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THE POLITICAL SIDE OF RISK: A NEW APPROACH

by

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THE POLITICAL SIDE OF RISK: A NEW APPROACH

(Preliminary Indicators of the Social Acceptability of Risk)

by

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ABSTRACT

The resolution of many of the Nation's most serious problems today is hampered by our apparent inability to systematically deal with the socio-political and political dimensions of the societal acceptance of risks in areas of technical development, decision-making, and policy formulation. Nowhere is this more apparent than in the energy field.

The nature of public hazards has changed drastically during the past half century or so, driving public considerations of risk into the political realm. This has given many of the socio-political parameters underlying individual, group, and institutional perception and acceptance of risk an importance not typically recognized in technical approaches to risk assessment. As a result, there is now a large gap between technically based views of risk and societal views of risk which, in our opinion, is largely responsible for impeding the resolution of the national problems alluded to above.

This paper proposes a general approach toward closing this gap, by using indicators from the political system to "measure" public perceptions and acceptance of risk, as a continuing function of time, to provide the technical community and policy- and decision-makers a basis from which to more effectively meet societal environmental, safety, and health goals.

The highly serious consequences now arising from this technical/societal risk-perception-and-acceptance gap, and the political dimensions of it, lead us to believe that it is vital that political scientists turn their attention to the role of risk perception in public decision-making and provide a means of bridging a gap, which affords the potential for drastically altering the nature of our society.

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ILLUSTRATIONS

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*The analysis and conclusions presented in this paper represent extensions of findings contained in a larger study undertaken under the auspices of Sandia National Laboratories for the Department of Energy (see Reference 6). Mr. Perry Gore of Tech. Reps., Inc., Albuquerque, New Mexico, is thanked for his efforts in helping prepare this paper.

THE POLITICAL SIDE OF RISK: A NEW APPROACH

Overview and the Need for Indicators

Environmental, safety, and health (ES&H) issues are largely responsible for the nation's rejection of, or ambivalence toward, many high technologies, new chemicals, resource development efforts, and so forth. Public acceptance of risks perceived to be associated with these activities is a critical factor contributing to societal decisions about the introduction and adoption or realization of competitive technologies, new products, and development options. If the public's perception of the associated risk leads to the judgment that the ES&H risks are unacceptable, whether or not the public understands or believes the risk statistics and/or analyses, then the technology, option, or product and its benefits may be lost, even if technologically feasible and cost-effective. One apparent reason for this situation is that a hiatus exists between the technical community and the public: The technical community has tended to concentrate mainly on the technical questions while failing to deal meaningfully with the political aspects of the public acceptance of risk.

The crux of the social acceptance of risk issue involves a societal value system for risk. Chauncy Starr and others of the Electric Power Research Institute in Palo Alto, California, call societal risk the "major unresolved issue."[1] This paper will attempt to explore the issue and propose a new conceptual way of bridging the gap between the technical community and the public. In part, it will propose that (1) the technical community must undertake an analysis of the public <u>acceptability</u>* of ES&H risks associated with a technical activity as well as study the technical feasibility, cost-effectiveness, and quantitative risk of a new technology, concept, chemical, etc. and (2) the identification of a set of generic indicators of public acceptability of risk, based on political expression of societal preferences, can be a first step in the direction of overcoming the gap between societal perceptions of risk and the present technical estimates of risk.

The seriousness of this gap is illustrated by the fact that, at times, a great deal of time, effort, and money must be expended to understand and control risk, only to find that society deems it unacceptable. In this framework, a number of specific "catch-22" problems arise. First, even when vast efforts are involved in risk assessment (as they were in the Reactor Safety Study, for example), public acceptance of the risk is not assured. Second, the controls needed to

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*In this regard, it is significant that recent Department of Energy policy (Order 5481.1, "Safety Analysis and Review Program") specifically requires that all operations be conducted so that "risk is acceptable."

achieve acceptable levels of risk may be prohibitively costly or may not even exist. Third, cost-effectiveness may be lost as a price of public acceptance, coupling technical objectives inextricably with ES&H perceptions. Fourth, no clear-cut way exists to determine a priori whether decisions might be significantly impacted by the public acceptance of risk.

A corollary of this fourth problem is that the criteria for the achievement of ES&H objectives cannot be easily predicted, and the achievement of the "coupled" technical objective of cost-effectivity may thus be one of constant uncertainty.

Thus, the gap between technical and public views of risk can present difficulties that inhibit policy or decision-making processes designed to resolve some of the Nation's most pressing problems. To begin to appreciate how this gap might be bridged requires a fuller understanding of the social nature of risk.

As a point of departure, we define a "hazard" as a thing which offers the potential for injury to, or illness in, humans or damage to the environment in the broad legal sense (including concern for social systems and institutions, certain scientific resources, etc., as well as land, air, water, flora, and fauna). The "consequences" that may arise from a hazard represent the scope and severity of the possible types of injury, illness, and damage that may be done by the hazard. Then, "risk" is typically defined as some compound measure of the consequences of a hazard and their likelihood of occurrence.

Such measures of risk come in many forms. Some examples might include:

- Man-days lost/100 man-years worked
- Induced cancers/U.S. population
- Average decreased life span (years)/local exposed population
- Man-rems/year
- Average number of deaths/million vehicle miles travelled
- Average number of deaths/$\$10^6$ spent on construction

It is important to recognize, however, that there are four primary means for interpreting risk: (1) real risk, determined by future objective outcomes, (2) statistical risk, as determined by available data and as typically measured by actuarial studies, (3) modeled risk, as projected from systems models, historical studies, or animal models, and (4) perceived risk, as seen by individuals who are typically conditioned by social values and personal experience.[1]

The determinant of the acceptability of risk on this list is perceived risk, whether by an individual, group, or institution. Thus, when new chemicals, new operations, or new technologies are proposed, the individuals, groups, or institutions which perceive themselves "at risk" exert pressure in the political arena to protect themselves from their perceived risk. They are, in essence, seeking an "acceptable" level of risk. This principle, that acceptability is directly dependent upon perception, is illustrated in Figure 1.

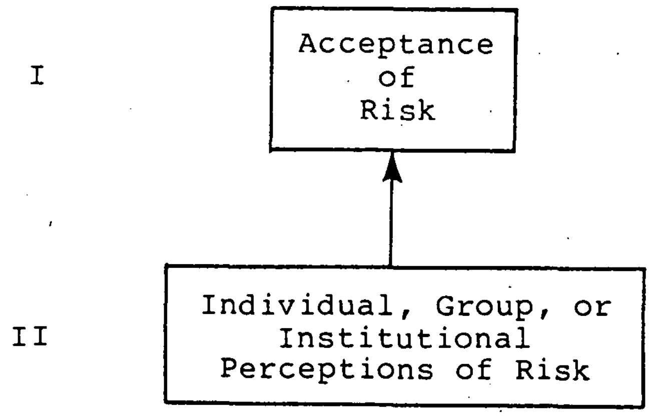

Figure 1. Perception of risk influences its acceptability.

The potential importance of this observation for today's world is illustrated by Trauth and Hollister,[2] who observe that, during the past century, society has moved gradually from a concern with hazards that

- Were simple and easily recognized,
- Generally impacted only individuals or small groups of people, and in fairly immediate and recognizable ways,
- Were controlled to a large extent by the persons who might be harmed, and
- Had associated benefits that were generally recognized and attained at the individual level,

to a concern with hazards that

- Are often very complex and hard to recognize and/or understand,
- May impact many thousands of persons over long time spans,
- Are often controlled by persons other than those who might be harmed, and
- Have benefits whose value to persons "at risk" is only indirect and not always easily measured.

Thus, in times past, "acceptance" of risk was largely an individual function, while today, for "high technology" and other hazards which may impact large populations, it is, of necessity, a group or institutional function. This represents a very fundamental change in the processes whereby society deals with risk. The changing nature of risk has contributed comparatively to a greater reliance on governmental intervention, regulations, and political solutions for our social (risk) problems. Public participation and consensus building activities become necessary. The proliferation in recent years of public participation, mandated by numerous Acts at all levels of government, underscores this process.

While the political nature of the resolution of conflict over risk-acceptance issues is recognized and dealt with in some detail by our system, the socio-political nature of the basis or modes of thought by which individuals, groups, and institutions form a perception of risk is less well-recognized and understood almost not at all. This complex basis or mode is often treated as if it contained only inputs from statistical or modeled risk studies. In short, an entire dimension of risk--the socio-political character of perception--is often ignored in technical applications of risk analysis. This oversight is illustrated in Figure 2.

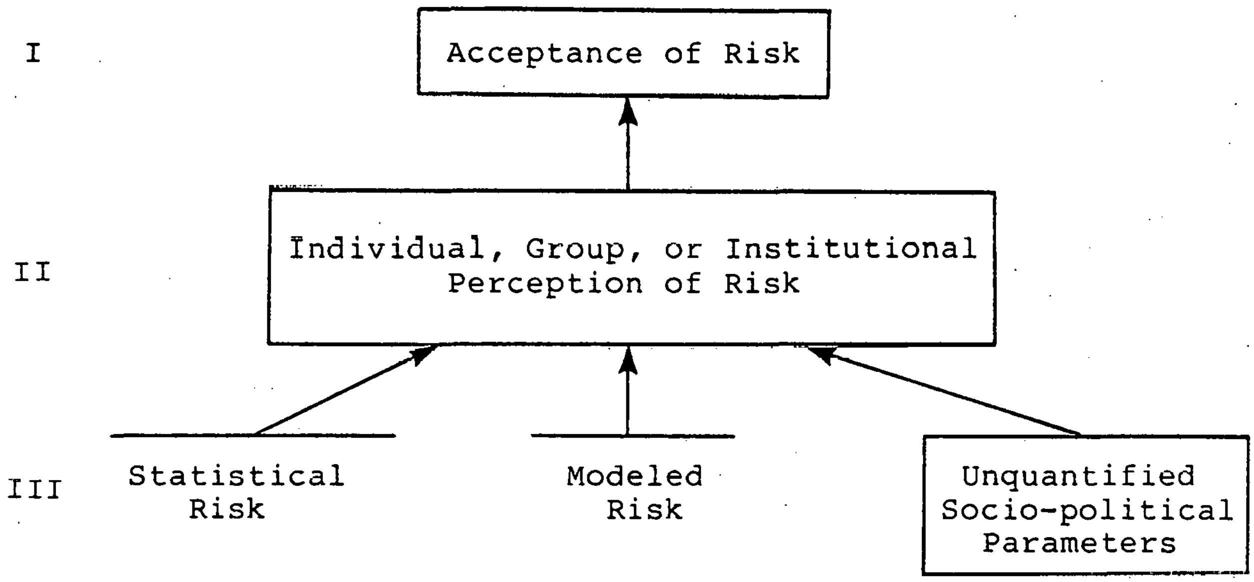

Figure 2. Illustration of the broad nature of the base from which perceptions of risk are derived.

There are good reasons for this oversight of a very significant dimension of risk acceptance in the operational systems which attempt to resolve risk-acceptance issues: The main one being that in times past, primarily individual perceived risk was of importance, and it was based on first-hand individual experience and was thus not unlike a qualitative version of statistical risk.

However, in today's framework of social decision-making about risk acceptance, these socio-political factors are critical for any effective treatment of the public acceptance of risks. In particular, they affect the view of statistical risk and modeled risk that will be held or expressed by individuals, groups, and institutions. Hence, the existence of socio-political factors has a direct bearing on the fact that public perception of risk is not solely based on statistical or modeled risk, and "explains" why the public perception of risk can change drastically in short periods of time.

A recent psychological study underlines this first point. Some of the key findings of this study were

- Cognitive limitations, coupled with the anxieties generated by facing life as a gamble, cause uncertainty to be denied, risks to be distorted, and statements of fact to be believed with unwarranted confidence.
- Perceived risk is influenced (and sometimes biased) by the imaginability and memorability of the hazard. People may, therefore, not have valid perceptions even for familiar risks.
- While expert risk perceptions corresponded closely with statistical frequencies of death, lay perceptions were based in part upon frequencies of death, but it appears that, for lay people, the concept of risk includes qualitative aspects such as dread and the likelihood of a mishap being fatal. Lay people's risk perceptions are also affected by catastrophic potential.
- Disagreements about risk do not evaporate in the face of "evidence." Definitive evidence, particularly about rare hazards, is difficult to obtain. Weaker information is likely to be interpreted in a way that reinforces existing beliefs.[3]

Additionally, much thought has been directed toward the nature of change in the "acceptable level" of risk. William Lowrance,[4] the author of Of Acceptable Risk, has observed that a change in public acceptability of the level of risk stems from a change in the personal or societal perception of risk or in the management of risk. The change in acceptance may reflect a rational or an irrational explanation (the nature of "perception" of "real" risks), a realistic grasp of the objective consequences of the risk, the assessments of specialists based on empirical research or model projections. Another property that Lowrance describes, which is peculiar to ES&H public acceptance problems, is that they often quickly assume crisis proportions. There may be little warning, and decision-makers may be caught by surprise. Against such a possibility, priorities can become difficult to establish. These rapid changes often occur because perceptions of the hazard or risk alter; the perceived "horrors" of the immediate risk stimulate such fear that they may distract attention from more important issues, which can even involve greater "real" risk; or the public may not know how to evaluate new information and, consequently, overreacts.

Knowledge of the socio-political parameters influencing individual, group, or institutional perception of risk is relatively scant and understanding of the nature of this influence is lower still. Our experience with automobiles suggests, for example, that exertion of personal control over hazards, or the conditions under which they are encountered, leads one to perceive risk as being lower than statistics would suggest that it is. How or why this is so appears to be unknown.

In the framework of Figure 2, it can be asserted that much of the difficulty experienced today in the search for a means of bridging the gap between technical estimates of risks and perception of risk is due to a lack of appreciation on the part of those desiring acceptance of risk on a technical basis of the existence of the socio-political factors alluded to in this figure. There appears to be a tendency to believe that technical estimates of risk form the only rational base from which to perceive risk. While the societal and political character of risk acceptance is recognized, in practice little recognition is given to the socio-political influence on risk perception. A striking example is that while the expected number of deaths in automobile accidents over a two-year period exceeds 100,000 (and society generally finds this acceptable), there is a strong indication that society would find unacceptable the expected loss of a community of 100,000 (during even a very long period of time). We attribute this, in part, to a difference in perception of the risk to society, a concept little dealt with. It is in this, largely unrecognized, area that our approach to handling the fundamental gap between technical (statistical or modeled) risk estimates and the public acceptance of risk is inadequate.

These thoughts are not especially new.[1 3] Indeed, Starr, et al.,[1] in their pioneering work state

> No general method of dealing with differences between perception and technical assessment exists in the societal decision-making process. . . . The difficult task of separating faulty perceptions from societal values has not been resolved.
>
> In the past, and to a lesser extent at present, the scientific community has tended to view risk-taking decisions based on factors other than the expected value of the risk as irrational. Because society responds to more factors than just expected value, a conflict has arisen.

Unfortunately, this situation has led some to essentially want to construct a societal value system for risk based on technical assessment and dictate that perceived risk shall be that which is calculated. This autocratic view is evidenced by proposals to base public protection regulations on calculated risk, a method which can lead in a time of crisis to a tendency to set up Energy Mobilization Boards to circumvent "unnecessary" regulation or concerns that are "perceived" to be "poorly" grounded, unjustifiable, and that interfere with "getting a job done." This seems to us to auger ill for the continuation of our traditional approach to societal resolution of issues--simply because the problem areas being impacted are of such importance to society today. Thus, we are inclined to view the "resolution" of the ES&H perception-versus-assessment issues as one of the most crucial to society--and in this framework propose a somewhat more conceptually realistic and immediate approach to its "resolution." It does not resolve the social-political problem basic to risk acceptance but allows for a more practical knowledge of society's acceptance of risk based on political behavior.

Specifically, our interest is in developing a gross set of leading generic indicators to gauge societal feeling about risk far in advance of their actual realization. At the present time in this context, society may be seen as divided into three components (differing slightly from the Otway and Cohen[5] division), as shown in Figure 3.

The "extremes" shown in Figure 3 (technology developers and the "public") often have very different perceptions of the risks associated with new technologies, chemicals, etc. The policy-/decision-maker is clearly in the middle and often possesses only rudimentary, conflicting, and fragmentary information, especially about the societal position. In order to proceed with the resolution of some of society's most pressing problems, the policy-/decision-makers must have more realistic information about the likely future perceptions of risk and must have technological proposals which take such considerations into account.

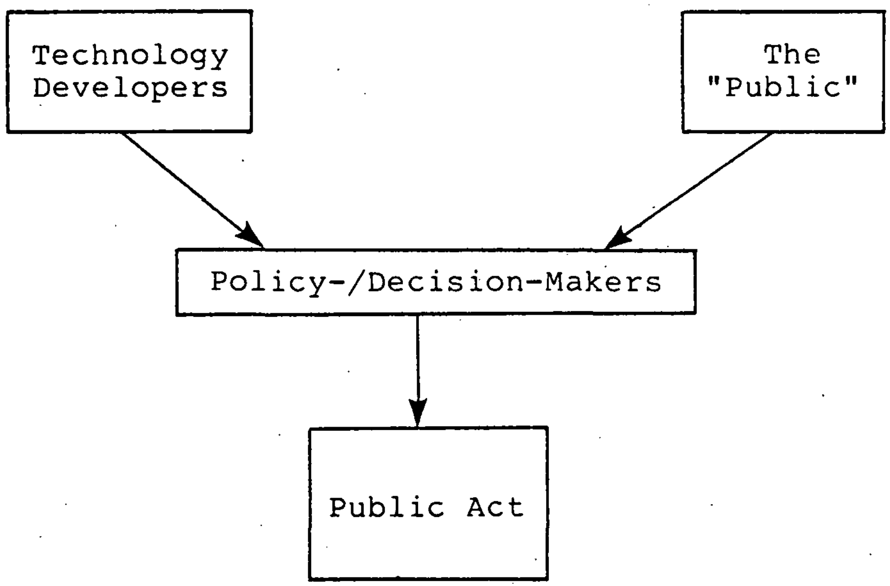

Figure 3. Three components of society.

This paper outlines a means for generating such information from observations of the political activities of society in such a way that changes in perceptions and acceptability of risk can be detected, and in such a way that judgments about the importance of such change might be made.

Political Processes in Risk Control

Overview

To predict the likely reaction of the public to a new technology, chemical, proposed action, etc., a framework of how the public expresses such reactions is needed. How will individuals react? How will groups and institutions subsequently react? How will various legislative bodies react to these reactions? And so forth.

Such a framework begins with a recognition of hazards associated with a new technology, chemical, process, etc. As discussed earlier, hazards underlie the perception of risk and its acceptability.

The first step in gauging the acceptance of a risk associated with a hazard is to estimate (average) individual perceptions about risk. This problem has been studied, and some of the gross characteristics which lead to a perception of high or low social risk and attendant acceptability are recognized.

Combining the work of Lowrance,[4] Starr,[1] and others leads to the following list of parameters that lend insight into individual perception of and acceptance of risk.

Array of Factors Influencing Risk Perception and Acceptance

Risk assumed voluntarily	---	Risk borne involuntarily
Effect immediate	---	Effect delayed
No alternatives available	---	Many alternatives available
Risk known with certainty	---	Risk not known
Exposure essential	---	Exposure a luxury
Encountered occupationally	---	Encountered non-occupationally
Common hazard	---	"Dread" hazard
Affects average people	---	Affects especially sensitive people
Will be used as intended	---	Likely to be misused
Consequences reversible	---	Consequences irreversible
Benefits easily recognized	---	Benefits indirect
Consequences limited	---	Consequences catastrophic
Risks less than "Acts of God"	---	Risks greater than death from disease

When a hazard has the characteristics to the left on this list, individual perception of risk tends to be low and acceptance of risk is high. As hazards are perceived to possess characteristics to the right of this list, the converse tends to be true.

The next step is, then, recognizing how individual opinions are combined into a social opinion and, finally, social action (control). As those of you at this meeting are well-aware, this is a process whose details (we occasionally agree!) are little known but one which is largely acknowledged to be political in character in our society. Nevertheless, the gross outline given in Figure 4 would appear to be a generally acceptable representation in today's society.

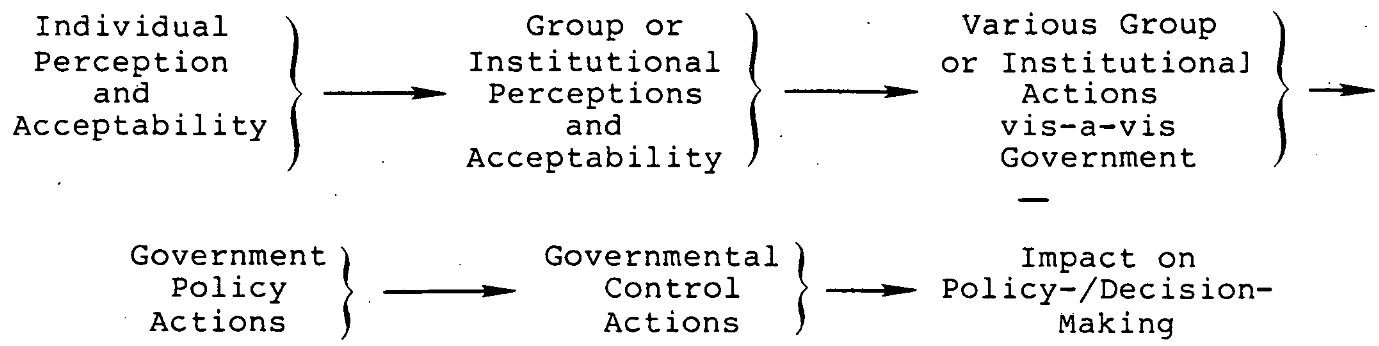

Figure 4. Gross structure of societal control.

As one would expect, the process emphasizes the role of special interest groups (including institutions) in the political process. It is necessary to appreciate in advance who the "group and institutional" actors may be. For our purpose this list includes nine types of "constituencies":

1. The public and its subgroups,
2. The local groups and impacted communities,
3. The scientific and technical community,
4. The public interest groups,
5. Industry, business,
6. Labor,
7. Agriculture,
8. The Government: executive, legistative, judicial (federal, state and local), and
9. The media.

This list recognizes that multiple roles in policy-making may be played by different groups. One governmental agency (EPA, for example) may be the major force in gaining legislation ("governmental policy action") and then be responsible for the exercise of "governmental control actions." Nevertheless, we feel that this is the generic list of actors in the political process about which policy-/decision-makers must be concerned.

A thorough discussion of the types of actions that these constituencies may take and their importance is given in a more comprehensive study under this project by Sorenson.[6] For purposes here, we will only list some of the important types of actions:

- Demonstrations, protests
- Fund raising
- Public relations
- Coalition formation
- Staffing
- Research
- Publications, news letters
- Voting
- Lobbying, bargaining
- Filing law suits
- Passing legislation
- Admitting "standing"
- Issuing regulations
- Striking
- Boycotting
- Inspecting
- Fines
- Holding hearings
- Issuing court orders
- Holding meetings

A More Detailed Model

Using the background just presented, a somewhat more detailed model of the political actions leading to societal control may be generated. This detailed model is shown in Figure 5.

This model is an adaptation of two others. The "first" part of the chart is adapted from a model by Paulsen and Denhart.[7] It rests on the recognition that policy solutions in the ES&H area are fundamentally a function of the interaction of technical and political forces. This model, illustrated on the left side of Figure 5, represents a systems approach to the policy process along the lines of an input/output analysis. Three principal phases are illustrated in this model: (1) problem definition through the input of needs, (2) a conversion of needs through the political decision-making process, (3) a final policy output or the final result of the policy process. The Paulsen/Denhart model also provides for identifying the operational effects of policies, which in turn creates feedback and sequential redefinitions of the problem.

The right side of the model of Figure 5 is adapted from a model developed by the World Health Organization (WHO) as a surveillance and monitoring model. The practical aim of WHO is "to develop an early warning system for the adverse effects of the environment on human health, the ultimate goal being a comprehensive health information network linking all countries of the world." One of the reasons this model was selected is that it appears to meet the fundamental requirement of built-in flexibility so that both orderly change and unexpected developments can be readily accommodated without compromising the entire structure.

The term "control" is taken to have the same operational meaning it did in the WHO model: "To cause the magnitude of a variable to remain within defined limits." Thus, to control gaps between technical decisions and public perceptions of risk means to restrict the frequency of the occurrence of ignoring public acceptability to the best practicable minimum level.

The control components in this model are seen to be the tools used to attain desired outcomes (the better use of signals). The control components are (1) the national political institutions and (2) the state and local political institutions. These replace the WHO's primary and secondary controls that represent the international community and the nation state, respectively. They represent the largest modification of the model. Another major change is that in the ES&H model, the primary and secondary control components monitor and aim at adaptive, corrective actions.

In the first phase of the total model of Figure 5, the process begins with conflict and adversary politics within which the problem is defined and the positions of the participants are identified.

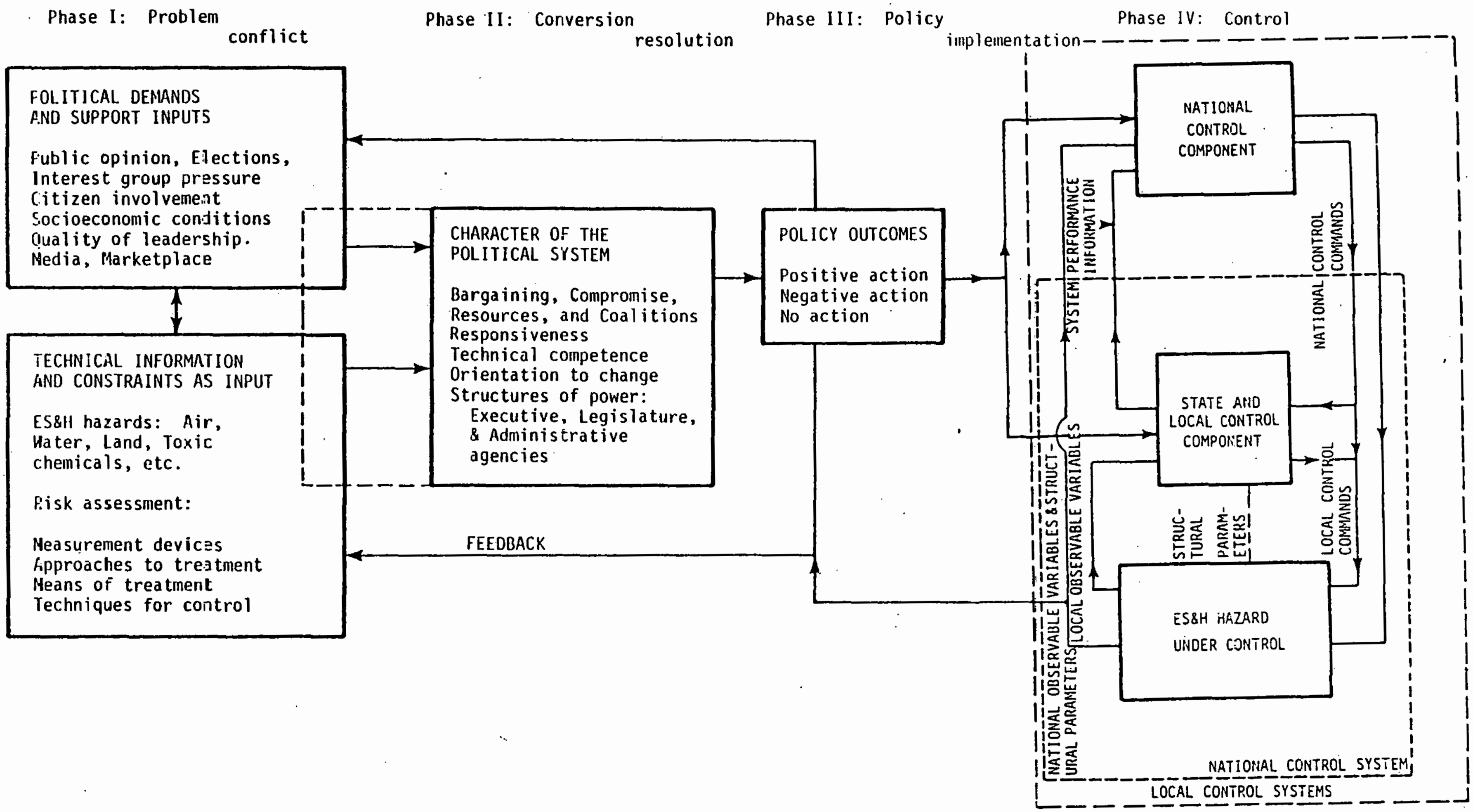

Figure 5. A detailed model of the political actions leading to societal control.

In brief, the "political demands and support" inputs, stemming as they do from concern about hazards and risks, have the character of "public acceptability," discussed in the previous section. Thus, a broad variety of individual or group opinions, generally expressed separately, may be anticipated, in which a high degree of conflict may be evident. In addition, there may be a great time variation in these opinions.

"Technical information and constraints" are generally capable of more precise expression but often with a fair degree of uncertainty remaining. Members of technical groups providing these inputs may, as individuals or through special interest groups, have further inputs in the "political demands and support" category. Typically, though not always, "technical" inputs relate to the identification of hazards, the determination of associated risks on a calculated or experimental basis, and the development of control technologies. "Political demands" inputs relate more often to perceived risk and its acceptability, as discussed in the previous section.

Federal, state, or local agencies, legislators, and administrators may have inputs in both categories, as may "public interest groups," scientists, industries, and members of the public viewed individually or in subgroups.

The dashed line of the control box of the model indicates that "conflict resolvers," i.e., policy-makers, can at times be instrumental in the input areas. Administrators (as "inputters") can influence legislative policy, for example, and indeed may be the major source of influence.

Conflict lies at the heart of the political process as it is expressed in the input/output model. This conflict is usually between two or more of the input "groups." It often takes the character of a difference of opinion on perception of risk (independent of assessed risk) or on the acceptability of risk. It is through a process of bargaining, coalition formation, and compromise that conflict resolution occurs.

Interest groups play a particularly important role in the ES&H political input process. Their principal function is to articulate ES&H demands, mobilize support, set public agendas, and organize campaigns on behalf of a direct interest or constituency, such as impacted communities, environmentalists, farmers seeking the continued use of a pesticide, or industry seeking amendment of environmental laws, and so forth.

Some interest groups are helped but others are hindered by the interaction within the political process and by the actions of the federal and local governmental agencies involved in controlling ES&H risks. Some of the more effective lobbies are, indeed, public agencies. Also important for inputs into the politics of public acceptability over ES&H risks is the media, which helps to form opinion and has a direct impact on the political process. Citizen involvement by means of the polls, elections, and direct participation is also an important political input. These inputs are illustrated in Figure 5.

It is in the "character of the political system," the second phase of the policy-making process, that the conversion of inputs into policy occurs. The process involves coalitions, bargaining, compromise, and authoritative political decision-making. The various levels of government (executive, legislative, and judicial) are seen to be the principal mechanisms for conflict resolution: the legislature principally for compromise and consensus building; the courts for judgment in an adversarial context; and the executive branch for its ability to persuade, bargain, or command. Political decision-making for ES&H problems is seen as particularly difficult because of the relative newness of many of the concerns and the complex interrelationship of technical and value elements.

Consideration of the system's resources and characteristics (wealth, urbanization, population and prevailing coalitions, distribution, education, economic and political characteristics, and so forth) is included in this phase. Pioneering studies have shown that the system's resources play a role in accounting for the system's characteristics and decision outputs. In other words, per capita personal income, percentage of urban population, and median levels of education tend to be more significant than political parties, voter participation, interparty competition, political party strength, and legislative apportionment[8] [9] in the authoritative outputs of policy. While a recent study cautions against exaggeration of the strength of the economic policy relationship,[10] it is safe to say not only that the socio-economic resource factors contribute to decision outputs, but also that they do so in the ES&H area as well.

The third phase of the process, "policy outcomes," centers upon the policy actually produced by political decision-making activities. The policy may be a statement of official intention, a law, a legal decision, or a regulation or quasi-legal action of an administrative agency. At this point in the process, government may undertake action to modify the ES&H risk environment through control of the activities of private individuals, the market sector, and other government agencies or processes, or it may treat only the public policy aspect of the issue, leaving the hazard untreated. However, government may act with varying degrees of competence and resoluteness. The decision-making process may produce negative action, such as an unfavorable court decision, a reduction in funds for an administrative agency, or the elimination of legal authority. If so, the political process may begin all over again, commencing with phase I of the process. ES&H policy, like all other public policy, reflects the configuration of political power at any given time.

In the last, control, phase of the model, the information symbolized by the arrows on the right-hand side of the figure consists of commands or signals whose nature depends upon the specific mechanisms by which control is mediated, e.g., whether a control command acts automatically or whether a verbal instruction is given.

The signals represented by the arrows on the left-hand side of the modified WHO model consist almost exclusively of information in the sense that inputs begin with these sources. It is this information flow that calls for the provision of special techniques for collection, sifting, and correlation.

A parallel control/secondary component occurs on the national level and is aimed at measures that are larger, indirect, or somewhat removed from the day-to-day activities of the local area or component. The local and the national levels interact, but the national takes precedence on issues of nationwide concern. One of the primary functions of the local component is to monitor and ensure transmission of information or compliance with the decisions of the primary or national component.

Both the national and the state and local activities are aimed at direct and indirect control, corrective measures, or monitoring each other. On the indicator level, the question is at what point decision-makers with national concerns about new technologies become sensitive to new developments which reflect changes in or strong attitudes toward risk taking. Once they do become sensitive, the process by which the technology concerns are balanced with the public acceptability concerns can begin.

Finally, an important effect of policy and control on society as a whole is change. The political and technical inputs are altered with policy formation and implementation, creating pressures for additional ES&H adjustments. Although the model gives no indication, the actual operation of the feedback process is most complex. Government activity may be a response to public ES&H demands and interest group activity, but many factors influence the system's essential policies, adding to its instability and stability. Among these factors are the hazards and the perception of risks by various subcomponents of society, as this perception changes with experience.

The public policy model helps to depict in a dynamic way the basis and means for expressing public acceptability of ES&H risks and the possible outcome of the process. The process of consensus building for the perpetuation of the system lies at its heart, and changing perspectives resulting from experience with controls are its nervous system.

Nature of Indicators

In the framework of Figure 5, we can now become more explicit about our view of the nature of some of the leading indicators of the public perception and acceptability of risk. There is a hierarchy of "concern" that is implied in this model:

Individual Concern → Group/Institutional Concern → Governmental Policy Concern → Government Regulatory Concern

Concern at any level may (or may not) lead to actions, which, in turn lead to events having certain consequences. Some examples might include:

	Concern	→	Action	→	Events	→	Consequences
a)	Strong Individual Concern (e.g., DDT)	→	Book Publication	→	Widespread Individual Concern	→	Public Interest Group Concern
b)	Strong Single Public-Interest Group Concern	→	Coalition Proposals and Bargaining	→	Multiple Public Interest Group Lobbying	→	Legislative Concern

Thus, in each phase of the model of Figure 5, there is a series of stages (concern → consequences) that takes place before the next phase of the model is entered. The "action" phase is primarily concerned with agenda setting, which stems from a "concern," the "event" phase is a decision-election phase (a specific event(s) to address the concern), and the "consequences" are interpretable as a generator of "concern" at the next phase. Indicators, in this context of an "event tree," are no more than things which may be measured that give information about the progression of people, groups, and institutions along this series of stages through the phases of the model. Before proceeding to outline generic indicators, some of the properties of actions taken in this event tree progression will be discussed.

Concern -- The "root" concern is that of individuals. As a general rule, progression through the phases of the model cannot be sustained without evidence of a reasonable level of concern on the part of a great many persons. The characteristics of hazards which lead to such concern have already been discussed. Concern at other levels is generated as a response to "consequences" of the preceding phase.

Actions -- The actions taken in the various phases of the model of Figure 5 are those which presume an effective level of policy or action agenda setting.[11] [12] Individuals decide to pursue their concerns, groups decide to publicize their concerns or to attempt to persuade other groups to join them, etc. Government bodies decide to develop policy. Thus, in all cases an "action" results from, and therefore presumes, a commitment.

Many ES&H issues surface constantly, but only a small portion receive serious attention at the hands of public interest groups, the business community, and public policy-makers. It is these issues that it is imperative to detect as early as possible.

Policy agendas are not necessarily highly structured or well-defined. In some cases it is not possible to find complete agreement on the content of a particular agenda, and this can occur on the congressional or public interest group level with equal ease. Clues to the importance of agenda items are picked up in numerous ways. Two key methods which are used to discern the importance assigned to an issue are quantitative and qualitative analysis, e.g., the number of times the issue appears on the agenda and the substantive importance or stress which the issue is assigned, wittingly or unwittingly.

Agenda setting is important to watch. Equally important is to determine, if possible, the transformation of a policy concern into a live political issue during phase II of the model. Little headway has been made on this question. A more detailed discussion of agendas and agenda setting can be found in Sorenson.[6]

Events -- The events that may follow an action are selected from a great many that may be possible. Even with a commitment, a group or institution may fail to progress through the model because of a poor choice of "event" or an inability to choose the most effective (due, for example, to a lack of funds or time, etc.). The nature of the events, nevertheless, combined with the effectiveness of opposing viewpoints, determines the "consequences" (level of concern at next phase). Ultimate events depend upon group, institutional, or coalition commitment, skill, resources, knowledge, and upon external factors such as individual (public) level of concern, media cooperativeness, timing in relationship to other issues, etc.

With this as a background, the general scheme for defining and monitoring leading generic indicators of the impact of the public perception and acceptance of risk on policy-/decision-making can be presented.

Generic Indicators of the Perception and Acceptability of Risk

Generic Approach

The material of the preceding sections is summarized in Figure 6, whose entries are, in fact, generic indicators of political activity to exert control over risk. This is cast in the framework of concern → consequences, and it must be remembered that such a sequence may be encountered at each phase of the model of the previous section. Different "actors," as indicated by the rows of the accompanying figure (Figure 6), play stronger or weaker roles depending upon the phase of the model being monitored and the issue in question.

It should be noted that while no overlap exists within the concept of concern-action-event-consequence sequences, the indicators, at different phases of this sequence, may overlap. In other words, at times the evidence of a concern (a public meeting, outcry, etc.) may itself constitute an act, and at times the evidence of a concern may become available only when an action occurs. Correspondingly, at times an indicator of an action (a protest or a conference) may also

SOME GENERIC INDICATORS

CONSTITUENCY → CONCERNS → ACTIONS → OBSTACLES → EVENTS → CONSEQUENCES → LEVEL OF CONTROL

INDIVIDUAL BASIS FOR CONSTITUENCY CONCERNS, ACTIONS

Indicators as listed on page 11

- Voluntary
- Immediate
- Alternative
- Certainty
- Essential
- Common
- Benefits

and so forth

CONSTITUENCY	CONCERNS	ACTIONS	OBSTACLES	EVENTS
Public and Subgroups	• Meetings • Announcements • Public meeting attendance	• Coalitions • Organizing • Lobbying • Protesting • Demonstrations	• Social indifference • Divided community • Industrial, labor, bureaucratic uncertainty/opposition	• Protest meetings • Demonstrations • Campaigns • Letters
Scientific and Technical Community	• Conferences • Symposia • R&D literature	• Publications • Conferences • Society bulletins • Organizations formed	• Uncertainty or conflict over data and/or its interpretation	• Studies • Debates • Public articles • Lobbying
Public Interest Groups	• Public statements • Bulletins • Meetings/speakers • Campaigns • Media use	• Protests • Lobbying • Litigation • PR efforts • Conferences	• Same as above two	• Protests • Testimony • Demonstrations • Litigation • Lobbying
Industry, Business	• Financial statements • Proxy fights • Reports • Advertisements • Litigation	• PR efforts • Lobbying • Bargaining • Litigation • Coalition	• Social credibility • Laws and regulation • Contradictory data	• Contracts • Litigation • Hearings • Media support • Lock-outs
Labor	• Public statements • Bulletins • Trade journals • Grievances	• Meetings • Bargaining • Lobbying • Coalition • PR efforts	• Industry opposition • Public indifference • Laws and regulation • Contradictory data	• Strikes • Litigation • Walkouts • OSHA complaint • Lobbying
Agriculture	• Trade journals • Public statements • Meetings	• Lobbying • Demonstrations • Meetings • PR efforts	• Same as above two	• Crop destruction • Litigation • Testimony • Lobbying
Government: Executive, Legislative, Judicial (all levels)	• Committee reports • Hearings • Court records • Public statements • Investigations	• Studies • Legislation • Regulation/guides • Grant standing • Public statements	• Direct interest opposition • Public opposition • Lack of jurisdiction • Inconclusive data	• Regulations • Laws • Legal rulings • Administrative decisions
The Media	• Quantity and quality of reporting • Editorials • Special features • Investigations	• TV specials • Documentaries • "Crusades" • Coalitions	• Commercial opposition • Public indifference • Laws and regulation • Litigation	• Lobbying • Interviews • Studies • "Exposes" • Recommendations
Local Groups and Impacted Communities	• Editorial letters • Civic statements • Surveys • Meetings	• Protests • Litigation • Rallies • Advertisements • PR efforts	• Direct interest opposition • Court decisions • Public differences • Conflicting data	• Codes • Litigation • Campaigns • Appeal to state or region

LEVEL OF CONTROL

- Inspection
- Lawsuits
- Fines
- Monitoring
- "Stop-work"
- Assurance of discontinuance
- Reorganization
- Orders
- Approvals

and so forth

Figure 6. Some generic indicators.

designate an event, and an indicator of consequences of an event (litigation) may be a measure of the event itself. In designing the approach, the indicators of actions tended to be associated with agendas, events with specific efforts to achieve a consequence as a result of the commitment implied by an agenda, and consequences with the results of the events--which at all but the "control" phase are assumed to be the stimulation of a "concern" at the next phase.

One column of Figure 6 that has not been previously discussed is "Obstacles." This is a self-evident category that sets a basis for further refinements discussed below. The phase monitored clearly has a relationship to the immediacy of impact as a result of progression through the phases and stages of the model of the previous section. Monitoring the scientific literature for evidence of new hazards, for example, represents an attempt to catch expert and public perception and acceptability issues before they even become political issues. On the other hand, monitoring agenda setting (actions) by regulatory agencies leads to information about controls that will, in all likelihood, be in effect in the relatively near future. Often the earliest indicators of concern (and therefore change) can be found in the scientific literature. In turn, "crisis" concern will be demonstrated first by the media. Correspondingly, "public opinion" will often demonstrably lag between these two, as indicated in Reference 13. This is one reason why, for example, a logical system of political indicators is preferable to measuring the public utility (or disutility) for risk, as has been proposed elsewhere.[1]

Some Refinements

The development of public control over specific hazards based on a logical progression of political activities, as this is represented in the previous section, may be viewed as a series of event sequences (concern → action → event → consequence), each designed to overcome some obstacle in the political process. The types of obstacles to be overcome depend upon the phase of political activity and the precise situation. Generic indications of the types of obstacles that may be encountered are given in Figure 6, above.

Ideally, the monitoring process would be able to lead to assessments of the probability and credibility of actions to overcome these obstacles as well as the identification of concerns and the ordering of the sequences of actions, events, and consequences. For a constituency or a group with a well-defined set of concerns and capabilities, there are a large number of decisions which must be made. The decisions and the likelihood of an act are a function of the distribution of choices relating to intensity of motive, options, obstacles, means available or preferred, which are apparent to the concerned constituency or group. Estimating the associated frequencies would be the task of a risk analysis.

Several approaches to a systematic characterization of the "credibility" (intent and feasibility) of a particular concern/action event sequence (by a community, group interest, etc.) are possible in terms of the time, skills, and resources required. Independent of the effects of the obstacles to be overcome, not all courses of action will be equally desirable to an organization, and, as indicated earlier, their choice will depend on the timing required, the financial and technical resources, personnel available, and the technical, administrative and leadership skills possessed. These factors (Figure 6) together with the perception of the probability of success of a given course of action are the key determinants of the credibility of the frequency of the individual sequences. The motivation of the action group will largely determine the absolute level of the frequency of the sequence. To the extent that motivation influences the desirability of a certain type or level of consequence, it may also affect the choice of events. (See Sorenson.[6])

With fairly complete knowledge about options, resources, commitment, and so forth, it might be possible to estimate the <u>likelihood</u> that an original concern in phase I will actually impact decision-/policy-maker decisions. In simplest terms, each phase, i, has a probability, P_i, of being "successfully" passed through on the way to societal control. This probability can, theoretically, be expressed in terms of the "values" of the indicators that may be analyzed in Figure 6. As an illustration of this, indicators of a constituency "level of action" aimed at influencing legislation might be

1 No agenda
2+ Letter writing
3+ Meetings
4+ Hearings
5+ Lobbying
6+ Media campaign
7+ Litigation
8+ Demonstrations

It is possible to impose a Guttman scale (1 → 8+), as indicated. This scale could then be used to determine the ES&H priorities of a constituency in terms of perceived organizational effectiveness as has been done with civil rights organizations, in studying riot-severity in American cities[14] and in the study of alienation undertaken by Eckhardt and Hendershot.[15]

This is but one possible technique for learning to estimate the likelihood that policy-/decision-making might be impacted by public concern. Others are discussed by Sorenson.[6]

Utility

The generic indicators presented above afford a reasonable basis for addressing the need to determine at an early stage the political concerns and possible conflict stemming from perceptions of risk. It offers a framework in which to:

- Capture the dynamics and information flows at discrete moments in a process of change and
- Discern the probability of political action by a concerned group with regard to concern over the acceptability of a risk.

The approach chosen for the development of the generic indicators focuses only on the identification, monitoring, and diagnosing of manifest and deliberate concerns and actions. While the larger question of a common level of risk acceptance based on societal preferences appears to be in the making, the indicator system proposed in this paper does not attempt to define an acceptable level of risk. Public acceptability is seen as a function of explicit conflict over technological decisions and social values, which are manifest in the social system.

It is our feeling that information of the sort that may be derived from such an indicator scheme would begin to allow technologists to appreciate, at early stages, possible public reactions to new concepts and developments and design their approaches accordingly.

Conclusion

There is, in our estimation, a vital need to close the gap which exists between technical estimates and societal perceptions of risk. Unlike other commentators,[1] we perceive the burden for the resolution as resting, in many respects, with the technical policy-/decision-making community. It is our belief that progress toward the resolution of some of the nation's most pressing problems can be expedited only if proposed technical solutions consider societal ES&H issues as well as technical issues <u>from the inception</u> of the technical project, just as technical cost-effectivity (or other) goals are considered. Consideration of society's ES&H objectives at early stages of technical design and development must be undertaken by the technical community.

Our society will continue to direct its ES&H conflicts and affairs through political processes,[2] and public acceptability will continue to turn on the public's perception of risk. Thus, in doing a complete job to meet both technical, and societal ES&H, objectives, technical persons must be maximally aware of the latter objectives.

In order to provide this awareness, an approach to measuring societal perceptions, and the implied societal acceptance or rejection of the risk, has been proposed. This approach identifies (1) gross indicators of <u>individual</u> acceptance of risk based on the properties of hazards and (2) gross indicators of <u>societal</u> perception and acceptance of risk, which arise from the political processes whereby society expresses its priorities. The approach suggested here recognizes the political side of risk-related decision-making and attempts to deal with it in a straightforward fashion--rather than to "finesse" it, as we feel is often done now.

There are doubtless other ways of closing the technical-societal gap regarding risk--many of which might ultimately be better, when based on a better understanding of the fundamental socio-political and political processes. The essential point that we are striving to make is that the resolution of the technical-societal gap over risk involves, in our society, socio-political inputs and the political process. It seems essential to us that a structured way for undertaking socio-political as well as technical analysis be provided for the technical policy- and decision-makers. Provision of the political dimensions of this new approach to risk analyses seems best done from the perspective of political science, and we see this as a challenge of the profession:

> Systems which are best understood by political scientists are apparently causing hardship to the technical community. This hardship, in turn, is seriously retarding our ability as a nation to resolve crucial problems. It is therefore vital, in our opinion, that this profession turn its attention to this political/technical interface problem in order to gain a better understanding of it and provide better means of bridging the gap, which, if we may be bold about it, offers, a potential for drastically altering the nature of our society.

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