

Review Essay

**HAZARDS, RISKS, AND ENTERPRISE:
APPROACHES TO SCIENCE, LAW, AND
SOCIAL POLICY**

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Aaron Wildavsky. *Searching for Safety*. New Brunswick, NJ: Transaction Books 1988. xii + 253 pp. Notes, index.

Mary Douglas. *Risk Acceptability According to the Social Sciences*. New York: Russell Sage Foundation, 1985. 115 pp. Bibliography.

Lee Clarke. *Acceptable Risk? Making Decisions in a Toxic Environment*. Berkeley, CA: University of California Press, 1989. xiii + 229 pp. References, list of interviews, index.

Sheila Jasanoff. *Risk Management and Political Culture*. New York: Russell Sage Foundation, 1986. ix + 93 pp. Notes.

David O'Brien. *What Process Is Due? Courts and Science-Policy Disputes*. New York: Russell Sage Foundation, 1987. xvi + 242 pp. Bibliography, list of cases, index.

“Learning to worry together as a species may well be our next essential evolutionary turning point” (Michael Shodell, 1985, contributing editor to *Science* 85). The statistics of risk warn us of common dangers we face as workers, consumers, or simply residents on planet Earth. The estimated risk of dying, we are told, is increased “one in a million” in any year by common (and some not so common) activities: drinking a half-liter of wine (from cirrhosis of the liver), smoking 1.4 cigarettes (cancer, heart disease), or eating 40 tablespoons of peanut butter (liver cancer caused by aflatoxin B); living 2 days in New York or Boston (air pollution) or 5 years at a site boundary of a typical nuclear power plant, spending 1 hour in a coal mine (black lung disease), or 6 minutes in a canoe, 10 miles riding a bicycle, 150 miles traveling by automobile, or 1,000 miles by jet airplane (all by accident); or having one chest

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X-ray in a good hospital (cancer caused by radiation); and on and on.

We have increasing control over many hazards that have plagued humankind in the past and, by nearly all measurable criteria, life is now less hazardous than in the past. Yet, ominous portents confront us on every hand. What is going on here?

Most of us are at least confused, if not anxiety-ridden, by twin paradox. *New knowledge* of harmful substances in the food we eat, the water we drink, and the air we breathe exacerbates our sense of the hazards of living. More disturbing is our growing realization that the potential for the destruction of life is as much a product of the crowning achievements of science and technology as is the enhancement and enrichment of life (see Dietz *et al.*, forthcoming). The sensationalism of some media reports contributes to the confusion by failing to place estimated risks in proper context. For example, reports fail to note assumptions on which estimates are based and fail to balance potential harms with benefits associated with the same hazards.

Other fundamental confusions also surround these issues, however. As the economist Frank Knight noted nearly three quarters of a century ago (Knight, 1921), there is often a critical failure to distinguish between risk and uncertainty. Knight defined risks as calculable contingencies of economic activity. Risks, in these terms, could be insured against. Absent calculable knowledge of future events (i.e., faced with uncertainty), entrepreneurs nevertheless must make decisions based on available information. Despite increased sophistication in the estimation of *particular* risks, a great deal of uncertainty is involved in the more serious risk debates of the day. In part this is due to the *coupling* of risks. The failure of individual parts in a technological system can be calculated and backed up by redundancy, but failure probabilities, and the seriousness of consequences, may increase in unknown ways when parts of complex systems are closely coupled (see Perrow, 1984) or when toxic substances interact or are added to already contaminated environments. These factors blur the distinction between risk and uncertainty in risk assessment and management as well as in common discourse.

Related to the failure to distinguish between risk and uncertainty is the failure, especially under conditions of uncertainty, to be precise concerning the margin of error associated with various risk estimates. The acceptable margin of error, rather than the acceptability of risk, often becomes the major public policy issue (Reiss, 1989). For a variety of reasons, margins of error appear in many cases to be narrowing. Our understanding of such problems as acid rain and the greenhouse effect is improving. Similarly, better estimates of the risks of nuclear weapons testing, of building nuclear power plants, and of depletion of the ozone layer are becoming possible. On the other hand, error terms for such esti-

mates remain very large. This is particularly true with respect to what Catton (1980) has called "ecological scarcity." Is the biosphere fragile and therefore not to be tampered with, or is it remarkably robust and resilient? If the latter, can we be sure of recovery from whatever insults and abuses we may have heaped upon it? Are we nearing—or have we surpassed—vital "tipping points" beyond which recovery may prove to be impossible?

Better science and technology are central to the resolution of such problems. As the preceding discussion suggests, however, there are no simple technological answers. While discourse about hazards and their attendant risks and uncertainties often become esoteric and technical, much of it is also necessarily vague and imprecise. When translated for public understanding and policymaking, this discourse often touches deeply held values and beliefs. In the process, participants and positions in debates over risks and uncertainty become polarized.

With a few notable exceptions (see Rifkin, 1985), debates concerning risk-related matters center not so much on scientific paradoxes as on social interpretations, often of the same or similar data. Risk analysts increasingly are aware that the most profound problems regarding risks associated with advances in science and technology are social in nature. Yet, the social and behavioral science disciplines paid scant attention to uncertainty and risk as integral to the human condition. Instead, the tendency was to focus on particular hazards and their consequences and on putative causal conditions. Examples abound: natural disasters, technological disasters, health, war, exposure to toxic substances, poor nutrition, drugs, crime. As a result, risk as a social phenomenon, including social aspects of those risks on which the bulk of attention has been focused, has gone relatively unnoticed.

This is changing rapidly. Scientists of all stripes have become increasingly dissatisfied with fragmented and particularistic study of traditional classes of hazards and "social problems" and have begun to search for commonalities across problems and disciplines (see Short, 1984, and forthcoming). This essay discusses a number of books that take a larger view.

WILDAVSKY

Few scholars have given us more to think about with respect to how institutions, governments, and other collectivities respond to risk and uncertainty than Aaron Wildavsky and his collaborators, among the latter, most notably the distinguished anthropologist, Mary Douglas (Douglas and Wildavsky, 1982). The volumes by Wildavsky and Douglas reviewed here extend their analyses.

Searching for Safety is no less than a new and rival theory as to how safety may be achieved. Safety is, of course, always a relative, rather than an absolute condition. As a goal, it is necessarily

elusive, perhaps illusive—best viewed as a process fraught with uncertainty. Statistical estimates of dangers often have large margins of error and are subject to change as new knowledge is discovered. Strategies designed to eliminate dangers often fail, and, more importantly, they are likely to involve recognized opportunity costs. Preventive actions taken in anticipation of danger may cause us to forgo potential benefits from a line of research or a new technology.

Wildavsky defines risk as “the potential for harm and/or safety” (p. 3). He insists that insofar as possible *all* costs and benefits be factored in to considerations of social policy with respect to risk. “‘Net benefit,’ not ‘no harm,’ should be the criterion of choice” (p. 57). His analysis is cast primarily in the contrast between *anticipation* and *resilience* as broad strategic alternatives in the search for safety. Each, he argues, subsumes other strategies: “Decentralized, rapidly moving trial and error contributes to a strategy of resilience. Centralized, slow-moving regulation of trials to prevent errors is essential to a strategy of anticipation” (pp. 8–9). The tendency of strategies of anticipation, and of much current governmental and popularly preferred policy, he charges, is “trial without error.” Wildavsky contrasts this with trial and error, noting that “benefits will never be discovered unless risk (in the form of trial and error) is tolerated” (p. 57).

While he acknowledges at various points that competing considerations must be balanced in order to improve prospects for safety, and that there are circumstances under which strategies of anticipation are to be preferred to strategies of resilience (pp. 121–23), the style of Wildavsky’s book is deliberately provocative. Following an introductory chapter in which the major arguments of the book are summarized, four chapters in Section I elaborate these arguments by drawing on “current controversies over risk—regulation of chemical carcinogens, efforts to reduce pollution of different kinds, safety on the job, and so on—that appear to have reached an impasse in terms of productive thinking” (p. 10). Section II, also four chapters, examines four very different areas in which the universality of resilience and anticipation as strategies is examined: how nonhuman forms cope with danger, coping with safety concerns in nuclear power production (written with Elizabeth Nichols and with an appendix by Robert Budnitz), “How the Human Body Defends Itself” (with Dennis Coyle), and “From Resilience to Anticipation: Why the Tort Law Is Unsafe” (with Daniel Polisar). Section III is devoted to “Principles”: “Why Less Is More: A Taxonomy of Error” (with William R. Havender) and a final chapter titled “The Secret of Safety Lies in Danger.”

Wildavsky’s examples, admittedly selective, make a strong case for preferring resilience over anticipation *except when predictability of change and knowledge about what to do are both high*. The Knight distinction between *risk* and *uncertainty* be-

comes critical, for except within very broad parameters, the “risks” we are talking about are quite uncertain. This is particularly the case when the effects of advances in science and technology are at issue. For Wildavsky, then, resilience wins hands down. Even when predictability is high and knowledge is low, or vice versa, it is argued, strategies of more resilience and less anticipation are to be preferred because the latter may do more harm than good and may entail unacceptable opportunity costs in terms of lost health and safety.

The case for resilience is based on “the principle of uncertainty” (certainty can never be assured), “the axiom of connectedness” (“safety and harm . . . are intertwined in the same acts and objects”), and “the rule of sacrifice” (p. 4). The first two of these are unexceptionable. In addition to inevitable uncertainty at the frontiers of knowledge, in many areas such as the environment it is virtually impossible to change just one thing. Therefore, we cannot be certain about the specific effects of applications of new knowledge.

Central to Wildavsky’s analysis is the rule of sacrifice, which holds that “the safety or macrostability of the whole” is “dependent upon the risk taking or instability of the parts” (p. 5); “if the parts of a system are prevented from facing risks, the whole will become unable to adapt to new dangers” (p. 6); and “whole systems cannot be stabilized unless the parts are destabilized in adapting to environmental change” (p. 72). From this rule Wildavsky takes on the “free-rider” problem, special interest groups, and the danger of state intervention to save large firms from failure. Redundancy in the form of backup parts and systems and competitive markets “works (as long, of course, as the failure of any single part is independent of the failure of its backups) because it divides risks” (p. 72). The caveat is critical, since as noted above, large, complex, and tightly coupled systems are prone to “normal accidents” (Perrow, 1984).

The rule of sacrifice is also invoked to criticize environmental and special protections accorded particular causes and interests, e.g., “health, safety, employment, inflation, urban, rural, and other impact statements”—one might add children, adolescents, and the aged; “the world of public policy is in danger of becoming all constants and no variables. How will the costs of change be borne if everyone says ‘Not me’? The NIMBY reaction (Not In My Back Yard) of those faced with necessary but inconvenient facilities is a potent example” (p. 73).

Aside from hyperbolic understatement in this last sentence—surely the NIMBY phenomenon cannot be dismissed as mere inconvenience—the issues posed by Wildavsky’s analysis are profound. His discussion of tort law is illustrative. Tort law, which is reactive, and regulation, which is meant primarily to be preventive, have traditionally embodied resilience and anticipation,

respectively. If fault was demonstrated, redress for harm was achieved through the law of personal injury. Frivolous suits were restrained and recovery of damages in serious cases was facilitated by the concept of duty. In recent years, however, changes “have transformed tort law in practice from being largely resilient to mostly anticipatory. By making tort law resemble regulation—where penalties are prescribed in advance in order to prevent practices known or believed to be harmful—tort law has lost the quality of resilience, the flexibility to fit the remedy to the harm in individual cases” (pp. 170–71). This has happened because standards of contributory negligence have been virtually abandoned; the standard of negligence has been replaced by one of strict liability.

Wildavsky notes the special vulnerability of smaller municipalities. “Since almost every accident that takes place is at least partially attributable to some condition over which some city had jurisdiction” (p. 179), these municipalities do not have the resources to insure themselves. Safety has been reduced by diversion of resources to rising liability insurance costs and “deep pockets” suits.¹ In the broader context of products liability and malpractice suits, resources that might be invested in safety are wasted and overall resources are depleted when, to forestall threatened suits, unnecessary medical tests are ordered or new products and services are withheld from the market. The “deep pockets” phenomenon obscures “the connection between prevention and safety. . . . The secret of the tort law was that in proportioning the punishment to the crime, it created a viable balance between a good deal of resilience and a lot less anticipation. . . . By making the tort law mostly anticipatory, huge expenditures have reaped minimal safety benefits, advantages so small they are undoubtedly overwhelmed by decreases due to declines in the standard of living” (p. 186).

Resilience, anticipation, opportunity costs, and unanticipated consequences are abstract and complex notions, even when copiously illustrated by example. Suffice to say that in Wildavsky’s book the examples chosen are numerous and strong. Interpretation, however, is another matter. There is ample evidence that tort law, as it emerged in this country, was “responsible for a good deal of 19th century callousness” (Friedman, 1985, p. 473). Changed as it is today it remains inadequate in many respects. Neither the neoclassical economic theory of tort law nor its practice has been effective in deterring corporate behavior related to latent injuries, for example, or in assuring compensation proportionate to the harms they were meant to redress (see Felstiner and

¹ A Rand Corporation study found that jury awards to plaintiffs who successfully sued the government were more than two and a half times, and awards to those who successfully sued corporations were more than four times, those to plaintiffs who sued individuals.

Siegelman, 1989). Moreover, the bench has never been monolithic, as legal scholars often have noted. Liability continues to evolve in the courts, and there is much disagreement among judges and lawyers as to “whether negligence or strict liability should be the general standard” (O’Brien, reviewed below, p. 48).

Wildavsky is fond of catchy titles and extreme positions. His “Goldilocks Is Wrong: In Regulation of Biotechnology Only the Extremes Can Be Correct” (Wildavsky, 1988) presents arguments that, like *Searching for Safety*, have the virtue of clarity (if one remembers the story) but the vice of oversimplification. “Goldilocks” is a masterful review of current debates concerning biotechnology and related social policy alternatives. Wildavsky has chosen his ground carefully. To alter slightly a common metaphor, in biotechnology, clearly the “genie is out of the bottle” to such an extent that social policy can do little except demand responsible behavior by its practitioners and cope with such dangers as it may produce. Here resilience in response is to be preferred over rigid and restrictive anticipation of such problems. It is quite impossible to anticipate these problems with any degree of certainty and quite likely impossible to prevent large-scale advances in biotechnology regardless of what we might wish to do about it.² Wildavsky also is correct that both benefits and harms (rather than “no harm”) should be factored into policy choices. This is especially true with respect to biotechnology, where the potential benefits to human health and the environment are truly mind boggling (cf. Koshland (1989), and responses by Berkowitz (1989), Cooper (1989), and Luria (1989)).

Wildavsky’s work raises many important questions concerning how society ought to address risks. However, his conclusion that resilience nearly always is superior to avoidance is premised on assumptions and biases that are at least questionable, and at worst dangerous.

The argument that initial risks must be taken in order to secure long-term safety is for the most part unexceptionable. One can stipulate, also, that “much vital knowledge can be developed only as a result of trials and use” and that “one must sample the unknown in small doses in order to keep in tune the coping mechanisms that are needed for dealing with surprises” (p. 58). He goes too far, however, in arguing that, since the “combination of the principle of uncertainty and the axiom of connectedness actually explains what we observe—namely, that society gets safer despite the continuous introduction of new hazards—it must be that safety benefits of the new outweigh their associated dangers” (p. 42).

Many “new hazards” are not “introduced” but “discovered” by

² A continuing problem will be that of balancing “naturally occurring” species and “engineered” species, as the former continue to be depleted via extinction. See, e.g., Fox (1989).

scientific study and by more careful monitoring of experience than has been possible in the past. Advances in health care and safety are attributable in large measure to such discoveries—discoveries that permit greater and more refined resilience *and* anticipation. The extensive monitoring of public health that at least in some measure is responsible for better health and lowered mortality rates might not have occurred had not governments played a more activist anticipatory role than Wildavsky's policy preferences would appear to allow.

He stresses the critical role of knowledge in the search for safety, noting that materially richer societies are also far more likely to be scientifically richer. But his emphasis is primarily on the usage of technology (experience) rather than on basic science and theoretical advance. The search for safety thus is heavily empirically biased. The importance of new empirical knowledge cannot be denied, of course, but the limitations of such knowledge, absent adequate *theoretical* knowledge, are increasingly apparent in risk-related matters. It is at least arguable that the absence of theoretical knowledge accounts in large measure for the inadequacies of empirical prediction. To the extent that this is true, the major thrust toward accumulating knowledge in the search for safety ought to be focused on the basic sciences out of which theoretical knowledge is most likely to come, rather than on the trial-and-error empirical process that Wildavsky prefers.

Wildavsky urges market strategies that promote trial and error rather than regulation by bureaucratic hierarchies or bowing to populist voluntary organizations that would hamper experimentation, overreact to fears of possible dangers, and exert unnecessary controls over entrepreneurs. Capitalism is the engine that promotes his search for safety. "The best process known to mankind for using our mistakes to do better," he argues, "is the decentralized, trial-and-error system of people coordinating their own efforts called capitalism" (Wildavsky, 1989).

As a general perspective on matters of risk and uncertainty, this strategy raises a host of problems to which there are no easy answers. As Wildavsky acknowledges (indeed he insists), his argument is biased toward aggregate benefits and harms and treats lightly issues of the distribution of benefits and harms. This utilitarian stance ignores the fundamental issue of fairness that is so critical with respect to risk and error perceptions and judgments as to acceptability. Just as "How safe is safe enough?" begs the more important question, "How fair is safe enough?" (see Rayner and Cantor, 1987), the prospect of often nebulous benefits flowing from unfettered trial and error is unlikely to assuage the fears and apprehensions of those whose lives may be affected adversely by the errors of others.

His resilience and fine-tuning argument assumes that the short-term interests of corporations and corporate personnel are

compatible with the sort of trial and error that brings about greater safety, an assumption that has not often stood up to empirical inquiry. This assumption is equally suspect among governments, unions, and most other players (including many lawyers and scientists) in risk-related matters. Governments, too, often cut corners in order to avoid short-term costs (see Clarke, reviewed below) and lie and conceal information to protect classified or proprietary interests. Unions and union leaders often have proven themselves to be as opportunistic as have their corporate and governmental counterparts. Further, professionals of all stripes have not been immune to self-interest, creating a host of ethical, as well as legal, problems (see, e.g., Goldblatt, 1989).

Wildavsky's preference for avoiding "Type 2 errors" (mistaken acceptance of false hypotheses) over "Type 1 errors" (mistaken rejection of true hypotheses) is justified in part by reference to evidence that the wealthier, developed countries are healthier and more resilient when faced with catastrophe than are poorer, less developed countries. This observation leads to the implication that in economic development lies safety. What is it about developed countries that make them safe? Wildavsky's answer is "trial and error" that is inherent in capitalism. Again, the assumption is questionable. Many years ago my mentor William F. Ogburn (1951; Ogburn and Allen, 1959) demonstrated that technological development was more responsible for the standard of living in the United States and in other countries he studied than private ownership (as an indicator of economic system), abundance of natural resources, and population size. The developmental solution also raises distributional issues. Technologically advanced countries have profited from exploitation of nonrenewable resources and by exploiting the people and resources of less developed countries. The political economy of safety is poorly developed. Wildavsky is an important player in its development, as are others who view matters from more centrist or left-of-center perspectives (see, e.g., Clarke, 1989; Carson 1989; O'Connor, 1989; Buttel, 1987).

Tying safety to economic growth "risks" what has been termed "Type 3 error," that is, "obscuring a more profound problem by preoccupation with a lesser issue."³ Some of the issues raised by the accumulation of knowledge in the basic sciences render the exploitation of nonrenewable resources trivial by comparison. Abuses to the biosphere, for example, have accumulated over centuries of industrial development and may be approaching a threshold beyond which recovery may prove impossible (see, e.g., Bello, 1989).

So, where does this leave us? Though more questions are raised than answered, the other books here reviewed provide partial answers.

³ I am indebted to Bill Catton for this insight; see Catton, (1989).

MARY DOUGLAS

Mary Douglas begins her analysis of social science contributions to understanding risk acceptability by highlighting issues of justice, freedom, and equality, noting that monitoring for fairness is a characteristic of institutions that “depend upon personal commitment rather than upon coercion” (p. 5). Her book is a brief but brilliant scholarly lecture, an extended conversation regarding the relevant theories and research literatures bearing on risk acceptability. Her basic argument is that assessments of risk cannot be understood without assessment of the different social environments in which people live and the types of societies they want and are working to build (see also Winner, 1986).

Douglas raises a host of questions with respect to which social science theory is generally in disarray: questions about distributive justice and about “danger money” as compensation for hazardous work and whether the hazards it is meant to compensate for should be regulated, questions about conflicts between principles of equality and health protection, and whether a community has “any inherent right to commit its future generations to heavy risks” (p. 11). More central, we do not have a language we can use to discuss these questions (p. 13).

But justice should not be separated from the theory of knowledge. Future generations are likely to see the present intellectual impasse as the consequence which tends to follow when a theoretical discipline (in this case the theory of rational behavior) has generated a powerful technology of analysis which in turn supports the intricate machinery of administration on which the contemporary society depends. . . . The dialogue about risk and justice tends to be conducted in two languages: traditional English rhetoric on behalf of regulation and mathematical language on behalf of principles of free choice. This is reminiscent of a medieval law court in which the native plaintiffs made their vernacular requests and were answered in dog Latin.

The route out of this difficulty, according to Douglas (pp. 17–19), lies in a probability theory that takes into account the social and cultural processes involved in concept formation that are fundamental to the selection of dangers:

Probability theory has by no means yet claimed its full domain in twentieth-century thought. At present, probability analysis, though heavily used, plays only an ancillary role: It is treated as a robot-like servant of the social sciences. . . . [A] new understanding of risk perception will supply a theoretical frame for mainstream sociological thought. . . . Probability theory will eventually transform the assumptions about rational behavior that currently guide research about risk perception. . . . The structure of society and its moral basis will be part of the probabilistic analysis.

The centrality of institutional experience to human thought and action underlies Douglas's analysis: "information does not even become information at all unless it is somehow seen and coded by the perceiver" (p. 27). The "focus ought not to be on the danger but on the institutions if we are interested in public perception. . . . [T]he expectation of dangers tends to be institutionalized so that it stabilizes and generally supports the local regime, whatever it may be" (p. 54). "We can safely assume that institutions stop curiosity as well as reward learning" (p. 55). As has often been observed, a way of seeing is also a way of not seeing.

Douglas softens the polarization of resilience and anticipation in the search for safety: "A truly human ecological approach to disaster which incorporates organizational models of the local social-natural system would also take into account anticipatory and remedial institutions which give resilience to a human population" (p. 54). Because institutions label and classify disasters "into existing categories of responsibility . . . disasters are not quite unforeseen. . . . The people are already alerted to the first symptoms of danger, but their attention is focused on moral or political weaknesses that they expect will escalate the damage" (p. 54).

The moral issues surrounding advances in science and technology are especially complex. For some, scientific "tampering with nature" challenges "expectations of the persistence of the moral social order" (Barber, 1983, pp. 16–17). The fact that human activity has often and always sought to alter nature is of little consequence. Uncertain consequences of unprecedented possibilities for altering human life, even with the best of intentions, pose the real threat. Moreover, the "moral significance" of "human dignity" seems to be at stake, threatening the very "essence of the human condition" (Stanley, 1978, pp. 62–65). Finally, specific technological hazards, such as radiation and other toxic poisons, even "betray the senses and deceive the body's alarm systems by seeming a good deal more innocuous than in fact they are." Their moral significance attaches to "the way they work rather than the amount of harm they do," as Kai Erikson (forthcoming) notes. The irony that some of the products of scientific and technological advance are associated with poison (historically "the epitome of evil and treachery"—Erikson) returns us to the second of the twin paradoxes, noted above.

Each of these issues is a challenge to the logic and limits of science and technology. Each undermines the faith and trust in science that has marked Western civilization. Combined with other issues (e.g., fairness, "normal accidents," and past institutional violations of trust), they underline the folly of dismissing public fears and protests as "irrational."

Conceptual shortcomings are accompanied by methodological ones. Douglas notes that her approach poses a serious challenge to conventional survey research techniques. "Risk perception ques-

tionnaires cannot tap this level of awareness" in part because "it is beyond the scope of a questionnaire to tap into underlying assumptions, even supposing the survey designer is interested in looking for them" (p. 54). Surveys reveal "inconsistencies" in public views toward safety, technology, and regulation; and they are unable to explain variations in public activism in this arena in terms of attitudes toward technological risk and benefits or salience of the issues posed. Douglas would agree with Gould *et al.* (1988), authors of the best surveys conducted on these matters, that "the population survey may not be the best vehicle for studying the relationship between public sentiments on technology safety and existing safety regulations" (p. 141). If not surveys, what then? Douglas calls for ethnographies "of what is said and done about disasters before and after they happen" (p. 94).

LEE CLARKE

While Lee Clark's study of the 1981 accidental toxic chemical contamination of the Binghamton, New York, State Office Building (SOB) is not ethnography, it is an exemplary sociological analysis of weaknesses in institutional anticipation of safety problems and of bureaucratic response to unanticipated problems. The result is both illustrative and critical of themes of the Wildavsky volume.

The Binghamton accident began when a failed switch gear in the SOB mechanical room created an electrical arc. The resulting fire released a large amount of a transformer's PCP-containing coolant and sent toxic soot throughout the building and into the streets of downtown Binghamton. Tellingly, Clarke notes that the spread of toxic chemicals would have been limited to the mechanical room had not New York State exempted itself from state fire codes which required that ventilation shafts must be sealed if they are located near a mechanical room.

Clarke's book is a carefully documented case study of organizational decisionmaking and public involvement under conditions of hazard and uncertainty. The accident (p. 12)

drew together more than a score of actors—including legislative bodies, health agencies, unions, government executives, hospitals, the media, private firms, universities, and a grass-roots association—to form a crowd of organizations. This early phase . . . was characterized by pervasive ambiguities as the actors struggled to define both the problem and their response. Over time, the organizational crowd configured itself so that three agencies were left with the responsibility for the exposed people and the polluted building. As this structuring process proceeded, policies that were designed to solve those puzzles underwent radical change.

Clarke notes that "the accident could not have happened in a

better place" (p. 158)—the building was fairly new, provisions for safety (aside from the state exemption, noted above) were in place, and state-of-the art science and technology were available for response. Nevertheless, science and expertise proved inadequate either to define or to delimit the hazards posed by the accident with sufficient specificity to provide clear guidelines for response. Adapting Cohen *et al.*'s (1972) metaphor for *intraorganizational* decisionmaking, Clarke describes the process by which city, county, state, and federal agencies struggled to define their authority and responsibilities in the aftermath of the accident as an "interorganizational garbage can" (p. 26). Prolonged negotiations between organizations were required before levels of risks that were deemed acceptable could be determined and organizational responsibility and authority allocated. The role of science and expertise was quite limited in this process. Only *after* complex and prolonged interorganizational negotiations and decisionmaking did formal risk assessment come into play. Risk assessment was a tool that helped organizations "construct a reality" in terms of which actions taken could be made to "seem reasonable" to elements in their environments (p. 181).

Part of the environment, in the Binghamton case and in other situations involving risk and uncertainty, is the threat of legal suit. In the United States (much less in other countries) the potential for lawsuits is ever present. Shortly after the Binghamton fire, for example, "lawsuits totaling \$1 billion were pending against the state of New York" (p. 16).

SHEILA JASANOFF AND DAVID O'BRIEN

The role of the law in risk-related matters is the focus of the last two volumes here reviewed. Sheila Jasanoff's *Risk Management and Political Culture* is a brief commentary on the manner in which Western democracies seek "to control a particular technological hazard: the risk of developing cancer from exposure to man-made chemicals" (p. vi). David M. O'Brien's *What Process Is Due?* is a more extensive examination of "Courts and Science-Policy Disputes" in the United States.

The picture of risk-related policies that emerges from these volumes is one of variation, compromise, and negotiation between interested parties rather than the extremes of unfettered "trial and error" or "trial without error" ("zero risk") in Wildavsky's "Catch-22" scenario. Jasanoff notes, for example, that the "impracticability" of the "zero-risk approach . . . enshrined in the Delaney clause of the Federal Food, Drug, and Cosmetic Act" (forbidding the introduction of most carcinogenic additives into food) gave rise to "a working consensus . . . around the proposition that the most stringent regulatory standards should be used in control-

ling substances shown to cause cancer in humans or animals" (p. 11).

Jasanoff's comparative analysis demonstrates the socially constructed nature of both the science and social policy of carcinogen control. The manner in which Western democracies establish criteria for identifying and classifying carcinogens is varied and changing: risk assessment is defined and used differently in different countries; the allocation of responsibility among scientists and regulators varies, as does the articulation of carcinogen policy for various publics and the extent to which public debate is encouraged.

Jasanoff's analysis examines the consequences of different styles of regulation in the United States, on the one hand, and in Europe and Canada, on the other. The U.S. system is relatively open and participatory, with a preference for formal, adversarial procedures, while the European and Canadian systems are more "informal, confidential, consultative, and cooperative" (p. 56). Certainly science and technology, as well as the social policy and implementation of risk analysis and management, are more matters of *public debate* in the United States. The deliberations and actions of national, state, and local legislative bodies, executive agencies, and courts are regularly reported in mass media and available to all who are interested through more specialized publications. Others have noted that this combination of elements leads to the "social amplification of risk" (Kasperson *et al.*, 1988) which has been the subject of debate in risk analysis circles (see, e.g., Rappaport, 1988; Rip, 1988; Svenson, 1988; Rayner, 1988; Machlis and Rosa, forthcoming; Short, forthcoming).

Jasanoff attributes these differences in style, in part, "to the extraordinary judicialization of the American administrative process in the past forty years" (p. 56). She acknowledges also the importance of such laws as the Freedom of Information Act and the tradition, often legally mandated, of public hearings when public interests are at stake.

Jasanoff is skeptical of the U.S. style, arguing that it is often needlessly cumbersome, time-consuming, and expensive, that it produces paralysis in the decisionmaking process and undercuts the capacity of government to act. In some respects these concerns parallel those voiced by Wildavsky, although Jasanoff does not address directly the search for safety; and her vision of the proper provenance of government appears to be quite different from Wildavsky's.

Neither Jasanoff nor Wildavsky discuss the hard realities faced by people who are directly at risk, or the concerns of the various publics whose interests are at stake. Importantly, they downplay the role of distrust in the search for safety. Whether faced by workers, consumers, or simply members of the general public, hazardous encounters and widely transmitted messages regarding un-

certainties associated with science and technology (some of them false or misleading, to be sure) provide ample justification for concern. The fairness issue, structural constraints on personal choice (e.g., regarding jobs and affordability of alternatives), lack of adequate information by experts, policymakers and implementors, as well as the public, lack of candor by those responsible for providing information and for carrying out public policy, the awful possibility of fateful “Type 3 errors”—all have led to a great deal of distrust. Distrust on all sides and among all parties to risk-related issues is, in fact, a common theme of most of the research in this area (see Dietz *et al.*, 1989; Clark, 1988; Walsh, 1981; Levine, 1982; Nelkin and Brown, 1984).

David M. O’Brien also is concerned with the judicialization of science-policy disputes, and he grounds his analysis firmly on fairness and trust issues. Noting that “courts are reactive agents of social change” and that they have a “remarkable degree of institutional independence” in the United States, his argument is summarized as follows (pp. vi–x):

What most critics of courts and the regulatory politics of science-policy disputes overlook is how deeply embedded the value of fairness—as identified with the judicial process—is in our cultural responses to dispute resolution. . . . [C]ourts are drawn into science-policy disputes, and the regulatory politics of managing risks tends to be judicialized, because of the interplay of the normative cultures of science, law, and democratic politics. . . . [W]hat process is due is culturally determined. . . . The surge of legislation and litigation involving science-policy disputes in the last two decades reflects profound social changes . . . that evolved in accordance with basic cultural characteristics of the American way of life. Specifically . . . science-policy disputes tend to be judicialized because the regulation of risks . . . almost uniformly poses a vexing trilemma for policymakers. That trilemma consists of accommodating competing demands for scientific certainty, political compromise, and procedural fairness in the regulation of risks.

O’Brien focuses on the historical role of private law litigation in the assessment and management of risks and on the evolving regulatory role of private law. His assessment is similar to, but more balanced than, Wildavsky’s. He notes that the tort liability system is at times unfair and unreasonable for victims, industries, and risk managers. He decries the imposition of “a judicial policy of no risk of risk,” as in “the area of strict products liability” (p. 68). Because regulatory agencies cannot assess and regulate all suspected and newly discovered toxins, and because courts are less likely than administrative agencies to be “captured” by those they are charged to regulate, private law litigation remains an important tool in risk management (p. 69).

O’Brien examines other issues, as well: the capacity of judges

to rule on complex science-policy disputes, where he notes that the latter are no more complex than many other issues facing courts, e.g., racial inequalities, abortion, evolving judicial/administrative partnerships in regulation, and the costs and tradeoffs of judicializing regulatory politics. He concludes, as have others, that science-policy disputes are less about science than about normative issues.

The “judicialization of risk” is an important issue for Wildavsky, Jasanoff, and O’Brien, and indirectly for Clarke. As Hurst (1980–81) notes, judicial review tends to be “episodic and unsystematic rather than comprehensive and ordered in its contacts with the full range of agencies’ activities” (p. 470). The extent to which risk-related grievances are judicialized depends on a large number of variables, among them the extent to which injurious experiences are perceived and rights to redress are known and realized or realizable, the availability of alternatives to civil suit, and a variety of characteristics of individuals, groups, and communities as victims or at risk (see, e.g., Miller and Sarat, 1980–81; Felstiner, Abel, and Sarat, 1980–81; Silbey, 1980–81; Nader, 1988).

Science-policy disputes are an important part of the even larger issue of the role of science in human societies. How are we to protect the integrity of “the office of citizen” in an increasingly specialized and technologically dominated society? (See, e.g., Stanley, 1978; Winner, 1986.) How are we to evaluate and accommodate or ameliorate the effects on the social fabric of technology and other engines of social change? How are we to create and sustain the trust that, some have argued, is a functional prerequisite for even the possibility of society, and that often seems to be absent in the search for safety? (Lewis and Weigert, 1985.) These books do not answer such questions, but they provide grist for their consideration.

CONCLUSION

At the heart of each of these books is a concern for understanding the nature and consequences of human response to risks and uncertainty related to hazards. The hazards of greatest concern have to do with advances in science and technology. All are agreed that human activity in all its variegated aspects is critical to the understanding of hazards, whether of natural or human origin, and to effective coping strategies.

Wildavsky tells a cautionary tale—of the age-old conflict between unbridled capitalistic enterprise and bureaucratic rationalization and restraint on that enterprise. Polemics aside, caution is warranted on all sides and among all parties to high-stakes conflicts such as those examined in these volumes. We must not pretend that we know more than we do, or conduct ourselves so that knowledge is restricted and opportunities for increasing safety are lost.

Yet, these are not the most fundamental issues in these conflicts, as the other volumes suggest. As in her previous book with Wildavsky, Douglas advances as the basis for risk acceptability certain *value frameworks*, viz., those associated with market-type (contractually oriented), bureaucratic (status-based, hierarchically organized), and egalitarian-collectivist relationships, institutions, and organizations. She notes the “paradigmatic centrality” of “bureaucracy and market” to understanding how modern societies are organized and how they function. Increasingly, however, social policy with respect to hazards is scrutinized and heavily influenced by the activities of voluntary associations. Even the science invoked to justify risk policy is subject to challenge. Once viewed as a peculiarly American (U.S.) institution, voluntary associations now attract the support of millions of people throughout the developed world and many citizens in less developed countries. Some come to resemble bureaucracies and markets more than the voluntary associations Tocqueville wrote about more than a century ago.

In complex societies each of us typically is involved, individually and with others, in multiple relationships characterized by features common to markets, hierarchies, and voluntary organizations. Our hopes and fears, our loyalties and allegiances, our perceptions and judgments, therefore, are influenced by considerations embedded in each of these organizational forms. Institutional analysis of the sort prescribed by Douglas is further complicated by the reality that the dimensions of her trichotomy are very likely continuous and overlapping, often flowing into one another, rather than being discrete and discontinuous (see, e.g., Leifer and White, 1986; Stinchcombe and Heimer, 1985).

Such complexity is a formidable challenge to the social and behavioral sciences, to the law, and to sociolegal scholarship. Important beginnings have been made in studies of the sort represented by Clarke (1988) and others (see, e.g., Erikson, 1976; Levine, 1982; Nelkin and Brown, 1984; and Hawkins, Manning, Shapiro, and Vaughan, all 1989). These studies add to our understanding of the manner in which individuals, groups, and organizations assess and cope with hazards and disasters. But we need to know a great deal more.

The law is a rich “research site” for studying these matters, concerned as it is with maintaining, correcting, or creating states or conditions—states and conditions, it must be said, that are often freighted with risk and even more often with uncertainty. Much is at stake, as these volumes demonstrate and as I have argued.

Sheila Jasanoff (1989), addressing the question of how “regulatory science” (“the science that forms the basis for regulatory decisions”) might be evaluated, argues that both “good science” and “good policy” demand the same qualities. If, as suggested by studies in the sociology of science and by countless studies of lawmaking and enforcement, her prescription seems hopelessly idealistic,

perhaps that is a major part of the challenge. What is needed, she argues (p. 273), is:

integrity, critical thinking, willingness to disclose the weaknesses in one's argument . . . quite simply the norms of good decisionmaking, fundamental to our democratic culture. Honesty, rationality, and full disclosure are virtues of paramount importance to science as well as public policy. Surely regulatory science, which calls for close collaboration between science and policy, should not conform to lesser standards.

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