

UCLA School of Engineering and Applied Science

Prepared for the
National Science Foundation
under Grant PRA 79-10804

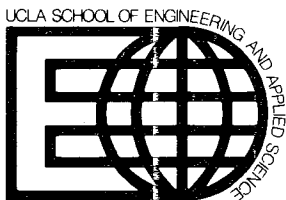
“Alternative Risk Management Policies for
State and Local Governments”

Principal Investigator: David Okrent

PROBLEMS OF STATE AND LOCAL
RISK MANAGEMENT: AN OVERVIEW

UCLA-ENG-8246
MAY 1982

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DECISION RESEARCH



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PROBLEMS OF STATE AND LOCAL RISK MANAGEMENT:

AN OVERVIEW

by

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ABSTRACT

This paper examines state and local risk management policy by considering it as a four-part process: risk identification, risk assessment, risk acceptance, and risk monitoring and intervention.

Significant differences are found to exist in the comprehensiveness of risk management policies between both state and local agencies, and among state agencies. In a large state such as California, agencies demonstrate a significant capacity to engage in comprehensive decision making, that is, they identify new sources of risk, assess their effects and set standards of risk acceptance. In smaller states more selective risk management is evident due to resource constraints. Oregon, for example, pursues an aggressive risk management policy in the area of water quality policy. At the local level, risk management is almost exclusively limited to risk monitoring and intervention. Only the largest municipalities have the capacity to undertake a full range of risk management activity.

Risk management policy at both the state and local levels is also evaluated according to the decision strategies that are employed. An incremental or "muddling through" strategy is found to be the primary means through which policy emerges. At the state level more formal techniques tend to be limited to the utilization of professional expertise. More comprehensive decision strategies such as cost-benefit analysis, or the comparison of safety standards across different hazards are rarely employed. At the local level, formal techniques are even more restricted with professional expertise the primary approach used in decision making.

PREFACE AND ACKNOWLEDGEMENT

This report is one of several topical reports prepared as part of the project entitled "Alternative Risk Management Policies for State and Local Governments" performed under Grant No. PRA 79-10804 from the National Science Foundation.

The complete list of reports prepared in the project is as follows:

Final Report, Alternative Risk Management Policies for State and Local Governments	UCLA-ENG-8240
Executive Summary, Alternative Risk Management Policies for State and Local Governments	UCLA-ENG-8241
Risk Management Practices in Local Communities: Five Alternatives, M.W. Meyer and K.A. Solomon	UCLA-ENG-8242
Management of Risks Associated with Drinking Water at the Local and State Levels, K.A. Solomon, M.W. Meyer, P. Nelson, J. Szabo and R. Tsai	UCLA-ENG-8243
Risk Management Policy for Earthquake Hazard Reduction, R.K. Sarin	UCLA-ENG-8244
Classification of Risks, K.A. Solomon, M.W. Meyer, P. Nelson and J. Szabo	UCLA-ENG-8245
Problems of State and Local Risk Management: An Overview, W. Bordas	UCLA-ENG-8246

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1. INTRODUCTION

Improving the quality of risk management decisions requires understanding extant policy--the way it is initiated, how it is carried out, its working conceptualizations and methods. Familiarity with the rich texture of actual decision making can assist in determining the effectiveness that alternative proposals may have. The tendency of analysts seeking to improve risk management processes, understandably, is to try and define the decision problem as they see it--to bring their perspectives to bear as the basis for finding solutions. While it is comforting to engage in such a common enterprise, it is also important to consider whether the exercise preserves the integrity of the problem at hand, that is, whether assistance promised will actually be forthcoming in the context of the policy process. The policy landscape is littered with models that could not withstand the cold light of day.

Analysts must be flexible enough to not only expect officials to learn their language and their methodologies, but they must be prepared to reciprocate--to acquaint themselves with problems as policy officials define them. The common interest between analyst and risk management officials should be to provide a more systematic way of approaching problems. The end result may be a compromise between the elegance of a particular model or approach, and the messy routines of on-going policy.

2. A CONTEXT FOR DECISION MAKING

There are reasons why hazards are managed in different ways-- why some are managed well, others poorly, and still others not at all. Trying to untangle them always risks violating the complexities which underpin social problems. There is nothing more self-evident in social analysis, and nothing more useless than the precept that everything affects everything else. Knowledge presupposes a social whole. Nevertheless, it is important to attempt an analysis, if only because the costs of ignoring the subject of societal risk management--in this instance at the state and local level--are certain to be higher than those of faulty inquiry.

The context for decision making outlined here begins with a brief discussion of the concept of risk management, and then defines three generic approaches to risk that will be considered as options to improving the quality of decisions.

2.1. The Process of Risk Management

This paper will view risk management as composed of a four-part process: risk identification, risk assessment, risk acceptance, and risk monitoring and intervention. Typically, risk acceptance has received the lion's share of attention.[1] All activities in risk management are considered as leading up to deciding upon some standard of safety (or eliminating the hazardous activity altogether). Making an acceptable risk decision is seen as terminating the decision problem. The position taken here is that this orientation unnecessarily restricts evaluating risk management policy. Risk acceptance decisions are not isolated choices, but a part of policies of a relative permanence which have emerged from complex interactions among previous decisions. Officials do not enjoy the splendid isolation of the experimental setting or groves of academe, but must constantly engage in both prospective as well as retrospective modes of analysis. The problems with which they deal have an obdurate reality. Choosing a particular standard of safety is just one phase of the policy process. Developing realistic policy alternatives entails considering the risk management process as a whole, rather than abstracting only one part of the problem.

The risk management process, therefore, will be understood to contain the following characteristics:

Risk identification. Placing a particular hazard on the decision making agenda may come about through an accident involving a technology heretofore regarded as safe; it may happen through "whistle-blowing" efforts by some disgruntled employee who calls attention to a concealed or dangerous industrial practice. Optimally, risk identification will be accomplished through more formal procedures such as the toxic waste "hotline" established by the EPA, or through the regular monitoring of

hazards during the course of which new dimensions of known hazards are recognized or new hazards are uncovered.

Risk assessment. After a risk is identified, it must still be measured and defined. Following Lowrance, [2] we may describe this stage as one designed to: specify the conditions of exposure, identify the adverse effects, relate exposure with effects, and, finally, estimate overall risk. The issues involved here are not all that straightforward, however. Factors such as the breadth of definition of the hazard, and the temporal conception of it will shape the nature of risk assessment. Problem definition, therefore, will depend on quantitative analysis, but, also, upon the judgments as to how the lines of inquiry will be drawn.

Risk acceptance. This is the normative activity of judging whether a hazard is safe enough. Different criteria will, of course, yield different standards of safety. Regardless of which approach is used, decisions regarding acceptable risk choices require the specification of objectives, the definition of alternatives and consequences, and the enumeration of values and probabilities.

Risk monitoring and intervention. After a hazard is "in place", the final step is to monitor it to insure compliance with standards, codes, statutes, etc., and to intervene when they are violated. Monitoring the hazard entails making routine observations of health and safety parameters, recovering and transmitting data, and collating and integrating the data to detect changes in the health and safety of the impacted population.[3] The objective of risk monitoring is the identification of either new hazards or the detection of previously unknown consequences of existing hazards. Information obtained in this stage can then be fed back into the risk management system for decisions on risk assessment and risk acceptability.

The elements of risk management are, of course, analytic distinctions. In practice, various elements of the process may be collapsed into one another or may be missing entirely. In a small agency, one person may be responsible for several problems. Different phases of risk management may utilize entirely different approaches. Some phases may be managed with rigorous distinction while others become the by-product of calamitous political struggle.

2.2. Alternative Approaches to Risk Management

The formal approaches considered here are adapted from a typology developed by Fischhoff, Lichtenstein, Slovic, Derby and Keeney (1981).[4] Although their framework focused on acceptable risk decision-making, it is felt here that the scope of their study readily encompasses some of the wider concerns of this report. Rather than evaluating the usefulness of a myriad of proposals for improving state and local policy, the advantage of their framework is that it groups and characterizes basic features of a wide range of risk management strategies. By focusing on generic attributes of different proposals, they provide a basis for under-

standing the assumptions underlying different strategies, the logic of their development, and the ways in which they might be improved. In subsuming many disparate alternative proposals into three analytic categories, the typology facilitates comparisons of the more basic strengths and weaknesses of other proposals with regard to their potential for improving state and local risk management policy. These proposed generic approaches to risk management policy are analytic methods, professional management, and "bootstrapping".

Analytic methods. Analytic methods are designed to combine and compare the good and the bad coming out of a set of proposed or existing technologies.[5] Cost-benefit analysis and decision analysis are the two most predominant examples of this approach in which (a) the decision problem is defined by listing all possible actions and the consequences of each; (b) structural models are constructed to describe the relationships between alternatives and their consequences; (c) a common measurement is used to assess the advantages and disadvantages of each alternative; and (d) the components of the analysis are combined to produce a number representing the worth or desirability of each alternative.[6]

Bootstrapping approaches. Bootstrapping approaches include a variety of historical standards. These ascertain how risks and benefits have been balanced in the past or are balanced presently as a guide for future decisions on new hazards. The particular standard utilized might be a compendium of risk in which different hazards are compared for risk acceptance; or legal statutes, laws, etc., that document societal judgments on risk, or natural standards which look to the geologic past for exposure levels to the species over time.

Professional management. Professional management relies on the decisions of experts in the field. The reasoning behind this approach is that, since the expert has the greatest scientific and technical familiarity with a given hazard, she or he is the most qualified to balance risks and benefits in making risk management decisions.

This paper contends that the selection of alternative formal approaches for risk management should be conditioned by the particular tasks or activities which confront state and local authorities. At this point, it will be argued, matching appropriate strategies to decision tasks does not happen consistently enough to make state and local risk management really systematic. The reasons can not (and should not) be reduced to any one factor. Each approach manifests its own matrix of scientific/technical, institutional, and cognitive interests which must be considered in toto. Science, values, and power do not develop independently of one another, but remain part of one historical dynamic.[7]

The features of these respective approaches, depending on the decision context, represent either strengths or application, or what must be overcome in current practice. Whether they are used, abused, or ignored, rests on the manner in which they address relevant technical,

and non-technical issues. Utilizing inappropriate strategies to manage risk is one sign of a disjunction between what a society is doing, and its self-understanding of what it thinks it is doing, particularly in regard to its ability to keep abreast of scientific and technological developments which generate many of the hazards we face. Reorienting theory to practice, in terms of risk management, should provide officials, and the general public, not only with the means of enhancing public health and safety, but with an opportunity to gain a deeper, more reflective understanding of the role which science and technology and its attendant risks and benefits should play in society.

Studying existing risk management can assist in pinpointing why particular management approaches are adopted in given situations, their adequacy, and ways in which policy can be made more effective.

2.3. Some Methodological Hedging

This paper is exploratory. As such, its motivating concern is to attempt, on the one hand, to develop a framework within which to consider problems of state and local risk management; on the other hand, because of the paucity of information in this area, it seeks to present something of the substantive nature of the problems which confront public officials.

The paper relies heavily on two sets of questionnaires that were conducted with risk management officials. The first set was administered directly in interviews with officials and consisted of semi-structured questions. The second set was more structured and was sent to officials who responded to the items over the telephone. Opportunities for open-ended responses were provided as well. The initial interviews were conducted with state, county, and municipal personnel in Oregon in the areas of radiation control, air quality, water quality, emergency services, solid waste management, and hazardous waste management. The second group contacted was restricted to water quality (including drinking water supply) and hazardous waste officials at the state, county, and local levels in California and Oregon.

The information these questionnaires provides serves as a resource rather than as a definitive basis for assertions about state and local risk management. Where necessary, available literature pertaining to the topic has been utilized as well. Together the information compiled have been used to assist in illustrating points central to the paper.

3. THE PRACTICE OF STATE AND LOCAL RISK MANAGEMENT

Because this is a preliminary effort, making generalizations about state and local risk management is a difficult undertaking. Like any other policy area, its formulation and implementation is subject to a host of political, economic, social, scientific, environmental and psychological factors. Like fingerprints, each jurisdiction is different. On the basis of the information obtained, however, some patterns do emerge in risk management decision making at the state and local level which warrant reporting, and, hopefully, further study.

3.1. Risk as an Operational Term

One insight obtained from the interviews and questionnaires was that, while the concept of risk may provide a useful heuristic in evaluating policy, it is not a term used in any operational sense by officials. Their concerns are with problems--spills, turbidity, leachates, compliance with codes, etc. Risk, on the other hand, is an abstract unifying principle--one way of viewing a range of problems associated with hazardous activity (though its definition remains the subject of intense debate).

That the concept of risk has not become a part of state and local risk managers' vocabulary should not be surprising, since most of what constitutes the field of risk analysis has had its origins apart from the kinds of concerns which they have traditionally faced. The risk-related field of probabilistic analysis, for example, emerged out of the growth of the civil nuclear industry, and was developed in the United States by the Atomic Energy Commission.[8] Decision theoretic tools such as cost-benefit analysis similarly were developed and initially applied at the federal level.[9]

Because risk analysis grew out of the need for strategies to deal with hazardous activity of truly societal-wide proportions, it is understandable that the models, methods, concepts and language which are now part of the field should constitute an authoritative realm of discourse. In considering problems of risk at the state and local level, it is necessary to remain sensitive to the fact that, while many of the substantive concerns of public officials converge with those of risk analysts, each group comes to such concerns from very different perspectives. As a result, each group may assign a different salience to various parts of decision problems.

From the standpoint of trying to integrate certain aspects of risk analysis into state and local policy, the terms themselves may prove to be an obstacle. Risk management, for instance, may be a particularly unfortunate term since it has long been associated by state and local officials with insurance-related problems such as estimating governmental liability, improving public employee safety, and determining whether to insure public agencies through internally-generated programs or with

private insurance companies. Typically, when contacting public officials about "risk management" problems, the interviewer was referred to individuals with responsibilities in these areas rather than to those with operational roles.

3.2. Risk Management and the Division of Labor

The interviews also indicated that responsibilities which have been thrust upon lower level jurisdictions, particularly on local government, have not been accompanied by the management resources necessary to effectively meet them. In effect, risk management is becoming increasingly centralized politically without a corresponding examination of what this development signifies administratively. Congress, for example, through a variety of statutes including the Occupational Safety and Health Act of 1970, the Federal Environmental Pesticide Control Act of 1972, the Safe Drinking Water Act of 1974, and the Toxic Substances Act of 1976, to name just a few, has moved, however unevenly and incompletely, to centralize certain risk management functions.

As a response to the political, technical, and legal weakness of existing policy, this legislation has gradually extended the regulatory authority of relevant federal agencies. Its effect is gradually redefining the functions of different levels of government with respect to their roles in the risk management process. Most significant, the authoritative tasks of policy formulation, specifically risk identification, assessment, and acceptability are being made increasingly at the federal and, to a lesser extent, at the state level. Policy implementation, including risk monitoring and intervention are becoming primarily the task of state, and especially, local government.

This "functional" division of labor, by breaking apart otherwise integrated activities, imposes a necessary interdependence among different levels of government. In a centralized system of risk management, all phases of the process must be effectively coordinated or the entire cycle suffers. Inadequate risk assessment provides shaky grounds upon which to determine standards of risk acceptability. Inadequate safety standards will become a burden to those who must monitor the effects of processes and products that have been sanctioned as "acceptable". And effective monitoring is an empty exercise if hazard definitions are constantly being gerrymandered (such as the liberal granting of "variances").

The appropriation of authority by higher jurisdictions to formulate risk policy necessitates, among other things, the ability of lower jurisdictions to live with received decisions which then form the parameters within which their own risk decisions are to be made.

3.3 The States and Risk Management Tasks

Although risk management functions of state and local government overlap, their differences warrant considering them separately. More generally, states, by virtue of their political, economic and administra-

tive position, confront a wider range of hazardous activities with greater resources than any one local jurisdiction. From the standpoint of risk management, states, because of their authority and resources, perform a greater range of tasks. They occupy what might be considered a "swing" position in the risk management process; that is, though they lack the enormous resources of the federal government, they perform policy formulation tasks of identification, assessment, and acceptability, and though they have less day-to-day experience with most hazards than local government, they are close enough to municipal and county problems to have practical experience in the policy implementation tasks of monitoring and intervention.

States have the capacity to engage in comprehensive risk management, although whether they do varies with the particular hazard under consideration. In radiation control, for instance, Oregon has pursued an aggressive policy. Through its Radiation Control Lab, under the auspices of the State Health Sciences Division, the state identifies and assesses new sources of risk. It takes primary responsibility for X-ray machines, naturally-occurring radioactive materials, accelerators, and environmental surveillance for the effects of Oregon's one nuclear power facility. Oregon, along with the other states, also provides the EPA with data on fallout testing. Also, under an agreement with the Nuclear Regulatory Commission, the Radiation Control Lab issues radiation material licenses.

Oregon's risk management policy in water quality is less comprehensive. The state has so far refused to take over from the EPA primary responsibility for drinking water monitoring and surveillance. Since 1974 (the year of the Safe Drinking Water Act), water quality has deteriorated because of the absence of enough trained personnel at either the federal or local level to manage water quality programs. In a preliminary study recently commissioned by the Oregon State legislature, water supplies from six counties were sampled. Twenty-nine percent of the water specimens contained water-borne diseases. The study ranked Oregon sixth in the nation in water-borne disease, which is three times the national average.[10]

Oregon does maintain programs through its Department of Environmental Quality in other areas of water quality that include streams, lakes, ground water, and the treatment of sewage and industrial waste. Although risk managers stated that their tasks included all elements of the risk management process, it appeared that most of their efforts are in monitoring and intervention. Little in the way of agency resources and time were allocated to risk identification and assessment. Laboratory facilities are designed for monitoring water ambience but not for turning up new contaminants, nor for estimating how dangerous they are. As for setting safety standards, Oregon officials utilized existing EPA guidelines. The only instance where the state took the initiative for setting standards was in specifying construction requirements for pipes, wells, and reservoirs.

Overall, the failure of Oregon to engage in more comprehensive risk management activity in water quality programs was traced by officials to the lack of adequate resources.

The hazardous waste management program in Oregon handles everything except nuclear waste. The supervisor of the program responded that his agency engaged in all four risk management activities. Identification, assessment, and acceptability of risk tasks, however, constituted less than twenty percent of his program. Monitoring and intervention consumed the rest of his agency's time.

The state of California exhibited a greater capacity to undertake comprehensive risk management in both the areas of water quality and hazardous waste, primarily because of the significantly greater resource base present, and, of course, by the fact that, unlike Oregon, which is lightly industrialized, California must deal with a far greater range of hazards. The contrast between California and Oregon seems to be representative in terms of the state orientation to risk management. Larger states, such as California, have been responsible for innovative risk management policy, including the identification and assessment of new hazards. Smaller states, such as Oregon, on the other hand, depend on information furnished either by federal sources or by larger states, and focus more on monitoring and intervention.

California, like Oregon, largely depends on federal agencies to identify and assess new hazards, but because of its resource base, it has the analytic capacity for innovative research. The state, for example, is currently assessing the impact of agricultural pesticides on ground water with an intent to eventually develop its own safety standards. Unlike Oregon, California is now responsible for its water quality program. An official of the state's Water Resource Control Board noted that California was setting water quality standards subject to federal review. It is also setting standards for what one official termed "extremely hazardous wastes".

Although officials in both states indicated that they allocated approximately the same relative amounts of time to each of the four risk management tasks identified, the absolute differences in their states' respective resource bases has meant that California has a greater capacity to formulate its own policies on issues of risk identification, assessment, and acceptability.

In a period when the need to develop a systematic policy to manage risk at all the stages of the cycle are becoming increasingly clear, the advantage of states being able to formulate as well as implement risk policy seems obvious. First, many hazardous activities have escaped regulation by the federal government. States may be in an advantageous position to identify and assess risks unique to their jurisdictions. Second, hazards manifest themselves in different ways under different conditions. States need facilities to deal with problems which uniform standards may not solve. Finally, given the enormous difficulties surround-

ing policy formulation for risk, a many-pronged approach, in which states undertake to formulate their own policies, may help offset the weaknesses of centralized administrators.

The quality of state risk management practice is determined, in part, by the comprehensiveness of programs. Centralization has left the states with a responsibility to both formulate and implement policy. Oregon has demonstrated less capacity to formulate risk policy and, in the case of drinking water quality, has relinquished its authority entirely to the EPA. California, on the other hand, has, in both its water quality and hazardous waste programs, pursued responsibility in all areas of the risk management cycle.

Comprehensiveness, however, is only one determining feature of the quality of risk management policy. Bringing the appropriate approach to bear on decision problems for different risk management tasks is another. It is this second feature to which this paper turns.

3.4. State Risk Management Policy--How It Is Done

Officials contacted through both sets of questionnaires all identified policy development and implementation as incremental in nature, that is, policy emerged largely by "muddling through". What salvaged policy from the pure chance offerings of the process was the incorporation of some elements of formal approaches in decision making.

By far, the most common formal approach utilized at the state level is professional management. It is not hard to understand why. Risk management at the state level tends to be problem-oriented rather than system-based; reactive instead of anticipatory. As a result, professional management answers the needs of the policy process in a very concrete way, and, in turn, reinforces existing procedure. Technical experts familiar with the most intimate details of a hazard have an advantage in practicality, in that they can give hard answers as to what people should do about safety. Unlike more analytic techniques, which when done well, require a multiplicity of skills and are often couched in exceedingly lengthy, complex and technical terms, professional judgment, framed in the language of threshold, criteria, tolerances, etc., can, at least, provide easily identifiable policy options. In a policy environment where decisions must be made within time, resource, and institutional constraints, professional judgment fits with existing realities.

Professional management also conforms with other policy parameters. Most information about hazards is presented in terms of professionally-generated standards which individuals trained in the field then need to interpret. Thus, professionals can make maximum use of extant technical knowledge. Whether this information has satisfactorily addressed questions of weighing costs and benefits, or is logically consistent is not salient, given the axis along which issues of risk management are presently raised and answered. Professional management is also adaptable. It takes the problems of its clients, the actors in the policy process, as its own, and respects institutional constraints. Finally, it is highly divisible,

in that decision makers can use as little or as much of it as they want within existing political and administrative processes. Officials only have to pay for the expertise they think is relevant.

Although professional management plays an important part in state risk management, its suitability must be judged on the basis of the different tasks it is called upon to perform. It is evident that, in dealing with technical problems, professional judgment is irreplaceable. There is no substitute for technical skills and hands-on experience. However, not all risk management tasks call for this kind of decision making. When the tasks involve more routine, technical decisions such as those involved in risk monitoring and intervention, professional management would seem the best approach. But it is less applicable when making authoritative decisions on risk policy. McLean (1980) writes that problems at this level are:[11]

...disturbingly general. They are dramatic because they involve life and death decisions which arouse considerable public concern. They are also complex, because the risk may be poorly understood, even by experts, thus raising further problems about determining and relying on public perceptions.

Risk management decisions of this order demand assistance not forthcoming from professional management. Its very practicality encourages partial rather than systematic solutions. The essential piecemeal character of professional management means that it cannot perform an important overview function upon which any authoritative decision on risk should be based. A second weakness is its lack of explicitness in generating decisions. Fischhoff et al.[12] note that professional management is governed by internal and largely inarticulate standards derived from within the professionals' own craft. This closed mode of reasoning has implications both for the conceptual soundness of an analysis as well as grounds for its justification as the basis for social decision making. In the first instance, Fischhoff et al.[13] observe that the very mode of analysis used by professionals mitigates against directly addressing problems of uncertainty, yet uncertainty is endemic to societal risk decision making. Professionals ask what can go wrong and how it can be prevented. As a hedge against possible miscalculation in estimates of safety margins, they will commonly overdesign systems which may not reflect a conscious balance of costs against risks. Perhaps more importantly, Fischhoff et al. note:[14]

...plans drawn without explicit expressions of uncertainty tend to assume the subject status of fact. The viewer forgets (or never thinks) that the search to identify problems may have been incomplete and that the solutions are still imperfect. This tendency to deny uncertainty may seriously reduce one's alertness to warning signs and the attention one gives to critics.

From the standpoint of justifying decisions, professional management tends to wrap itself in the aura of expertise. The lay public finds itself incapable of ascertaining what went into and what was left out of an analysis. For decisions affecting the society as a whole such procedures can only fuel already contentious social debate over risk. What is needed are analyses both comprehensive, and explicit enough to register a wide range of public concern, and are open to public evaluation.

Neither analytic methods, nor bootstrapping approaches, at this point, constitute viable options, although conceptually each addresses concerns ignored in professional management. Cost-effectiveness studies are done by state agencies, but the questionnaires indicated that, generally speaking, analytic approaches were not conducted systematically, competently, or evenly enough to warrant consideration as real control strategies. Bootstrapping techniques were virtually non-existent at the state level.

Since neither of these approaches are utilized, it is necessary to drift into the arena of speculation as to how they might be used. Here, it would seem, they could contribute in precisely those areas where professional management is weakest; that is, in the policy formulation tasks of identification, assessment and acceptability.

One potential application would be to assist in structuring a process to identify new risks. Currently, most states have not developed procedures to prioritize testing chemicals, and other substances thought to be hazardous. Only three of eight state officials questioned in the second round of contacts said that new risks were identified by some formal decision process. Three officials, including two in water quality and one in hazardous waste, said that risks under their agencies' supervision were identified as the result of accidents or other unforeseen problems.

While the actual testing of hazardous substances should be done by professionals, the process whereby they are rank ordered for testing is a very different decision problem, and one for which professional management is ill-suited. At this point, decisions as to which substances get tested and which do not is a product of informal reasoning that does little to insure that state laboratories will not be occupied with testing materials that present little or no threat to public health and safety. An analytic approach to testing could develop criteria that would more comprehensively score chemicals for their potential threats to the public and the environment.

Another application for analytic methods or bootstrapping approaches would be in insuring better consistency of safety standards across hazardous activity. A major source of inconsistency arises from public perceptions. Unlike the federal government, where its relative distance from public pressure assures a measure of independent judgment, state officials are more subject to rapidly mobilized public perceptions

of controversial policy decisions in which more heat than light is often generated. The use of more analytic techniques could allow a more formal explication of the decision problem. Comparative statistical data on risk and an exploration of a hazard's costs and benefits could all be placed before the public. Even if a social consensus is not achieved, a careful structuring of the issue may, at least, reveal the source of disagreements. In such a milieu, con artistry, glibness, and misinformation stand a greater chance of being exposed.

Many of the characteristics, however, which make analytic and bootstrapping approaches a valuable input into policy decisions, also serve to limit their application.

Analytic techniques run into difficulties when dealing with the realities of risk policy. Using them means working against the institutional and cognitive grain that encourages current practice.

Cognitively, analytic methods presume the existence of well-informed, highly rational decision makers. A burgeoning literature on risk perception,[15] however, is now detailing many of the difficulties people have in making decisions on risk. At least two conclusions stand out. One is that when it comes to handling complex informational tasks such as making probability judgments (an essential task when analyzing risk), we are not very skillful. In the absence of sufficient cognitive skills, individuals tend to rely on various heuristic devices such as the "imaginability" of events, to simplify decisions they have to make. The result, as Slovic et al. [16] observe, is that

...although they are valid in some circumstances, in others they lead to large and persistent biases with serious implications for risk assessment.

Seemingly, the very analytic tools we need to overcome the dilemmas presented by risk questions are the very ones we are least able to cognitively master. In this regard, it is easier to understand why professional management is so widely used, as it conforms more closely to the incremental ways in which people ordinarily make decisions.

Secondly, it seems that in judging risk, people also incorporate other, more qualitative features into their conceptions of what is safe or unsafe. Characteristics such as dread, and the potential for the catastrophic loss of life, influence judgments of risk.

Judgmental problems connected to risk can create discontinuities in perceptions. It is not surprising to learn from state officials, that wide discrepancies exist in the relative expenditures allocated to managing different kinds of risk. While these differences are, no doubt, at least partially explained by differences in political power, they also reflect deep-rooted fears which people have for the hazards they confront.

Certainly, analytic techniques can assist in making objective comparisons of risk. But in cases where public recalcitrance towards a hazard is fueled by such visceral perceptions as global catastrophe or dread, the continued pursuit of policy objectives in the name of societal optimization may, at best, be misplaced and, at worst, a form of technocratic conceit.

Institutionally, the current status of state risk management presents numerous difficulties to overcome in order to systematically implement analytic methods. Several officials, for example, pointed to the abundance of jurisdictional problems which exist among federal, state, and local authorities. Also, regulations are being constantly amended and revised to be in accord with technological as well as political realities. Can hazards really be managed by comprehensive strategies? How can jurisdictions really control hazards, when the hazard cycle, itself, is legally divided in such a way that different officials have responsibilities for different stages of the problem? A case in point is toxic substances. When do they cease being "materials" and become "wastes"? One state official commented that he had no authority over hazardous materials, was generally unaware of the types of dangerous substances imported in his state, or what their consequences might be, or what quantities they presently could be found in his jurisdiction. His responsibilities began only when such materials became waste, and were dumped at licensed state disposal sites. How much hazardous waste was being deposited in unsanctioned locations was, for him, a subject for conjecture.

Alternatively, can state officials manage risk when they are forbidden, by law, to engage in certain control activities? Such is the case in Oregon where private, wood-burning fireplaces and stoves are explicitly exempted by state law from air pollution standards, although they constitute the third largest source of air pollution in Portland and Eugene, the state's two largest metropolitan areas.

How useful can analytic methods be in these circumstances if they require a coherence in organization, which the institutional framework does not allow?

A further fragmentary influence on state policy is the political demands imposed on officials. A particularly noteworthy feature of state risk policy is the eroding insulation between the public and policy makers. Risk assessment and acceptance decisions, formerly viewed as primarily technical in nature, beyond the purview of citizens, now involve large numbers of groups representing a wide cross-section of the population.[17] Public hearings now resemble military encounters, as contending parties come prepared with their own experts, analyses, and strategies to counter those of their opponents.

The capacity of analytic methods to withstand the heat generated by the intense politicization of bureaucratic decision making is uncertain. While they retain a capacity to incorporate a wide range of values, their

highly technical nature leads to a reliance on experts to construct and interpret analyses. For certain issues this may be unacceptable to particular actors in the process. If methods, such as decision analysis and cost-benefit analysis, are to become an integral part of decision making, they will have to be constructed in such a way as to allow for public scrutiny every step of the way. So far, this has not been done, and analytic methods remain inaccessible to a large public.

Resource limitations also prevent more widespread use of these methodologies. States are particularly vulnerable in this respect. Unlike federal risk managers, who can (generally) count on fairly consistent allocations due to the great size of the resource base upon which it depends, those working for states are far more likely to feel the effects of selective economic adversity. With less of a fiscal cushion, fluctuations in the economy can play havoc with state budgets. Oregon, for instance, has had to face severe problems owing to a decline in the wood-products industry, the backbone of the state's economy. California, on the other hand, with a larger, more diversified economy, has been in a better position to weather particular setbacks to one industry or another. The economics of Proposition 13, however, now loom as a future threat to state appropriations. A number of risk management officials in California expressed concern that the spin-off effects of the measure would inevitably cut into their funding, which they viewed as either inadequate or barely sufficient.

The episodic, fragmentary nature of state risk management policy represents a formidable obstacle for analytic methods. The policy processes involved do not easily lend themselves to the kind of rationalistic procedures demanded by these techniques. When they are used, they can not avoid becoming part of the process itself, in which contending parties will seek to manipulate the analysis as a means to enlist political support for their cause.

A major question, then, is that given the fragmentation that exists, can analytic methods be incorporated piecemeal? Or, as Fischhoff et al. phrase it, "will they degrade gracefully?"[18] Are parts of formal analyses better than no analyses at all?

Practically, bootstrapping, as another suggested alternative formal approach, suffers from the absence of a well-developed information base. Okrent has noted that the effort to compile comparative data on societal hazards is meager.[19] Establishing an information base would, most logically, have to come at the initiative of the federal government since individual states, first of all, have no incentive to develop compendia of risks not directly relevant to their own situations, nor, secondly, the resources to do so. Once in place, though, such comparative information would provide states with an economical information source from which all could draw.

Conceptually, bootstrapping techniques would be restricted to risk acceptance decisions, since they are, in effect, simply numbers which reflect societal action already taken, rather than a "book" on how to do risk management.

The potential value of such information is evident. Historical records can be an important resource for future guidance, especially in working to insure some consistency in societal decision making over a range of hazards.

Unfortunately, bootstrapping conceals more than it reveals, and in the situation of state risk management, fails to address a number of important institutional and cognitive questions. First, although there is a lamentable absence of quantitative information, interviews with risk officials indicated that the manner in which numbers are generated are at least as important as their existence. Once they serve as an input to public policy, they will be carefully scrutinized by all contending parties as to how particular interests are advanced or blocked by this information. The numbers produced will not be self-evident, but may become a point of conflict.

Because bootstrapping approaches treat existing standards at face value, they fail to consider the context in which they were determined. Proponents of bootstrapping take an end-result view of historical codes, assuming that standards somehow reflect an optimal balance of risks and benefits. Disparities in political and economic resources that may have influenced the social decision process are conveniently ignored.

While bootstrapping approaches offer decision makers with a ready quantitative answer to risk acceptance choices, they fail to include substantive historical, political and economic understandings underlying the standards, leaving decision makers at the mercy of those who decide to challenge the status of the information.

The static quality of bootstrapping presents other difficulties as well. Its methods imply that we stand mute, and permit past behavior to dictate future action. Policy makers, however, operate in a dynamic environment in which public attitudes towards hazardous activity change. Shifts in public opinion towards nuclear power is one example. Moreover, bootstrapping offers little, if any, guidance for determining standards for new societal hazards, which are so novel that past experience is irrelevant. Finally, it fails to take into account that, even if standards already known were capable of covering all possible future decision problems, they would still be inadequate, because they would neglect the express needs of communities to actively register preferences to participate in decisions governing social welfare.

Cognitively, bootstrapping methods presume the same attributes of the highly rational decision makers as analytic methods. Existing standards are seen as reflecting equilibrium points arrived at by the well-informed

citizen. Many of the most significant aspects of societal risk, though, contain elements of great complexity, precisely the types of challenges to human judgment which psychological research has shown we fare poorest on. The insight furnished by this literature must give us pause as to just how optimal historical decisions on risk have been.

3.5. Local Risk Management

The failure to match managerial resources with changing responsibilities in the overall schematics of risk management is particularly obvious at the local level. Although state and federal authorities do provide assistance to local governments in the form of categorical assistance, and more direct help (e.g., federal monitoring of local water supplies in Oregon), local units are in situations where they must fend for themselves in meeting their risk management responsibilities. These responsibilities, as previously noted, consist primarily in monitoring and intervention. Risks are identified, assessed, and sanctioned at the federal and state level, leaving local units with the task of dealing with their manifest consequences. It is the local stream, airshed, landfill, and drugstore which play host to the hazardous products and processes deemed safe enough at higher jurisdictions.

As a case in point, fire departments, usually under municipal control, now confront problems of far greater complexity and uncertainty than in the past. They are responsible for providing emergency services, e.g., reacting to chemical spills, tanker derailments, etc. In fighting fires, department personnel must now anticipate the dangers presented by a growing range of synthetics, plastics, fibers and chemicals. Yet, the training, information systems, and organizational procedures required to deal with these problems is lacking.

Professional management would provide local government with the skills needed to meet its responsibilities in the risk management process. The institutional and cognitive obstacles to implementing a more formal approach at the local level are, however, great. At this point, it would be unrealistic to assume that most local governments will be able to internally generate the solutions needed for the problems they face.

Professional management varied widely from one local jurisdiction to another. In Oregon, communities like Eugene and Portland employ highly skilled individuals in administrative positions. Other communities leave risk management to people with little or no training. Perhaps the volunteer fire department best exemplifies this latter practice. As jurisdictions grow smaller, what fragmentary use is made of professionals tends to disappear entirely. Many smaller communities in Oregon, for example, are so small, that they must depend on the State Emergency Services Division to monitor risks and intervene when necessary. These services are both sporadic and do not form the basis of any coherent risk management policy.

Unfortunately, the presence of hazardous activity does not necessarily imply the availability of proper managerial skills to deal with problems. While smaller communities usually contain fewer and less significant societal hazards, this is not always the case. The most extreme example of a community which would warrant more comprehensive risk management in Oregon is Albany, a city of less than 35,000. As the precious metals processing center in the United States (it produces, among other things, the zirconium rods for nuclear reactors), its industrial plants generate a variety of extremely hazardous chemical and radioactive wastes. The local health and environmental effects of these facilities on workers, groundwater, and air quality have only recently become the target of investigation and then, by state, not local authorities.

Probably the major factor preventing more extensive professional management of risk at the local level is the sheer lack of financial resources. Municipal and county governments are currently experiencing critical fiscal problems. Where local jurisdictions, at the turn of the century, raised the bulk of public revenue, today the nation's 18,000 local governments raise less than the fifty state governments, and far less than the federal government.[20] With a dwindling resource base, in comparison to increased demand for services, local officials find themselves pressed to allocate precious resources. The difficulties in funding risk management activity is exacerbated by the pressures to attract or hold industry (a practice sometimes referred to as "smokestack chasing") which may be among the major hazard producers in a community. There is little incentive to more systematically monitor risk or intervene against companies whose presence may hold the key to a locality's economic well-being. The reluctance of local officials to closely monitor the dumping of hazardous wastes in Love Canal, and their subsequent inaction after the dangers of the area were well-publicized, dramatically illustrates the situation confronting many communities.

Of the seventeen local officials contacted in the second questionnaire, only five considered their resources adequate. Those who said their resources were inadequate qualified their statements in several different ways. One local official working for a public utility said his budget was adequate to monitor "mundane" contaminants, such as microbiological problems, but was insufficient to detect and measure heavy metal content. A California official expressed concern that his agency was not equipped to monitor most chemicals in the drinking water supply. Though his laboratory could do some of the work, he relied upon the state to do a great deal of his testing. Results often took two or three weeks to arrive. An emergency services official said that adequacy depended on the hazard in question. According to him, his office was unprepared for a disaster involving a chlorine spill. It could, alternatively, respond adequately to the problems resulting from an earthquake which registered six. It could not respond to a seismic event, however, which registered seven. A hazardous waste official in Los Angeles noted that he had a staff of six people to monitor 20,000 hazardous waste generators.

Officials contacted expressed the belief that they did little in the way of really managing problems. Said one official, "we are fighting fires".

Another institutional factor that hinders implementing professional management is the resistance local interests demonstrate at the prospects of placing decision making authority in the hands of alleged "experts". Professional management, like the other formal approaches, is not simply an objective way of looking at risk, but a way of considering political and value issues. New modes of decision making affect an entire range of political accords that have been carefully structured over time. Local politics are especially sensitive to even minor changes in the conduct of public business. Increased protection from hazardous activity may not be enough to justify an expanded technical elite. Health and safety issues do not exhaust the public agenda.

The cognitive issues surrounding professional management are also a factor in risk policy at the local level. People respond to hazards they perceive as the psychological literature demonstrates. While many hazards may be manifest at the community level, some are more evident than others. Thus, while a community may be subject to hazards of serious, chronic effects, it will react to threats more immediately recognizable. Visual observation and odor, for instance, were the two most frequent cues which one official said prompted public complaints to his air pollution agency. Another official expressed the public's concern this way, "keep the cops out on the street, and the fire department running".

The lack of professional management at the local level leaves risk monitoring and intervention to the most informal kinds of decision making, in which institutional and cognitive frailties entwine. Coming at a time when risks to public health and safety at the local level are increasing, the need for improved management in communities is especially urgent.

4. CONCLUSION

Equating risk acceptance with state and local risk management ignores the comprehensiveness of the process. It also places undue emphasis upon an activity that is less significant than other tasks that occupy the attention of risk management officials. Local authorities do not engage in acceptable risk decision making, and state authorities devote only a fraction of their resources to it. The majority of decisions that state and local officials make in regard to risk are in the area of monitoring and intervention. These activities are best left to what has been identified here as professional management as they involve routine, technical issues which conform to the problem-solving skills of professionals.

Decisions about risk identification, assessment, and acceptability represent the authoritative functions of risk management. Although these are not a major focus of management at the state level, these are significant activities since they form parameters for the entire process. The authoritative tasks call for strategies which are explicit, comprehensive, and logically sound. Professional management, the prevailing approach in all areas of risk policy is deficient in addressing these tasks. Bootstrapping approaches do provide a societal perspective on risk, but contain institutional and behavioral assumptions which would make them difficult to apply in a policy context. In any event, bootstrapping approaches require an information system which is barely developed.

Among the formal approaches examined, analytic methods hold the greatest promise for assisting decision making in policy formulation. Their flexibility, openness and logical rigor can address many of the problems endemic to risk assessment and acceptability.

Regardless of the formal approach used, risk management can not be expected to approximate the self-contained, smoothly functioning properties of a cybernetic-like system, since each approach is an amalgam of institutional and cognitive, as well as scientific/technical interests.

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