the enactment of "worker right to know" rules which now apply to firms producing or using hazardous chemicals.

In addition, the views of early political leaders are imbedded in the American approach to modern technological risks. Some 200 years ago, Jefferson and Madison premised democracy on the voluntary exercise of choice by an informed citizenry. Today, their views are frequently used in policy debates about how to deal with technological risks, particularly since Three Mile Island, Bhopal and other events which have discredited reliance on agency and industry "experts".

Perhaps an even more fundamental support for informing the public derives from widespread recognition that the ultimate risk issue, "how safe is safe enough", is essentially trans-scientific or subjective, and cannot be conclusively or satisfactorily answered by experts for a dynamic and pluralistic society like the United States.

Increasing the public's right to risk information now appears to be an irreversible process because it is now supported by several new forces at work in the United States. These include rapid scientific progress which permits the discovery of new risks, powerful communications systems and aggressive media coverage of risk issues, and growing public concern about risks as threats to aspirations for improved health and safety. These new forces combine to increase the public desire for risk information.

Where will all this lead? Harry Otway of the European Community Research Centre, predicts that "as risk communication requirements are implemented, they will increase the public's appetite for information. What began, perhaps, as demands of elitist activist groups for more open access to information will spread to a broader public, creating demands for increased public involvement in decisions regarding hazardous industrial activities paradoxically, the demand for information and participation in decision processes is always greater if access to them is difficult. The ready availablity of information and the possibility of influencing decisions tend to enhance the credibility of decision-makers and reduce the demand for participation." (5)

3. The freedom of information act

The federal Freedom of Information Act (FOIA), enacted in 1966, is the primary law which provides any member of the public with the right of access to agency-held information. It guarantees this right by imposing on all federal agencies the duty to promptly disclose information that is requested with reasonable specificity, and providing for judicial review of agency non-compliance. However, FOIA also permits agencies to withhold from disclosure industrial trade secrets, national security information, and several other types of information. (6)

To facilitate public access, FOIA also provides that agencies must officially publish their FOIA policies and descriptions of their record-keeping systems, and make their interpretations of FOIA requirements available for public review. Agencies may charge reasonable direct costs for locating and duplicating records, but may waive these charges "in the public interest".

Thus, information held by an agency, such as data and studies it has developed on a pollution problem or data and memoranda provided by other agencies, industrial firms or trade associations, is available to the public unless the agency can justify withholding such informaiton under one of the nine permissible exemptions provided in FOIA.

In practice, certain factors have limited the information agencies actually disclose to the public. These include requests which are too vague and do not "reasonably describe" the documents sought; dilatory tactics by the agency to obstruct persons seeking information to challenge an agency decision; and loss of informaiton in volumious and disorganized filing systems.

But the chief limitation has been agency use of the nine exemptions. [7] These exemptions authorize agency non-disclosure if the information sought

1) has been officially designated as relating to national defense or foreign policy;
2) relates only to internal agency personnel rules and practices;
3) has been restricted from diclosure by other federal laws;
4) constitutes a trade secret or proprietary commercial information;
5) consists of inter-agency or intra-agency documents that would not be available to other parties in litigation;
6) would invade the privacy of persons (e.g. personnel and medical files);
7) involves investigatory records used for law enforcement;
8) consists of agency analysis of financial institutions; or
9) contains certain geological or geophysical data.

In 1973, Congress found that agency refusal to provide information, based on these exceptions, had become widespread practice, and that delaying tactics were also frequently used. Congress therefore amended the law in 1974, restricting several of the exceptions. [8] It also provided that when a complaint is filed in a federal district court alleging that an agency has improperly withheld its records, "the court shall determine the matter "de novo", and may examine the contents of the records "in camera" to determine "whether such records or any part ... shall be withheld under any of the exemptions ... (with) the burden ... on the agency to sustain its action". [9] Thus, a court may now review the records claimed by an agency to be exempt on trade secret grounds; and if it finds that they do not consist in their entirety of trade secrets, the court can order the disclosure of the non-secret segments.

Despite these reforms, numerous complaints are still filed in court each year by persons claiming that agencies have improperly withheld requested information, and FOIA law has become a complex web of judicial decisions. In addition, corporations and other submitters of information to agencies have brought "reverse FOIA" actions in court, seeking judicial decisions to prevent an agency from releasing information to a person (or company) that has requested it. [10]

Those who use FOIA for environmental purposes most often encounter agency opposition on grounds that the information they seek includes industrial trade secrets, or relates to national defense, or consists of intra-agency memoranda of a "deliberative" nature which is not ripe for public disclosure.

When denied, these persons often seek judicial review for in camera inspection of the documents. This has led to numerous court decisions that invalidate the agency action, in whole or in part. [11] But this course of action requires a commitment of time and funds for the person seeking the information, and many do not pursue it.

FOIA has been of substantial benefit to many environmentalists, but the promise of public access to agency records will never be fully achieved because the law is designed to permit agencies to protect certain national, industrial and personal (e.g. privacy) interests which have traditionally been recognized in American law.

Nevertheless, FOIA and other federal laws which similarly deal with environmental information have become a central feature of the American environmental law framework. [12] Although attempts to enact FOIA-style laws and directives have been narrowly defeated in Britain, West Germany and the European Parliament, similar laws have been enacted in the Netherlands and Denmark, and related "right to know" laws for worker protection now exist in Italy and West Germany. [13] European firms regularly use FOIA to secure information from American agencies; [14] and regularly submit information to American agencies in order to conduct their activities in the U.S., even though they realize the information may thereafter be disclosed because of FOIA requirements.

All in all, there seem to be no compelling arguments or unsolvable problems to prevent the adoption of FOIA in West Germany and other European nations. Exemptions similar to those in the U.S. could be provided to protect trade secrets and other traditional legally-recognized interests, and there is the opportunity to carefully craft a method for resolving disputes that would be more consistent with the European political and legal context than the reliance on litigation that is used in the United States.

4. The right to know laws

During the 1980's, the Reagan administration has made severe cutbacks in federal regulatory programs for health, safety and environment. But two remarkable developments have taken place which more than compensate.

First is the explosion of toxic tort actions brought by environmental interest groups, communities, workers and other victims of technological risks. The courts have adapted tort rules to enable these victims to overcome various procedural and evidentiary obstacles and secure compensatory and punitive damages, and other remedies. The results include more adequate compensation for injured persons, and high liability and other losses (e.g. transaction costs of litigation, loss of reputation) for industry. (Thus, the tort system now frightens industry into taking voluntary measures to reduce risk and losses, and has a deterrent effect on industrial conduct of risky activities. [15]

The other major development has been the enactment of laws and regulations by federal and state governments to provide workers and community residents with the "right to know" hazard information held by industry. [16]

For example, the "hazard communication" rule, enacted in 1983 by the federal Occupational Safety and Health Administration (OSHA), requires that certain standard forms of communication be used to provide workers with risk information. [17] The duty to provide this information is imposed on the manufacturers and importers of hazardous chemicals, and the "downstream" firms which purchase and use these chemicals for processing and other purposes. The rule requires that a manufacturer or importer of designated chemicals (over 2000) provide labels and Material Safety Data Sheets (MSDS's) for such chemicals to their own workers who are foreseeably subject to exposure to the chemicals, and to downstream firms which purchase and use the chemicals. The downstream firms must then assure that the labels and MSDS's are made available to their own workers. All firms must also adopt programs to educate workers about safe use of the chemicals.

In the European Community, labelling requirements have been established for firms in the twelve member nations by the EC's "6th Amendment", but the provision of data sheets is left to industry discretion and national law. Several large European chemical and oil firms now provide data sheets on a voluntary basis, and Britain and several other nations now require that data sheets be provided workers. However, the U.S. doctrine that a worker has a legally-enforcible right to such information has not been adopted by E.C. directive. (18)

The OSHA rule on hazard communication establishes worker "right to know" on a national basis, but it conflicts in many respects with laws enacted for similar purposes by over 25 states. Thus, American firms have faced conflicting responsibilities, and have turned to the courts to resolve these problems. In opposition, state officials and unions have argued in court to preserve the state laws and to expand the scope of the OSHA rule. (19)

Both interest groups have had some success. The courts have held that OSHA's rule preempts state law when state law deals with the same sectors of industry regulated by OSHA but provides conflicting requirements, a result favorable to industry which seeks a uniform set of communication requirements across the nation. But the courts have also ordered OSHA to expand the scope of its rule (to cover various other industrial sectors if warranted by sufficient evidence of worker illness due to lack of information), and to restrict the protection of trade secret information that the original OSHA rule had broadly provided. OSHA has now revised its rule, and the states are now conforming their laws to the OSHA rule. Thus, problems are being slowly resolved by means of litigation. (20)

"Community right to know" laws, which deal with the accident hazards of industrial facilities, have also been enacted by federal and many state governments in the United States, in response to the Bhopal tragedy, and the occurrence of many chemical plant accidents in the U.S. (some 6900 reported accidents in the last 5 years, which caused 138 deaths, the evacuation of over 100.000 people and many injuries to health and property). (21)

Under the federal Emergency Planning and Community Right to Know Act of 1986. Congress has required all firms which produce, use or store some 400 designated chemicals in certain quantities to provide four types of reports to state and local emergency planning officials:

(1) notifications of any accidental releases of chemicals,
(2) sheets on designated chemicals found in the industrial facility;
(3) data on the columes and locations of the chemicals; and
(4) data on the chemicals routinely discharged into the community environment. (22)

The law also requires each state to establish emergency planning agencies, and requires the agencies to review the reports and prepare emergency response action plans. Most important to community residents, the law provides that they have the right to secure these industrial reports from the agencies for independent evaluation. (23) But special provisions protect trade secrets from disclosure, and exempt research laboratories and certain other organizations from the disclosure requirements. (24)

Over 25 states and hundreds of municipalities have now enacted similar laws, some of which contain additional requirements, which are not preempted by the federal law. Probably the most significant additional requirement has been enacted in New Jersey and proposed in New York. It requires each firm to also do a risk or safety study of their facility accident potential, and to provide the study to state and local officials for determination as to whether the facility is sufficiently safe or not. If found to be unsafe, various other state laws permit these officials to require additional safety measures or closure of the facility. (25)

This approach is consistent with the traditional powers of local officials to protect community health and safety, powers which had not been used in the past but which in recent years are being used more vigorously. Thus, just before enactment of the federal law, local officials in Cambridge, Massachusetts issued an order to stop the A.D. Little Co. from further research on chemical warfare materials, because of community fears of an accidental release of the chemicals. (26)

Support for community right to know laws has come from a diverse group of interest. Local environmental activists, and persons opposed to certain companies, support these laws because access to industrial information empowers them. Many industrial firms also support these laws to gain credibility and trust from communities, and because they fear the liability that would follow an accident if they had not disclosed information to community officials and had thereby prevented the preparation of appropriate emergency plans. (27)

Support has even come from the most conservative, anti- environmentalist groups, because they view the provision of information as a "new federalism" alternative to further federal government regulation of industry. By supporting information disclosure policies and local problem-solving, they hope to reduce the federal government's regulatory growth and budget. Anti-federal government attitudes are therefore proving even stronger than distaste for environmental activism, for the conservatives in American politics.

The expectations of all these diverse groups are being met. Local activists now have much more information to use against industry and to protect the community. Industry now has a framework for cooperation with local officials and helps develop appropriate emergency plans which will reduce their liability should an accident occur, and which may help them secure liability insurance which has been scarce. And anti-government conservatives take pleasure in the fact that the federal government has not undertaken a major effort to inspect and license the thousands of chemical facilities in the U.S.

But the question must be asked: Does this American model which has released a flood of new information actually lead to real improvements for safer management by industry and for greater protection of community safety and environment? Does reliance on local officials and local activists lead to real advancement of environmental protection? Would a systematic federal regulatory effort be more effective?

My own view is that this model will achieve substantial benefits. First of all, it promotes information-sharing and the responsibility of industry to work jointly with the persons it exposes to risk. It provides recognition that citizens have the fundamental

right to know about deliberately undertaken acitivites of industry which benefit but also endanger them.

Second, the model is promoting substantial advances in U.S. companies to voluntarily act to improve safety. Firms fear that the disclosure of information on the risks they create will lead to local opposition and litigation, and to consequent economic losses and disruption of activities. Therefore, to reduce this potential scenario of trouble, many large firms are improving their management, facility safety features, and reducing the amounts and types of toxic chemicals they use and store. By disclosing information on risk reduction, they thereby lessen the chance of potential controversy and loss. Some firms which produce dangerous chemicals are also developing "expert systems" software and other materials on how to properly handle the chemicals and deal with emergencies, and intend to provide this information to their downstream industrial customers. Thus, corporate risk management is being substantially improved at all levels. (28)

Third, the U.S. model is producing benefits for other nations which host dangerous industrial facilities. The U.S. law does not require firms working in other nations to provide such information to officials or the public in such nations. But many multi-national firms now feel that they must voluntarily do in other nations what they do in the U.S., since denying such information in other countries would lead to charges that they are using dual standards and showing less concern for protecting health and environment in these other nations. (29)

Thus, I am an optimist about the benefits the U.S. model will produce, although I remain concerned about its reliance on local controversy and other ad hoc factors to achieve greater safety for the human environment.

The European Community, in 1982, enacted the "Seveso Directive", on the "major accident hazards of industrial activities", following the Hoffman-LaRoche facility explosion in Seveso, Italy. (30) This directive is similar in many respects to the U.S. model in that it requires firms in the 12 European nations to report accident risk information on 178 chemicals to national and local officials to facilitate their emergency response planning for accidents. (31) In some respects, the Seveso Directive is more demanding than the U.S. law. For example, it requires firms to do a complete safety evaluation of their facilities, and to provide these to national officials, who can then act under national laws to secure industrial reforms to prevent accidents more effectively, if necessary (similar to the New Jersey state law in the U.S.). (32)

However, in one major respect, the Seveso Directive is more limited than the counterpart U.S. law. It does not provide the public with a legally-enforcible "right to know" for access to the information reported by industry to national and local officials. Instead, the Directive provides that the information shall be reviewed by these officials, but that the officials shall provide "persons liable to be affected by a major accident" only that information on what safety measures to take which will ensure that they adopt "the correct behavior" in the event of an accident. This paternalistic approach has led to interpretation of the Seveso Directive as providing information to the public on a "need to know basis", (e.g. warning signals, medication and evacuation procedures, etc.), not on a U.S.- style right-to-know basis. (33)

Criticisms have led the E.C. Commission to approve a proposed amendment in March 1988, which would revise the public information provision, Article 8, of the Seveso Directive. The proposed amendment would require the "active provision" of designated types of information about facility chemicals and risks to the public, and would therefore provide persons in Europe with essentially the same information available to persons in the United States. (34)

Industrial expressions of concern about the disclosure of information to the public in the U.S. and the E.C. have been focussed on potential loss of trade secrets, loss of management autonomy, creation of unwarranted public anxieties and controversies, and the blurring of legal responsibility as to who is truly responsible for plant safety. (35) Nevertheless, large U.S. firms with facilities in Europe are now responding to Seveso Directive requirements, and large European firms with plants in the United States are now responding to federal and state right to know laws, without major problems.

As with Freedom of Information law, there seem to be no compelling rationales or unsolvable problems to obstruct adoption of a U.S. style "community right to know" doctrine in West Germany or other European nations. European firms with plants in the U.S. now work unter this principle and it would be awkward for them to deny persons at home in Europe the information and rights provided to Americans. Protection of trade secrets is effectively provided by many laws in Europe (36), and costly controversies and litigation are less likely in the European environment than they are in the U.S. One aspect of the U.S. experience which has troubled Europeans, namely the resolution of disputes by means of litigation in the courts, can be modified for the European context so that disputes would be resolved by arbitration, negotiation, administrative judgment or other less-adversarial means.

5. Conclusions

Both American and European societies are moving in the same direction - towards greater recognition of the need to make risk information available to the public, and greater reliance on communication as a policy instrument for reducing technological hazards.

Because of contextual factors, the American approach has been more expansive in providing information rights to the public and promoting public involvement in solving technical risk problems; but has not paid sufficient attention to actual performance problems, such as how to resolve disputes and systematically provide equivalent safety to all persons.

The European approach, because of different contextual considerations, has sought to maintain traditional joint responsibility of industry and government for systematically solving problems, but has resisted conferring public rights of access to industrial information which would permit the public to effectively participate in the development of the programs to prevent and respond to accidents.

One can only conclude that each industrial society has much to learn from the other.

6. Appendix

Emergency planning and community right-to-know act of 1986 [37]

Out of concern about the effect of chemical releases on communities, Congress passed the Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA). See 42 U.S.C.S. §11001 et seq. EPCRA is Title III of the larger Superfund Amendments and Reauthorization Act of 1986 (SARA), but it is considered a free-standing law. EPCRA is intended to encourage and support emergency planning efforts at the state and local level. It is also intended to provide local communities with information about potential chemical hazards.

Unter Subtitle A (Emergency Planning and Notification) of Title III, the governor of each state must designate a state emergency response commission consisting of people with "technical expertise in the emergency response field". This state commission, in turn, will "designate emergency planning districts in order to facilitate preparation and implementation of emergency plans" and appoint members of a local emergency planning committee for each district. These local committees will include state and local officials, members of the media and representatives of industry and citizens' groups. Id. at §11001.

An emergency response plan includes the identification of facilities subject to the law, on and off-site emergency response procedures, designation of community and facility coordinators, notification procedures, methods for determining an occurrence of a release of hazardous chemicals, the area or population likely to be affected by a release of hazardous chemicals, evacuation plans, training programs, and methods and schedules for testing the emergency plans. Id at §11003 (Section 303).

On November 17, 1986, the EPA published a list of 402 "extremely hazardous substances" and the threshold planning quantity (TPQ) associated with each substance. See 51 Fed. Reg. 41470. Under Section 302 of EPCRA, any facility that "produces, use, or stores" any of these substances in an amount over its TPQ must notify the appropriate local committee and comply with the emergency planning requirements of this Act. See 42 U.S.C.S. §11002.

Under Section 304, a facility must report any accidental release of the 402 extremely hazardous chemical or chemicals covered by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) in an amount over the reportable quantity for that substance. See 42 U.S.C.S. §11004; 42 U.S.C.S. §9601 et seq; 52 Fed.Reg. 13395 (1987); 40 C.F.R. Part 302, Table 302.4.

This notification will include:

- The name of any substance involved in the release - If the substances involved are on the list of 402 "extremely hazardous substances"
- An estimate of the quantity released - The time and duration of the release
- The medium or media into which the release occurred
- Any known or anticipated health risks and medical advice for treating exposed individuals

- Precautions to take as a result of the release -Perosns to be contacted for further information

After an accidental release, a facility must also provide additional information with respect to actions taken to contain the release and any furthr medical information relating to health risks associated with the released substances and treatment for exposed individuals.

Under Subtitle B (Reporting Requirements), a facility must provide information to the appropriate state, local, and federal officials on the type, amount, location, use, disposal and release of chemicals. Section 311 requires facilities to submit a list of certain chemicals on site or material safety data sheets (MSDS) for these chemicals. Section 312 requires an inventory of certain chemicals at the facility. Section 313 requires an annual inventory of routine or non-emergency releases of certain chemicals. See 52 Fed. Reg. 38344 (1987) (Codified at 40 C.F.R. Part 370).

Under Section 311, a facility must have Material Safety Data Sheets (MSDS's) required under the OSHA Hazard Communication Standard on MSDS's, to the appropriate local emergency planning committee, state emergency response commission, and fire department with jurisdiction over the facility (state and local emergency authorities). See 42 U.S.C.S. §11021.

Under Section 312, a facility must provide state and local emergency authorities with general information on the amount and location of hazardous chemicals over the preceding calendar year. This Tier I information consists of estimates of the maximum amount of chemicals at the facility, the average daily amount of these chemicals and their general location at the facility. Upon request of the appropriate state and local emergency authorities, a facility must provide more detailed information about the amount and location of hazardous chemicals at the facility over the preceding calendar year. This Tier II information consists of

- The chemical name as provided on the MSDS
- An estimate of the maximum amount at the facility
- An estimate of the average daily amount at the facility
- Description of the manner of storage
- Exact location of the chemical - Notificaiton if the location information will be withheld Id at §11022.

Since most of the Tier II information must be provided anyway, some state and local authorities have requested the Tier II reports in lieu of Tier I reports.

The EPA has set identical threshold limits for reporting and MSDA purposes under Section 311 and 312. In the first two years of enforcement, a threshold of 10,000 pounds will be used and a threshold of zero pounds will be used thereafter. The EPA said it will study the permanent threshold level to see if it should be raised. A local planning committee can ask for information on any substances for which an MSDS is required, regardless of the quantity at the facility.

Under Section 313, a facility must provide the EPA with a report of routine emissions of certain toxic chemicals from the facility for the preceding calendar year. ID at

§11023 (Emergency releases are covered by Section 304 of this Act). This section applies to owners and operators of facilities that "manufactured, processed or used" a listed toxic chemical over Industrial Classification (SIC) Code of 20-39. The sectors covered are as follows:

SIC Code	Industrial Sector
20	Food and kindred products
21	Tobacco
22	Textile mill products
23	Apparel and other textile products
24	Lumber and wood products
25	Furniture and fixtures
26	Paper and allied products
27	Printing and publishing
28	Chemicals and allied products
29	Petroleum and coal products
30	Rubber and miscellaneous plastic products
31	Leather and leather products
32	Stone, clay and glass products
33	Primary metal industries
34	Fabricated metal products
35	Machinery, except electrical
36	Electric and electronic equipment
37	Transportation equipment
38	Instruments and related products
39	Miscellaneous manufacturing industries

The initial list of toxic chemicals subject to Section 313 is a combination of lists created by New Jersey and Maryland for their right-to-know programs and consists of over 300 toxic chemicals and 20 categories of chemicals. This list can be modified by the EPA administrator based on an EPA determination of health or environmental hazards, or upon petition by a state governor or member of the public.

The threshold quantity for a toxic chemical used at a facility is 10,000 pounds per year. The threshold quantity for a toxic chemical manufactured or processed at a facility starts at 75,000 pounds per year in 1988, and shrinks to 50,000 pounds per year in 1989 and 25,000 pounds per year in 1990 and beyond. The EPA Administrator can modify the threshold amount for any toxic chemical. To relieve the reporting burden on small businesses, a facility wiht releases under 1,000 pounds per year can report the range of the release, rather than an exact figure. After 1989, the EPA will valuate this range reporting option.

The EPA is required to store information it receives under Section 313 in a "national toxic chemical inventory" and make this information computer-accessible to the public, subject to tradė secret restrictions.

The first year costs of meeting Section 313 reporting requirements will approach $500 million, according to the EPA. These costs will be borne by approximately 30,000 facilities. The EPA estimated that in an average facility, two full-time employees will need

about 200 hours each to pull the data together, estimate releases and complete reporting forms. This information will not be accurate enough to allow the EPA to write permits or develop regulations; however, it will be useful as a screening tool to direct treatment, enforcement and regualtory actions in the future. See Right-to-Know Planning Report, The Bureau of National Affairs, Inc., Washington, D.C., Feb. 18, 1988.

Under Section 321, EPCRA is meant to coexist and compliment existing state, local, and federal law (and does not preempt state or local law). In addition, a State or locality can require supplemental information to be submitted with an MSDS. See 42 U.S.C.S. §11041.

Under Section 322, trade secret information can be withheld, upon a proper showing. Id. at §11042. Trade secrecy claims are limited to the specific chemical identity of chemicals and toxic substances covered by Sections 303, 311, 312 and 313. Id. At § 11042 (a); See 53 Fed. Reg. 28771 (July 29, 1988) (Codified at 40 C.F.R. Part 350).

In order for a trade secret to be allowed, a person must prove that:

1. Such person has not disclosed the information to any other person, other than (authorized individuals), and such person has taken reasonable measures to protect the confidentiality of such information and intends to continue to take such measures.
2. The trade secret is not required to be disclosed, or otherwise made available, to the public under any other Federal or State law.
3. Disclosure of the trade secret will cause substantial harm to the competitive position of such person.
4. The chemical identity is not readily discoverable through reverse engineering. 14 U.S.C.S. §11042 (b).

Under Section 323, trade secret information must be provided to a health professional, doctor or nurse for the diagnosis or treatment of individuals, for a medical emergency or for preventive measures (e.g., epidemiological studies of a given chemical). However, these health professionals must submit a written statement of need and a written confidentiality agreement. 42 U.S.C.S. §11043.

Finally, under Section 423, all information, except for trade secrets, provided by industry (including each emergency response plan, MSDS, list, inventory form, toxic chemical release form and follow-up emergency notice) will be made available to the public. Id. at §11044.

Under Section 325, the penalties for failing to comply with this Act are as follows:

Violation	Maximum Penalty
Emergency Planning (§302)	$25.000/day
Emergency Notification (§304)	$25.000/day
Repeated violation	$75.000/day
Willful violation	$25.000 fine + 2 yrs. in jail
Repeated willful violation	$50.000 fine + 5 yrs. in jail
Reporting Requirements	

Sections 312 or 313	$25.000/day
Sections 311 or 323	$10.000/day
Trade Secrets	
Frivolous claim	$10.000/claim
Unauthorized disclosure	20.000/fine + 1 yr. in jail

Id. at §11045.

The EPA Administrator is responsible for enforcing this Act. However, "any person" may commence a civil suit to enforce, and if successful, can be awarded costs of litigation, including reasonable attorney and expert witness fees. Id. at §11046.

The background which led to the EPCRA

From 1980 to 1985, there were over 6.900 accidents in the United States which involved the release of "acutely toxic" substances. These accidents resulted in 138 deaths, 4,717 injuries and the temporary evacuation of 217,000 people. These accidents had an average estimated cost of §30 million each. See M. Baram, Corporate Risk Management, p. 82.

These statistics, coupled with the tragic accident at Union Carbide's Bhopal facility, resulted in a flurry of regulations, programs, and legislation. The EPA created a guidance document for state and local officials and company managers to help regulate plant safety: the Chemical Emergency Preparedness Program: Interim Guidance. The Chemical Manufacturer's Associate created the Community Awareness and Emergency Response Program to share information with communities where chemical facilities were located. In addition, many states (over 20) and municipalities passed legislation and regulations for emergency response planning and risk communication. The culmination of all of these activities was the federal Emergency Planning and Community Right-to-Know Act of 1986.

Enforcement protocol.

The enforcement protocol for Title III, both locally and nationally, is evolving. The EPA is planning to have a federal enforcement strategy in place in 1989. The EPA is concentrating its efforts in 1988 towards providing technical assistance, training and information to the States in order to help them set up the infrastructure required by Title III. The EPA wants the States, through local regulation and legislation, to develop their own parallel enforcement program, similar to the federal program established in Title III. Once these parallel programs are in place, the States will be primarily responsible for enforcement, with the option to refer enforcement actions to the EPA, if necessary. It will still be the responsibility of the regional offices of the EPA to negotiate settlements of any civil fines levied against a facility. Concerns have been raised, both national and locally, about the funding and the staffing necessary to enforce the provisions of this Act and other similar state and local legislation.

One preliminary proposal for enforcing Section 313 on a nationwide basis consists of two stages:

1) Screening submitted reports - The EPA office in Washington, D.C. will be choosing at random a certain percentage of submitted reports. Those submitted will then be notified of any errors and fined accordingly (i.e., similar to a traffic ticket fine).

2) Catching non-reporters - the regional offices will classify the facilities in their region by SIC code. The regional offices will identity those facilities which should report and target those most likely to be required to report. The offices will then determine if these facilities have actually submitted reports.

Until the State and federal enforcement programs are in place, the EPA will enforce Title III regulations as it deems necessary. Particular attention will be paid to violations of Section 304 (reporting accidental releases of extremely hazardous chemicals) due to the imminent dangers created by such violations.

References

(1) See generally, F. Grad, Environmental Law 3d., M. Bender, Inc. (1985) for a review of regulatory programs for environmental protection; and Federal Administrative Procedure Sourcebook, Admin. Conf. of United States (1985) for essential information on administrative procedures and opportunities for citizen participation in the regulatory law sector.

(2) See M. Baram, Alternatives to Regulation, Lexington Books, Inc. (1982) for a review of common law and other non-regulatory approaches to environmental protection; and G. Nothstein, Toxic Torts, McGraw Hill (1984) for detailed discussion of tort doctrines and evidentiary considerations.

(3) The federal Freedom of Information Act, 5 USC 552 (1966), as amended; the Superfund Amendments and Reauthorization Act, Title III (the "Federal Emergency Planning and Community Right to Know Act"), 42 USC 11001 (1986); and the Hazard Communication Rule ("Worker Right to Know Rule"), 29 CFR 1910.1200 (as revised through 1987) enacted by the federal Occupational Safety and Health Administration represent the three primary federal laws. Some thirty states and numerous municipalities have enacted similar laws.

(4) See generally, W. Prosser and R. Keeton, Torts, 5 th ed., West Publ. Co. (1984).

(5) H. Otway, "Risk Communication and Policy in the European Communities," paper presented at International Conference on Responsibilities of Multinational Corporations to Disclose and Communicate Risk Information, Boston University Law School, Boston, Mass, USA (March 24-25, 1988). To be published in Conference Proceedings by Butterworths, Ltd.

(6) The federal Freedom of Information Act, 5 USC 552 (1966) as amended, has served as a model for similar laws in several states which provide public access to the records of state agencies. Comprehensive coverage is provided in J. O'Reilly, Federal Information Disclosure, McGraw Hill, Inc. (1977, semi-annual supplements).

(7) 5 USC 552 (b).

(8) P.L. 93-502, §§1-3, Nov. 21, 1974.

(9) Id, now incorporated in FOIA at 5 USC 552 (a)(4)(B).

(10) See Short Guide to the Freedom of Information Act, and annual Case List, U.S. Dept. of Justice.

(11) Id.

(12) Consistent with FOIA are the Federal Advisory Committee Act and the Government in Sunshine Act, which afford citizens access to agency meetings and committee membership; and the National Environmental Policy Act, which requires that agencies provide the public with "environmental impact assessments" of intended agency actions. Many states have adopted similar laws which apply to state agencies.

(13) See chapter on "Environmental Information" in European Environmental Yearbook 1987, Docter Int'l., London (1987); and European Environmental Review, v.1, n.4 (1987), pp.27-28.

(14) According to Prof. Frity Nicklisch of the University of Heidelberg Law School, several West German firms involved in an international contract dispute recently secured relevant information for resolving the dispute from an American agency by using FOIA (April, 1988).

(15) See M. Baram, "Chemical Industry Hazards: Liability, Insurance and the Role of Risk Analysis", paper presented at annual conference of the Geneva Association, Oslo (June 1985).

(16) For an extensive analysis of "right to know law" in the E.C. and the U.S., see M. Baram. Corporate Risk Management: Industrial Responsibility for Risk Communication in the European Community and the United States, Commission of the European Communities, EUR 11555 EN (April 1988).

(17) 29 CFR 1910.1200, as amended through 1987.

(18) See M. Baram, Corporate Risk Management; note 16 supra.

(19) Id. Also see M. Baram, "The Right to Know and the Duty to Disclose Hazard Information", American Jnl. Public Health, v. 74, n.4 (April 1984) p.385.

(20) Note 16 supra.

(21) Id.

(22) Note 3 supra. The four reporting requirements are found in sections 304, 311, 312, 313.

(23) Note 16 supra. Also see C. Chadd, et al. "Superfund Amendments Offer Hope for Plaintiffs in Toxic Tort Actions", National Law Jnl., (March 21, 1988) p.16.

(24) Id.

(25) Id.

(26) A.D. Little, Inc. v. Cambridge Commissioner of Health, 395 Mass. 535 (SJCt., 1985).

(27) Note 23 supra.

(28) Note 16 supra.

(29) Personal communication with corporate officials (1988).

(30) Directive on the Major Accident Hazards of Certain Industrial Activities, 82/501/EEC (24 June 1982), commonly referred to as the "Seveso Directive".

(31) Id.

(32) As dicussed in Baram, note 16 supra.

(33) Id.

(34) Proposed amendment to Article 8, issued March 8, 1988 by the European Commission; as reported in International Environmental Reporter (April 13, 1988) p.212.

(35) Note 16 supra.

(36) See Confidentiality of Data and Chemicals Control, OECD, Paris (1982); and J.M. Devos, "The Protection of Confidential Data Communicated to Public Authori-

ties, Particularly with Regard to Chemicals", Industrial Property (July/August, 1987) p.303.

(37) For further discussion of community right to know laws in the U.S., see M. Baram, Corporate Risk Management: Industrial Responsibility for Risk Communication in the European Community and the United States, Report to the Joint Research Centre of the Commission of the European Communities, EUR 11555 EN (April, 1988) pp. 82-104.

Results of the Working Group "The Right to Know and Community Dynamics"

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1. On the need and right to know about technological risks

During the past 20 years the need and desire to know about risky technologies has strongly increased and will continue to grow. This is mainly due to the increased scale and distribution of technology-based activities, greater public sensitivity to actual and potential damage to health and environment, the occurrence of a number of disastrous accidents (Seveso, Three Mile Island, Bhopal, Chernobyl), and a growing public distrust in safety declarations by experts and managers.

The increased need and desire to know about technological risks have led to regulations initiating some degree of a public right to know. This would involve the timely and full disclosure of relevant information in an understandable form about the risks and hazards of a technology (e.g., a chemical plant, a prescription drug or a transport of liquified energy gas). Recipients of this information would thereby be in a better position to judge for themselves what could and should be done by way of protective action for human and non-human life.

Proper execution of the right to know should, in principle, enhance the public's knowledge of possible danger and appropriate protective measures, their sense of control over the technology, actual safety and environmental protection, and degree of public involvement, and it should promote "good neighbourship" (mutual trust, cooperation, joint responsibilities) and an improved "safety attitude" among industrial, or technological, managers. These principal purposes provide the normative, moral or ethical grounds supporting the public's right to know.

Actually to achieve these purposes is a matter of careful design and implementation of public risk information programs. "Effective risk communication" may be achieved following various schemes and methods and using different materials. To what extent its normative purposes are actually achieved, and the nature of the resulting beneficial and detrimental effects are empirical questions which require evaluative research.

Obviously, a public right to know about technological risks may be denied in cases where personal privacy, trade interests or national or internal security have to be protected. Also, a public right to know may be abused, in the manipulative sense, either to

block a particular project or to push it through. In general, however, proper execution of the right to know leads to active and constructive public processes rather than to reactive and possibly destructive "social dynamics".

2. Review of current legal status of right to know

In the United States the idea that citizens have a right to information regarding industrial sites is now embodied in the law in three ways.

First, the common law tradition holds manufactors liable for injuries caused by a product if the manufactor failed to warn the user of products' risk. This in turn has led to a formal duty covering, for example, "worker right to know" rules which now apply to firms that produce on hazardous chemicals.

Second, the Freedom of Information Act of 1966 and 1974 gives any member of the public a right of access to information held by government agencies. This right is limited by a number of exemptions, which include information relating to national and internal security, trade secrets and information about individuals that is private.

Third, in 1986 Congress passed the Emergency Planning and Community right to know Act (Title III of the Superfund Amendments and Reauthoration Act), which requires all firms that produce, use or store quantities of some 400 designated chemicals to provide reports to state and local emergency planning officials, notifying them about the volume of these chemicals they store. The amount they routinely release into the environment, and any accidental releases that may occure. This law also provides that community residents have access to this information. Currently research programs are underway to discover how best to assist communities in handling their new rights and responsibilities.

In the European Community freedom of information in a generalized legal form exists only in the Netherlands, Denmark and France. Elsewhere, and to a large extent for most environmental matters, throughout the Community a right to know appears only in a few regulations and laws. Extension of rights to know in Member States have generally been hard fought and involve considerable effort by pressure groups campaigning for freedom of information.

Rights to know about environmental risks are provided through a number of European Directives, including product labelling, chemicals evaluation, major accident hazards from industry, and environmental impact assessment. However, even in these cases, there is no complete right to know in supportive national legislation.

In the Federal Republic of Germany, in certain fields, a public right to know covers:

- *Consumers' protection*, for example, for drugs, regarding indication, contra-indication, the risks of side effects etc.

- *Workers protection*, for certain high risk work places (e.g. in nuclear energy and chemical plants) management must inform and educate workers about toxic emissions. Generally, however, the aim is to give information which the workers need in order to handle materials in a safe manner.

- *Environmental protection*, for example, in some (though not in all states) of the FRG every citizen has the right to study the so-called "Wasserbücher" (waterbooks), in which the toxic emissons from chemical plants into water have to be registered by the government.

- *Patient education*; in the FRG - as well as in the USA - the physician has to ask the patient for the latter's "informed consent" to medical treatment; this implies education on the reason for and nature of treatment as well as possible consequences, i.e. the risks of negative effects. The legal requirements here are rather rigid.

The Seveso Directive on accident hazards associated with industry contains only a limited right to know. The general public are not required to be told about possible dangers: at present, industry and regulators can decide who needs to know this information. However, workers do have to be supplied with data covering training and equipment regarding occupational risks. The European Commission is presently preparing proposals to ensure that a fuller and more active right to know is legally required.

3. Case examples

We examined four specific case studies of risk situations in which issues of right-to-know entered in a variety of different degrees. What follows are brief descriptions of each of these cases:

- *Surface storing of radioactive waste in the Netherlands*

  In the Netherlands attemps are being made to set up a long-term interim surface storage facility for all kinds of radioactive waste. First, three candidate sites have been selected in 1985, on the basis of "political-administrative suitability". Then a formal environmental impact assessment (EIA) "for any site" was conducted in 1986. Here the public could provide comments and suggestions on guidelines drafted by an independent EIA- committee of experts. Later the public could again comment on the formal evaluation of the EIA (itself prepared by the project's initiator) as produced by the experts' committee. The first, site-independent EIA was criticized and practically dismissed as being "amateurish".

  In 1987, after a "politically suitable" site had been provisionally selected, a second, now site-dependent EIA was conducted. The (local and regional) public could again comment on the proposed guidelines for this EIA, it was informed (at a rather late stage) by the initiator, it could submit formal statements of objection and it could again comment on the expert evaluation of the resulting EIA. Against the advice of the EIA- committee, no systematic assessment of local opinions and preferences regarding the project was made. The EIA was publicly criticized for this.

  In 1988, the local community realized that the final decision on the selected site was about to be taken and that local public opinion had been neglected. This led to organized protests resulting in a municipal decision that a new search committee was to find a "technically at least as suitable" and "socially more acceptable" site for the storage facility. Now, in the Fall of 1988, a full EIA-procedure for the newly selected (further- away) site is being followed. The opportunities for involved pub-

lics to comment, object and contribute are open again. Apart from their intention to inform the public and their hesitation to poll their opinions, the relevant authorities now consider setting up a liaison committee of local public representatives.

- *Cleaning up chemical waste disposal sites at Toms River, New Jersey, USA*

A Public Education Program at an EPA (Environmental Protection Agency) Superfund Site at Toms River, New Jersey was initiated by the U.S. Environmental Protection Agency before the "Title III" legisltation was enacted in 1986. However, the objective of the program is in the spirit of this law.

The Ciba-Geigy superfund site at Toms River, New Jersey consisted of five inactive chemical waste disposal areas on Ciba-Geigy property that were leaking into the groundwater supply of the community.

The purposes of the EPA pilot education program, which took place in 1985, were to (1) identify environmental concerns related to the site, (2) determine the information needs of the community, (3) develop educational materials to address the community's needs, (4) disseminate to a broad audience the appropriate material, and (5) evaluate the effectiveness of the material in increasing knowledge and understanding of the relevant issues. This type of program was critical in Toms River, a community with a great financial and emotional investment in both its environment and in Ciba-Geigy, its number one employer.

A major objective of the program was to increase community awareness of and involvement in all phases of the clean-up effort. This was accomplished through community presentations and distribution of fact sheets. One of the cornerstones of this program was the establishment of a community leaders network. The network, comprising leaders of social, civic, environmental, government, and other groups, enabled the program to reach a broad cross-section of the community, including many citizens who ordinarily would not get involved in environmental issues. The network, through meetings with leaders and with their constituencies, gave program planners a better understanding of the needs of the community. Members also assisted in the development and dissemination of educational materials.

On the basis of this experience EPA has drawn the following insights which they plan to apply to similar activities in the future:

1. Form a Community Leaders Network at the outset of the risk communication efforts as an mechanism for outreach to and involvement of the larger public.

2. Evaluation strategies (goals and evaluation criteria) should be applied from the outset of the communications program to assess community needs and wants and to identify public reactions to the overall communication program and its components. Focus groups and other appropriate methodology should be built into the evaluation strategy and utilized through the program.

3. Flexibility and adjustment to community dynamics in program management are crucial. Community responsiveness can be better predicted by developing a

community profile based on social, economic, financial and environmental characteristics.

4. Timing is crucial in a communication program. Presentations should be planned around the community's timetables and scheduled to coincide with the release of specific information such as a report on clean-up proposals.

- *Contamination of (garden) soil by heavy metals and benz(a)pyren in Bielefeld, FR Germany*

  Critical concentrations of cadmium and benz(a)pyren were detected on former sewage fields in 1986. About 1000 residents inhabited one- or two-family middle class houses that were located on these fields.

  They were confronted by the knowledge about prolonged possible contaminations by eating fruit, vegetables or by inhaling or contacting the soil.

  The municipal authorities chose an information policy, matching many features of the Right to Know Act including

  - leaflets informing the public about ways of exposure and health hazards;
  - plenary sessions informing about potential risks and procedures of risk assessment;
  - free access to all data for the residents concerned;
  - counselling of residents concerned;
  - the establishment of a joint commitee by representatives of the local authorities, residents concerned and experts. This committee was responsible for planning the information policy (leaflets etc.), surveys of soil, plants and humans in order to reliably assess the degree of contamination and risk;
  - a budget for financing (independent) environmental experts aiding the information acquisition for a local citizen action group.

  These measures were implemented by the municipal authorities on a voluntary basis. The measures established an allover open, faithful process of discourse which was free of destructive actions. In the end (1988) all measures (e.g., to exchange the top soil of those areas which showed critical concentrations) were unanimously consented by all participants (i.e. residents concerned, politicians, municipal authorities).

- *Nuclear fuel and waste processing in Sellafield, North-West England*

  The Sellafield Nuclear fuel fabricating and waste reprocessing facility in North-West England has established three means of communicating with their workers and the public:

  1. Through a worker ombudsman to take complaints regarding safety management straight to senior staff.

2. A community relations display which is becoming a popular tourist attraction and information centre.

3. A community trust fund to be used for stimulating local economic enterprises.

All this has helped to show the company in a positive "good neighbour" light. Implementations of the right to know provisions of the Seveso Directive have been very variable. The European Commission is threatening legal action in 10 of the 12 member states and is proposing to make the provisions for actively disseminating key information mandatory. In general, case studies show that good neighbour relationships and sincerity coupled to appropriate constructive mechanisms work wonders for alleviating public concern and establishing communal trust.

4. State of knowledge and research needs

Most of our current knowledge and understanding of issues related to the right-to-know, including the effectiveness of alternative implementations, derives from qualitative inferences drawn from a rather small number of case studies similar to those outlined above.

In order to improve our knowledge of such issues the following research questions should be addressed:

1. What do people from various social and interest groupings in a community presently know regarding specific risks, where did they learn it, and what are their views about the trustworthiness of different sources? Having such data in a form that would allow cross-national comparisons would be particularly desirable.

2. How well do people know about existing legal provisions that implement or limit right-to-know in their respective countries? What practical barriers exist to the implementation of existing right to know arrangements?

3. What do such people feel they should be told and in what forms? Which other parties do lay people feel should be informed and in what ways? How do these reactions differ cross-nationally?

4. What do experts believe different groups in the population should be told about various risks? What criteria are relevant in determining how and in what form information should be presented?

5. How do people's knowledge, perceptions, and behaviors change regarding the control of environmental dangers and trust in management and regulation after various alternative forms and implementations of right-to-know arrangements have been implemented?

6. What is the relative utility to various groups of alternative forms of presentation and interpretation of information obtained via right-to-know programs? What alternative organizational arrangements best facilitate such use? Again, cross-national comparisons would be illuminating.

A limited amount of research has already been done or is now underway on a few of these questions. For example there have been studies in the medical profession of patients' desires for information and doctors' views of what patients should be told. Studies now in progress at Carnegie Mellon University are exploring what various groups of Americans know about a number of hazards including radon in homes, AIDS, dam safety (flooding), motorvehicle accidents, and possible risks from the electromagnetic fields associated with electric power. In the Nuclear research Center Jülich, FRG, a study is in progress which explores what the German public thinks about the health risks of the Chernobyl accident and the trustworthiness of different sources that informed them about the Chernobyl accident.

The US-EPA has studies now in progress to determine what lay people know about chemical hazards and what they know about U.S. right-to-know laws under Superfund Title III. The comprehensive baseline study and analysis of public knowledge and perceptions of chemical risks will provide a basis for qualitative and quantitative evaluation of effectiveness of educational, informational, and risk communication efforts nationally and in communities receiving special interventions compared to control communities not experiencing a known hazard. Two studies will be conducted: A national opinion study of public knowledge, perceptions and understanding of chemical risks, representative of the US population, and a community study, an in-depth study conducted for 300-500 representative individuals in six selected communities.

These national and community research projects will supplement focus groups studies and in-depth data collection to obtain qualitative profiles of certain risk issues.

5. Policy issues

Four issues require the special attention of policy makers:

1. *Research*: At the moment the empirical base upon which to design right to know and other risk communication programs is extremely limited. In order to assure that such programs will be effective and socially productive a vigorous program of research will be required.

2. *Program design choices*: A variety of design choices require specific consideration:

    - Should the right to know program be mandatory or voluntary?
    - Should the program be active or passive in its supply of information?
    - Should it perform analysis and synthesis? That is, is it sufficient to simply provide raw data or should interpretation and explanation be undertaken as an explicit part of the program? From what range of sources should information and interpretations be acquired?
    - Should the program be centralized or decentralized?
    - Should a single strategy be adopted for dealing with all risks or should different strategies be tried with different risks? Should the concept of adapting and modifying the program as experience is acquired be explicitly incorporated?

3. *Resources*: Both operating and using a right to know process requires resources. Policy makers must consider:

- The level of national, regional and local government resources which will be applied.
- The extent to which corporate expenditures will be mandated.
- The extent to which private/voluntary sources of resources will be relied upon.

Disaster and Crisis Communications: Findings and Implications for Research and Policy

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1. Introduction

Disasters and crisis add a special dimension of urgency to the task of effectively communicating risk information. They also involve dramatically increased stakes. One need only examine the short- and long-term consequences of the crisis at Three Mile Island, Chernobyl, Seveso, Love Canal, and Bhopal to gain a sense of the importance and complexity of the task.

During the past two decades, researchers have produced a large and diverse literature on disaster and crisis communications (see, e.g., Drabek, 1986; Lagadec, 1982; 1987; Rogers and Nehnenvajsa, 1984; Shrivastava, 1987). Part of this literature consists of case studies, including analyses of comunications at Three Miles Island (e.g., President's Commission on the Accident at Three Mile Island, 1979; Cutter and Barnes, 1982), at Bhopal (e.g. Bowonder, 1985; Shrivastava, 1987; Kurzman, 1987), at Mount St. Helens (e.g., Perry, Greene and Lindell, 1980), and at a variety of the other natural and technological disaster sites (e.g., Drabek, 1985; 1986; Lagadec, 1987; Quarantelli, 1981). Another significant part of the literature consists of analyses of specific components of the disaster and emergency communication process. This literature includes studies of warning systems (e.g., Turner et al., 1981; Nilson and Nilson, 1981; Bresnitz, 1984) evacuation and evacuation communications (Perry et al., 1980, Lindell, 1984; Lindell et al., 1983; Quarantelli, 1983; Sorenson and Vogt, 1987); and the role of the media in communicating disaster and emergency information (e.g. Mazur, 1984; Rogers and Sood, 1981; Kreps, 1984; Scanlon et al., 1985; Sandman Paden, 1987).

This paper reviews this literature. The review is organized to correspond roughly to the sequence of events in a disaster, crisis, or emergency. The first section reviews studies on disaster education and emergency preparedness. Studies in this area have focused mainly on the effectiveness of communication programs aimed at raising levels of public awareness and emergency preparedness. The second section reviews studies on disaster and emergency warning systems. The third section reviews studies on evacuation and sheltering communications. The final section reviews studies on communications during an ongoing emergency or disaster, including a discussion of communication channels during disasters and crises and the role of the media in such situations. The final section

discusses future research needs and lists some of the major practical and policy lessons from the research literature.

2. Studies of disaster education and emergency preparedness

Disinterest and high levels of personal optimism

It may appear paradoxical that while disasters make dramatic headlines and dominate public attention after they occur, it is extremely difficult to alert people to the possibility of a disaster and its consequences before it occurs. At least for natural disasters, researchers have found that people are generally disinterested in disaster preparedness. Explanations for such disinterest tend to focus on cognitive factors, especially high levels of personal optimism, such as a belief that a disaster will not affect one's life in a personal way (e.g., Fischhoff et al., 1981; Weinstein, 1980). For example, people tend to overestimate the safety of dams, to be reluctant to buy low-priced flood insurance or other disaster insurance, and to underestimate the possible consequences on hurricanes (Kunreuther et al., 1978; Rogers and Sood, 1981). Other research on disinterest and high levels of personal optimism include: a study by Greene et al. (1981), which found that people generally did not perceive Mount St. Helen's to be a threat before the eruption.

In some instances, high levels of personal optimism aggravate an already potential dangerous situation. For example, people often move into flood plains after a dam is built unless they are prevented from doing so by laws or by restrictive home loan conditions (Kunreuther et al., 1978).

One practical consequence of disinterest and high levels of personal optimism is that people rarely make personal plans for possible disasters and emergencies (see Turner et al., 1981). This finding extends to most industrial cooperations and government agencies. While acknowledging the inevitability of disasters and emergencies, organizations and agencies in both the public and private sector are often ill-prepared (e.g., Shirvastava, 1987).

There appear, however, to be at least two exceptions to these observations:

(1) Awareness and preparedness tend to increase substantially, sometimes for many years, following an extreme disaster that has the potential to reoccur. For example, people living in the vicinity of Mount St. Helens developed basic emergency preparedness plans after the eruption of the volcano (Perry, 1983). Many residents, for instance, always kept their car gas tanks half full and always kept a packed suitcase on hand.

(2) People living in areas exposed to frequent hazards typically learn to live with the possibility of a disaster and are generally alert and prepared for the eventuality (see e.g., Mileti and Sorenson, 1987).

These findings on disinterest and high levels of personal optimism have been well documented for natural disasters. However, some research on low probability/high consequence technological disasters suggests different tendencies (e.g., Kasperson and Pijawaka, 1985). For example, people tend to overestimate the probabilities and conse-

quences of rare technological disasters (Lichtenstein et al., 1978; von Winterfeldt et al., 1981). Specifically, people appear to be substantially less confident than technical experts about the possibility of avoiding catastrophic accidents at industrial facilities such as nuclear power plants and chemical plants (see, e.g. Slovic, 1987, Slovic, Lichtenstein, and Fischhoff, 1979; von Winterfeldt et al., 1981; Lindell and Barnes, 1986). One important contributing factor is the confusion caused by highly visible and bitter disagreements among technical experts about the probabilities and consequences of such accidents. Moreover, beliefs about the possibility of large-scale industrial accidents are socially embedded and strongly influenced by a complex web of social, economic, political considerations (see, e.g., Johnson and Covello, 1987).

Disaster perceptions and preparedness.

One might expect that people who think that a technological or natural disaster is likely would develop the most comprehensive emergency preparedness plans. However, little evidence exists that these views translate into better planning. Among the various factors underlying this inconsistency, one of the most important is the uncertainty about what constitutes an effective and efficient response to disasters and emergencies (e.g., uncertainty about the effectiveness of sheltering versus evacuation).

Disaster awareness and proximity.

Several studies have examined the links between disaster awareness, judgements of risk, and proximity to a possible source of disaster. For example, prior to the eruption of Mount St. Helens (Greene et al., 1981), as might be expected, residents who lived closest to the volcano were most aware of possible volcanic activity.

Similarly, studies by Maderthaner et al. (1978) and others (e.g., Office of Technology Assessment, 1984) found that the greater the distance a person lives from a plant, the less the perceived risk. However, this apparently does not hold for people living within close proximity to the plant. Somewhat counter-intuitively, people living very close to the plant, and presumably subjected to the greatest risk, do not perceive the risk to be great. The explanation appears to lie in several factors (Covello, 1983). First, utilities are usually careful to select places with favorable public attitudes when siting nuclear power plants. Second, utilities often embark on large-scale public relations activities once a site is selected. Third, the population living closest to the plant often receives direct economic benefits, such as jobs and tax revenues. Fourth those living closests to the plant are likely to experience cognitive dissonance if they truly believe that the plant is dangerous. One way to resolve the dissonance is to revise one's judgement about the safety of the plant. Finally, some of the people concerned about living in the vicinity of a nuclear power may have moved out of the area.

Research also suggests that people's perceptions of the risks of a disaster tend to be highest during the planning stages of a potentially hazardous project. For example, Marks and von Winterfeldt (1984) found that people's perceptions of risks increased when a risky activity, such as oil drilling, was about to be undertaken in the immediate vicinity of their homes.

Media studies.

Researchers have found that people obtain a significant amount of disaster information through both the electronic media and the print media (Wenger et al., 1975). However, people who pay more attention to print media are generally more knowledgeable about disasters due in part to the greater amont of 'before-the-fact' information provided by print media (Peltu, 1985).

Disasters and accidents with the greatest severity do not necessarily receive the greatest amount of media coverage (e.g. Combs and Slovic, 1979; Mazur, 1984; Adams, 1986). For example, coverage of the accident at Three Mile Island was considerably more extensive than that of a major train derailment and toxic spill at approximately the same time in Canada (see Burton, 1983).

Several factors appear to play a role in explaining this bias. First, journalists give greater coverage to dramatic and sensational events, especially those that cause major disruptions in the routine functioning of society or communities (e.g. Combs and Slovic, 1979; Sandman et al., 1987). Journalists tend especially to focus on disputes among experts and authorities in coping with disasters and crisis (e.g. Sandman et al., 1987; Nelkin et al., 1978). Second, journalists give greater coverage to accidents and disasters with the greatest signal value, e.g., large-scale industrial accidents. Factors affecting signal value include catastrophic potential, dread, familiarity, scientific uncertainty, reversibility of effects, trust in authorities, competence, culpability, and other characteristics of perceived risk (e.g., Slovic et al., 1984). Third, media are strongly influenced by factors such as photographability and human interest (Rogers and Sood, 1981; Peltu, 1985). One consequence of these and other factors is that the causes and consequences of disasters and crisis are often distorted or misrepresented by the mass media.

In addition to covering disasters and accidents as they develop, the media also play an important role in agenda-setting by communicating the existence and relative importance of various issues to the public and to public officials (e.g., Gans, 1980; McCombs and Shaw, 1972; Rogers and Dearing, 1988). Especially when disasters are slow to evolve, it is often the media that first draw wide-scale public attention to the situation. Peltu (1985), for example, cites the Ethiopian drought and famine, noting that the disaster drew public attention only after a BBC reporter collected dramatic visual footage. A more recent example is the AIDS epidemic, which first drew wide public attention after a series of reports by a San Francisco newspaper.

Emergency communication planning.

Case studies of actual disasters and evacuations - such as the successful evacuation of over 220.000 people of Missassauqua- Toronto, Canada (Burton et al., 1983) - have shown that effective emergency communication plans depend heavily on the participation and cooperation of organizations in the public and private sector (e.g., Lagadec, 1987; Burton et.al., 1983)). Plans not based on close consultation among government agencies (federal, state, and local), industrial firms, media organizations, voluntary groups, and other interested parties are generally of little use in actual emergencies. Effective emergency communication planning is an active process based on review, consultation, exercises, training, teamwork, and preparedness.

3. Studies of disaster and emergency warning systems

The difficulties in emergency preparedness and disaster education translate directly into difficulties in designing effective disaster and emergency warning systems. Such systems have several objectives, including drawing people's attention rapidly to disaster and emergency information, alerting people to impending danger, and instructing people to be prepared for further action.

Long-term disaster warnings and predictions.

A substantial number of studies of disaster warning systems have concentrated on earthquake warning systems (e.g., Nilson and Nilson, 1981; Turner et al., 1981), especially long term predications. Because of the uncertainties of most long-term predictions of earthquakes, some researchers have argued that they create a high potential for false alarms (see, e.g., Nilson and Nilson, 1981). Uncertain, long term disaster predictions may also desensitize people to disaster information and may encourage them to deny the reality of the threat. According to this view, such predictions can be counterproductive and may undermine effective public response to short-term disaster warnings.

Other researchers have argued, however, that withholding long-term disaster information can be even more damaging. Rumors, unofficial leaks, and conflicting reports, coupled with the surprise of late warnings, can create widespread public mistrust and may result in inadequate preparation for a disaster. It may also result in damage suits by business and citizens if a disaster occurs. Some of these issues are addressed in a study by Turner et al. (1981) of long range predictions of a major earthquake in Southern Californisa. Positive effects of long-range predictions included increased earthquake awareness through media coverage and discussions with other people but with no sense of alarm or unwarranted feelings of threat among the population. The study also found no evidence of significant costs of false alarms.

Staggered warning systems.

One implication of the latter study is the need for carefully staggered public warnings. These warnings should ideally be characterized by greater and greater degrees of certainty and scientific support. A second implication is the need to link disaster warnings with practival information about emergency preparedness. Turner et al. (1981), for example, found that people took few special precautionary steps for major earthquake. Moreover, the media provided little information about emergency preparedness.

Similar lessons have been learned from studies of technological disasters and emergencies. Bolton et al. (1981), for example, found that to correctly interpret warning signals people need to be provided with four types of information:

- the specific warning system(s) that will be used in an emergency (sirens, loudspeakers, tone-activated radio);
- how to recognize and distinguish different emergency signals (e.g., if a siren is used, what will it sound like?);
- how to distinguish emergency signals from non-emergency uses (e.g., testing),
- specific actions to take if an emergency signal is heard (e.g., go indoors and turn on the radio).

Studies on medium- and long-term warnings of floods, fires, and volcanoes also indicate the usefulness of staggered disaster warning systems. Such systems (1) allow people time to develop their own sense of urgency and awareness, and (2) guide people through the stages of emergency preparedness (Mileti, 1975, Nilson and Nilson, 1981). For particular types of disasters, Nilson and Nilson (1981) have proposed the development of color coded warnings similar to the system used by the U.S. National Forest Service for forest fires. Specific warnings would be issued only in the final days before a probable disaster, and only in connection with well developed instructions for protective action and evacuation.

Warning systems for quick onset disasters.

Most of the above findings relate to natural disasters for which long-term warning systems are feasible. For quick-onset disasters - such as flash floods, tornados, mudslides, and most technological disasters - a different set of problems arise. One of the most significant is that people frequently misread or do not understand the warnings. A study of tornado warnings by Hodler (1982), for example, found that most people understood television announcements indicating a tornado wath but that 17 percent failed to understand the meaning of a civil-defence siren warning of th emminent approach of a tornado. Similarly, a study of the accident at Bhopal, India found that people misunderstood the plant's emergency siren. Thinking that the plant was on fire, many residents ran toward the plant (e.g., Kurzman, 1987). Most of these individuals died.

Formal analyses of disaster warning systems.

The question of when and how to warn people of a pending or possible disaster has been formally investigated by researchers using signal detections models (see, e.g., Green and Swets, 1966). These models weigh the relative costs and benefits of four possible outcomes: correct prediction (hit), incorrect prediction (false alarm), correct non-prediction (correct rejection), and incorrect non-prediction (miss). According to this schema, the consequences of a 'hit' depend largely upon the success of disaster mitigation efforts. The consequences of a false alarm depend on several factors, including the costs of unnecessary evacuation. The consequences of a correct rejection are determined largely by the avoided costs of evacuation, shelter or anxiety. And the consequences of a miss - the outcome most feared by risk managers and designers of warning systems - depend largely on the specific adverse consequences of a disaster.

In specific studies based on this model, information about the costs and benefits of different outcomes is combined with other types of information, including information about lead times, the probabilities of the disaster actually occurring, and the effects of false alarms on people's subsequent behavior. Using expected utility theory as a framework, the 'best' warning strategy can be identified through the integration of information about probabilities, costs, and benefits (see e.g., Raiffa, 1968; von Winterfeldt and Edwards, 1986; Pate-Cornell, 1983, 1986).

False alarms and system sensitivity.

One critical aspect of warning systems is their sensitivity (Pate-Cornell, 1983). If the system is extremely sensitive (e.g., as is a fire alarm system that responds to the slightest

puff of smoke), the alarm will provide earlier warning (e.g., in the event of a real fire). However, false alarms will be so frequent that people may stop paying attention to the warning. On the other hand, if the warning system lacks sensitivity, the alarm may not function properly or may provide too short a lead time for an appropriate response. Optimizing the sensitivity of the warning requires detailed information about the expected costs and benefits of different warning outcomes and about expected human responses to the warning system.

In recent years, researchers have developed a variety of strategies for minimizing the loss of credibility from false alarms. Bresnitz (1984), for example, has argued for warning systems that are highly differentiated between the first and final warning stage. False alarms from low-level warnings are less likely to degrade the credibility of higher level warnings. Following the cancellation of a warning, people would be provided with information about how close, how serious, and how harmful the threat really was. Providing information on the uniqueness of a threat may inhibit people from generalizing from the incident, and thus help reduce the damaging effects of false alarms.

Credibility, confirmation, and reception.

People often gauge the seriousness of a warning by assessing the credibility of its source (see for example Mileti, 1975; Perry et al., 1980). A study of earthquake warnings by Turner et al. (1981), for example, found that people assign higher credibility to disaster warnings from scientific sources, even though the warnings may be vaguer than warnings from other sources. Warnings from information sources with low credibility are often ignored. More seriously, people may deliberately engage in activities counter to those recommended by authorities (Sorenson and Vogt, 1987).

Second, people often gauge the seriousness of a disaster warning by obtaining confirmation from one or more (Rogers and Nehnevajsa, 1984). Numerous studies have shown that people require confirmation through various channels and media before they believe and act upon a disaster warning (Hodler, 1982; Kreps, 1984). Studies of flood and volcano disasters, for example, have found that people typically seek out at least one confirmation of the original warning before taking action (Lindell et al., 1983; and Perry et al., 1980). One important policy implication is the need to provide ways to confirm disaster warnings, e.g., through information hotlines, loudspeakers, door-to-door canvasing, and multiple communication channels.

Third, people often use physical cues in determining the seriousness of a disaster warning (e.g., Dynes, 1970; Drabek, 1986). People are generally more likely to comply with a disaster warning when the threat can be seen, heard, felt, or otherwise verified by the senses. Conversely, warning compliance is typically more difficult to achieve when physical cues are absent.

Fourth, special circumstances often interfere with the reception of disaster warnings by particular subgroups (Sorensen and Mileti, 1987). For example, sirens frequently cannot be heard by people who are hard of hearing, who are physically isolated, or who spend time near loud machinery (e.g., loud industrial equipment or home air conditioners. Finally, the effectiveness of a disaster warning (measured, for example, in evacuation compliance) increases with the number of warnings (see e. g., Perry et al.,

1980). There is a significant increase in effectiveness between the first and second warning, but little increase after the third warning. An exception are warning issued to communities living under a constant threat of disaster. Such warnings are typically heeded immediately.

4. Studies of evacuation and sheltering.

Overall findings.

Evacuation and sheltering are among the most common methods of dealing with disasters. However, (1) people are generally reluctant to evacuate when urged by authorities to do so (Perry et al., 1980; Quarantelli and Dynes, 1977; Baker, 1965); (2) significant numbers of lives are lost due to the failure of people to comply with evacuation instructions (e.g., Gruntfest, 1977), (3) evacuation declines as the perception of threat decreases and as distance from the threat increases (e.g., Sorenson and Vogt, 1987); and (4) having evacuated, people generally ignore communications directing them to public shelters and prefer instead to go to homes of friends or relatives (Perry et al., 1980; Cutter and Barnes, 1982). In most cases, the percentage of people who go to public shelters is extremely low, often less than the percent.

The failure to evacuate.

Several factors play a role in explaining the failure of people to respond to instructions by authorities encouraging them to evacuate and use public shelters. First, people often fear losing control over the fate of their property and valuables. Second, people are often concerned about looting (Perry et al., 1980), although looting narely occurs during natural disasters (Quarantelli and Dynes, 1977; Cutter and Barnes, 1982). Third, people often perceive public shelters to be anonymous, cold, and threatening. Fourth, high levels of evacuation are difficult to achieve when visual or other physical cues are not present to aid detection (e.g., Mileti et al., 1975; Mileti, 1985). Finally, some populations are difficult to notify. These include seasonal and tourist populations, transient populations, and minority groups isolated because of language and other cultural barriers (e.g., Perry and Greene, 1982; Perry et al., 1982; Perry, 1983; Quarantelly, 1983).

Evacuation during technological disasters.

In contrast to natural disasters, people are generally quite willing to respond to statements by authorities encouraging them to evacuate in technological emergencies and disasters (e.g., Burton et al., 1983; Liverman and Wilson, 1981; Perry, 1983; Rogers and Nehnevajsa, 1984). Moreover, technological disasters often result in spontaneous evacuation and more people evacuating than recommended by officials (e.g., Lindell and Perry, 1983; Johnson, 19xx; Johnson and Ziegler, 1984; Houts et al., 1984). For example, many more people (about 145.000) evacuated Three Mile Island than were advised to do so (Cutter and Barnes, 1982; Houts and Goldhaber, 1981). Studies of behavioral intentions in hypothetical technological disasters also indicate 'excessive' evacuation intentions (Johnson and Ziegler, 1984; Seasonwein Associates, 1983). For example, when Lindell and Barnes (1986) asked people about the likelihood that they would evacuate a disaster at a chemical plant or at a nuclear power plant, people stated their

intent to evacuate even though they were told that sheltering was an appropriate and recommended alternative.

Factors underlying evacuation response in natural and technological disasters.

People typically perceive the risks posed by natural disasters to be familiar while the risks posed by many technological disasters are generally perceived to be unknown and uncertain, even to experts (e.g., Fischhoff et al., 1981; Perry, 1983). Given this uncertainty, people typically adopt a conservative approach to evacuation and pay greater attention to evacuation communications and recommendations in technological disasters.

Case study: Evacuation at Three Mile Island.

A substantial number of studies that have investigated evacuation have focused on Three Mile Island (e.g., Brunn et al., 1979; Cutter and Barnes, 1982; Houts and Goldhaber (1981). For example, Cutter and Barnes (1982) surveyed residents living in the vicinity of Three Mile Island at the time of the accident. The study found that approximately 40 percent of the sample evacuated after a statement by the Governor advising only pregnant women and pre-school-age children residing within 5 miles of the reactor to evacuate (other people were advised to stay indoors and to keep their doors and windows shut). Almost all evacuees moved to private accommodations, including homes of fruends and relatives. Elderly people were much less likely to evacuate than younger people. Only about 14 percent of the elderly (60 years or over) evacuated among those living within 10 miles of the plant, while about 50 percent of younger people evacuated. Among the reasons were health problems and fear of losing property, valuables, and friends. By contrast, younger people who did not evacuate stated (1) that they were waiting for stronger evacuation orders, (2) that they did not feel truly threatened, (3) that they feared looting, (4) that they had to go to their job, (5) that they lacked money, and (6) that they had nowhere to go.

One of the principal factors thought to underlie the large evacuation response at Three Mile Island was the conflicting information from official sources. Houts and Goldhaber (1981), for example, found that 78 percent of those who evacuated cited this as one of their primary reasons for leaving. Exacerbating the problem was the lack of visible cues. Given that radation is invisible, many people resolved the problem of conflicting information by taking what appeared to them to be the safest course of action.

Message sources, channels, and sequence.

Studies of evacuation at Three Mile Island and uring other disasters point to several general conclusions about evacuation and communication.

First, as noted earlier, people usually do not evacuate on the basis of a single message or recommendation from a single source. Instead, people seek confirmation from several sources and base their final dicision on multiple, reinforcing messages (see e.g., Cutter and Barnes, 1982; Perry et al., 1980; Frazier, 1979).

Second, evacuation recommendations are most effective when issued by a single authoriative person (e.g., the Governor). The message should be relayed simultaneously by multiple channels, including television and radio. In urgent situations, the message

should be relayed through mobile emergency teams using loudspeakers. Reliance on sirens and other such systems is generally not recommended, since many people misinterpret or forget what these signals mean (see e.g., Hodler, 1982).
Third, evacuation instructions are best understood when they are staggered. Detailed and complex evacuation information is seldom understood when provided immediately prior to the onset of a disaster. Instead, the last few minutes should be reserved for instructing people that the time has come for them to evacuate (see e.g., Mileti, 1975). In general, the greater the specificity of evacuation instructions (e.g., routes, means or transportation, checkpoints, safe locations(, the greater the compliance and the greater the effectiveness of the instruction (Perry et al., 1980; Mileti, 1975; Lindell et. al., 1984).

5. Studies on communications during ongoing emergencies and disasters

Obstacles to effective risk communication during emergencies and disaster.

After the onset of a disaster or emergency, new communication obstancles and challenges arise. First, large numbers of new actors and organizations become involved, including police departments, fire departments, paramedics, and emergency response teams. Second, normal communication channels often break down, including telephones, radio, and television. Third, rumors often spread through the community. Fourth, disaster officials often find themselves drawn into jurisdictional conflicts and battles. Finally, existing problems are exacerbated by media reports that focus on sensational and dramatic aspects of the disaster. Each of these obstacles in decribed in further detail below.

Communication breakdowns.

A frequent occurrence during disasters is the breakdown of normal communication channels (e.g., Lagadec, 1987). Cutter and Barnes (1982), for example, found that communication channels became blocked at Three Mile Island and that this blockage seriously aggravated the crisis. A specific defect found by the study was that the communication lings at Three Mile Island were almost exclusively designed for normal, not emergency, operations. With the exception of a direct link between the Pennsylvania Emergency Management Agency (PEMA) and the State police, all communications between on-site teams and off-site agencies were handled through a manual switchboard. This switchboard could handle only incoming calls. Moreover, it was frequently unattended (Dynes et al. 1979). The subsequent bottleneck limited access to the on-site emergency teams and prevented verification of information by local and country officials.

When serious breakdowns occur in normal communication channels, disaster managers must rely on alternative communication channels, including emergency frequencies and short-wave radio. In some cases, unusual channels are used. For example, ham radio operators provided much of the initial information about the 1986 earthquake in Mexico and in volcano eruption in Columbia. Ham radio operators also provided information about disaster survivors and established links wiht relatives at far distances.

One factor contributing to breakdowns in channels of communication during disasters and emergencies is information overload. Several studies have found that agencies and

organizations seldom have the capacity to process the huge volume of information available to them during an acute disaster and emergency (e.g., Drabek, 1985).

Coordination.

A major problem affecting communications during disasters and emergencies is the failure of authorities to coordinate their actions and communications (e.g., Sorensen et al., 1985; Lagadec, 1987). Exacerbating the problem is the lack of clear authority lines and relations. During emergencies and disasters, it is seldom clear which agency or organization has the authority to structure, control, regulate, and coordinate the flow of disaster-related information (e.g., Drabek, 1985). At Three Mile Island, for example, significant communication problems developed as a result of the lack of inter- and intra-organizational coordination at the local, state, regional, and federal level (e.g., President's Commission on the Accident at Three Mile Island, 1979a; 1979b; Thornburgh, 1987). Agencies and organizations failed to contact and communicate with other organizations and groups. They also failed to mesh and integrate their activities toward a common goal. One consequence of the lack of coordination was that spokespersons from industry and government frequently provided completely different pictures of the situation, even when reporting the same event (e.g., the development of a hydrogen bubble in the reactor containment. In general, statements to the media made by spokespersons frome the electric utility company were more optimistic than statements made by spokespersons from government agencies.

In many cases, serious coordination problems arise when units within an organization act on their own initiative (e.g., Lagadac, 1987). Examples include the premature release of information by a sub-unit within an organization claiming that an accident situation is under control. If not prevented, such initiatives seriously compromise the credibility and effectiveness of the overall disaster management effort.

Information centralization.

Closely related to coordination problems are difficulties arising from the failure of authorities to centralize the flow of disaster- related information through a single source and organization. At Three Mile Island, for example, it was only on the fifth day of the crisis that the Governor of Pennsylvania centralized the flow of information, designating the U.S. Nuclear Regulatory Commission as the only authorized source of official information (e.g., Thornburgh, 1987). Even after this action, however, some information took days to be relayed from one organization to another. In several cases, this was due to oversights, while in others it was caused by to the lack of available communication channels (Sandman and Paden, 1979). As a result, officials frequently had to rely on radio and television reports for information.

Several studies have found that information centralization is often critical to effective risk communication in disasters (e.g., Lagadec, 1987). As Scanlon et al.(1985) note, "the most effective disaster reporting occurs when one well-known and credible person does most of disaster broadcasting and that person is not changed during the regular broadcast period." More generally, the centralization of information through a single credible source and organization facilitates communications among all organizations, helps

control rumors, and helps reporters and emergency personnel obtain timely, valid, and reliable information.

In recent years, researchers have conducted several in-depth studies related to information centralization. On conclusion from these studies is that the effectiveness of disaster communication efforts increases substantially when all emergency response organizations are aware of, and represented at, a common location, such as a emergency operation center. Emergency operation centers (EOCs) are most effective when they are used primarily for coordination purposes, that is, for integrating all concurrent activities toward an agreed upon goal (Quarantelli, 1984). A second element in the effective operation of EOCs is that EOC organizational liaison personnel be knowledgeable about their own organization's activities and possess decision making authority within that organization.

Several of these elements were evident in the organizational response by the U.S. government to the Chernobyl accident (Covello 1988). Soon after the accident, a government-wide task force was organized. The task force, chaired by the Administrator of the Environmental Protection Agency, assumed clear authority and responsibility for managing the situation and for communicating information about the accident and its consequences to the public and the media. Information flow was centralized through an emergency operations center established at the Environmental Protection Agency. All media requests for information from other federal agencies, including the Department of Energy, were transferred to the Environmental Protection Agency for handling.

Panic.

Panic in disasters has been definded as "acute fear of entrapment coupled with attempted flight behavior (Quarantelli, 1957). One of the major joals of government and industry officials during emergencies and disasters is to prevent panic. However, the literature on disasters and emergencies shows very little evidence of panic during disasters and emergencies (Kreps, 1984). As Lindell et al. (1984) note, three conditions must be met before panic occurs. These are:

- a perception of immediate and severe danger;
- a perception of a limited number of escape routes that are about to close, necessitating immediate escape;
- lack of communication about the situation.

These three conditions are rarely met in actual situations (e.g., Quarantelli, 1957; 1960). Despite the popular belief that people often panic in disaster situations (Dynes, 1979; Quarantelli, 1977), none of the available evidence supports this view (e.g., Mileti et al., 1975; Perry et al., 1980). In nearly all documented cases, flight from the site of a disaster is orderly and goal-directed (Kreps, 1984).

Rumors.

The spread of rumors during disasters is, on the other hand, more common. Rumors tend especially to spread when information is withheld, contradictory, or ambiguous (e.g., Turner et al, 1981). A variety of means have been developed for controlling rumors. For example, one strategy is to provide information "hotlines" (Perry et al., 1980).

Since people typically seek confirmation of disaster information, and since the telephone is usually one of the first means used by people to obtain such confirmation, hotlines have been found to extremely effective.

The role of the media.

A variety of functions are performed by the media during a disaster or emergency, including rumor control, transmitting evacuation instructions, and providing information updates. Because of the importance of these functions, disaster managers tend to rely heavily on the mass media for transmitting information.

In most major disasters, the role of the media undergoes an important shift. Rather than continuing normal operations, media personnel frequently become de facto managers of emergency information. A study by Adams (1977), for example, examined the functioning of a radio station during a forest fire. Adams described how the station became an "emergency appendage" for several disaster management organizations, including the civil defense, the police and fire departments, the County sheriff, and the Salvation Army. The station not only collected information through its mobile unit but also disseminated the information to emergency response teams.

Although disaster managers recognize the importance of this function, the transformation of the media from information transmitter to disaster information manager is typically ad hoc and only loosely planned. Moreover, media personnel are seldom properly trained, adequate in number, or equipped to perform this function (e.g., Waxman, 1973). For example, radio stations have often had to assign secretaries, bookkeepers, engineers, and salesmen to answer incoming calls during disasters.

Most case studies have found that the media are willing to cooperate with emergency response teams if disaster managers are willing to cooperate with them (e.g., Rogers and Sood, 1981; Hodler, 1982; Kniffin, 1987). For example, editors have, on occasion, agreed to delay the printing or broadcast of a story in order to keep emergency routes clear (e.g., Kreps, 1984).

Despite the general willingness to cooperate with disaster officials, the media have often been criticized for interfering with the effective performance of disaster managers and emergency personnel (Adams, 1977; Scanlon et al., 1985). One commonly perceived problem is the tendency for the media to use information sources of questionable reliability and expertise (e.g., Sandman et al., 1979). The media have also been criticized for perpetuating the myth of panic and looting by mislabeling or misrepresenting isolated incidents or instances (e.g., Sorenson, 1987). Finally, the media have been criticized for contributing to 'convergence', that is, the arrival of large numbers of people and donations of food and other goods in excess of local needs, which severly interferes with relief efforts by typing up local transportation and communication facilities (e.g., Scanlon et al. 1985). The media can, of course, also help officials cope with convergence problems, e.g., by urging people to stay away from a disaster site, or by encouraging people not to use telephone lines unless absolutely needed.

Conflicts between disaster officials and the media occur most frequently when authorities withhold disaster-related information (e.g., Lagadec, 1987). Trust and credibility are

undermined if the media believe that information is being withheld. Silence by disaster authorities is often interpreted by the media as evidence of guilt or bad news, even it not warranted. When information is not forthcoming from official sources in a timely and appropriate format, journalists will find alternative sources of information. For example, when officials at Three Mile Island were not forthcoming with information about the accident, reporters conducted home interviews with over fifty plant employees tracked down through their licence plate numbers (Scanlon et al., 1982). Reporters also found ways to monitor special emergency radio frequencies used by officials.

Source credibility.

At Three Mile Island, conflicts of interest, managerial incompetence, and hidden agendas undermined the credibility of officials from both the electric utility company and government (e.g. President's Comission on the Accident at Three Mile Island, 1979a; 1979). In the early days of the crisis only the Governor of Pennsylvania and his staff had high credibility, in part because they were perceived to be competent, to have extensive links with other organizations, and to have the least apparent conflict of interest.

A variety of factors influence the credibility of responsible authorities during emergencies and disasters. These include perceived competence or expertise including intelligence, training, authoritativeness, experience, and professional status (Hass, 1981); trustworthiness in the form of honesty, fairness, objectivity, and altruism (McGuire, 1969); presentation skills such as the ability to speak well in public, to recognize and avoid the use of jargon, and to clarify technical concepts; and interactive skills such as the ability to deal effectively with people, to listen and give feedback, and to respond to emotions (Covello et al., 1988).

Cases studies of communications at Three Mile Island indicate that at last one spokesperson for the federal government possessed these skills and used them effectively. According to the Governor the onsite arrival of Harold Dento, the Nuclear Regulatory Commission's Director of Nuclear Reactor Regulation, on day three of the disaster represented a turning point in the crisis (Thornburgh, 1987). Denton quickly established rapport with the press and is credited with helping people understand the nature of the accident and its consequences.

Conflicts of interest.

In many disaster situations, especially technological disasters, establishing and maintaining trust and credibility can be extremely difficult, particularly when there are perceived or actual conflicts of interest. For example, strong personal and organizational incentives often influence industrial managers and plant operators during acute disasters or emergencies. Among other motivations, they have their jobs and organizations to protect, which makes them typically more optimistic about their ability to solve an acute problem than may be warranted (Bowonder, 1985). Moreover, strong incentives exist to tailor information to avoid liability suits and avoid damage to the company's public image (e.g., Cutter and Barnes, 1982).

Information disclosure.

Two communication problems in quick-onset technological disasters are the lack of accessible and reliable disaster-related information (e.g., data on toxic release properties, health consequences, remedial measures, and recommended medical treatment); and the reluctance of industry and sometimes government officials to release disaster-related information (e.g., Dorman and Hirsch, 1986; Friedman, 1981; Stevenson, 1984; Lagadec, 1987). Each of these problems was manifest in a dramatic way during the Chernobyl crisis (e.g., Dorman and Hirsch, 1986).

Secrecy and delays in releasing disaster-related information are often justified by operators, managers, and officials on several grounds: that the situation can quickly be corrected or brought under control, that the information may cause undue alarm among the public; and that the information may expose operators, managers, and officials to criticism and reprimand (see e.g., Bowonder, 1985; Cutter and Barnes, 1982; Dorman and Hirsch, 1986; Lagadec, 1982).

Most case studies of disasters have found, however, that the most effective communication strategy is to be candid, honest, and forthcoming from the outset (e.g., President's Commission on the Accident at Three Mile Island, 1979a; 1979b; Thornburgh, 1987; Anderson, 1987; Friedman, 1981; Kniffin, 1987; Stevenson, 1984; Dorman and Hirsch, 1986; Lagadec, 1987; Wilkins et al., 1987). First, accident or other disaster-related information is likely to be leaked. When this happens, trust and credibility are lost. Second, the public has a right to information that may affect their lives, property, or the things they value. Third, disaster managers are better able to control the accuracy of information if they are first to present it. In the absence of information, vacuums form. These are quickly filled by rumors. Fourth, prompt relase may prevent the development of similar problems elsewhere; it allows others to participate in finding a solution; and it allows managers to concentrate on the problem at hand rather than dealing with criticisms for withholding information. Seventh, people recognize and respect candor, honesty and forthrightness. As a result, prompt relase of information can often enhance credibility and managerial effectiveness.

6. Research directions and practical lessons

Research needs.

Despite the relatively large number of studies on disaster warnings and emergency information, there is no lack of research needs (Drabek; 1986). Several of the most important unresolved issues and research needs are:

- research on the most effective means for raising public awareness of disasters;
- research on the most effective means for enhancing public disaster preparedness;
- research on the precise nature of differences in public response to technological versus natural disasters;
- research on the most effective way to design staggered warning systems;
- research on how to make disaster warnings more credible;
- research on the relationship between the propensity to evacuate and variations in the content and design of warnings;

- research on the most effective means for achieving compliance with evacuation instructions;
- research on the most effective ways to involve the public in emergency planning;
- research on the precise ways in which source credibility affects evacuation decisions;
- research on the conditions under which disaster-related information is withheld and on the importance of withholding such information;
- research on the most effective means for achieving agency coordination during emergencies and disasters;

Practical lessons.

A broad and diverse set of practical lessons can be drawn from the literature on disaster and crisis communication. Several of the most important are listed below, organized according to the sequence of events in a disaster, emergency, or crisis.

Practical lessons on emergency preparedness and general disaster education:

- develop disaster awareness campaigns that educate and inform, not frighten, people;
- present disaster and emergency preparedness information in the context of concrete events and scenarios;
- provide specific information on measures that people can use in preparing for a disaster or emergeny;
- identify specific actions that people can take in the event of a disaster or emergency;
- provide explicit information on arrangements for evacuating or sheltering children, disabled people, and other vulnerable group;
- provide information about how to obtain updated disaster information;
- inform the media of emergency communication plans and procedures;
- ensure that appropriate officials and emergency personnel are fully and accurately informed about potentially dangerous processes and activities (e.g., transport of hazardous materials, stockpiles of toxic substances);
- establish on-line sources of information on toxic substances (e.g. health consequences, remedial measures, medical treatments);
- devote resources to resolving uncertainties and expert disagreements about what constitutes an effective and efficient response to disasters and emergencies;
- develop communication plans and strategies for various disaster or emergency scenarios: expect the unexpected;
- ensure that local emergency personnel are informed about where important emergency equipment and responsible individuals are located, how to find the equipment or individuals quickly in an emergency, and about any prearranged plans for using the equipment or individuals in an emergency;
- hold training and mock disaster exercises with all relevant organizations to test emergency communication systems.

Practical lessons on disaster and emergency warning systems.

- design warning systems that strike a balance between sensitivity and false alarm;
- coordinate the disaster warning systems of different organizations;

- provide information that will help people understand uncertainties in warning systems and the reasons for false alarms;
- confirm that people understand the precise nature of different warning signals and their meaning;
- use multiple warning systems (e.g., loudspeakers);
- use all available channels to confirm and reinforce the warning message (e.g. radio, television, newspapers).

Practical lessons on evacuation and sheltering

- involve community groups in the drafting of evacuation and sheltering plans and programs;
- provide evacuation and sheltering instructions through a single, authoritative, credible source;
- carefully coordinate evacuation and sheltering plans and programs;
- stagger the provision of evacuation information;
- provide opportunities for people to confirm information about evacuation and sheltering through multiple communication channels;
- provide clear instructions about evacuation routes and shelters;
- provide opportunities for people to reach their primary shelter goals, e.g., homes of relatives and friends;
- provide personalized communication and assistance to the elderly and other vulnerable populations;
- institute highly visible measures to protect evacuated properties and to assure people that their property is safe against looting and abandonment;

Practical lessons on communications during an ongoing emergency or disaster

- organize a crisis management team or task force at the outset to coordinate all disaster-related activities and communications;
- establish a centralized disaster communication center at the outset to collect, analyse, verify, and interpret all disaster- related information; and manage all disaster communications;
- carefully and closely coordinate all inter- and intra- organizational communications, initiatives, and actions;
- centralize the flow of emergency and disaster information through a single, highly credible, senior spokesperson with good presentation and interaction skills;
- provide frequent updates and briefings about the disaster situation (e.g., the geographic area affected, the population at risk, alternative escape routes);
- prepare for breakdowns of normal communication channels;
- establish free and easily accessible telephone hotlines to control rumors and provide the latest information;
- carefully evaluate and cross-check the validity and reliability of all disaster-related information;
- establish mechanisms (e.g., daily polls) to track people's awareness, perceptions, and knowledge of the disaster;
- expect and prepare for panic only when emergency information is ambiguous, emergency and evacuation routes are closed, and channels for confirming information break down;

- disclose disaster or emergency information fully and promptly;
- provide details on how management conclusions are reached (e.g., merely assuring the public that everything is all right and that there is no cause for alarm is seldom sufficient);
- provide precise, unambiguous information about actions that people can take to protect themselves and their property;
- add staff to answer all media queries;
- hold regular and frequent press conferences and briefings, even if no new information is available;
- respect media deadlines;
- provide information tailored to the needs of different media (e.g., visual material for television and short spoken quotes by senior officials for radio);
- take steps to ensure the quality of media reporting (e.g., establish a news monitoring system);
- respect and work closely with the news media, but do not depend on them;
- evaluate performance and learn from past mistakes.

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Results of the Working Group "Risk Communications for Emergencies and Disasters"

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This working group was concerned with the communications processes that support the management of technological crises, emergencies and disasters such as Chernobyl, Seveso, Bhopal, and Three Mile Island as well as chemical fires and spills and other emergencies that effect the public. Global emergencies have focused world attention on technological hazards, but natural hazards and local emergencies are no less important to the population.

The new view is that risk communication extends beyond the time of the disaster itself. It also includes disaster risk communication and technology implementation prior to any emergency to help people understand risk associated with disaster and what to do when emergency occurs. In addition to traditional communication during the disaster, it includes communication after the disaster regarding safety of food, water and energy supply, available medical care, the provision of social and psychological support in returning to normal life and other material and technical assistance.

Enhancing crisis communication is important to industry, government and the public. The public is becoming increasingly concerned about technological failures as our reliance on technology increases. Better preparedness and more public awareness can increase public acceptance of and confidence in ability to manage high consequence technologies including ability to manage its failures. Failed communications in emergencies has increased the loss of life and property and public scepticism. Effective communication can

a) engender confidence and trust in authorities;
b) give rise of acceptance of risks and risk management and
c) reduce the consequences of disasters.

Communication problems often result from little or poor planning as well as a failure to conceptualize the issues from the perspective of the affected population. This represents a management failure. Effective planning and communication is good management and can be recognized by industrial managers, politicians and the public. Risk communication about technological disasters needs to be an integral part of technology management. It must be considered in the design, choice and deployment of technological options. Finally, new laws, such as SARA Title III in the US and directives such

as the Seveso Directive in Europe, require government, business and industries, and the public to engage in risk communication as part of the process of siting and managing technologies for production, shipping and waste management.

Case studies, retrospective analyses and other descriptive studies of past disaster have helped identify myths and provide guidance for the disaster communication process. Contrary to conventional wisdom:

* People almost never panic in emergencies. Such behavior as running away from a threat is often misinterpreted as panic, even if flight or rapid evacuation is appropriate.

* Failure to heed warnings is a more significant problem. People rarely respond to the first warning they hear. In fact getting people to respond at all is a significant problem; especially when people do not trust in the information by the authorities.

* People are not overwhelmed by information. They are highly motivated to receive information which will help them cope. If they do not have good information rumors and ad-hoc advice will be followed with adverse, somehow counterproductive consequences.

* People do not want only simple and non-technical information. Trustworthy and specific, situationally relevant information and personal relevance are key issues.

* False alarms are typically viewed by officials as a constraint to getting people to respond in a future emergency situation. Research has shown, however, that if the basis for the mistake is explained, that people will respond to another warning.

Research has also provided knowledge that has improved the management of the communications processes:

* Multiple sources and channels are necessary to improve the penetration and acceptance of emergency and preparedness messages.

* It is helpful to provide ways for affected publics to positively confirm the communications of warning, informations and instructions.

* Warnings from credible sources are the most effective. The credibility of sources depends on the experiences which have been made in previous crisis situations.

* Frequent warnings with consistent messages are necessary.

* People who are not in the mainstream of society due to ethnicity, language barriers or other handicaps are less likely to act on warnings.

New research is needed to further improve emergency risk communications. Little is known about the effectiveness of pre-emergency risk communications. No attempts have been made to compare efforts on a transnational basis or to share and contrast European and American experiences with risk communications in emergencies. We still lack knowledge on the unintended and counterproductive effects of informations and communications. More research is needed on the optimum design of communications

systems and the wording of warning messages and information strategies. Finally, as new computers and communication technologies are developed, research is needed on how to apply such technology to improve emergency risk communication practices and to avoid negative side-effects caused by the use of this new technology.

Some specific ideas for additional research include the following:

* Disaster risk communication applications in collaboration with researchers (e.g. "Planungszelle"; industry/government/university-collaboration).

  - Application of "Planungszelle" in choice of technology or siting decision;
  - Retrospective case studies of public behavior;
  - Cross cultural field experiments and case studies.

* Relative effectiveness and strength and weaknesses of centralized disaster planning and disaster management in comparison with decentralized support of local autonomus (self help) disaster planning and management.

* Investigation of the impact of new information technology (e.g. electronic communications, data bases, expert systems) requirements in support of centralized or autonomous (self help) disaster planning.

* Longitudinal studies of the effectiveness of disaster planning implementation and alternative disaster plans.

* Use of simulation technologies for training, planning and disaster decision making.

Results of the Working Group "Evaluation of Risk Communication Strategies"

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1. What is effective risk communication?

Whether by government, industry or private organizations, risk communication is undertaken to inform people at risk of their potential hazard, to elicit concerns of the public, and to induce risk-reducing activities. In late 1988, a growing number of risk communication programs are apparent in both Europe and North America. Such programs must eventually address the question: "What is effective risk communication?"

In the view of this working group, an effective risk communication program is one that:

* clearly defines and meets the communication need, as envisioned both by risk assessment experts and those who are at risk, and that sets forth specific risk communication objectives to guide the program;

* identifies the target groups that must be reached in the program and is successful in establishing communi cation with the full diversity of such groups (taking the radon risk as an example, this in volves such diverse groups as local officials, homeowners, financial institutions, the real estate industry, local health professionals, etc.);

* achieves the outcomes identified as necessary in the program (e.g., do homeowners around hazardous chemical plants actually read materials on emergency re sponses and save them for future use);

* succesfully places the risks in the context of other risks, the size of benefits, the amount of risk re duction possible, the management difficulties, etc. so that individuals not only know about risks but can put them into broader perspective (i.e., is based on evaluation criteria which re flect perspectives of both the risk-exposed people and risk-managing institutions);

* involves various stakeholders and interested parties in the design and implementation of the evaluation;

* is adaptive to new scientific information about the risk or changes in the management situation; such an adaptive capability will require continuing two-way communication between the communicators and those communicated to.

There are other important attributes, of course, to successful risk communication but these are primary considerations. Determining whether these criteria have actually been met requires careful empirical analysis and is the central task for a systained effort in evaluating risk communication strategies.

2. Why is evaluation important?

At the outset, by evaluation we mean the scientific assessment of the content, processes and outcomes of interventions designed to communicate risks according to defined criteria of success. These criteria are to be deduced from the objectives and purposes of the risk communication program. The question that must be addressed is why is evaluation necessary? What can we learn form formal evaluation that will not be learned simply form ordinary experience?

Evaluation studies are essential for several reasons. They

* force clear thinking about the goals of the communi cation, the nature of the communication problem, and optional strategies that may be employed;

* can provide new information about the risk problem and available risk management options;

* are essential for our understanding of which strategies and techniques work in certain situations and which did not (as well as why);

* allow to evaluate whether the costs and efforts necessary to conduct the risk communication are appropriate;

* help to meet the responsibility of pertinent decision makers to ensure that the program uses the most effective tools in avoiding or reducing harm to people;

* allow on-going monitoring of the effects of the risk management program as well as mid-course corrections when problems become apparent;

* develop greater accountability of risk managers to policymakers and affected publics (e.g., residents or workers), an effect of which may be larger credibility and trust in their activities.

However, systematic empirical evaluations of risk communi cation programs (such as information campaigns on environ mental hazards, behaviour modification strategies related to health issues, approaches to meet the 'right to know' of risk- exposed residents, etc.) are still rather seldom, and altogether 'hard' evidence on the effectiveness of the many conducted programs is restricted.

3. What approaches are necessary and available?

While risk assessment and particularly risk communication is a new field, evaluation research is a well developed area of study (e.g., with respect to health or education programs) and much is known. Although risk communication problems are often complex and challenging, proved evaluation approaches are available. The working group recommands three major approaches:

(1) *Content evaluation:* How accurate and complete is the scientific (and contextual) information communicated? (for example: are uncertainties noted and properly described? If comparisons are made (such as the risks associated with the energy sources for electricity generation), are the comparisons appropriate and meaningful?)

(2) *Process evaluation:* How appropriate is the structure and the course of the program used for communication, and which are the crucial stages for the intended effects? (e.g., are the various interested parties involved in designing and implementing an emergency warning program? Which difficulties and deviations from the planned intervention occurred during its realization? Is two-way communication actually achieved?)

(3) *Outcome evaluation:* To what extent are the desired outcomes of the risk communication program actually achieved? (e.g., has the understanding of probabilistic information about risks from radiation been improved? Do cessation of smoking or dietary changes occur? Are seat belts used more often?)

Defining evaluation criteria which are both relevant and measurable is the key problem. This task has to be related to the specific kind of risk and the employed communication strategy. Examples are: quality and comprehensibility of information, degree of information distribution, attention of the public, increased knowledge, attitude change, amount of participation, behavior modification (e.g., use of protection measures), facilitation of joint conflict resolution, reduction of the consequences of risky behavior (e.g., accidents or mortalities).

There are challenges, of course, because risks are often complex and many sources and types of communication are constantly occurring. Thus evaluating risk communication programs will confront such troublesome issues as:

* establishing causal relationships between the interventions used and the outcomes that occur in the face of many confounding variables

* the duration of the effects (i.e., to differentiate short-term versus long- term impacts)

* determining the dependency of the outcome noted with the context of the risk situation (i.e., is the effect generalizable?)

* defining valid measurements of criteria variables and controlling for social- psychological biases in judgement processes

* identifying unintended consequences also caused by the risk communication program.

Only an understanding of the risk communication process at whole will enable valid inferences about the impact of particular interventions.

4. What can we recommend?

The working group has a number of key recommendations as to how the practice risk communication evaluation may be improved:

* No risk communication program should be undertaken that does not include, as part of its design, an evaluation approach, and evaluation should be conceived as an essential ingredient in risk communication program development and modifications over time.

* Rigorous state-of-the-art methodologies should be employed, including the use of control groups, longitudinal designs with differentiated timing according to the course of the program, problem-representative sampling, and appropriate statistical analysis. (Evaluation designs not meeting this standard - which is often the case - should not be implemented as they may do more harm than good and are easily discredited).

* If 'small-scale' evaluations are conducted or secondary data are interpreted 'ex post', the internal and external validity of findings should be critically assessed.

* A broad range of interests should be consulted and involved in the design and implementation of an evaluation program.

* Careful consideration should be given to the most useful focus of the evaluation, i.e., whether the evaluation should be external (by an independent institution), or whether an internal evaluator is more effective (with provision for controlling potential conflicts of interest).

* Efforts should be made to establish a network of evaluation research in this field, enabling accumulated experience with risk communication strategies, as well as comparability and cross-validation of important findings.

Finally, as ignored evaluation studies are useless, provisions should be made to ensure that evaluation results are well explained and widely disseminated to those responsible for the respective strategies and programs so that they can be utilized for the improvement of risk communication.

Hazard Versus Outrage:
A Conceptual Frame for Describing Public Perception of Risk

Peter M. Sandmann, Rutgers University, New Jersey

1. What the Core Problem Is--and Isn't

a) Scientists and managers who study risk for a living are consistently irritated that the public seems to worry about the "wrong" risks--which is certainly true if you take mortality statistics as your standard. The correlations between expected annual mortality (for example) and public fears are very low. Fundamental axiom of risk communication: the risks that kill people and the risks that distress or frighten people are completely different.

b) Industry, government, and risk assessment experts often see this as perceptual distortion. Traditional version is "ignore the public". Both versions assume that in the conflict between public and expert over what's risky, the public is "wrong".

c) But rather than see this as a perceptual distortion on the part of the public, it's more useful and more accurate to see it as an oversimplification on the part of the scientists and managers.

d) In other words, the concept of "risk" means a lot more than mortality statistics. I want to play fast and loose with terminology here. Let's take the classic definition of risk--how many people are how likely to incur how much damage if we do X--and call that hazard. Hazard is what risk assessments are designed to estimate. Now let's take everything else that goes into laypeople's risk perceptions and call that outrage. Outrage is everything about a risk that's relevant except how likely it is to hurt you.

e) Here, then, is the fundamental premise of my argument: People's concerns and fears are more a product of outrage than of hazard. That is, we consistently underestimate the hazard of risks that are low-outrage, and overestimate the hazard of risks that are high-outrage. Everyone does this, even risk assessment experts when they are outside their own fields. The ability of risk assessment experts to define risk in terms of hazard and make it stick is a wonderful example of the power (and I'm tempted to add, arrogance) of expertise. Instead of com-

paring public perception of risk to expert knowledge, I think it helps to see this as two different definitions of what risk means--the definition experts use on the job, which ignores outrage, versus the definition in everyday use, which emphasizes outrage.

f) Let me stress before I get into the details of outrage that the hazard-versus-outrage distinction is not a distinction between fact and emotion. Outrage and its various components are as real, as measurable, as tangible, and as controllable as hazard. In fact, in most cases we have better outrage data than hazard data. The risk assessment people trying to calculate the carcinogenicity of low doses of dimethylmeatloaf have their hands full. But we can fairly easily study--and quantify--the extent and nature of the community outrage provoked by dimethylmeatloaf emissions.

g) I think it is useful to see risk as properly an amalgam of both hazard and outrage. It is tempting to let "risk" continue to mean what I have called hazard, and argue simply that these other non-risk factors have a legitimate claim to policy attention. There are two objections to this: (1) The public does mean these things by risk, and will have trouble accepting a discourse that does not accept this; and (2) Risk policy-makers have a powerful tendency to lose track of these factors--to backslide--unless they are considered actually part of risk rather than something separate.

h) Let me stress also that in distinguishing hazard from outrage I am not implying that high-outrage risks are necessarily low-hazard. The two variables are, I think independent, neither positively nor negatively correlated. Even paranoids have enemies. The hazards may be great or small. In either case, how people assess these hazards--whether they are exaggerated, confronted calmly, or ignored--is mostly a product of outrage.

2. **Hazard Versus Outrage:**

I am going to review just a few of the characteristics of outrage--these are what separate risks people are likely to take seriously from risks they are likely to ignore... regardless of the actual hazard. The literature lists about 25 such characteristics. I will cover nine. Note that they are intercorrelated, and we don't know very much yet about which are dominant and which minor when they are teased apart. Note also that the research that uncovered these factors is not mine--I am offering a conceptual frame for work done by Paul Slovic, Sarah Lichtenstein, Baruch Fischhoff, and many other researchers.

a) *Voluntary versus involuntary.* Most environmental risks are like muggings--they are involuntary, and therefore enormously objectionable. People who voluntarily assume risks naturally tend to consider them acceptable, and thus underestimate the risks as a result. Voluntariness is correlated with acceptability. The distinction between voluntary and involuntary is harder to define for a community than for an individual, but the same dynamic applies. When a community feels coerced by the state into accepting a particular risk, it not only objects to the

coercion per se; the outrage generated by the coercion leads the community to see the risk as more dangerous. By my definitions, a coerced risk is literally more risky, even though it is no more hazardous.

b) *Natural versus artificial.* The middle position on this issue is naturalness--a natural risk (like geological radon) is more outrageous than a voluntary risk, but a whole lot less outrageous than a risk forced on you by somebody else. In New Jersey we have watched people react with overwhelming apathy to geological radon, while responding with considerable fear and outrage to radon from landfill contaminated with radium from a luminescent watch factory. Part of the difference is that natural radon provides no enemy to get mad at; on the landfill radon issue the state Department of Environmental Protection became the enemy.

c) *Familiar versus exotic.* A carcinogenic household cleanser is not going to get as much reaction as a strange-looking high-tech new industrial facility. Familiar surroundings lead to underestimation of the risk. (This also helps explain why we have so much trouble getting people to worry about geological radon). So does familiarity with the risk itself--if you have survived the risk for years (driving without a serious accident, say), the risk loses much of its power to command fear.

d) *Not dread versus dread.* We don't fully understand what makes some outcomes so such more dreadful than others--but we know it's so. Examples: AIDS/Cancer. I know an environmental manager who has let stand a false (or at least questionable) impression that certain industrial effluents are carcinogenic, because the effluents are associated with other health problems like asthma and emphysema, but only the incorrect association with cancer gets them regulated.

e) *Diffuse in time and space versus focused in time and space.* This is one of the main reasons why airline safety arouses so much more public concern than auto safety, the statistics notwithstanding. Airline passengers die in larger bunches. If smokers all died in October 13 in Chicago we would long ago have outlawed smoking. (Note that this preference for diffuse risks accurately reflects the society's sense of equity. A risk that is sure to kill fifty anonymous people a year, spread throughout the country, is far more acceptable than one that has a ten percent chance of wiping out a town of 5000 some time in the next ten years).

f) *Controlled by the individual versus controlled by the "system".* This is connected to voluntariness, but it has more to do with who protests against the risk. How many feel safer driving than riding shotgun? 85 % of the American public consider themselves better than average drivers, and as long as *they* control the car they feel fairly safe. In fact, people who feel the solution is in their own hands are often so reassured by this that they feel little need to actually carry it out.

(Radon versus Superfund; household pesticides versus public spraying.) Putting oneself in the hands of a corporation or the government provokes a very different level of concern. Chauncey Starr uses the example of carving a piece of meat (vegetarians may have trouble relating to this)--you hold the meat much closer to the knife if *you* are holding the knife than if another person is.

g) Fair versus unfair. This is also connected to voluntariness, since a coerced risk is bound to feel unfair. But it also has to do with whether the risks and the benefits are going to the same people, and whether the risks wind up where they do for reasons more acceptable than raw power or raw politics. Hazardous waste facilities, for example, typically accept imported waste, and often export the profits to nonlocal owners. The unfairness of a community stuck with all the risk and little of the benefit exacerbates its assessment of the risk.

h) Morally irrelevant versus morally relevant. Some risks are just risks; others are wrongs, evils as well. The distinguishing characteristic of moral imperatives, of course, is that they are to be obeyed without counting the cost. This has happened with many kinds of environmental risk. To many ears it now sounds callous, if not immoral, to assert that cleaning up a river or catching a midnight dumper isn't worth the expense, that the cost outweighs the risk, that there are cheaper ways to save lives. Nor can the regulator make much headway pitting cost-benefit analysis against morality. The police do not always catch child molesters, but they know not to argue that an occasional molested child is an "acceptable risk".

i) Trustworthy sources versus untrustworthy sources. So far this list has been concerned with characteristics of the risk itself. But much depends on the relationship that has been built up with the person or company or agency imposing the risk or recommending the potentially risky behavior. Why do most people accept vaccinations, despite the doctor's informed-consent speech about the possible risks? Part of the answer is that the behavior is voluntary, under their control. Part is that the benefits are clear. But a big part is that they trust the doctor. Most patients, in fact, don't ask for much risk information from their physician; they simply want to know what he or she thinks they should do. Way at the other end of the scale, people who feel betrayed by an agency demand *all* the information--and insist on total certainty and zero risk. The core of the problem when this happens isn't that the agency hasn't explained the risk carefully enough; it's that the public no longer trusts anything that the agency has to say.

3. Implications

a) What are the implications of this distinction between hazard and outrage? I see four:

- In deciding how risky something is, and how acceptable that level of risk is, the public responds more to outrage than to hazard. You can rely on people to overestimate hazard--and resist it vehemently--when the outrage is high. You can count on them to underestimate hazard--and respond apathetically--when the outrage is low.

- People do not listen discriminatingly to risk data when they are experiencing high outrage. They ignore the data, or they mine the data for ammunition. This is not irrational. Finding a way to reduce the outrage takes precedence over assessing the risk. If *over*assessing the risk is the best way to build a head of steam to attack the outrage, it will be overassessed.

- Outrage is more than just a distraction from hazard; it is important in its own right. It is true, of course, that outrage leads to serious distortions in risk management. A society has only so much time, energy, attention, and money to "spend" on reducing risks. When many people are deeply worried about a relatively modest hazard, the price is measured not just in their needless distress, or in non-cost-effective restraints on some industry. The price is measured in the more serious hazards that go unattended as a result. Real people die, I think, because we are more attentive to outrage than to hazard. However, outrage isn't just a distraction from hazard. It's also outrage, and it's a real issue in its own right. Our society values local autonomy and individual freedom; we care about fairness and moral values and trustworthiness and the other distinctions that determine the extent of outrage. A community that is exposed to a risk it didn't agree to, doesn't benefit from, and wasn't told about has a right to be very angry indeed--even if the risk is small. When environmental activities organize communities to oppose such risks, they may not be doing very much to reduce hazard, but I think they are performing a real public service nonetheless. An investigative story that exposes an outrage of this sort is, I think, also a real public service.

- It follows that when the hazard is low, authorities should do everything in their power to get and keep outrage also low. (And when the hazard is high, work to make outrage high--passive smoking, MADD, radon). This means making risks voluntary rather than coerced, familiar rather than exotic, fair rather than unfair. It means sharing power with the community. It means building trust and credibility. When risk managers begin attending seriously to outrage, I believe this will free the public to begin attending seriously to hazard.

b) I should add the irony that risk managers already attend to outrage more than they think is wise--but typically after it has boiled over. EPA's study of comparative risk, for example, found that the agency's budget for dealing with various environmental problems was much better correlated with the degree of public concern over the problem than with the extent of the environmental or health risk. In my terms, EPA spends money based more on outrage than on hazard. But arguably this is the worst of both worlds: an agency that fails to reduce public outrage and winds up compelled by outrage to reduce an insignificant hazard. The core implication of the hazard-versus-outrage distinction, in other words, is

a paradox. The public will see risk in terms of hazard, and will allow the agency to regulate risk in terms of hazard, only if the agency first shows that it can see the risk in terms of outrage, and takes effective action to reduce the community's outrage.

Risk Communication in the Search for a Global Climate Management Strategy

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Most of the discussion of risk communication at this first international conference on the topic has been concerned about communication between the proposers of a technology and a host community. We have noted that this communication can be of two types; the transmission of information and the creation of a common discourse that offers the possibility of a convergence upon shared meanings. In my opening remarks on the topic of "Global Environmental Change and the Public," I intend to concentrate on the communication between holders of different views about a controversial risk that potentially affects them all as inhabitants of the global community. This problem differs importantly from the problem of facility siting. Global climatic change cannot be framed in terms of clear dichotomies between those who impose and those who bear environmental health risks, although it does seem that the costs of climatic change will be unevenly distributed across the world. My thoughts on risk communication in this context are primarily concerned with the second type of communication. Rather than address the issue of how scientists can convey information to broader publics about the current estimates and uncertainties of probabilities and magnitudes of potential climate impacts, I want to address the issue of communication between various constituencies of scientists, public interest groups, and political decision makers across national and institutional boundaries in the search for a global climate management strategy.

Among scientists, policy makers, and others familiar with the climatic change issue, quite diverse responses can be identified. There are those who argue that the possible consequences of climatic change are imminent and so bad that we must act at once to prevent it. There is usually a moral dimension to this preventivist argument that it is somehow wrong to mess with nature which itself is seen to be a fragile system, prone to irreparable human disruption. On the other hand, we also hear more optimistic views that see global warming as an opportunity for human adaptation. With more atmospheric CO_2 it appears that plants may grow larger and faster while human populations can install air conditioning in their homes and workplaces. In any case, add the adaptivists, cutting CO_2 emissions means curtailing growth and the opportunities for the poorer people and nations of the earth to share in the benefits of industrialism. It would be morally wrong, therefore, to act to prevent climate change. A third position was soon synthesized from this classic Hegelian dyad, the sustainable development path that advocates continued growth without exhausting resources or eliminating otherwise viable future choices.

It is impossible to choose between the preventivist and adaptivist positions on scientific grounds alone, while it is always difficult to pin down the advocates of sustainable development on what exactly the concept means and how we should make practical decisions about which development paths actually are sustainable (Brown et al.1987). Although scientists pretty much agree that doubling pre industrial revolution levels of CO_2 will result in a global average warming of 3°C +/- 1.5°C, they really have no idea what this means locally. Because we do not know enough about the behavior of the oceans as a sink for both CO_2 and heat, and because we do not know what will be the effects of the shape and location of land masses, there is endless room for speculation about what the problem will mean in different parts of the world.

It is quite likely that the warming will be much less in tropical regions than in temperate zones. However, we cannot say that this necessarily will be unwelcome, for example, in the Soviet Union which might benefit from ice-free northern ports and extended agricultural zones into energy rich Siberia. Possible losers, on the other hand,would include Bangla Desh and the Maldive Islands that would disappear from the face of the globe with only a one metre rise in sea level.

In addition to the problem of the regional distribution of potential winners and losers, is that of the divergent imperatives facing the industrial and the developing worlds. Not only do less developed countries (LDCs) tend to be concentrated in the tropical regions where warming will be less noticeable, but LDCs have different concerns from industrial world.

- Curtailing economic growth would be political suicide for some national leaders. It is possible that climatic change would increase the options for potential growth in LDCs.
- Most LDCs rely on carbon fuels for industrialization.
- Any strategy that requires LDCs to refrain from solving their short term development problems through fossil fuel resources will have to include alternatives that make economic sense for the LDC, e.g. end use efficiency.

The scientific uncertainty and the issues of distributive justice indicate that both the scientific and decision problems of climatic change are nonlinear and highly complex. They can be represented by three kinds of scientific inquiry (Funtowicz and Ravetz 1985) predicated by two variables, systems uncertainty and decision stakes (Fig.1). Whereas systems uncertainty describes the elements of inexactness, uncertainty and ignorance encountered in technical studies, decision stakes refers to the costs and benefits of the various possible decision outcomes for all relevant parties.

Low systems uncertainty and decision stakes describe situations in which databases are large and reliable, and the technical community largely agrees on appropriate methods of investigation. This is the province of consensual or applied science. Technological choices are straight forward, based on good statistical or actuarial information about past performance. When both systems uncertainty and decision stakes are higher, but professional expertise is still a useful guide to action, we enter the clinical mode of technical consultancy. This kind of activity is exemplified by medical practice in which quantitative tools are supplemented explicitly by experienced qualitative judgment.

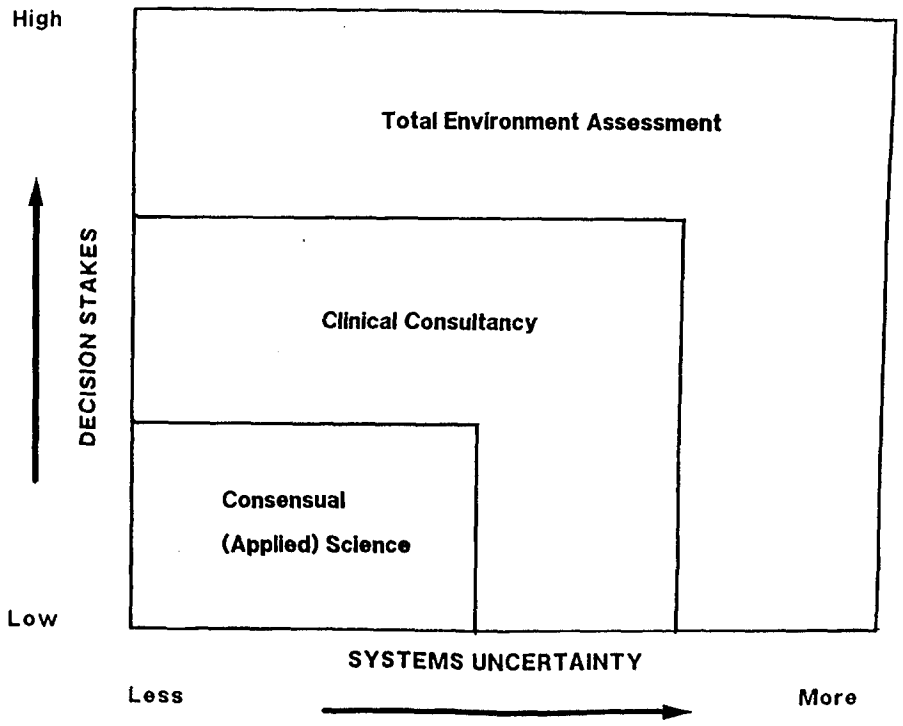

Fig. 1. Three kinds of science

Finally, when both variables are very high we find total environmental assessment, where differences in opinion are clashes of world views.

At the present level of knowledge, particularly in the light of the very high uncertainties among scientists concerning the regional distributions of impacts, it is clear that the climatic change issue ranks high on both systems uncertainty and decision stakes. It seems to be assumed by many participants in both the scientific and policy communities (e.g. by the International Geosphere Biosphere Program) that the reduction of systems uncertainty will make problem resolution more straightforward.

However, we should consider that lifting the veil of ignorance (Rawls 1971) about the outcomes of climatic change could make it more difficult to implement any global measures to prevent or adapt to its impacts. We can see from the diagram that reduction of scientific uncertainty alone cannot resolve the climatic change problem for us. While the problem remains in total environmental assessment, due to the high decision stakes, exactly where one stands on the continuum from adaptivism through sustainable development to preventivism remains essentially a moral preference between two logical limits. Some adaptation is inevitable but we cannot double atmospheric CO_2 indefinitely.

The moral dimensions of the climate issue are far deeper than the well recognized problem of the North/South divide and whose turn it is to develop. Equity issues are not merely problems to be resolved in dealing with climatic change, but are fundamental components of the way that different societal constituencies shape the issue of climatic change both within nation states and across national boundaries.

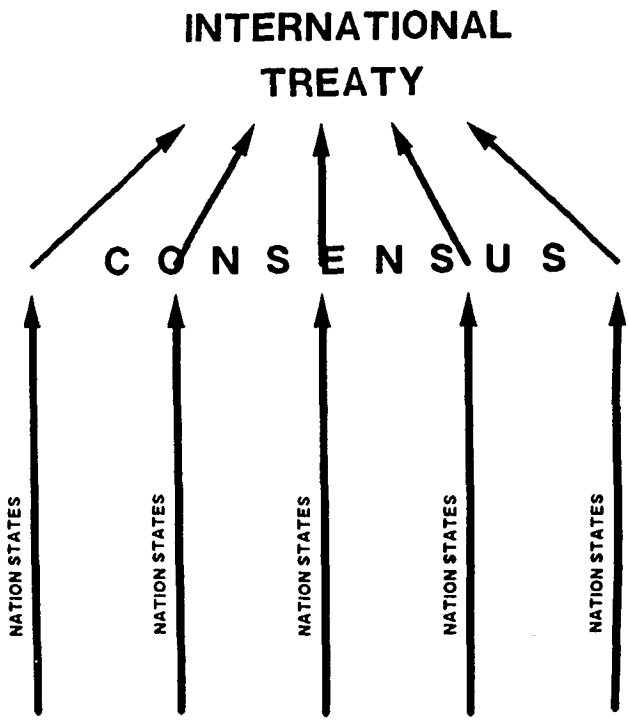

Fig. 2. Traditional Decision Model

The principal problem of global climate management in the absence of a global government is that described by Garrett Hardin (1968) as the tragedy of the commons. This term describes the situation where the rational exploitation of a resource by individuals produces the irrational outcome of resource depletion. However, the tragedy of the commons is a misnomer. It really describes open access property arrangements in which a resource is available to all without restrictions on its use. Traditional societies have successfully managed common property for generations by defining the legitimate user group for a specific resource, recognizing the reciprocal externalities associated with its use and enforcing sanctions against its abuse.

These frameworks for common property management traditionally have relied for their efficacy upon the sharing of culture by the user group. However, there is no more a shared global culture than there is a global government. How then can the common property model help us to understand how global resources might be managed? I suggest that a regime approach to international resource management may provide the functional equivalent of a shared culture. To understand a regime model let us begin by looking at a traditional model of the sort that one would expect from the so called realist school of political science exemplified by Niebuhr (1949) and Morganthau (1974).

According to the realist model (Fig. 2), individual nation states determine their policy agendas according to their custom and law, culminating in government decisions. Governments then come together and generate an international consensus that is embodied in a treaty, perhaps enshrined in international law, and subsequently is enforced within their own borders by each of the national governments.

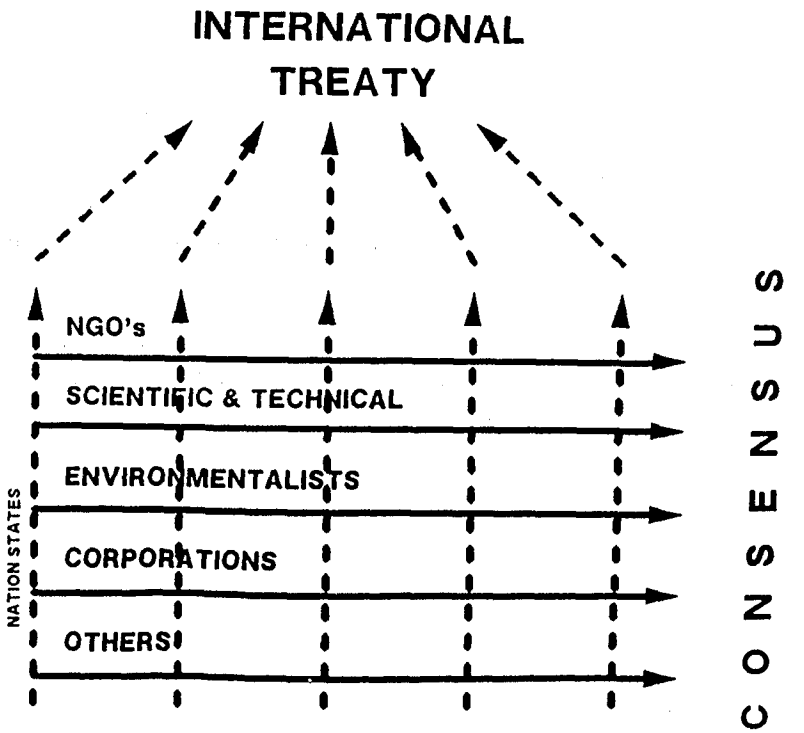

Fig. 3. Proposed Decision Model

On the surface this model describes the Montreal Protocols for Protection of the Ozone Layer, which frequently are cited as a model for future global cooperation for atmospheric management (Chandler et al. 1988). However, the resemblance is largely superficial. The Ozone Treaty was preceded by long processes of informal networking between environmental groups, scientific organizations, industrial associations, etc. across national boundaries and outside of normal diplomatic interstate or other customary intergovernmental channels.

This suggests a somewhat different model of international decision making known as a regime model (Young 1982, Gerlach and Rayner 1988). According to this view,national culture provides only one dimension of social affiliation for decision makers who also play particular roles of various, often competing, interest groups (Fig. 3). In our contemporary world of high speed communications, these groups frequently are well networked internationally and provide common institutional cultures for their members irrespective of national cultural background. The important point is that consensus may be reached among international constituencies about how to deal with various aspects of a complex large scale problem, like climatic change, without committing nation states to positions that may be viewed as being contrary to national interest. Furthermore, such small scale interventions may have far reaching consequences without requiring nation states to enter into comprehensive agreements that are notoriously difficult to justify scientifically.

Ultimately, the participants in such a process could generate global solutions even if no central body of global decision makers formally decides upon a concerted course of action. That is, the problem solving process will move forward by a form of organiza-

tion that seems barely visible. Participants in such a many stranded, loosely coupled network are free to innovate in many small ways, without facing the challenge of accepting or rejecting a single big treaty. The process is analogous to that by which the United States established its current national policy for nuclear energy: to continue research while holding a moratorium on installing new capacity. This policy is clearly established, but no decision point or decision maker can be identified. Thus, this kind of decision making permits a high level of constructive ambiguity. Because the decision process remains implicit, the process itself does not become a focus of conflict between powerful constituencies with incompatible preferences for ways of making policy decisions. Important discussions are not stymied by interminable disagreements about the shape of the conference table or the presence of ideologically repugnant delegations.

With this model treaties are primarily of symbolic value. This is not to say that they are unimportant. The Montreal agreement actually had a technology forcing effect. It demonstrated the political will of the major producing countries to take action to protect the ozone layer. However, the agreement would not have been possible but for

(1) the discovery of the Antarctic ozone hole,
(2) the belief of major manufacturers like DuPont that they were on the verge of producing a substitute,
(3) the ability of the US to threaten nonsignatories with trade restrictions.

For all this, the USSR was exempted from the strict reduction requirements of the treaty and allowed to put new factories into production if it became a signatory. Soviet participation in an agreement was considered more important than strict adherence to the terms of the treaty. This fact can be interpreted as an implicit understanding that the symbolic statement of intent was more important than the instrumental effects of the production cutbacks that the treaty required. For this reason and because the treaty is based on prior consensus at the substate level, the problems of enforcement inherent to the realist model are less threatening to the desired outcome.

Will the regime model work for global climate? There are major differences between the problems of CFC production and greenhouse gas emissions.

- There are limited producers of CFCs
- CFC impacts are uniformly bad for everyone (nb. skin cancer in temperate latitudes, cataracts in tropical). It is unclear that climatic change is uniformly negative (at least in the short to medium term).
- There are commercial incentives to CFC producers to find substitutes. But China, USSR, and India have hugh coal reserves and the incentives to industrialize. Nuclear power is not a viable substitute for LDCs.
- There is an immense diversity of constituencies affected nationally and globally.
- The US is unable to threaten credible trade restrictions against dissenting countries.

These constraints may give us good cause for reservations about the effectiveness of the regime model for managing global common resources. However, they are all factors that would present even larger obstacles to a realist model.

The designation of a category of resources as global common property has already begun. Issues are being allocated to this category from two directions. Some, such as the UNEP Regional Seas Program (Hulm 1983), the Law of the Sea Convention and the Montreal Protocol deal with what previously were treated as open access resources. Others, such as endangered species, tropical rain forests, and historical resources, are being elevated to global commons from the category of national resources.

Of course, this trend does not proceed unimpeded. The present US administration has characterized the notion of global commons (as used in Law of the Sea Convention) as an attempt to control resources on the part of counties unable to exploit them themselves. In other words, as attempts by developing nations to regulate developed nations. Brazilian President Sarney recently described rain forest as "our national treasure." The Prime Minister of Malaysia has made similar rumblings. The world Bank and AID have encouraged privatization of existing common property arrangements in LDCs.

The existence of these countervailing trends is to be expected since the establishment of common property regimes necessarily involves the renegotiation of some existing property rights. This brings us again to what is at the heart of so many risk issues problems of distributive justice and equity. These are particularly difficult because as I have argued elsewhere (Rayner 1984, Rayner and Cantor 1987) different institutions and cultures may validly disagree about principles of fairness and procedures for decision making. The regime model represents the best framework that I know of to facilitate effective communication between widely diverging national and institutional constituencies. Such communication will not be free from conflict, nor should it be. For in such conflict, tempered by participation in a shared and diverse discourse, lies the resilience in human decision making that offers our best hope for a global future.

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Risk Communication ... Where to From Here?[2]

Bill L. Long, OECD, Paris

During my last two years at the U.S. Environmental Protection Agency, I often heard EPA Administrator, Lee Thomas, voice his concern about the difficulty of communicating to the public on the matter of environmental risk. Administrator Thomas expressed dismay, in particular, at having to deal with members of the Congress and the American public who seem to feel that a risk free society should be both a near and long term goal. He observed also that certain words ... such as 'cancer' and 'radiation' ... immediately trigger strident opposition, regardless of the probability of occurence, and to the neglect of other potentially more serious threats.

This same concern was advanced in a different way by political scientist Aaron Wildavsky in a recent article in Science Magazine. He noted: "How extrordinary! The richest, longest lived, best protected, and most resourceful civilization, with the highest degree of insight into its own technology, is on its way to becoming the most frightened.'

In the last few years, the risks to humans and to the global environment from a variety of human endeavours have become a much-debated topic. Accounts of the global risks associated with catastrophic accidents (e.g., Chernobyl) and chemical pollution (e.g., ozone depletion), as well as the more local risks of automobiles and AIDS, have sharply increased both the visibility and level of debate with respect to risk assessment and public acceptability of risk.

For example, studies of public perceptions of risk show that a majority of lay persons believe that they are subject to more risk today than twenty years ago, despite the substantial increase in risk-management activities by governmental regulatory agencies, consumer advocates and industry.

The one common feature of the numerous studies that have been launched recently to dissect and interpret public attitudes and behaviour with respect to environmental risk is the failure of the models to confirm to the investigator's preconceptions. For example, a recent U.S. Environmental Protection Agency study which compared its own estimates of high, medium and low priority risks to citizen perceptions revealed a very low correlation.

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2 The opinions expressed in this paper are those of the author and do not necessarily represent the opinion of OECD.

And, in a recent survey of the American public (Roger Poll), 76 % of those interviewed on the matter of chemical waste disposal judged it to be a 'most serious' environmental problem, and the same percentage said that there is not enough regulation of industrial toxic waste. However, only 36 % were aware of toxic waste problems in their own communities, and only 16 % considered toxic wastes to be near enough to their homes to be a threat to their personal health.

At the less theoretical level, however, the 'not in my backyard' remains rampant. When it comes down to actual cases .. and referenda ... citizens around the world are speaking out and voting repeatedly in opposition to nuclear plants, landfills, incinerators, ocean dumping, and virtually anything else that suggests a new environmental hazard in the vicinity.

So, given this reality, is there any 'good news'?

The 'good news' is that the issue has been joined, and joined forcefully as government agencies, international organisations and industrial firms are all stepping up efforts to determine how to improve the communication of information about environmental risk to the public.

Events like this Conference, for example, by raising awareness, surfacing issues, and pushing the state of knowledge and inquiry, are making vital contributions in an area which has become a critical new dimension of environmental protection.

To use the US EPA as an example again, the Agency has been conducting major efforts over the past year to communicate to the public information about risks associated with radon. This colorless, orderless gas has been found to be accumulating in houses throughout the United States build on certain soils which contain radioactive elements. EPA estimates that such radon build-up causes more cancer deaths per year - 5.000 to 20.000 - than any other pollutant under its jurisdiction. This unfortunate situation does present a particularly good opportunity for evaluating risk communication approaches for several reasons: the risk is relatively unfamiliar to the public; there is usually no ready villain to blame, in contrast to the situation for industrial accidents; testing for radon gas is inexpensive; and the homeowners' mitigation choices can provide an objective measure of the impacts of a communication effort.

The results of several carefully designed and controlled tests of various approaches being used by EPA to communicate to the American public on this problem are revealing new insights into public perception and reaction. Some of the findings are quite surprising.

EPA's analyses provide substantial evidence that the manner in which risk information is packaged and conveyed is a powerful determinant of learning, perception of risk and ultimate behaviour. The studies have thus brought home to EPA the fact that, if attempts by public agencies to inform people in identical responses, then government information programs on risk involve significant ethical responsibilities.

The radon communication surveys also revealed that different groups (e.g., older people) respond to the same message differently, which suggests the need for specially targeted materials and delivery vehicles. For example, what appeared to be a reasonable

strategy of providing less information to groups at low risk from radon exposure than that provided to high risk groups actually generated higher levels of anxiety in the low risk group and caused them to over-invest in protective measures. The policy implication is that too little risk information can actually do harm, even when risks are negligible.

Industry, too, has discovered the field of risk communication, and is working hard to find new and better ways to carry its message to the public. In addressing the 'Only One Earth Forum on Managing Hazardous Materials', held at the Rene Dubos Center for Human Environment in New York City, last May, the Director of Science and Technology of Monsanto Company discussed the problems that industry faces in communicating with the public on biotechnology. Dr. Leohard Guarraia spoke of the need for new approaches by industry to overcome the 'dread factor', approaches which must be based on doing a better job of explaining the process. He noted that, 'if we can do a better job of communicating the essential philosophy behind biotechnology - to convey the understanding that this is a joint venture with nature - the public we are attempting to serve will more quickly accept the technology, and receive the benefits we have to offer.'

Clearly, industry has a credibility problem to overcome, and honest communication rather than propaganda is essential. In recent years, however, there appears to have developed and improved climate of co-operation between industry, environmental groups and the public across a range of environmental issues. This offers considerable hope in the risk assessment-risk management area.

One manifestation of this is US EPA's recent experience in monitoring the impact of a new domestic law which requires chemical firms which are using and storing hazardous substance to inform the local populations. Quite surprisingly, there was very little public outcry when residents adjacent to such plants where informed of the risk, a tribute to some very well-designed community awareness programs.

Within the OECD, we are finding that our work to obtain agreement from our 24 Member countries on common policies and approaches to environmental problems increasingly requires attention to risk assessment and risk communication. This should become evident from just a listing of the priority issues we are addressing at the moment: preparedness for and response to industrial accidents; transboundary transport of hazardous wastes; safety in biotechnology; chemicals in the environment; urban air pollution; and global climate change.

Of particular interest to us is a new, three-year project on 'Technology and Economics' which is designed to bring together the expertise and interests of a spectrum of OECD Directorates to identify principal barriers to technology innovation and diffusion, and to decide on how such constraints might be overcome. My Directorate is responsible for developing the 'environmental dimension' of this project which, as we are defining it, will include the positive contributions that technology can make to the solution of environmental problems, and also technology's adverse impacts on society and ecosystems. In selecting specific priorities, we have decided to address public acceptability of risk and risk communication as one of our theme areas. This should provide

us with excellent opportunities to explore the subject in close co-operation with our more economic growth and technology-oriented OECD brethren.

I would be pleased to discuss this new venture privately with any of you. There may be good opportunities for collaboration. Clearly we want to identify and draw on the best expertise in the world, and that is one of the reasons I am so delighted to have been given the opportunity to join you here today.

I believe we can all agree that there has indeed been a recent renaissance in the field of environmental risk assessment and communication. And, while we are keenly aware of the many analytical shortcomings and contradictory results of risk assessment and communication efforts - and that we have only just touched the surface of some of the very difficult issues (for example, how to establish and communicate risk in areas of large scientific uncertainties, such as global climate change) - we know also that many promising new concepts, methodologies and approaches are emerging.

The key question is ... what should be the agenda for the future?

1. *Risk assessment methodologies.* The management of risks, including public acceptability, must be grounded on good scientific assessment of risk. It must also include intelligibile, effective communication by the scientific community of the nature of the risks, their probabilities and their potential consequences for human health and the environment. This whole area of the scientific underpinning or risk assessment must, therefore, become a higher priority for government agencies, universities and industrial laboratories.

Concurrently, the economics of risk must be better analyzed and elaborated. This was highlighted in a recent analysis by the Group of Economic Experts of the OECD's Environment Committee of 'Risk Assessment and Risk Management for Accidents Connected with Industrial Activities.' Specifically, the Experts Group recommended an intensification of work on 'risk acceptability and, in particular, the weighing to be applied to low probability - high consequence occurence', and called for new economic studies to 'evaluate accident cost, safety cost and implicit damage value ...'. In addition, it stressed the need to ensure that the international community's future work on risk addresses three current weaknesses:

(1) the fact that risk assessment capabilities are still developing slowly, with insufficient attention being paid to information exchange on assessment methodologies and to experiences, and to the incorporation of new knowledge into training and education programs;
(2) the fact that some spontaneous trends seem undesireable, especially oversimplification in presenting risk information to the public; and
(3) the still inadequate interaction between risk assessment and risk management, particularly with respect to the economic linkages.

2. *Information/communication.* Regarding risk communication, per se, there are needs, and opportunities, at two levels. First is the matter of keeping the concept of risk and its many complexities before the public. This is principally a job for regulatory agencies and academia which by the very process of presenting risk information to the public in

terms of reasonable options, can help overcome a 'no risk' mentality. In the field of waste disposal, for example, there appears to be increasing (albeit grudging) public acceptability of land-base incineration, given the more objectionable nature of all other available options e.g., landfills, ocean dumping, incineration-at-sea, shipping the wastes to other countries. It is also noteworthy that the nuclear energy industry may be getting new life because of the climate change issue, with coal becoming the more important villian and the 'soft energy' path seemingly inadequate to get us from here to there fast enough.

The point is that citizens appear to be more willing today to at least confront the tough personal choices involved in deciding on how to manage new environmental threats - even if much opposition and irrationality (as perceived by others) persists in many instances.

A second important aspect of information communication about risk involves its packaging. Here, the evidence seems convincing that material on risk must be tailored for different sectors of societies. Further, as pointed out above, a delicate balance seems to exist between too much and not enough information, with serious 'downsides' and costs in both directions.

3. *Equity imperatives.* If one can overcome the 'no-risk-at-all' demand, then the issue becomes one of fair and equitable treatment. The wealthy suburbs do not want landfills, and their poorer neighbours are increasingly rising up against the feeling that their 'backyards' always become the eventual dumping grounds.

Progress would seem to depend on generating a much better sense of equity within and among countries in the acceptance of risk. This area deserves significantly more analysis and creative thinking to determine, for example, whether it might be possible to proceed at local, regional and national levels with new strategies for distributing the risks that citizens are being asked to accept. Such an approach is being tried by some governments in the area of nuclear waste storage; but an effective strategy might better involve a mix of environmental risks. If one state or county, for example, were being asked to be a site for an incinerator, chances for a favourable response by citizens or counties were being asked to accept other risks.

While this will be difficult to accomplish in practice - at least to achieve a complete and quitable sharing of environmental risk - just knowing that 'government' is aware of such a need, and is trying to accomodate it, could prove to be a salubrious reinforcement of other approaches designed to achieve risk management goals. Public perception of fair treatment is critical to effective risk management.

4. *Incentives:* Greater attention must also be paid to economic incentives for risk acceptance. In some cases this might mean only better definition and communication of benefits that will naturally accrue to states, local communities or citizens if they agree to accept new types or degrees of risk. For example, better publicity of expanded employment opportunities could help industry find homes more easily for facilities which utilize or produce hazardous substances.

At another level, new incentive schemes might be designed and introduced. These might include, e.g., direct monetary payments to local governments and citizens, commitments by firms to give employment priority to local residents, or agreement by industry to construct desirable facilities (e.g., schools; parks) as part of their 'contract' with local communities.

My point is not that these particular incentives should be adopted; rather that his whole area needs to be examined to assess opportunities and potential problems.

5. *Risk reduction and avoidance.* This is, of course, the ultimate solution to the problem of risk. Reduction or elimination of the source of potential risk is a goal on which all parties agree. It is therefore encouraging that new coalitions of government agencies, industrial associations and environmental groups are emerging to seek solutions to, for example, the generation of industrial and municipal wastes. This appears to us in the OECD to be a high-payoff area, and one we intend to emphasize in our environmental work programme for 1989 amd beyond. Our near-term target is to try to accelerate the pace of efforts by the international community to develop new strategies and technologies for the minimization or recycling of potentially hazardous wastes.

I began by referring to EPA Administrator Lee Thomas, and I will conclude in a similar fashion. Speaking to the National Conference on Risk Communication, in Washington D.C., in 1986, Mr. Thomas observed that, 'The risk communicator has few friends'. That is undoubtedly still true, but - in my view - that messenger of bad news today has a growing number of sympathisers, allies and not altogether unfriendly listeners. At least a more constructive and informed dialogue is now possible.

Program of the Workshop

International Workshop on

Risk Communication

17/20 October 1988 · Jülich · Fed. Rep. of Germany

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Programme and Registration

Scope of the Workshop

The purpose of this workshop is to review and to draw conclusions about the state of knowledge and practice in five areas related to risk communication:

* media reporting of risk information
* trust and credibility of risk communicators
* emergency preparedness and disaster management
* the right to know and community dynamics
* evaluation of risk communication strategies.

These issues will be examined in relation to various areas, e. g., toxic chemicals, radiation, food additives, and biotechnological products. Additionally, the workshop will identify research needs and policy recommendations.

About 40 invited experts from the United States of America and from Europe will participate.

Thursday will be open to invited representatives from governmental institutions, administration, industry, research organizations, and the media.

Programme

Sunday, 16 October 1988

18:00 **Get-Together and Registration** at the Restaurant "Elisenbrunnen" in the City Centre of Aachen (until 20:00)

Monday, 17 October 1988

Lecture Room 139 in Building 14.6

9:00 **Registration** (continued)

9:15 **Opening**
Gotthard Stein, KFA Jülich
Helmut Jungermann, Technical University of Berlin

9:30 *Introductory Lecture*
Themes and tasks of risk communication
Roger E. Kasperson and Pieter J. Stallen*
Clark University, Worcester, Mass., USA
*Institute for Environment and System Analysis, Amsterdam, The Netherlands

10:30 C O F F E E

11:00 *State of the art paper I*
Media reporting of risk information
Judith Lichtenberg, University of Maryland, College Park, MA, USA
Malcolm Peltu, London, UK

12:00 **Discussion**

12:30 L U N C H

14:00 *State of the art paper II*
Trust and credibility of risk communicators
Ortwin Renn, Clark University, Worcester, Mass., USA

14:30 **Discussion**

15:00 *State of the art paper III*
Emergency preparedness and disaster management
Vincent T. Covello, National Science Foundation, Washington D.C., USA

15:30 **Discussion**

16:00 C O F F E E

16:30 *State of the art paper IV*
The right to know and community dynamics
Michael S. Baram, Boston University, Boston, Mass., USA
Timothy O'Riordan, University of East Anglia, Norwich, UK

17:30 **Discussion**

18:00 *Plenary session*
Preparation for Working Groups

19:00 **Reception** by the Board of Directors of KFA Jülich

20:30 Bus for Aachen

KFA **KERNFORSCHUNGSANLAGE JÜLICH GmbH**

Tuesday, 18 October 1988

Seminar rooms in building 14.6

9:15 *Working groups*
Research assessment and recommendations

12:45 L U N C H

14:15 *Working groups* (continued)
Application assessment and recommendations

16:45 **Plenary session**

18:00 Bus for Aachen

Wednesday, 19. October 1988

Seminar rooms in building 14.6

9:15 *Working groups* (to be continued)
Final conclusions and general recommendations

12:45 L U N C H

14:15 **Plenary session**

15:30 **Excursion to Cologne**
Cathedral, Museum Ludwig, Local Pub

22:30 Return to Aachen by train

Thursday, 20 October 1988

Auditorium of KFA Jülich

10.00 **Risk communication - tasks for the future**
Chair: Helmut Jungermann,
Technical University, Berlin, FRG

Results of the working groups

*** Media reporting of risk information**
Peter M. Sandman and Hans P. Peters*
Rutgers University, New Brunswick, NJ, USA;
*KFA Jülich, FRG

*** Trust and credibility of risk communicators**
George Cvetkovich and Peter M. Wiedemann*
Western Washington University, Bellingham, Washington, USA; *KFA Jülich, FRG

11:15 C O F F E E

*** Emergency and disaster management**
John H. Sorenson and Wolf Dombrowsky*
Oak Ridge National Laboratory, Oak Ridge, TN, USA;
*University, Kiel, FRG

*** The right to know and community dynamics**
M. Granger Morgan and Charles Vlek*
Carnegie-Mellon University, Pittsburgh, Penn., USA; *University, Groningen, The Netherlands

*** Evaluation of risk communication strategies**
Roger E. Kasperson and Bernd Rohrmann*
Clark University, Worcester, Mass., USA;
*Technical University, Darmstadt, FRG

12:45 L U N C H

14:30 *Special Lecture*
Risk and danger: Social consequences of a distinction
Prof.Dr. Niklas Luhmann, University of Bielefeld, FRG

15:00 *Panel*
Global environmental change and the public

Prof. Dr. Wolf Häfele; KFA Jülich, FRG

Prof. Dr. Roger E. Kasperson;
Clark University, Worcester, Mass., USA

Dr. Bill L. Long; OECD, Paris, France

Dr. Steve Rayner; Oak Ridge National Laboratory, Oak Ridge, TN, USA

Prof. Dr. Ernst Ulrich von Weizsäcker;
Institute for European Environmental Policy, Bonn, FRG

16:30 **General discussion**

18:00 **Closing** of the Workshop

18:30 Bus for Aachen

20:00 A final beer in an Aachen pub ....

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RISK COMMUNICATION

The Research Programme of the Working Group "Man and Technology", Programme Group "Technology and Society" at the Nuclear Research Centre Jülich

The research group "Man and Technology" has recently concentrated its activities in the field of technology assessment on risk communication. The new research programme focuses on the conditions and difficulties of communication about technological risks as well as on approaches for improving risk communication.

The research group will concentrate on technology fields which have vital importance to society. The focus will be on risk problems found in the following domains: energy technology, in particular nuclear power, information and communication technology, biotechnology and genetic engineering, global climate change, medical and chemical technology. Important tasks are:

- identification of crucial aspects of perceived risks,
- presentation and explanation of risk-information,
- influencing risk-related behavior,
- development of strategies for informing in case of emergencies/disasters,
- improvement of participation concepts and joint conflict resolution.

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