
Introduction

When this work began, we conducted a fairly exhaustive review of the literature on regulation. Specifically, we sought research on how to improve compliance with regulation. Although we discovered a rich literature on macroissues such as market alternatives to regulation and the regulation-deregulation debate, there was surprisingly little on the microissue of how to make regulation effective.¹

Direct command-and-control regulation has been criticized on many fronts in recent studies. Salamon, for example, notes the political difficulties inherent in the use of coercive policy tools and how government, as a consequence, has steadily moved toward the adoption of less coercive measures.² Kagan presents a picture of an increasingly fragmented and dysfunctional system.³ Neither Salamon nor Kagan suggests how regulatory power can be made politically acceptable in instances where direct command-and-control regulation is required. Sparrow, in contrast, advises practitioners on specific ways to make their policy programs more successful.⁴ He believes that regulators can be more effective by adopting promising enforcement approaches for improving regulatory performance.

It is reasonable to focus on the issue of regulatory effectiveness because regardless of the normative values and preferences of researchers, it is clear that regulation is here to stay.⁵ Policymakers in the United States continue to rely on regulation as a means of influencing individual and corporate behavior. Yet regulation has been too narrowly construed as command-and-control standard setting and enforcement. More accurately, the concept of regulation includes the full range of activities intended to influence private behavior to conform to public goals. Given

the tendency of Congress to regulate, it makes little sense to focus academic study solely on the wisdom of regulation and ignore the issues of regulatory effectiveness and compliance.

In a real sense, the issue of overregulation is a phony one. Given the high level of corporate influence in the policymaking process,⁶ truly ruinous regulation is either safely ignored or lightly enforced. The issue is less dramatic than it appears to be. It is in the public interest for American industry to produce as many goods and services as efficiently as possible. It also is in the public interest for government to prevent industry from harming people in the process of accumulating wealth. In most cases, the public will have to pay for increased levels of safety. From double-sealed drug containers to hazardous waste cleanup, the public pays. In other cases, regulation can actually improve productivity by forcing modernization and the adoption of new technologies. For example, recycling regulations have helped promote energy efficiency, and new equipment for engine emissions control has improved air quality.

A problem with the debate over whether to regulate is that it diverts attention from the real trade-offs policymakers must make. Instead of learning how to develop a viable, creative, interactive relationship between business and government, policymakers focus their analytical guns on a war that will never be fought. Regulation is not an ideological preference; it is a practical necessity. Given the complexity of modern economies, government must play a role in mitigating the harsh side effects of economic development.

Even in the antiregulatory environment of the Reagan administration of the 1980s, regulation never ceased.⁷ In many areas, it was only slightly curtailed, and in other areas it even expanded.⁸ The reason that President Reagan was unable to “end” regulation was that ending regulation was never his goal. It could not have been. There is, in fact, a fairly broad consensus that certain industries must be regulated in order to avert negative consequences. This is a matter of practical necessity and a result of the complexity and interconnectedness of modern economies.

Despite the political appeal of decentralization and despite our society’s attraction to the concepts of “small is beautiful” and “back to nature,” the future is likely to see the country’s (and world’s) economy

become even more complex and interdependent. Few are about to return to the land and farm. If anything, the need for regulation is likely to grow. Therefore, the ability to regulate effectively must improve, or the efficiency of the economic system will suffer. Regulation should be seen as a method of social and economic management in need of improvement.

If our regulatory process is unable to grow out of its relatively primitive state of symbolic politics and posturing, the country will face one or more of the following unwelcome outcomes:

- Economic inefficiency due to unnecessary compliance costs
- Negative externalities caused by unregulated economic behavior (unsafe technology, tainted food and drugs, and environmental pollution, for example)
- The development of nonsustainable societies

Despite its economic problems at the turn of the century, the Japanese, among others, have demonstrated the importance of close government-corporate relations in competitive modern economies. Unless an effective partnership is created, American business will be overwhelmed by foreign businesses that have learned to combine state and corporate power. Effective regulation is a critical component of a sophisticated government-industry relationship.⁹

This book introduces the concept of strategic regulatory planning and presents an overall approach for achieving compliance with hazardous materials laws. Although this book primarily focuses on the decision to include and later exclude methyl tertiary butyl ether (MTBE) in gasoline and the implementation of a critical provision of the Hazardous and Solid Waste Amendments of 1984, specifically the regulation of underground storage tanks (USTs), many of its conclusions are applicable to other pollution control programs and probably to other policy areas (e.g., education, health care, and transportation). Little research has been conducted on how to design effective regulatory programs, and the design of such programs is the principal concern of this study.

This introduction provides a general introduction to issues pertaining to the management and regulation of hazardous waste and materials and reviews the problems and policies in this area. Specific attention is paid

to the use of MTBE in gasoline as a way to lower air pollution emissions and efforts to abate leaking USTs. Although both the MTBE issue and the UST issue represent separate policy dimensions, they are interrelated in that MTBE is a gasoline additive and a large percentage of USTs store gasoline. This provides a good balance between shared policy similarities and differences across the two issue areas and makes comparisons meaningful and potentially insightful. The chapter concludes with an overview of the book. The discussion begins with an analysis of the issues concerning the delegation of authority by Congress.

Congressional Delegation of Authority

Lowi offers an insightful and compelling indictment of contemporary American government in general, and of congressional delegation of power to regulatory agencies in particular.¹⁰ Although he does not object to delegation in principle, he does criticize delegation without guidelines and standards, a practice he attributes to widespread acceptance of interest-group liberalism. He later writes that the congressional delegation of authority “is an inevitable and necessary practice in any government,” and “no theory of representative government is complete without it.”¹¹ Nonetheless, “the delegation of broad and undefined discretionary power from the legislature to the executive branch deranges virtually all constitutional relationships and prevents attainment of constitutional goals of limitation on power, substantive calculability, and procedural calculability.”¹² He reasons that “every delegation of discretion away from electorally responsible levels of government to professional career administrative agencies is a calculated risk because politics will always flow to the point of discretion; the demand for representation would take place at the point of discretion; and the constitutional forms designed to balance one set of interests against another would not be present at the point of discretion for that purpose.”¹³ As a consequence, liberalism is undoing itself because public policies are resulting in privilege, and private goods are going not to the deserving but to the best organized.

Fiorina questions the correctness of Lowi’s explanation, pointing out that there are a number of good reasons for legislators to delegate regulatory authority (e.g., lack of technical information and time).¹⁴ He

demonstrates how these reasons are empirically supported by previous research. He then turns his attention to the role that uncertainty plays in the literature on regulatory origin, and he offers various formal models of the role of uncertainty in the regulatory process.¹⁵

The Rule-Making Process

Despite Lowi's concerns, rule making has become an important component of public policymaking.¹⁶ Numerous government agencies, such as the U.S. Environmental Protection Agency (EPA), are required by legislative mandates to draft and implement specific guidelines and regulations that are broadly referred to in enacted legislation. The Administrative Procedure Act (APA) of 1946, written by Congress to bring consistency and predictability to the decision-making processes of government agencies, states that a "rule means the whole or part of an agency statement of general or particular applicability and future effect designed to implement, interpret, or prescribe law or policy."¹⁷ Rules provide the specific information often missing in laws, and rule making brings a capacity for adaptation to changing conditions that a statute alone would lack.¹⁸ Rules originate in agencies, stipulate law and policy as directed by authorizing legislation, have either a broad or narrow focus, and attempt to influence future conditions. According to Kerwin, "Increasingly, rulemaking defines the substance of public programs. It determines, to a very large extent, the specific legal obligations we bear as a society. Rulemaking gives precise form to the benefits we enjoy under a wide range of statutes. In the process, it fixes the actual costs we incur in meeting the ambitious objectives of our many public programs."¹⁹ The process of rule making, as Kerwin explains, is central to the formulation and implementation of public policy in the United States. It differs and is separate from the legislative and judicial process, but it also is a critical part of the overall policymaking effort.

The New Deal and the 1960s and 1970s were eras of sharp growth in governmental programs that required extensive rule making to meet ambitious goals.²⁰ Rule making also expanded during the 1980s and 1990s. Today, despite criticisms and attempts at reform, it is an indispensable governmental process, and this is unlikely to change in the

future. The manner in which rule making is carried out has significant implications for the functioning of democracy and the nation's well-being.

Although rule making was intended to be efficient, factually oriented, nonpolitical, and objective, it has become something quite different.²¹ Rule making appeared to grant bureaucrats an immense amount of freedom of action. Instead, they must adhere to a long list of procedural guidelines and are subjected to political pressure from different quarters—the White House, Congress, interest groups, and the public.²² The rule-making process has become increasingly open and information driven, thereby providing stakeholders an opportunity to influence the final outcome of the process.²³ Opportunities for participation have grown and diversified since the passage of the APA, and agencies are under pressure to take public comments seriously.²⁴ The Office of Management and Budget plays a crucial role in the rule adoption process by reviewing new regulations and assessing their economic impact.²⁵

Kerwin identifies and discusses eleven stages of rule making.²⁶ Briefly, they include origin of rule-making activity, origin of individual rule making, authorization to proceed with rule making, planning the rule making, developing the draft rule, internal review of the draft rule, external review of the draft rule, revision and publication of a draft rule, public participation, action on the draft rule, and post-rule-making activities. It is a mistake to assume that the rule-making process has a clear start and finish; components of rules can be challenged and altered at any time.

Due to congressional impatience with the length of time certain government agencies took to promulgate rules, Congress has inserted “hammer” provisions in particular types of legislation. These regulations are required to go into effect by a specified date unless the agency adopts its own regulations. These “regulations by statute” normally include regulatory requirements that no one, including Congress, truly prefers. They are used to place pressure on agency officials to accelerate the rule-making process. Hammer provisions, along with deadlines, have become a widely used popular accountability tool of Congress.

The APA suggests that there are three categories of rules: legislative or substantive, interpretive, and procedural.²⁷ Legislative or substantive rules are promulgated when, by legislative mandate or authorization,

agencies draft what in essence is new law. Interpretive rules explain to the public how agencies interpret existing law and policy and do not create new legal requirements. Procedural rules outline the organization and processes of agencies and often concern matters of importance to the public.²⁸ Rules can also be classified by the segment of society they influence and direct (e.g., rules for private behavior).

Negotiated Rule Making

Regulatory negotiation, or “reg-neg” as it is frequently referred to, offers competing interests a direct and meaningful role in rule making. A fairly recent concept, this idea began to take shape in the early 1980s with the changing political climate and as academics and practitioners began to write about the approach. Writings at the time discussed the rationale for regulatory negotiation, its likely benefits, the necessary conditions for success, and the obstacles to its execution.²⁹ Harter, for example, severely criticized contemporary rule making for its adversarial process, distortion of information, foundation for litigation, and the lack of progress that had resulted.³⁰ As a consequence, announcements of rules were often delayed, and their quality was frequently poor. Affected parties were frustrated and disillusioned by the process, and compliance suffered as a consequence. Instead, Harter recommended the adoption of an alternative process, one in which conflict was resolved through face-to-face negotiations, bargaining, and compromise.³¹ Agency officials would organize and participate in the negotiations rather than remain aloof from the process. In this way, information would flow more freely, thereby producing higher-quality regulations in less time than in traditional rule making. Stakeholders would also be much less likely to litigate after the rule was issued because they were part of the process and therefore would perceive the regulation to be legitimate.³² Compliance was predicted to increase, saving taxpayers money on enforcement costs.³³ In 1990 the federal government responded to these and other criticisms and calls for reform by passing the Administrative Dispute Resolution Act and the Negotiated Rulemaking Act.³⁴ In 1993 the National Performance Review, chaired by Vice President Al Gore, made a number of recommendations, including widening the use of reg-neg to improve rule making.³⁵

Since the adoption of regulatory negotiation by certain agencies, including the EPA, there has been considerable research of the process. Coglianese, for example, has analyzed the timeliness and litigation experience of rules developed using negotiation.³⁶ He finds that negotiated rules are not produced more quickly than are rules developed using standard procedures.³⁷ He also reports that rules developed using negotiation are, on average, challenged in court more frequently than those that resulted from traditional processes.³⁸ In another study, Langbein and Kerwin examine the quality of the experience of participants in both reg-neg and conventional rule making.³⁹ Based on their interviews with random sets of participants, they find that those involved in negotiated rule making give that process higher ratings on the quality of information it generated, the amount learned, economic efficiency, cost-effectiveness, compliance, legality, overall quality, net benefits for the organization, and the personal experience of the respondents than participants in the conventional rule-making process. In contrast, Siegler, who represents the American Petroleum Institute in regulatory negotiations, believes that reg-neg is a cumbersome process “for everyone involved.”⁴⁰ Coglianese reports that “negotiated rulemaking has not lived up to its promising potential to save regulatory time or prevent litigation.”⁴¹ He concludes that regulatory negotiation is not worth the additional time, money, and resources required for its operation. Overall, Coglianese and Coglianese and Allen argue that reg-neg does not necessarily lead to improved policy design and more effective regulation.⁴²

The Time It Takes to Make Rules

The time it takes to make rules in government agencies, especially in the EPA, has been a topic of research. Kerwin and Furlong, for instance, analyze the average time it takes to formulate rules in four major programs at EPA: air, water, toxic substances, and waste.⁴³ They report that rule making takes anywhere from just over two years to a little under five years.⁴⁴ Although it is difficult to say how much time EPA should take in issuing rules since conditions vary from one policy context to another, Congress has clearly grown frustrated with the pace of rule making in the EPA. By 2003, Congress had passed approximately one

thousand statutory deadlines for the issuance of regulations under a variety of environmental laws.

The EPA, for example, experienced serious delays in the rule-making process for the Resource Conservation and Recovery Act (RCRA) of 1976. The law is designed to regulate generators, transporters, and disposers of solid waste (garbage). Initially, the EPA's Office of Solid Waste and Emergency Response (OSWER) concentrated its efforts on trash collection and disposal services provided by local governments because these activities generated the greatest amount of trash. By the early 1980s, however, it became clear that a much greater threat to the environment and public health was posed by the inclusion of toxic wastes in garbage. Reports of serious groundwater contamination led Congress to amend RCRA and pass the Hazardous and Solid Waste Amendments (HSWA) in 1984. This new law, among other things, substantially altered OSWER's mission and approach to rule making, greatly expanded its jurisdiction, and imposed tight deadlines for the issuance of the numerous regulations needed to implement the new statutory provisions.⁴⁵ As a consequence, OSWER became the most efficient rule-making unit in EPA, issuing regulations quicker than any other program office in the agency. However, in an EPA report titled "The Nation's Hazardous Waste Management Program at a Crossroads," it was observed that the great volume of rule making within a short period of time resulted in low morale, high staff burnout, and turnover in the RCRA program.⁴⁶ Thus, although many rules were issued in record time, the result was an inconsistent, incoherent regulatory program that may not have been fully understood by the target population.⁴⁷ Clearly, then, speed in rule making can have costs.

EPA and Rule Making

Despite these earlier problems, the EPA has become quite efficient and effective at rule making.⁴⁸ McGarity, for instance, observes, "With the very notable exception of the turbulent early 1980s, EPA has acquired a well-deserved reputation as one of the most intelligently run agencies in the federal government. While its output has never been high, it has . . . been of increasingly high quality."⁴⁹ Over the years EPA has moved away from, for example, its practice of appointing a work group for all rules

and has fashioned a new, more sophisticated tier system. Rules are now assigned one of three tiers depending on the rule's importance, its cross-environmental media implications, and the potential for controversy inside or outside the agency. Kerwin believes other agencies in the federal government are likely to adopt this model.⁵⁰

Coglianesse, in his examination of negotiated rule making in the EPA, however, cites the failure of the Clean Fuel Negotiated Rulemaking Committee to head off conflict concerning the requirements for reformulated gasoline under the Clean Air Act of 1990.⁵¹ In its effort to secure consensus, the reformulated gasoline rule led to the adoption of MTBE. Immediately following its adoption, however, citizens complained about headaches and dizziness associated with the additive. Others complained about the increase in fuel prices. These complaints were widely covered in the media. Coglianesse concludes, "To this day, press reports about the rule continue, though now they focus on cases of groundwater contamination with MTBE, a substance which is reported to be a possible carcinogen."⁵²

As Harter points out, the EPA has valued negotiations and partnering highly, and it has strongly promoted negotiated rule making.⁵³ The aim has been to reach a consensus in rule making. Although there have been some complaints, most applaud the EPA's effort to pursue and improve negotiated rule making. More generally, and in opposition to Coglianesse, Harter believes that negotiated rule making has worked well throughout the bureaucracy.⁵⁴

The Hazardous Waste Problem

There is widespread agreement among scientists and policymakers that the production and disposal of hazardous materials has become an enormous and complex problem in this country. The data certainly bear this out. At the end of World War II, the United States produced about 1 billion pounds of hazardous waste per year.⁵⁵ Since then, the generation of hazardous waste has increased at an alarming rate, approximately 10 percent per year.⁵⁶ About a ton of waste is now generated annually for every citizen in the United States. According to Rosenbaum, "Today, about thirty-five thousand chemicals are used daily in U.S. industry. Between five hundred and one thousand new chemicals are created annu-

ally. Currently the EPA has more than ten thousand new chemicals pending review, as required by the Toxic Substances Control Act (TSCA) of 1976.”⁵⁷

Hazardous materials and hazardous wastes differ from one another. Hazardous materials are potentially toxic substances used in manufacturing processes. Hazardous wastes are potentially toxic substances that are the unwanted by-products of manufacturing processes. Unfortunately, a significant amount of these wastes are not disposed of in an environmentally safe manner.⁵⁸ Though no estimates are available on the amount of hazardous materials used in manufacturing, that number should be considerably higher than the figure for waste.

A wide variety of industries, led by the organic chemical and metals industries, generate hazardous wastes and dispose of them in different ways.⁵⁹ Although exact figures on waste generation, transporters, and disposal sites are unavailable, Plehn, a former director of the EPA's Office of Solid Waste, estimates, “Over 750,000 businesses generate hazardous waste, and over 10,000 transporters move it to treatment or disposal at over 30,000 sites. Up to 50,000 sites have been used at some time for hazardous waste disposal.”⁶⁰ About 2,000 of these sites pose a serious and imminent threat to the environment and, in many cases, to public health. Among the dangerous substances transported and stored at hazardous waste dumps are flammables, heavy metals, asbestos, acids and bases, and synthetic organic chemicals. Even radioactive material has been discovered at some sites. A large number of these substances are carcinogenic, cause birth defects, or affect the central nervous system. Clearly, hazardous waste management is one of the most important and pressing issues policymakers at all levels of government face today.⁶¹

Although agreement exists on the pervasiveness of the problem, there is much disagreement over how best to regulate the handling of toxic materials and the disposal of hazardous waste. Environmentalists, for example, demand direct government intervention to ensure compliance with standards in the handling of dangerous materials. Industry leaders, however, argue that such actions will require huge expenditures on their part, possibly forcing them out of business. As a result, they will have no choice but to ignore strict regulations and procedures. Policymakers, who are in the middle of this controversy, must therefore choose regulatory approaches that will satisfy the most intense concerns of involved

parties and also protect the environment and public health. How to select and implement the most acceptable and effective regulatory plans is a major concern of both legislators and environmental officials.⁶²

Background of Hazardous Materials Policy

In an attempt to ameliorate the hazardous materials problem, the federal government has enacted several laws directly concerning dangerous materials. The passage of the Toxic Substances Control Act in 1976 signaled a new awareness among policymakers of the need to regulate the introduction each year of thousands of new chemicals into the environment. The well-publicized tragedy at Love Canal, New York, led to the enactment of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980. Better known as Superfund, the bill established a five-year, \$1.6 billion program to clean up the nation's worst abandoned, hazardous, and toxic waste dumps.⁶³ Superfund was reauthorized in succeeding years and funding was increased; however, its implementation proceeded slowly. By the late 1990s, it became clear that the magnitude of the abandoned waste problem and the money required to clean up the worst sites far exceeded initial expectations. By 2004, 883 sites on the National Priority List had been cleaned up substantially. Although the progress of Superfund site abatement improved considerably in the 1990s, the program still faces a backlog of seriously contaminated sites (about 475), cost overruns, technical complexities, and political controversy.⁶⁴ President George W. Bush decided not to reauthorize and continue funding the program during his first term in office, and as of late 2004 the restoration of funding for this program was still in the hands of Congress. RCRA requires the federal government to formulate specific rules for handling and disposing of hazardous waste.⁶⁵ States are expected to ensure that private parties obey these rules within their borders. The major incentive that a corporation has for spending money to comply with RCRA is avoidance of punishment.

Underground Storage Tanks

HSWA regulates, for the first time, the owners and operators of over 1 million underground storage tanks. In contrast to previous hazardous

waste laws (e.g., Superfund in 1980), the regulation of USTs was passed without any widespread outcry from the public. Following the allegations of mismanagement in the EPA's hazardous waste program, Congress was searching for a vehicle to demonstrate that it was aggressively controlling toxic pollution. The revisions of RCRA became a forum for demonstrating Congress's "get tough" policy.

HSWA is one of the most detailed pieces of environmental legislation ever written.⁶⁶ After battling over interpretations of environmental legislation during the reign of EPA administrator Anne Gorsuch-Burford in the early 1980s, Congress decided to leave nothing to chance. EPA was placed on tight schedules, and regulations were required to conform to detailed congressional specifications. If EPA did not meet the deadlines for promulgating guidelines, Congress included statutory "hammer clauses" in HSWA. Thus, industry understood that the result of contesting and delaying standards would be stricter standards.

In addition to tightening hazardous materials regulation, HSWA significantly expanded the number of individuals and firms subject to regulation. Prior to 1984, toxic-bearing municipal garbage dumps, small-quantity generators of hazardous waste, and UST operators were not regulated by federal law. HSWA placed all those parties under federal control.

The single most dramatic expansion of regulatory power is the provision of the law regulating USTs. Every gasoline station in America is now regulated under HSWA. (Therefore, the consumer product gasoline, not a hazardous waste, is the primary target of the legislation.) To comply with the law's edicts many tank owners have replaced their tanks (at a cost ranging from \$10,000 to \$100,000) and cleaned up tank leaks (at costs ranging into the millions). This authority was expanded when Superfund was reauthorized in October 1986. The Superfund Amendments and Reauthorization Act (SARA) required owners of USTs to carry insurance and provided EPA with a \$100 million per year trust fund to pay the cost of abating tank leaks.

The complexity and challenge of this regulatory task was staggering, primarily because of the large and diverse size of the target group. Tens of thousands of firms were included in the UST program, most of them small businesses with unique problems and characteristics. Management

of the UST program presented EPA with a formidable and nearly unprecedented challenge since it rarely has had to oversee a target population of this nature or magnitude. The only truly analogous program is the regulation banning leaded gasoline in new automobiles, a program that required the installation of smaller gasoline pump spouts. In 1985, when the UST program began, EPA senior management believed that to achieve adequate rates of compliance in the UST program, it would have to develop a new approach to regulation.

In December 1984 the EPA's OSWER contracted with the National Academy of Public Administration (NAPA) to analyze the long-range implementation issues associated with the UST provisions of the newly enacted HSWA. In the mid- to late 1980s, EPA adopted a unique, strategic, and results-oriented approach to implementing one part of that new act: the regulation of USTs. Working with senior staff and management in the EPA, NAPA developed a strategic regulatory plan for USTs. Enough time has now passed to evaluate accurately this regulatory effort. Accordingly, this book presents a case study of this unique regulatory program. The EPA and NAPA analysts who developed the plan are referred to as the program's planners in the text.

Methyl Tertiary Butyl Ether

The administration of George H. W. Bush worked with environmentalists and key members of Congress to revise substantially the 1970 legislation by passing the Clean Air Act Amendments of 1990. Rosenbaum believes the legislation represented "the most important, and imaginative, regulatory reform in more than a decade."⁶⁷ The new law added to the original legislation two sections concerning acid precipitation and ozone protection and significantly revised a majority of the remaining provisions. Title II addressed mobile sources and outlined numerous new emission standards for automobiles and trucks. Among the requirements was that oil and gasoline companies must produce and sell cleaner-burning fuel in the most polluted areas by 1992 and in all areas with ozone problems by 1996.⁶⁸ Among other things, this required the use of oxygenated gasoline (gasoline that has been blended with alcohol or ethers that contain oxygen) in areas that did not meet the federal ambient air standards for carbon monoxide. California was one of these desig-

nated areas and is a focus of this study. Ambient carbon monoxide levels are highest during the cold-weather months, and oxygenated gasoline, which reduces carbon monoxide emissions, was to be used during these months in various states. The 1990 Clean Air Act (CAA) required at least 2.7 percent oxygen content in gasoline, which is typically achieved by the addition of about 15 percent of MTBE, an effective oxygenate.

California requested a waiver by the EPA of the 2.7 percent oxygenate requirement to one that is 2 percent oxygenate, which is the amount California's winter gasoline has contained since November 1992. In addition, California adopted the federal reformulated gasoline program in 1995, which required the use of reformulated gasoline in the smoggiest regions of the state. It was at this point that MTBE's importance and dependence began to increase substantially.

Under the CAA of 1990, the California Air Resources Board (CARB) determined the need to reduce vehicle emission beyond federal standards to deal with the state's excessive air pollution problem. CARB sought to reduce volatile organic compounds by 55 percent as well as achieve the maximum feasible reductions in vehicle emissions of particulate matter, carbon monoxide, and toxic air contaminants by December 31, 2000. The agency thus introduced Phase II Reformulated Gasoline, which is capable of providing significant reductions beyond those of federally mandated reformulated gasoline. Therefore, by federal law, gasoline must contain an oxygenate to be in compliance with the California Phase II Reformulated Gasoline measure in order to reduce air pollution. Oxygenates are used for this purpose, and many states, including California, have largely turned to MTBE in their effort to stay within these clean air standards. MTBE as a fuel oxygenate was therefore added to gasoline.

California quickly implemented the use of reformulated gasoline in its most polluted areas. Initially, the benefits of this cleaner-burning gasoline were apparent and seemingly legitimate. Gasoline containing MTBE was to reduce immediately emissions from all existing on-road, gasoline-burning automobiles, trucks, and other motorized equipment. The reduction in ozone-forming emissions from the use of cleaner-burning gasoline was to account for approximately 25 percent of the total ozone reductions expected from all new pollution control measures to be adopted in

California. This emissions reduction from using reformulated gasoline was equivalent to removing approximately 3.5 million motor vehicles from the state's roads and highways and producing the largest emission reductions of any control measure since the adoption of unleaded gasoline.⁶⁹ As a consequence, significant amounts of carbon monoxide as well as cancer-causing pollutants, such as benzene, were prevented from entering the atmosphere. Although gas mileage suffered somewhat, leaders and the public believed the air was cleaner. Refiners favored MTBE over other oxygenates because of its ability to boost octane levels and blend with gasoline.

Not much time passed before problems began to arise with the use of MTBE. Almost immediately after its introduction, people reported headaches and nausea after coming into contact with gasoline containing MTBE. This prompted the federal government and the oil industry to finance jointly a study on the possible health hazards associated with the additive. Initial studies were conducted by the Lawrence Livermore National Laboratory, and the research showed MTBE to cause cancerous tumors in rats. Reproductive and developmental studies on MTBE also revealed that inhalation exposure could result in maternal toxicity and adverse effects on a developing fetus. At the end of 1998, a team of researchers from four University of California campuses submitted a report to California governor Gray Davis and the state legislature titled, "Health and Environmental Assessment of MTBE."⁷⁰ The ten-month study provided detailed information and data on human health effects, air quality and ecological effects, groundwater and surface water, risk and exposure assessment, water treatment, and cost-benefit analysis. Based on the findings of the research, the principal recommendation of the study was that a phase-out over several years should take place (rather than an immediate ban) so that refiners could be given the flexibility to achieve air quality objectives in their modifications. Overall, the researchers demonstrated that the gasoline additive MTBE posed a serious risk of contaminating water supplies, particularly underground aquifers.

The first discovery of MTBE in groundwater came in 1995 in Anaheim, California. The Orange County Water District, the first agency in the state to test for MTBE, found high levels in wells used to monitor

groundwater. In February 1996, Santa Monica first detected its groundwater to be contaminated by the chemical, and the wells were promptly closed. Officials began a search for the source of the pollution and found that it came from a leaking underground gasoline tank. Shortly after, three other municipal drinking water wells in Santa Monica were found to be contaminated by MTBE. In the months that followed, Santa Monica city officials were forced to shut down seven wells, losing more than half their water supply. The cost of the cleanup was estimated to be about \$100 million over the next decade. Since the discovery of MTBE in Santa Monica's drinking water, reports of MTBE contamination in groundwater have become widespread in California. This includes South Lake Tahoe, where at least twelve of its thirty-four wells had to shut down; the San Francisco Bay Area, where MTBE has been found in at least three of ten Santa Clara Valley Water District drinking reservoirs; and in more than three hundred shallow groundwater monitoring wells within Santa Clara County.

The majority of MTBE in groundwater was discovered to come from leaking underground gasoline tanks and their associated piping. Well over 32,000 leaking underground storage tank sites have been found in California alone. The average cost of an industrial cleanup is approximately \$150,000. Since the widespread introduction of oxygenated gasoline, the treatment of water contaminated with MTBE has become problematic. MTBE, due to its small molecular size and solubility in water, does not readily attach to soil particles and moves rapidly and far into groundwater. This makes widespread MTBE contamination a real and serious problem.

Overview of the Book

This book examines the concept of strategic regulatory planning and presents an overall regulatory program for achieving compliance with policies designed to improve air quality through the use of a gasoline additive, MTBE, and with the UST provisions of HSWA. The book contains three parts with ten chapters and a Conclusion. Part I offers a model for regulatory strategy formulation. Parts II and III apply the model to the cases of MTBE and UST regulation, respectively.

Part I comprises four chapters. Chapter 1 discusses the concept of strategic regulatory planning. The design of strategic regulatory plans is the principal focus of this study. Chapter 2, the theoretical core of the work, presents a model of a tactical approach to regulatory planning. Chapter 3 develops a framework for selecting specific regulatory devices. The framework directs agencies to evaluate regulatory activities according to cost of implementation and degree of coerciveness. Chapter 4 reviews a number of specific regulatory devices available to program planners.

Part II contains three chapters. Chapter 5 explains how MTBE was selected as a gasoline additive and the negative impact it was later found to have on water quality. Chapter 6 discusses the lack of strategic regulatory planning in the selection of MTBE as a gasoline oxygenate. Chapter 7 analyzes the effort to adopt a strategic approach for resolving the MTBE issue.

Part III has three chapters. The model for developing strategic regulatory plans introduced in chapter 2 (and elaborated on in chapters 3 and 4) is applied to the case of USTs in chapters 8, 9, and 10. The Conclusion then assesses the applicability of strategic regulatory planning to other environmental programs and to other policy areas. It also summarizes the major findings of the book and offers possible future avenues for policy research.