Chapter 1 The Case for Comparative Analysis

Avoiding technological risks is a central preoccupation of our age. We are haunted daily by risks of varying probability, magnitude, and emotive impact: dioxin in the air, trihalomethanes in the drinking water, pesticides on our food, drunken drivers on the highways, nuclear power plants in our backyards, and overarching all, the threat of extinction through war. Toxic chemicals figure prominently in our images of disaster. Most technologically advanced countries have experienced their distinctive national trauma with toxic substances: chemical plant explosions in Italy and Great Britain, a calamitous gas leak in India, mercury poisoning in Japan, the slow death of the Black Forest in Germany, and the "ticking time bomb" of hazardous waste sites in the United States. Such catastrophes have helped push risk management to the forefront of our scientific, political, and public policy agendas. We expect our scientists to make increasingly sophisticated measurements of risk and our government officials to translate this information into immediate and effective policy prescriptions.

The use of science in risk management is the subject of this monograph. The topic has attracted considerable attention in re-

cent years not only among policy-makers, but also among concerned interest groups, scientists, and academic "science-watchers." For policy-makers and the public, a prime challenge is to devise scientifically credible ways of dealing with technological risk, since information about such risks is usually incomplete and subject to differing interpretations. Regulatory policy often has to strike a balance between the benefits of waiting for definite scientific proof and the costs of exposing the public to risk until such proofs are available. Groups who are threatened by technology understandably want to make sure that their interests are adequately considered in this balancing process. However, designing effective participatory mechanisms for the lay public is increasingly difficult in a decision-making environment heavily dominated by technical expertise.

The scientific community has discovered that it, too, has much to gain from a closer familiarity with the procedures developed by political officials to mediate expert disagreements and to bridge uncertainties in the technical record. Scientists have a large stake in assuring that such procedures do not impede progress in science or compromise the norms of distinterestedness and objectivity which are universally regarded as hallmarks of good science. For academic observers of science, the analysis of science-based regulatory decisions offers insights into the nature of scientific uncertainty, the negotiation of competing scientific claims, and the institutional conflicts that arise between science and other societal interests when scientific information becomes a key factor in political decision-making.

Many risks of modern technological civilization, including those created by toxic chemicals, are global in origin and impact. It is difficult to imagine solutions to transboundary problems such as pesticide pollution, acid rain, or the "greenhouse effect" without cooperation among the scientific, regulatory, and business communities of many different countries. Although these risks are transnational in character, surprisingly little comparative research has been done on the way different societies think about and seek to control them. The dearth of cross-national research can be attributed, in part, to the provincialism of traditional policy analysis. Such studies tend to regard risk management decisions as the product of distinctively national legal and administrative processes and are skeptical about the possibility that lessons learned within one policy system can be transferred to another.

Accordingly, studies of risk management by policy analysts have usually focused on the experiences of single nations.

Belief in the universality of science is another major factor that discourages comparative research on risk. When science is viewed as the primary determinant of risk management policy, the possibility of cross-cultural variation in the analysis and control of risk tends to be downplayed. Yet a growing body of literature in the sociology and anthropology of science challenges the notion of scientific determinism and emphasizes the role of cultural factors in shaping public responses to risk. Faith in science's independence from social influences has gradually eroded under the scrutiny of a generation of sociologists led by such influential figures as Robert Merton[1] and Thomas Kuhn.[2] Among studies focusing specifically on risk, Mary Douglas's work is especially notable for showing intricate connections between beliefs about pollution and other social concerns in both primitive and advanced societies.[3] A number of scholars have used the framework of decision theory developed by Fischhoff, Slovic, and Lichtenstein to demonstrate how ideological and cultural factors influence public perceptions of risk.[4] This research both documents and partly explains the differences that are frequently found between "lay" and "expert" assessments of risk. The political alignments that underlie modern scientific controversies have been explored in detail by Dorothy Nelkin and others interested in the politics of technical decisions.[5]

These lines of research all suggest that comparative analysis can offer special insights into the problems of using science in technological risk management. Studies across several countries can illuminate the ways in which particular legal and institutional features color the interpretation of scientific data and influence the resolution of technical controversies. Such comparisons make it possible to identify the strengths and weaknesses of alternative national approaches to dealing with expert conflicts. In this way, cross-national research advances both the descriptive analysis of risk management and the prescriptive goal of improving existing mechanisms of scientific decision-making. More generally, understanding the role of cultural factors in the assessment and management of risk promotes a more sophisticated appraisal of the limits of science as a tool for public policy-making about risk.

Within the last decade, a handful of scholars from a variety of disciplines have begun making explicit comparisons among the

risk management policies of different technologically advanced countries. Though all of these studies fall under the broad heading of policy research, they are distinguished by different methodological approaches and they display different levels of interest in the scientific basis for risk management decisions.

One approach has been to investigate risk management primarily within the framework of comparative politics. Such studies include Lundqvist's work on clean air policies in Sweden and the United States,[6] Nelkin and Pollak's comparison of the French and German anti-nuclear movements,[7] and Kelman's analysis of Swedish and American occupational safety and health policy.[8] In a related vein, Kunreuther, Linnerooth, and Starnes's volume on the siting of liquefied natural gas facilities in Europe and the United States examines the impact of different institutional arrangements on the analysis and management of risk.[9] Other scholars are concerned with risk management primarily as an indicator of national regulatory styles and the structure of business-government relations. For example, Vogel's work on British and American environmental policies[10] and Badaracco's case study of vinyl chloride regulation in four countries[11] both draw contrasts between the essentially "cooperative" European approach to risk management and the more "confrontational" approach prevailing in the United States. Scientific issues and the role of the scientific community have played at best a peripheral role in these studies, which focus rather on the demands of interest groups and the responsiveness of political institutions to claims about risk. For purposes of cross-national comparison, science is held to be a constant, and relatively little attention is devoted to the activities of scientific elites or to variations in the use of technical information by private pressure groups.

A quite different orientation to the comparative study of risk management has emerged from the tradition of critical studies in science. A central assumption in this body of work is that science itself is not immune to social and cultural pressures; to varying degrees, scientific knowledge is "socially constructed." Sociologists of science have found support for this hypothesis in comparative research, particularly in the discovery that the same risk has been assessed differently by regulators and their scientific advisers in different national settings. Thus, both a study of pesticide regulation by Gillespie, Eva, and Johnston[12] and a study of the estrogen replacement controversy by McCrea and Markle[13]

asked why British and American advisory committees, acting on the basis of the same technical record, reached different conclusions about risk. Their work sought explanations in a variety of institutional variables ranging from the internal organization of the relevant administrative agencies to the ideological concerns of scientists and affected interest groups.

One of the few attempts to marry the sociology of science perspective with the comparative politics approach was undertaken in a four-country comparison of chemical control policies by Brickman, Jasanoff, and Ilgen.[14] To test the impact of politics on science, this study systematically investigated the positions adopted by scientists, interest groups, and government officials in Europe and the United States with respect to the identification and control of carcinogens. One conclusion of the book was that a fundamental feature of political organization—the allocation of political authority among the three branches of government—heavily influences the form and intensity of scientific debates relating to risk. In particular, the extreme fragmentation of political power in the United States not only increases the demand for scientific explanations of risk decisions, but also encourages competition among different perceptions of risk. This helps explain why the technical basis for regulation is debated more extensively and at a higher level of sophistication in the United States than in Britain, France, or West Germany.

This monograph builds on the existing comparative literature on risk management and seeks to extend it in three ways. First, it explores some of the special institutional and procedural problems occasioned by the use of scientific information in risk management. One problem arises from the fact that decisions about risk are neither wholly scientific nor wholly political, and therefore demand novel collaborations between scientists, public officials, and private interest groups. Weinberg's seminal work on science and transscience called attention to the fact that many issues relevant to risk management lie outside the bounds of scientific investigation. In Weinberg's words, such questions "may arise in or around science, and can be stated in the language of science, [but] they are unanswerable by science—that is, they transcend science."[15] Cross-national analysis helps define the boundaries between the scientific and transscientific aspects of risk management and illustrates the methods that policy-makers can adopt in dealing with issues at the borderline of science and politics.

Another problem—the need to secure dependable or "certified" knowledge—is common to all consumers of science, whether they are scientists or government agencies. In the context of risk management, however, the problem of quality control acquires a special edge, because the science available to policy-makers is new or contested and because political officials generally cannot afford to wait for the gradual processes of scientific dissemination to sift good studies and methodologies from bad. A comparative study of risk management can provide useful information about the procedures that governmental agencies can use to control the quality of policy-relevant science.

Second, the monograph compares emerging national policies concerning the use of quantitative risk assessment in the regulation of hazardous technologies, particularly toxic chemicals. Although many observers believe that such methodologies will play an increasingly important role in worldwide efforts to manage technological risks, the scientific and political conflicts surrounding risk assessment have not yet been extensively studied in a cross-national framework. The current governmental interest in risk assessment developed largely as a result of attempts by the United States and other industrial countries to regulate certain low-probability threats to public health, including those presented by radiation and by chemicals suspected of causing cancer. This monograph examines the history of carcinogen regulation in Europe and North America during the 1970s in order to explain some of the differences in current national preferences for the use of quantitative risk assessment.

Third, this monograph uses comparative analysis to enlarge our understanding of the way political cultures influence the balance of power between citizens and technical elites in modern democracies.

As we approach the end of the twentieth century, we appear to have unleashed a variety of technologies that threaten not only our immediate health, safety, and well-being, but the continued survival of humanity. In seeking to master these pervasive risks, democratic societies are committed to preserving certain basic values, such as the citizen's right to understand and to participate in governmental decision-making. In this context, the relationship between the average citizen and the expert who possesses specialized knowledge about risk has become a matter of acute concern. With science and technology playing an ever more im-

portant role in risk management, how can private citizens strike a reasonable balance between activism and restraint, between deference and skepticism, in their relations with technical experts? Are we moving, as Dickson contends,[16] into an era of dangerous complacency about rule by technocrats? To what extent do national political cultures condition the relationship between experts and the lay public in the policy process? The existing scholarship on comparative political culture has largely neglected these special problems of democracy in a technological age.[17]

In exploring these broad issues of science policy and politics, the monograph focuses on a specific area of risk management: the regulation of chemical carcinogens. Carcinogens as a class have aroused greater public concern and attracted more regulatory attention in the past two decades than most other categories of toxic substances. As a result, both the scientific and policy issues relevant to the management of carcinogenic risk have been widely debated in public, creating a useful record for comparative analysis. Examples of divergent national approaches to the regulation of carcinogens are drawn from the United States, Canada, and several European countries. In all of these countries, a relatively open decision-making system makes it possible to retrieve information about major policy initiatives and to trace the history of particular regulatory decisions. There are numerous reasons to expect a parallel development of risk management policies in all the countries discussed in this monograph. They have broadly similar political systems, share a common scientific tradition, and participate in joint decision-making and information exchange through such international organizations as the United Nations and the Organisation for Economic Cooperation and Development. Divergences among them are thus particularly intriguing and provide a rich basis for studying the problems and limitations of alternative national policies for the assessment and control of risk.

The succeeding chapters begin with specific issues of carcinogenic risk management and move to larger questions about science policy and political culture. Chapters 2–5 present some basic contrasts among national approaches to controlling carcinogenic risk. An overview of "cancer policies" in several countries in chapter 2 is followed by an analysis in chapters 3 and 4 of national procedures for identifying carcinogens and quantitatively estimating their risks. Chapter 5 discusses the response of policy

systems to advances in knowledge about the mechanisms of cancer causation. Chapter 6 looks at the impact of national philosophies of risk management on the regulation of formaldehyde, a suspected human carcinogen. The next two chapters examine the institutional choices made by different governments for managing scientific and political disputes about risk. Specifically, chapter 7 focuses on institutional arrangements for public participation and relates these to underlying features of each country's political culture. Chapter 8 examines the role that two relatively neutral sources of expertise—the scientific community and international organizations—can expect to play in resolving controversies about regulatory science. The concluding chapter summarizes the major findings of the comparative study and indicates some directions for future research.