SOCIAL AMPLIFICATION OF RISK: THE MEDIA AND PUBLIC RESPONSE

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ABSTRACT

The risks associated with radioactive and other hazardous waste disposal may be expected to interact with societal processes to enlarge or attenuate the consequences of risks and risk events. This article summarizes a conceptual framework that depicts the social amplification of risk. Using a data base of 128 hazard events that have occurred largely over the past ten years, the authors examine the role of physical consequences, media coverage, and public perceptions of risk in generating social and economic impacts. The analysis concludes that social amplification processes substantially shape the nature and magnitude of those impacts but also that such social amplification appears to be systematically related to characteristics of the risks and risk events.

Two years ago at this annual conferance on waste management we proposed for the first time a new conceptual approach to understanding the public response to risk, which we termed the "social amplification of risk." Such an improved understanding has obvious implications for the management of waste problems where public response plays such a critical role in social and economic impacts and in management decisions. Since that meeting we have published a major article in *Risk Analysis* (1) and undertaken a research program, supported by the State of Nevada and the National Science Foundation, designed to test our initial conceptions and to develop and elaborate the conceptual framework. This paper, after a brief description on the social amplification of risk conceptualization, presents a number of primary results of the first round of empirical work.

THE SOCIAL AMPLIFICATION OF RISK FRAMEWORK

Social amplification of risk, in our usage, denotes the phenomenon by which information processes, institutional structures, social-group behavior, and individual responses shape the social experience of risk, thereby contributing to or reducing risk consequences. The interaction between risk events and social processes makes clear that, as used in this framework, risk has meaning only to the extent that it treats how people think about the world and its relationships. Thus there is no such thing as "true" (absolute) and "distorted" (socially determined) risk. Rather the information system and characteristics of public response that compose social amplification are the two key stages in determining the nature and magnitude of risk.

Like a stereo receiver, the information system may amplify risk events in two ways:

- by intensifying or weakening signals that are part of the information that individuals and social groups receive about the risks
- by filtering the multitude of signals with respect to the attributes of the risk and their importance.

Signals arise through direct personal experience with a risk object or through the receipt of information about the risk object. These signals are processed by social, as well as individual, amplification "stations," which include the following:

- The scientist who conducts and communicates the technical assessment of risk
- The risk-management institution
- The news media
- Activist social organizations
- Opinion leaders within social groups
- Personal networks of peer and reference groups
- Public agencies.

Social amplification stations generate and transmit information via communications channels (media, letters, telephones, direct conversations). In addition, each recipient group or individual also engages in amplification and attenuation processes, thereby acting as an amplification station for risk-related information. In some cases, of course, particular groups or individuals proactively seek out risks or risk events as part of their agenda of concern. We hypothesize that the key amplification steps consist of the following:

- Filtering of signals (e.g., only a fraction of all incoming information is actually processed);
- Decoding of the signal;
- Processing of risk information (e.g., the use of cognitive heuristics for drawing inferences);
- Attaching social values to the information in order to draw implications for management and policy;
- Interacting with one's cultural and peer groups to interpret and validate signals;
- Formulating behavioral intentions to tolerate the risk or to take actions against the risk or risk manager;
- Engaging in group or individual actions to accept, ignore, tolerate, or change the risk.

We also envision major societal mechanisms that shape group and individual responses to the risks and risk events.

Prominent among these are:

Heuristics and values. Individuals cannot deal with the full complexity of risk and the multitude of risks involved in daily life. Thus people use simplifying mechanisms to evaluate risk and to shape responses. These processes, while permitting individuals to cope with a risky world, may sometimes imtroduce shortcomings in the assessment. More importantly, the application of individual and group values will do much to determine which risks people consider important or minor, how these risks connect to other social considerations, and what actions, if any, should be taken.

Social group relationships. Risk issues enter into the political agenda of social and political groups. The nature of these groups will influence member responses and the social orientations brought to risk issues. Social alignments tend to become anchors for interpretations of risk management and tend to resist new or conflicting information.

Signal values. The seriousness that the public attaches to a risk event is determined, in part, by what that event signals or portends. The informativeness or "signal value" of an event appears to be related systematically to the characteristics of the event and what it suggests about the risk and the adequacy of the risk-management process. High-signal events suggest that a new risk has appeared, that the risk is different and more serious than previously, or that the management process is not understood.

Stigmatization. Stigma refers to the negative imagery associated with undesirable social groups, places, or individuals. Love Canal, the Valley of the Thousand Drums, Times Beach, and the Nevada Test Site evoke vivid images of waste and pollution. Since the typical response to stigmatized persons or environments is avoidance, risk-induced stigma, as Paul Slovic points out in his paper for this conference, may have significant social impacts and policy or decision-making consequences.

Trust and credibility. Finally, the sources of the risk event and the ways in which managers respond to the event may either build or erode trust in the institutions responsible for risk management. If the public perceives that the risk managers failed to diagnose the risk or to respond in appropriate ways, confidence may be diminished and concern over the risk may grow accordingly. The presence of attributed blame seems to enlarge concern over the event. The degree of candor and openness also appear quite important, with the capacity either to enlarge or reduce the impacts of the event.

Social amplifications of risk can affect behavioral responses, thereby increasing or reducing secondary impacts. Secondary impacts can include such effects as the following:

- Enduring mental perceptions, images, and attitudes (e.g., antitechnology attitudes, alienation from the physical environment, social apathy;
- Stigmatization of an environment, place, or risk manager;
- Local impacts on business sales, residential property values, and economic activity;
- Political and social pressure (e.g., political demands, changes in political climate and culture);
- Changes in the physical nature of the risk (e.g., feedback mechanisms that enlarge or lower the risk);
- Changes in training, education, or required qualification of perating and emergency-response personnel;
- Social disorder (e.g., protesting, rioting, sabotage, terrorism);
- Changes in risk monitoring and regulation;
- Increased or reduced liability and insurance costs;
- Increased or reduced levels of trust in government and social institutions;
- Repercussions on other technologies (e.g., lower levels of public acceptance).

Secondary impacts are, in turn, perceived by social groups and individuals so that another stage of amplification may occur to produce third-order impacts. The impacts thereby may spread, or "ripple," to other parties, distant locations, or future generations. Each order of impact will not only disseminate social and political impacts but may also trigger (in risk amplification) or hinder (in risk attenuation) positive changes for risk reduction. The concept of social amplification of risk is hence dynamic, taking into account the learning and social interactions resulting from experience with risk.

The analogy of dropping a stone into a pond provides a metaphor of the spread of the higher-order impacts that can be associated with the social amplificaiton of risk. The ripples spread outward, first encompassing the directly affected victims or the first group to be notified, then touching the next higher institutional leval (a company or an agency), and, in more extreme cases, reaching other parts of the industry or other social arenas with similar problems. This rippling of impacts is an important element of risk amplification since it suggests that amplification can introduce substantial temporal and geographical extension of impacts.

TESTING THE SOCIAL AMPLIFICATION CONCEPT: THE DATA BASE ON 128 HAZARD EVENTS

To test a number of the components and relationships specified in our framework of social amplification of risk, we assembled a data base of some 128 hazard events, largely occurring over the past ten years and largely concentrated in North America. The events were accidents, releases, reports on exposures or the *discovery of new consequences*--manifestations, in short, of general hazards that could be located in time and place. The selection of hazard events drew upon the taxonomy of technological hazards developed at Clark University (2), augmented by a selection of natural hazards and a sub-sample of radiological events

For each of these hazard events, data were collected about five major variables:

- the physical consequences of the event (e.g., mortality, illness, exposure, environmental damage)
- the amount and duration of print media coverage
- individual lay perceptions of the hazard event
- social group activity
- the magnitude and types of social and economic impacts of the event.

Identification of the events themselves proceeded primarily through a search of the New York Times Index. For each event, information was gathered about the event from abstracts appearing in the Index and about the hazard more generally from the scientific literature and from technical risk assessments. Scored the physical consequences on a scale of 1-9 by A panel of three risk analysis experts at Clark University's Center for Technology, Environment, and Development (CENTED) for each of four dimensions: magnitude of human exposure, severity of human consequences, magnitude of nonhuman consequences, and extent of nonhuman consequences. Media coverage was ascertained through a search of the NEXIS data base of news reporting and a rating of the coverage rated on a 1-10 point scale as well as a recording of the duration and half-life of coverage. Public perceptions of risk events were assessed on some 16 characteristics of the event by a sample of 120 subjects, who responded to a newspaper advertisement at the University of Oregon, on a 1-7 point scale devised by Decision Research investigators. Social group attention and socioeconomic impacts of the events were judged in a group delphi process by a panel of experts composed of journalists, teachers, lawyers, business people, and others. Details of the methodology used in creating this rich and variegated data base are available in forthcoming studies by the authors (3).

Each of these data pools were subjected to statistical analysis. In the first step we reduced the number of variables within each pool by applying factor analysis. Factor analysis is a technique to reveal the underlying common factor(s) of several variables. The common factor can then be used as a single substitute for all the variables that are major contributors to this factor. In a second step we used regression analysis to investigate the structural relationships among the different variables or factors within the social amplification model.

STUDY RESULTS

The initial factor analysis reduced the number of variables in each variable class. The physical consequences could be expressed by four dimensions: magnitude of exposure to health-threatening substances, severity of health consequences, magnitude of negative environmental consequences, and the geographical extent of environmental degradation. The media variables were integrated into one index by multiplying the number of articles by the duration of press coverage (in days). The risk perception variables were reduced to four factors: dread (perceived severity of hazardouis consequences), rareness (perception of probability), personal blame (consequences are basically caused by the victims), and institutional blame (institution responsible for the occurrence of the event). Table I shows the factor loadings for each of these four factors.

TABLE I
SORTED ROTATED FACTOR LOADINGS (PATTERN) FOR THE RISK PERCEPTION VARIABLES

VARIABLE	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
warnsign	0.911	0.259	0	0
industry	0.905	0	0	0
oldnew	0.903	0	0	0
govt	0.858	0	0	0
nature	-0.833	0	-0.833	0
agency	0.821	0.283	0	0.282
foresee	0.817	-0.345	0	-0.267
outrage	0.706	0.473	0.401	0
involunt	0	0.872	0	0
victim	0	-0.872	0	0
dread	0.358	0.705	0.375	0
serious	0.494	0.673	0.360	0
criminal	0	0	0.845	0
person	0	-0.401	0.514	0
rare	0	0	0	-0.885
risk	0.573	0.337	0	-0.685
	INSTITUTIONAL BLAME	DREAD	PERSONAL BLAME	RARE

Socioeconomic impacts and sociopolitical attention were treated as one variable because they were highly correlated (coefficient = .93). A correlation coefficient denotes the strength of a relationship between two variables. The closer the coefficient is to the value of 1, the more the two variables are related to each other. A correlation higher than .9 is an indication of a strong congruence between two variables. Since the same group conducted the assessments of the socioeconomic impacts and sociopolitical attention, the close relationship may be attributable to a measurement artifact. Consequently, we decided to use socioeconomic impacts as our dependent variable and are currently redoing the analysis of social group mobilization.

What kinds of relations did we find among our key variables? The highest simple correlation is between media coverage and socioeconomic impact. Since a correlation does not reveal the causal direction of a link, the result could mean that the social-amplification effect is caused by the amount of media coverage or that the amplification effect triggers the amount of media coverage about the initial event. Both explanations are plausible and may interact. But it is certainly instructive that social amplification is a better predictor, at least in this analysis, of the judged overall

socioeconomic impacts of risk events than of the magnitude and extent of their direct physical impacts (human harm, exposure, and environmental impacts).

Surprisingly high also is the relationship between physical consequences and socioeconomic impacts. But the most interesting result here is the weak link between severity of health consequences and any variable other than socioeconomic impact. By contrast, a strong link exists between exposure (to a health hazard) and the magnitude of impacts, media coverage, and public perceptions. Apparently the amount of damage and the exposure to a hazard may act as cues for the media and the public to judge the seriousness of an event and (perhaps) its impact on human health.

The results indicate a typical pattern of social amplification: the social amplification process--media coverage and public perceptions--and the overall socioeconomic consequences seem to be a function of exposure to the risk rather than to the actual magnitude of health effects. This important finding needs further testing, but its support by more studies may well change our long-held concepts of risk perception and media coverage. It may well turn out that the gap between expert judgments about the seriousness of risk and laypersons perceptions extensively documented in the risk-perception literature (4,5) is only partially related to qualitative risk factors, and may be predominantly due to a different strategy of determining the magnitude of a risk event. The actual number of people killed or injured may not be the cue for social particpants to judge the magnitude of an event, but rather the number of people or the area exposed to a specific hazard may be the key.

The often-expressed hypothesis that risk perception is just a mirror of media coverage has to be revised given the rather low correlation between dread and media coverage (.34). Both variables, media coverage and the perception of dread, are linked to physical impacts. Most risk perception variables are, in fact, related to physical impacts. This is particularly true for dread. It reflects partially the exposure to a hazardous event and acts as an additional enforcement of this intervening variable in influencing socioeconomic impacts (.44). Also personal blame is associated with risk amplification, but this relationship is basically the product of a strong connection between dread and personal blame. Media coverage, the perception of dread, and the amount and exposure to physical consequences are the decisive variables for explaining the magnitude of the secondary socioeconomic impacts covered in our analysis.

If we group all the variables in each variable class into one unit and study the multiple correlations between the different variable classes (TABLE II), the interrelatedness of the four classes becomes even more distinct. The highest correlation is between the media and the socioeconomic impacts (.62), followed by the relationship between physical consequences and socioeconomic impacts (.58) and physical consequences and media coverage (.51). All risk perception variables account for a correlation of .48 with socioeconomic impacts. This is due almost entirely to the single strong relationship between dread and impacts. The relatively low correlation of .42 for the link between consequences and risk perception is a product of the canceling effect of positive and negative correlations (with dread positive, and rareness negative). As stated earlier, the relationship between risk perception and media coverage is relatively low, though significant (.43).

It is fairly obvious that the physical consequences have to be at the beginning of a causal chain linking hazardous events to socioeconomic impacts. But Table II also includes multiple correlation coefficients for an analysis focussing on the media as the primary variable in the regression and another analysis focussing on the perceptions as the primary variables. This change of order does not alter the partial influence of each variable pool. If media coverage is selected first, the physical consequences are selected next and the perception variables last. If perceptions are selected as the first pool in the analysis, the media coverage is second, and the physical consequences third. The basic order of influence does not change if physical consequences are selected first and perception variables are forced into the model as second predictor. The amount of declared variance increases slightly (because the media effect is not included) but is still considerably lower than the additional amount of declared variance due to the effect of the media coverage (independent of the physical consequences and the perception variables). Thus it is clear that physical consequences and media coverage are the primary causes of event impacts, whereas perception reflects both of these variable classes but has only a relatively minor additional influence on the impacts of events.

CONCLUSIONS

The results of this research are still preliminary and need further confirmation. But, if confirmed, they have far-reaching implications for the management of hazardous waste as well as other hazards. Specifically:

(1) attempts to assess the social and economic impacts of a hazardous facility or a particular hazard event without explicit consideration of social amplification processes are almost certain to underestimate substantially the magnitude of associated socioeconomic impacts

(2) public perception and media coverage are not as dissociated from the properties of risk suggested in technical assessments as has frequently been claimed but rather appear to be related systematically to the magnitude (but not the severity) of potential human exposure (numbers of persons at risk) and scope of potential environmental effects.

(3) public perceptions of risk reflect partially the physical consequences of risk and media coverage, and add only in a minor way to the variance in the judged overall socioeconomic impacts of hazard events. Specifically, the social amplification of risk is less determined by (biased) perceptions of risk probabilities than by a combination of media coverage that is roughly

TABLE II
Multiple Correlations Between Explanatory Variables and Socioeconomic Impacts for Different Stages of the Social Amplification Process.

STAGE OF AMPLICATION	MULTIPLE R	MULTIPLE R SQUARED	CHANGE IN R SQUARED (%)
Consequences	0.5850	0.3422	0.3422 (0%)
Consequences + Media	0.7081	0.5014	0.1592 (32%)
Consequences + Media + Risk Perception	0.7634	0.5823	0.0809 (14%)
Media	0.6202	0.3846	0.3846 (0%)
Media + Consequences	0.7081	0.5014	0.1168 (24%)
Media + Consequences + Risk Perception	0.7634	0.5823	0.0809 (14%)
Risk Perception	0.4826	0.2329	0.2329 (0%)
Risk Perception + Media	0.6800	0.4624	0.2295 (50%)
Risk Perception + Media + Consequences	0.7634	0.5823	0.1199 (20%)

proportional to actual physical consequences and some rather sensible qualitative risk factors

(4) societal response to risk may, therefore, be both more influential in shaping identifable social and economic impacts and more "rational" in its inner workings than has commonly been assumed. If correct, this points to a need for a reappraisal of our views on public perception of risk and on adequacy of existing methods of environmental impact analysis.

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REFERENCES

1. R.E. Kasperson, O. Renn, P. Slovic, H. Brown, J. Emel, R. Goble, J.X. Kasperson, and S. Ratick, "The Social Amplification of Risk: A Conceptual Framework," RISK ANALYSIS, 8, 177-187 (1988).
2. C. Hohenemser, R.W. Kates, and P. Slovic, "The Nature of Technological Hazard," SCIENCE, 220, 378-384 (1983).
3. O. Renn, R.E. Kasperson, P. Slovic, and S. Emani, "The Process of Social Amplification of Risk: A Comparative Analysis is of 128 Hazard Events" (unpublished manuscript).
4. P. Slovic, "Perception of Risk," SCIENCE, 236, 280-285 (1987).
5. V.T. Covello, "The Perception of Technological Risks: A Literature Review," TECH. FORE, AND SOC. CHANGE, 23, 285-297 (1983).