ENVIRONMENTALISM CONTAINED: A HISTORY OF CORPORATE RESPONSES TO THE NEW ENVIRONMENTALISM

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Abstract

This dissertation describes how affected industries responded to the new environmentalism that emerged as a potent political and cultural force in late-twentieth-century America. Through a series of case studies, it traces how large corporations linked to pollution or toxics problems sought to contain the broad environmental agenda embodied in the landmark environmental laws of the 1970s. These companies and trade associations used public relations and advertising campaigns to shape popular perceptions of industrial environmental impacts. They also employed a variety of tactics to strategically manage scientific information on alleged harms, to inject cost and feasibility considerations into federal environmental laws and the regulatory process, and to challenge the policies used by federal regulators to estimate environmental risks.

Drawing on internal corporate documents, records of public relations and advertising campaigns, as well as more traditional sources, this dissertation argues that affected industries were a driving force in moving the discourse of environmental politics toward an increasingly narrow, more technical language of cost-benefit analysis, risk assessment, and risk-benefit balancing. By portraying environmental regulation as an expensive endeavor fraught with heavy economic costs, affected industries helped recast environmental discourse in terms of "costs" and "benefits" that must always be carefully balanced. And by pressing for ever higher standards of proof in the scientific domain while deriding more precautionary approaches to environmental regulation as impractical quests for "zero risk," affected industries helped move discussions of environmental hazards into the highly technical arena of risk assessment where regulatory action could often be delayed for years.

This project offers a revision to the standard narrative of the environmental movement that has portrayed business as caught off guard by environmentalism and hence placed on the political defensive until the late 1970s. It shows that, even as the environmental movement obtained victories in the legislative arena, affected industries were already on the offensive on a variety of fronts by the early 1970s, working to fundamentally recast the methodologies and discourse of environmental politics in ways that would severely restrain the ambitious goals of the environmental laws of the 1970s.

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Introduction

In October of 1970, the magazine *Business Week* editorialized on the implications of the new environmental movement that had brought millions of Americans together for teach-ins and clean-ups earlier that year on the first Earth Day. "The sudden concern with ecology and the protection of the environment," the magazine observed, "reflects the abrupt realization that a nation operating on the scale of the U.S. literally can destroy the land, air, and water that nourishes it." Urging that America's "life-style" must be made to "harmonize with the natural matrix that contains it," the magazine aligned itself with the growing number of business leaders who predicted that environmental issues would be a long-term concern of corporate management rather than a passing fad. "Most corporations…" said the magazine, "are only now beginning to accept the fact that in a huge, urbanized economy, other values besides profit and efficiency must figure in management's thinking. In the future, recycling and pollution control will become part of the cost structure." *Business Week* spoke for many in the business community in calling for a corporate-led, consensual approach to solving the nation's environmental problems.[1]

Yet even as some in the business community spoke of partnership and cooperation, others were already warning about the prohibitive costs of the emerging environmental agenda. Charging that environmental protection involved a zero-sum tradeoff against the bottom line of corporate profits, some top executives staked out defiant stands that foreshadowed the highly contentious environmental politics to come. At a January 1970 pollution conference, for instance, the head of one steel company complained, "We can't put any money into pollution control that we haven't first made as profits."[2] Meanwhile, the head of American Electric Power, the nation's largest private provider of electricity, spoke of the heavy costs that would ultimately be passed along to consumers. "It is one thing," he said, "to say that a utility company must spend $100-million on air-pollution control equipment; it is another for the customers to realize that

[1] "The U.S. Can Still Make the Biggest the Best*,"* *Business Week*, October 17, 1970, p. 192.
[2] Quoted in Gladwin Hill, "Industrialists Get Word: Environment," *New York Times*, January 11, 1970, p. 471.

their electric bills must increase by $15-million a year to make this expenditure possible."[3] In addition to voicing concerns about costs, some business leaders maintained that many alleged environmental problems had been wildly exaggerated—the result of ill-informed public hysteria and alarmism stirred by new consumer and environmental organizations. Even before pesticide makers responded to the publication of Rachel Carson's *Silent Spring* in 1962 with attacks on the irrational "fear of chemicals," many companies had gained experience in rebutting public health "scares" implicating their products or in reassuring downstream residents that the smoke billowing from their smokestacks posed no health risks.[4]

Whether urging corporate voluntarism as the solution to the nation's environmental problems or warning of heavy economic costs, by 1970 affected industries were already working to shape the terms of the nation's unfolding environmental politics around concepts and vocabulary familiar to corporate management. As a new generation of environmental issues revolving around air and water pollution and toxics ascended the national political agenda in the 1970s, affected industries treated the new environmentalism as a political and cultural force to be strategically *managed*. Business historians have documented the changes wrought by the decade's landmark federal environmental laws on internal corporate organizational structures and production processes, including the creation of new environmental committees and task forces, expanded R&D programs focused on pollution control, and the diversion of capital toward environmental cleanup.[5] Others have documented how polluting industries expanded their lobbying operations in Washington and worked through inter-industry business lobbies to stem the legislative tide of new "social" regulation spurred by the environmental and consumer movements.[6] This dissertation focuses on some less explored channels through which affected industries sought to contain the new

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[3] Quoted in "The Replies: Environment," *New York Times*, January 11, 1970, p. 484.
[4] See, for example, Linda Lear, *Rachel Carson: Witness for Nature* (New York: Henry Holt, 1997); Thomas Dunlap, *DDT: Scientists, Citizens, and Public Policy* (Princeton, NJ: Princeton University Press, 1981), 98-125; Scott Hamilton Dewey, *Don't Breathe the Air: Air Pollution and U.S. Environmental Politics, 1945-1970* (College Station: Texas A&M Univ. Press, 2000), 3-14.
[5] See, for example, Andrew Hoffman, *From Heresy to Dogma: An Institutional History of Corporate Environmentalism* (Stanford, Calif.: Stanford University Press, 2002).
[6] See, generally, David Vogel, *Fluctuating Fortunes: The Political Power of Business in America* (New York: Basic Books, 1989).

environmentalism and limit its impact on their operations. It seeks to answer several questions. First, how did affected industries begin to adapt their corporate imagery and public relations to the new era of environmental concern? Second, how did affected industries seek to manage the highly-contested debates over the scientific assessments that informed environmental policymaking? And, finally, how did they seek to recast the methodologies and language of environmental politics in ways that would contain the sweeping agenda embodied in the new environmental laws of 1970s?

In the standard narrative of the American environmental movement, the business community was caught off guard by this potent new political force, surprised by the surge of popular support for new initiatives to protect environmental quality and public health. As historian Samuel P. Hays writes in his history of environmental politics, "To business leaders the environmental movement was hardly understandable. At first it was looked on with fascination, but as its influence increased in the late 1960s and early 1970s, this perception turned to incredulity and fright."[7] According to this usual narrative, affected industries were put on the political defensive after 1970 as they waged a series of rearguard battles to mitigate the impact of new environmental laws such as the Clean Air Act of 1970 and the Clean Water Act of 1972. In this story, not until the late 1970s would the business community regain its political footing, finally slowing the wave of new federal laws and regulations put in place during the "environmental decade," then taking the offensive during the Reagan years. For historians who have explored the business side at all, American corporations seemed initially unable to predict or adjust to the emerging landscape of environmental politics.[8]

This dissertation shows that by the early 1970s (and in some cases earlier) affected industries were on the offensive on a variety of fronts: Glass and aluminum container manufacturers, for instance, launched expensive campaigns to stave off deposit-return legislation at both the state and federal levels by promoting recycling as a preferable alternative. Energy and manufacturing industries began wide-ranging PR and lobbying campaigns aimed at injecting cost considerations and cost-benefit balancing

[7] Samuel P. Hays, *Beauty, Health and Permanence: Environmental Politics in the United States, 1955-1985* (New York: Cambridge University Press, 1987), 307.
[8] See, generally, Vogel, *Fluctuating Fortunes*.

provisions into the administrative process and into new environmental laws. And chemical firms, among others, were already battling federal regulators over the science underpinning regulatory action, pressing for ever higher standards of proof of harm before restrictions could be placed on their products, and seeking to reframe environmental regulation as a matter of balancing risks against benefits.

To be sure, the new environmentalism did present substantial new political uncertainties for business. Recognizing this threat, however, many large firms began closely monitoring emerging environmental problems well before they became public issues. For successful long-term planning, the modern corporation increasingly sought to minimize the uncertainties posed by external forces. As John Kenneth Galbraith argued in his classic work *The New Industrial State* (1967), the dictates of planning meant that the modern industrial firm increasingly sought long-term control over both prices and demand, and prepared for major new products and capital outlays years in advance.[9] But planning also meant minimizing the uncertainties stemming from new social and political demands on the corporation. As citizens' groups agitated for stringent action against pollution, politicians positioned themselves as champions of the environment, and environmental laws were in dizzying flux, corporate management faced a host of new uncertainties: What pollution controls would be required in five or ten years? Could new facilities be cited as planned without stirring strong local opposition? What products might soon be banned or severely restricted?

To understand how corporations managed the political and economic risks posed by the new environmentalism, this dissertation draws upon a variety of sources, including government documents, court cases, newspapers and magazines, advertisements, and scientific papers. It also draws upon available records of affected companies and industry trade associations. Until recently, source material speaking to the internal deliberations and strategies of corporations responding to environmentalism and other postwar social movements has been largely unavailable to historians. Even those large corporations and trade associations that have publicly accessible archives generally place moving windows of several decades on their files that restrict access to more recent material. Corporate

[9] John Kenneth Galbraith, *The New Industrial State* (Boston: Houghton Mifflin, 1967).

legal departments, meanwhile, often ensure that certain sensitive material is never slated for public release. But, like the copious tobacco industry documents that are now public, many revealing internal industry documents have become part of the public record through lawsuits brought by plaintiffs' firms and by leaks of documents by industry insiders.

Extensive internal documents detailing the meetings and planning of the Manufacturing Chemists' Association (later renamed the Chemical Manufacturers' Association, and now known as the American Chemistry Council) were obtained during discovery by the Louisiana-based law firm of Baggett, McCall, Burgess, and Watson in *Ross v. Conoco, Inc.*, in which surviving family members of two chemical workers who died after exposure to vinyl chloride and other carcinogens brought suit against employer chemical companies and other parties.[10] These documents were subsequently obtained and made available in a searchable online database by the Environmental Working Group, a Washington, D.C.-based environmental organization.[11] Internal documents detailing Monsanto's management of the controversy surrounding polychlorinated biphenyls (PCBs) were obtained during a lawsuit brought by residents of Calhoun County, Alabama, against Monsanto, Pharmacia (its parent corporation since 2000), and Solutia, Inc. (which was spun off in 1997), alleging health effects and property damage as a result of exposure to PCBs and other chemicals released by Monsanto's plant in Anniston, Alabama.[12] These documents have also been made available on the internet by the Environmental Working Group. Finally, internal documents detailing how the American Paper Institute—the principal trade association of the paper industry—managed the public release of findings of dioxin in pulp and paper mills were made public by a leak from an industry insider and were obtained by the environmental group Greenpeace.

From the start, corporations responding to the new environmentalism focused heavily on the arena of public opinion and on reshaping their corporate imagery to adapt to new environmental concerns. Yet the role of PR and advertising in relation to

[10] 828 So. 2d 547 (La. 2002).
[11] See Environmental Working Group, *Chemical Industry Archives* <http://www.chemicalindustryarchives.org> (September 8, 2006).
[12] See *Ex parte* Monsanto Co., 862 So. 2d 595 (Ala. 2003).

environmental politics has remained little explored by historians and other scholars. The little that has been written—largely by journalists in the muckraking tradition—has often focused on dramatic incidents of corporate malfeasance and the "greenwashing" whereby industrial polluters deflected attention from their environmental impacts. As a result, this work has often been hampered by a failure to appreciate the diverse motivations and strategies behind corporate PR and how it was fully integrated into the pursuit of specific political objectives. Yet surprisingly rich sources exist on both the goals and artifice of even relatively recent PR and advertising campaigns. This dissertation, for instance, draws upon internal planning documents from the J. Walter Thompson (JWT) to trace why and how the natural gas industry began selling gas as the "clean" energy in the 1970s. It draws upon less traditional sources to document other early corporate image campaigns in response to the new environmentalism—submissions for an annual award competition honoring America's best PR campaigns. Archived entries for these "Silver Anvil Awards"—an annual award by the Public Relations Society of America symbolizing the forging of public opinion—provide extensive documentation of the goals and execution of the often elaborate corporate campaigns designed to reshape public perceptions.

Drawing upon these sources, this dissertation explores how large corporations navigated the uncertain waters of the new environmental politics. Through a series of case studies, it examines how companies and industry trade associations adapted existing corporate imagery and political tactics to the new era of environmental concern and deeply shaped the contours of environmental discourse, regulation, and policymaking. Even as affected industries strategically gave ground to minimize political surprises, they also engaged in a broad struggle to contain the environmental agenda after 1970. This involved far-reaching efforts to influence public attitudes and understandings of environmental issues, and to shape the approaches, methodologies, and language of environmental policy. The case studies that follow offer a window onto the evolving imagery, themes, and political strategies employed by large corporations to defuse and minimize growing economic and political risks as the environmental movement secured landmark legislative victories and legal precedents. These included efforts to shape popular perceptions of industrial environmental impacts through public relations and advertising, to strategically manage and control scientific information relating to alleged harms, to inject cost and feasibility considerations into federal environmental laws and the administrative procedures through which agencies implemented the laws, and to reshape the policies used by federal regulators to estimate health and environmental risks.

This dissertation is not a work of traditional political history, and it focuses little on the legislative debates and outcomes in which affected industries certainly played a major role. Instead, it is an attempt to understand the role of affected industries in shaping the terms, language, and methodologies of environmental politics in the United States since the 1970s. In so doing, it presents affected industries as a driving force in moving the discourse of environmental politics toward an increasingly narrow, more technical language of cost-benefit analysis, risk assessment, and risk-benefit balancing. By portraying environmental regulation as an expensive endeavor fraught with economic costs, affected industries helped recast environmental discourse in terms of "costs" and "benefits" that must always be carefully balanced. By pressing for ever higher standards of proof in the scientific arena and deriding more precautionary approaches to environmental regulation as impractical quests for "zero risk," affected industries helped move discussions of environmental hazards into the formal and highly technical framework of risk assessment and toward concepts of "acceptable risk." As complex technical debates ensued over quantitative estimates of risks, costs, and benefits, regulatory action in the administrative arena could at times take more than a decade. And with the technical discourse of environmental politics ever more opaque, affected industries used increasingly sophisticated public relations techniques to convince the public that the real risks lay in overregulation of vital products and services.

This dissertation also speaks to areas of interest to historians and sociologists of science. First, it intersects with the literature on how scientific claims are shaped within particular institutional and disciplinary contexts and laden with concomitant economic and political interests. Scholars have largely explored the "social construction" of science in the context of academic research, specifically the university-based laboratory.[13] But the context of regulatory science—in which significant economic and political consequences often hinge on the outcome of scientific debates—offers a particularly revealing window onto the institutionally situated and interest-laden nature of scientific claims. As Sheila Jasanoff has observed, "regulatory science is particularly susceptible to divergent, socially conditioned interpretations." According to Jasanoff, regulatory science often differs from academic science in several important ways: "standards for assessing quality tend to be more fluid, controversial and sensitive to political factors"; it is "often constrained by strict time limitations that impede scientific consensus-building"; and "the stakes are so much higher…that different interest groups have incentives to press for divergent, politically congenial interpretations of the available facts."[14] In the adversarial context of environmental policymaking, business interests and environmental organizations alike appealed to the authority of science to promote favored policy outcomes.[15] But with their typically far superior economic and technical resources and ready access to relevant information, affected industries were more often the source of scientific claims that competed with those advanced by regulators.[16] By tracing how industries linked to two classes of toxic chemicals clashed with regulators over the chemicals' risks (PCBs in Chapter 3 and dioxins in Chapter 5), this dissertation shows how scientific claim-making in the regulatory arena was at times tightly integrated with the dictates of economic and legal planning in large corporations responding to new environmental problems.

More generally, these case studies draw attention to the richness of the field of business-controlled science and expertise as a locus for the production and interpretation of scientific knowledge. Business historians have explored the relationship between science and American big business through studies of particular firms and science-based

[13] For a survey of constructivist approaches to the history of science, see generally Jan Golinski, *Making Natural Knowledge: Constructivism and the History of Science* (New York: Cambridge University Press, 1998).
[14] Sheila Jasanoff, "Procedural Choices in Regulatory Science," *Technology in Society* 17 (1995): 279-293, p. 282.
[15] See Stephen Bocking, *Nature's Experts: Science, Politics, and the Environment* (New Brunswick, NJ: Rutgers University Press, 2006), 22-25.
[16] See *Ibid.*, 37.

industries that detail the interplay of science and corporate planning.[17] But these studies have generally excluded the "internal" content of science, not to mention the localized social life of scientific practice in corporate labs. Historians of science, meanwhile, have only ventured into the domain of corporate science in a handful of cases, particularly in the field of biotechnology.[18] No doubt this stems from the far greater availability of archival sources dealing with research conducted at universities, research institutes, and government agencies. This dissertation explores corporate-controlled and corporate-commissioned science primarily in relation to the regulatory process, detailing how the political and economic objectives of affected industries informed the direction of corporate-financed research and shaped choices about which experimental systems and conceptual frameworks were used to understand environmental risks. But the types of newly-available internal corporate documents that this project draws upon offer a far broader opening for historians of science and other scholars to explore the nature of scientific norms, experimental practices, and "fact"-making in the corporate context. Particularly in the high-stakes and highly-contested areas of research surrounding environmental risks, our understandings of science will remain limited unless we go beyond the university-based laboratory to explore the varied landscape of business-controlled science and expertise, whether in corporate labs, think tanks, or the growing network of specialized consultancies.

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[17] See, for example, David A. Hounshell and John Kenly Smith, Jr., *Science and Corporate Strategy: Du Pont R&D, 1902-1980* (New York: Cambridge University Press, 1988); David F. Noble, *America by Design: Science, Technology, and the Rise of Corporate Capitalism* (New York: Knopf, 1977).

[18] See, for example, many of the pieces in Arnold Thackray, ed., *Private Science: Biotechnology and the Rise of the Molecular Sciences* (Philadelphia: University of Pennsylvania Press, 1998).

Chapter One: Before Environmentalism: Science, Advertising, and Corporate Power

PART I

In 1936 three young workers at a factory owned by the Halowax Corporation died after attacks of severe jaundice. The first death, early in the year, was of a twenty-one-year-old with no previous medical history. After suffering severe constipation and abdominal pain, he was admitted to a hospital where doctors diagnosed him as slightly jaundiced and anemic. They also found numerous skin lesions on his arms, face, chest and back—symptoms of chloracne, a skin disease caused by exposure to certain chlorinated chemicals. Chloracne was also found among others at the plant whose work exposed them to the same chemical mixture—of chlorinated napthalenes and chlorinated diphenyls (or polychlorinated biphenyls, PCBs). The young worker died within days. An autopsy revealed cirrhosis of the liver and "acute yellow atrophy," indicating the fatal jaundice. By March, two more workers had died, friends who both worked in close contact with chlorinated napthalenes. For some twenty-five years, Halowax had manufactured chlorinated napthalenes under the trade name "halowaxes" as insulators for electric wires with no reported health effects in exposed workers. But in the 1930s the company began incorporating more highly chlorinated napthalenes and chlorinated diphenyls into its products. Soon Halowax and major customers such as General Electric began observing severe cases of chloracne and other health problems among workers.[1]

Within months, Halowax requested an investigation by one of the nation's leading industrial hygienists, Cecil Drinker, professor of physiology and dean of the Harvard School of Public Health. Drinker's team began its investigation by visiting factories where chlorinated napthalenes were used. Using a specially designed absorption apparatus, his team measured the concentrations of chlorinated hydrocarbons in the air at thirty different factories. After estimating the levels at which workers were exposed, the

[1] Cecil K. Drinker et al., "The Problem of Possible Systemic Effects from Certain Chlorinated Hydrocarbons," *Journal of Industrial Hygiene and Toxicology* 19 (September 1937): 283-311.

Harvard researchers began animal inhalation tests at concentrations designed to be "fairly representative of industrial experience." Caged rats were placed in exposure chambers for up to four-and-a-half months, where they were exposed to steady concentrations of different mixtures of chlorinated napthalenes and chlorinated diphenyls. At six-week intervals, groups of rats were killed and examined for pathological changes. Histological examinations by Drinker's team found that both the more highly chlorinated napthalenes and the chlorinated diphenyls could cause liver damage even at relatively low concentrations. Drinker concluded, however, that workers would likely never be exposed to concentrations high enough to cause the "acute yellow atrophy" of fatal jaundice that occurred in the Halowax workers. Instead, he posited that workers may "acquire a substratum of liver damage upon which acute yellow atrophy may develop." Based upon both the laboratory and field investigations, Drinker concluded his study by recommending a "safe" ambient air concentration of 0.5 milligrams per cubic meter of air. Companies could easily achieve this level, Drinker said, through adequate ventilation and "good housekeeping." "Compared with benzene, lead tetraethyl and many other compounds," wrote Drinker, "these substances are very little toxic and operations employing them can easily be safeguarded."[2]

As new and uncertain chemical hazards appeared on the shopfloor in the 1920s and 1930s, corporate management increasingly opened its doors to experts in occupational disease such as Cecil Drinker. During the 1920s, Cecil, his brother Philip Drinker, an engineer, Joseph Aub, a clinical scientist, and others in the new department of industrial hygiene at Harvard, helped pioneer what historian Christopher Sellers has called "a newly experimental medical science of occupational disease."[3] Assembled by physician David Edsall, Harvard's faculty was at the fore of the professionalizing industrial hygiene that soon gained institutional footholds at university medical and public health schools, state departments of labor, and the U.S. Public Health Service (PHS). Its practitioners sought to move beyond the qualitative field investigations of Progressive era reformers, such as the American Association for Labor Legislation and

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[2] *Ibid.*
[3] Christopher Sellers, "Factory as Environment: Industrial Hygiene, Professional Collaboration and the Modern Sciences of Pollution," *Environmental History Review* (Spring 1994): 55-83, p. 67.

Alice Hamilton, by creating a new quantitative and laboratory-based science of occupational disease. To recast occupational disease research as a rigorous science, they turned to animal studies to bring the study of the workplace environment into the laboratory where the causes of occupational diseases could be analyzed and explained in chemicophysical terms. As Sellers has shown, the new approach pioneered at Harvard was shaped by collaboration between physician-physiologists such as Cecil Drinker, who applied the emerging concepts and laboratory techniques of physiological chemistry, and engineers such as Philip Drinker, who developed new laboratory apparatuses for experimentation and new equipment for sampling dust, gases, and fumes in the workplace. With a mix of field and laboratory work, teams of industrial hygienists used increasingly sophisticated sampling technologies to quantify workplace exposure levels to hazardous chemicals, then sought to replicate the industrial experience for the suspected toxin in the laboratory with animal tests.[4]

In the 1920s and 1930s, industrial hygienists carved out an institutional niche for this new science of occupational disease. But the field's research agenda and its professional norms were strongly shaped by its heavy dependence upon industry funding. Corporations underwrote much of the basic research and the workplace investigations by the new university-based industrial hygienists. As the Harvard department expanded in the 1920s, according to Sellers, "the Drinkers and Aub continued to correspond with, meet with, contract with, and accept research money from managers and company doctors in some of the nation's biggest corporations."[5] Although corporate sponsors generally placed no specific limitations on the investigations by industrial hygienists, they largely determined what types of studies would be conducted in the first place and often exerted significant control over the ultimate results. Companies such as Halowax viewed investigations by industrial hygienists as a means of ameliorating the most severe workplace hazards and, in turn, minimizing the risk of lawsuits or workmen's compensation claims and reducing insurance costs. Professional industrial hygienists such as the Drinkers increasingly met this demand through fee-based contracts to

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[4] Christopher Sellers, *Hazards of the Job: From Industrial Disease to Environmental Health Science* (Chapel Hill, NC: University of North Carolina Press (1997), chapter 5.
[5] Sellers, *Hazards of the Job*, 172.

investigate outbreaks of illnesses among workers at large corporations such as General Electric, U.S. Radium, or Eastman Kodak. This commodification of their investigations meant that the results were increasingly reported not in scientific journals but in confidential reports to corporate sponsors. According to Sellers, the new conventions of confidentiality gave corporate sponsors "not just preventive knowledge about the hazards of their workplaces but significant control over its appearance in print."[6]

Industrial hygiene's orientation toward servicing managerial needs also shaped the type of knowledge that was produced and how it was acted upon. Studies and recommendations by the Drinkers and other leading industrial hygienists were framed by the objectives of corporate sponsors to identify and solve immediate and obvious workplace hazards. Absent significant health problems or deaths among workers, industrial hygienists were simply not called upon to investigate workplace conditions. When called upon, meanwhile, their prescriptive recommendations centered on identifying safe concentration levels, or "thresholds," for the suspected toxins. Developed by German toxicologists in the early twentieth-century, the threshold concept presumed that any substance, no matter how toxic, would be harmless below a certain level.[7] As in the Drinkers' Halowax investigation, industrial hygienists sought to estimate thresholds through animal studies. They then recommended ameliorative measures, typically simple and inexpensive ones, such as improved ventilation, protective gear, or showering by workers after exposures. To be sure, such investigations by industrial hygienists often brought real improvements to workplace conditions. Cecil Drinker, for instance, claimed that only one company investigated by Harvard researchers failed to implement the resulting recommendations during the 1920s.[8] Still, even where major problems were uncovered, corporate sponsors could expect industrial hygienists to recommend only modest changes that would not significantly interfere with production.[9]

One example of how the orientation of industrial hygienists toward managerial goals shaped the field came in the codification of "threshold limit values" (TLVs) for

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[6] Sellers, *Hazards of the Job*, 179.
[7] Robert N. Proctor, *Cancer Wars: How Politics Shapes What We Know & Don't Know About Cancer* (New York: Basic Books, 1995). 154-156.
[8] Sellers, *Hazards of the Job*, 179.
[9] Sellers, *Hazards of the Job*, 183.

common industrial toxins during the 1940s by the American Conference of Governmental Industrial Hygienists (ACGIH), an organization consisting of industrial hygienists at various levels of government. TLVs represented recommended upper limits for workplace exposures—or levels below which workers would not be expected to suffer clinical effects. On the one hand, this project was a triumph of industrial hygiene and its application of biomedical and engineering expertise to reconstruct workplace hazards in the laboratory and offer practical quantitative standards aimed at minimizing occupational disease. But it also reflected the institutional limitations within which industrial hygienists worked and the power of industry in a legal environment where implementation ultimately depended upon the cooperation of affected economic interests. As public health historians have shown, the TLVs for silica dust, vinyl chloride, and other toxins were often based on little or no toxicological or epidemiological evidence. Many TLVs did not in fact represent levels known to be sufficient to protect worker health, but instead reflected what affected industries believed to be achievable at the time, factoring in the economic concerns of both employers and equipment manufacturers, who worried about the impacts of standards on their products. In 1972 and again in 1989, the Occupational Safety and Health Administration (OSHA) adopted batches of TLVs as official exposure limits, thereby institutionalizing standards for many chemicals that had been set largely to accommodate the feasibility concerns of industry.[10]

After World War II, the toxicological paradigm of industrial hygiene—with its concept of a threshold and its focus on acute toxicity—would emerge as the central approach to the study of "environmental" health hazards outside of the workplace. Industrial hygienists moved from their authoritative position on chemical hazards inside the factory to preeminence in the study of the risks posed by chemical exposures and industrial pollutants in the environment. From early discussions of the risks of pesticide

[10] See Gerald Markowitz and David Rosner, *Deceit and Denial: The Deadly Politics of Industrial Pollution* (Berkeley: Univ. of California Press, 2002), 171-172; Gerald Markowitz and David Rosner, "Industry Challenges to the Principle of Prevention in Public Health: The Precautionary Principle in Historical Perspective," *Public Health Reports* 117 (November-December 2002): 501-512; S.A. Roach and S. M. Rappaport, "But They are Not Thresholds: A Critical Analysis of the Documentation of Threshold Limit Values," *American Journal of Industrial Medicine* 17 (1990):727-753; S.M. Rappaport, "Threshold Limit Values, Permissible Exposure Limits, and Feasibility: The Bases for Exposure Limits in the United States," *American Journal of Industrial Medicine* 23 (May 1993): 683-694.

residues on foods, to postwar debates over the health effects of air pollution, industrial hygienists would reassure Americans that such low-level exposures posed little more than a "nuisance." As industrial hygienists extended their authority outside of the workplace setting, they remained strongly tied both professionally and institutionally to the corporate sponsors who continued to underwrite much of their research. As Gerald Markowitz and David Rosner have observed, "Until the 1970s, there were few opportunities for those trained in industrial hygiene to find employment outside of industries themselves. Even university programs in industrial hygiene, largely without access to federal funding for their studies, generally turned to industry for grants."[11] Moreover, beginning in the 1930s, major corporations such as Du Pont and the Dow Chemical Company brought industrial hygiene expertise in-house with the creation of toxicological research laboratories.[12] These structural arrangements ensured that industry would have significant sway in the postwar years over both the direction of research and what information would be shared with the public.

During the 1950s and 1960s, however, the authority of industrial hygiene and the traditional toxicological paradigm would be radically challenged by expert communities whose conceptual frameworks and techniques were more attuned to the often subtle and long-term effects of environmental exposures to industrial pollutants and chemicals. This new generation of researchers worked on environmental and occupational hazards outside of the community of experts that identified as industrial hygienists. Benefiting from rising federal funding for science, researchers increasingly turned to the study of chronic diseases, such as cancer, and developed experimental techniques and methodologies geared toward detecting the effects of low-level environmental exposures, such as chronic disease epidemiology and long-term animal bioassays. Meanwhile, by the 1960s

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[11] Markowitz and Rosner, "Industry Challenges to the Principle of Prevention in Public Health," 507.

[12] In 1935, Dupont spent $130,000 to found the Haskell Laboratory for Industrial Toxicology after some seventy employees at a dye plant in New Jersey developed bladder cancer. Early research at the Haskell Laboratory included animal studies by German-trained pathologist Wilhelm Heuper and colleagues that identified the chemical beta-napthylamine as the likely source for the cancer suffered by the dye plant workers. See Sellers, *Hazards of the Job*, 193-194. The Dow Chemical Company had also established an in-house toxicological program by the late 1930s. Dow's Biochemical Research Laboratory in Midland, Michigan would play a leading role in the development of new methodologies for toxicological testing and, in the 1960s, Dow's early recognition of the hazards posed by chemicals such as dioxin. See Richard J. Kociba, "Profiles in Toxicology: V.K. Rowe (1914-2004)," *Toxicological Sciences* 79 (2004): 209-210.

a growing community of university and government researchers identified as "environmental" scientists. Crossing disciplinary lines, they traced the complex movement of toxics and pollutants through ecosystems and food chains. When the Environmental Protection Agency (EPA) began implementing the new federal environmental laws of the 1970s such as the Clean Air Act (1970) and Clean Water Act (1972), it would draw heavily upon this postwar infrastructure of expertise in chronic disease epidemiology, analytical chemistry, chronic toxicology, and ecology.

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By the late 1930s, industrial hygienists were applying their methods to chemical hazards outside of the workplace environment to study the health effects of the widely-used pesticide lead arsenate. With the support of fruit growers and their allies in Congress, industrial hygiene and its focus on acute toxicity would emerge as the central approach used by the federal government to assess the health risks of pesticides before World War II. After two cases of arsenic poisoning in England in 1925 were traced to American apples, federal agencies explored setting standards for permissible levels of residues of lead arsenate on foods. The U.S. Department of Agriculture (USDA) set "tolerance levels" for arsenic in 1927 and lead in 1933. Efforts to set more stringent standards through the New Deal years met with fierce resistance from apple growers and their allies in Congress. But some medical researchers, the American Medical Association, and officials at the Food and Drug Administration (FDA) voiced concerns that residues of arsenic and lead in fruit remained too high and could pose a public health hazard. In 1935, the FDA began animal tests on lead and arsenic. Unlike the short-term animal tests used by the Drinkers and other industrial hygienists to search for signs of acute toxicity, FDA scientists observed the animals over their lifetime. Such long-term studies—subsequently a central piece of the armature of regulatory science—were designed to adduce evidence of potential chronic effects.[13]

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[13] Thomas Dunlap, *DDT: Scientists, Citizens, and Public Policy* (Princeton, NJ: Princeton University Press, 1981), 43-55.

Concerned about the implications of the FDA's animal testing, apple growers turned to their most important ally in Congress, Representative Clarence Cannon of Missouri, who became chairman of the Subcommittee on Agricultural Appropriations of the House Appropriations Committee in 1937. Cannon attached language to the 1937 appropriations act that barred funding for the FDA's tests. Instead, Congress appropriated $50,000 per year to the U.S. Public Health Service (PHS) for studies of the health effects of pesticides. The Industrial Hygiene Division of the PHS launched a three-year study focused on the apple growing area around Wenatchee, Washington. While the animal studies at the FDA had been designed to uncover potential chronic effects, the PHS's industrial hygienists searched for signs of classical poisoning in the population around Wenatchee. The team looked for signs and symptoms of classic toxicity in a group of 1,231 people, including both the general population and orchard workers exposed in an occupational setting. They supplemented clinical examinations with laboratory analyses of blood samples. Many of the children and adults studied had elevated levels of lead and arsenic. But the researchers found only seven people whose combined clinical and laboratory data indicated "absorption of lead arsenate," and none of these rose to the level of lead poisoning. As Thomas Dunlap has observed, the "most important conclusion of the study" was "that cases of lead and arsenic poisoning were rare and not clinically important." Through the prism of industrial hygiene's toxicological paradigm, in the absence of evidence that exposures were causing symptoms of classic toxicity, pesticides would be presumed safe. As DDT began to displace earlier insecticides after World War II, this focus on clinically-discernible symptoms of poisoning convinced many regulators and public health officials that it posed no threat to public health.[14]

Industrial hygiene's toxicological paradigm also became a dominant force in post-World War II investigations of the health effects of air pollution. By the mid-1920s, academic and government industrial hygienists had become interested in the problem of

[14] Dunlap, *DDT*, 52-53; Sellers, *Hazards of the Job*, 201-213. The study was subsequently criticized for failing to survey either the most susceptible members of the population or the migrant field workers most exposed to the pesticide.

"atmospheric pollution," but largely as a public nuisance rather than a public health hazard. In 1925 Lewis R. Thompson, head of the Industrial Hygiene Division of the PHS, formed a committee to study the effect of air pollution on sunlight. Its members included Philip Drinker, Harry Meller, a physician and smoke pollution investigator at the Mellon Institute in Pittsburgh, and Frederick G. Cottrell, a German-trained chemist and inventor of the "electrostatic precipitator," which had been widely marketed for the abatement of industrial smoke. Between 1931 and 1933, the PHS conducted a study of the effects of air pollution on sunlight through laboratory work and a field survey of pollution in several major cities, the results of which were published in 1936. Only in the wake of the Donora deadly smog episode in 1948, however, would industrial hygienists at the PHS begin studies of the health effects of air pollution.[15]

At Harvard, Philip Drinker took a growing interest in "atmospheric pollution" during the 1930s and 1940s. As he emerged as a leading authority on air pollution in the years before World War II, Drinker also became a leading skeptic of the notion that industrial air pollution posed any significant threat to public health. After publishing a study on atmospheric pollution and sunlight in 1930, Drinker expanded from his work on airborne hazards in the workplace to a broader exploration of indoor air hygiene both in the factory and in the home. In the mid-1930s, for instance, he studied the effectiveness of filters and air conditioning equipment at removing pollen and airborne bacteria from the air. In a 1939 article reviewing the state-of-the-art in air pollution research, Drinker suggested that pollen was generally of greater concern to the public health than industrial smoke. Chiding the alarmist sentiments stirred by anti-smoke campaigners, Drinker explained the problem in terms of industrial hygiene's toxicological paradigm and the theory of a natural threshold:

> When smoke abatement campaigns are initiated in any community it is usual to turn to the health authorities and urge that they appear before the committee and state the health of the community is

[15] Leslie Silverman and Philip Drinker, "The Donora Episode—A Reply to Clarence A. Mills," *Science* 112 (July 21, 1950): 92-93; Chemical Heritage Foundation, *Frederick Gardner Cottrell,* <http://www.chemheritage.org/classroom/chemach/environment/cottrell.html> (July 29, 2006); University of Pittsburgh Library, *Guide to the Records of the Smoke Investigation Activities of the Mellon Institute of Research (Pittsburgh, Pa.), 1911-1957*, <http://www.library.pitt.edu/guides/archives/finding-aids/ais837.htm> (July 29, 2006).

> at stake. The engineer is too apt to indulge in the fallacious theory that a little inhaled smoke or soot must be injurious since it is admitted that overwhelming doses are harmful. Unfortunately there is a law in physiology which states that a stimulus has to reach a certain level (usually unpredictable) before any reaction results. A little dust or a little smoke, or even a little of some poison, may be completely without effect, whereas a dose of threshold intensity or greater produces a characteristic response. The question from the standpoint of public health really is, then, what is the threshold concentration of city smoke, and not whether a certain city is smoky or not.

From the traditional toxicological approach adhered to by Drinker and other leading industrial hygienists, air pollutants almost always fell below a biological threshold and therefore were merely a nuisance rather than a health risk. Only high dose exposures such as the 1930 deadly smog incident in the Meuse Valley in Belgium, which had killed dozens and left hundreds ill, would threaten human health. In that incident, Drinker noted, there were extraordinary levels of toxic gases, and the symptoms observed were of "acute gassing, similar to those from the lethal agents used in chemical warfare." Such incidents, he reassured his readers, could only occur under rather unique topographical and meteorological conditions. "Our stacks emit the same gases as did the Belgian," Drinker observed, "but fortunately, so meteorologists tell us, we have no districts in which there is even a reasonable chance of such a catastrophe taking place."[16]

After World War II, the toxicological paradigm of Drinker and other industrial hygienists would become preeminent in early postwar discussions of the health effects of air pollution in the wake of the Donora deadly "smog" incident of 1948. Industrial hygienists not only led the immediate investigation of the Donora episode, but also occupied much of the field at the first nationwide air pollution conferences in the late 1940s and early 1950s. The two principle investigations at Donora were both conducted by teams of industrial hygienists—from the PHS and from the Kettering Laboratory of Applied Physiology in Cincinnati. As Christopher Sellers has observed, industrial hygienists were also the preeminent experts at both the first National Air Pollution

[16] Philip Drinker, "Atmospheric Pollution," *Industrial and Chemical Engineering* 31 (1939): 1316-1320. For citations to Drinker's other publications on air pollution in the 1930s, see Sellers, "Factory as Environment," n. 100, p. 83.

Symposium in Pasadena, California in 1949 and the first federal Technical Conference on Air Pollution in 1950. According to Sellers, some fifty-eight percent of the citations in the "health panel" at the 1950 federal conference "were of studies of workers, or studies published in industrial hygiene journals, or studies performed by industrial hygienists."[17]

In 1948, a cloud of dense smog, trapped by a temperature inversion, settled over the steel town of Donora, Pennsylvania for five days. Some twenty people died during the episode, and hundreds more suffered breathing difficulties and various respiratory illnesses in the ensuing months and years. State and local health officials focused immediately on emissions from American Steel & Wire's Zinc Works as the cause of what the *New York Times* dubbed a "mysterious air-borne plague."[18] Within weeks, American Steel & Wire denied responsibility for the smog incident and blamed unusual weather conditions and the surrounding terrain for trapping pollutants in the town at high levels. "We are certain," said a company statement, "that the principal offender in the tragedy was the unprecedentedly [sic] heavy fog which blanked the borough for five consecutive days—a phenomenon which no resident could recall ever happening before."[19] American Steel & Wire asked for investigations by industrial hygienists as it began to prepare a defensible line against anticipated lawsuits and the demands of some local residents for a municipal air pollution ordinance. The company first turned to experts at the Industrial Hygiene Foundation, a group created by manufacturing firms in 1935 to respond to public concerns about workplace toxins through research at the Mellon Institute in Pittsburgh.[20] The company then contracted with Robert Kehoe's Kettering Laboratory of Applied Physiology at the University of Cincinnati for a field study in Donora that included air sampling and a health-effects survey.[21]

The study by Kehoe's group would provide key support for American Steel & Wire's claim that weather conditions and topography, rather than its Zinc Works, were to

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[17] Sellers, *Factory as Environment*, pp. 74, 83, n. 103.
[18] "20 Dead in Smog," *New York Times*, November 1, 1948, p. 1, 12; Lynn Page Snyder, "'The Death-Dealing Smog over Donora, Pennsylvania': Industrial Air Pollution, Public Health Policy, and the Politics of Expertise, 1948-1949," *Environmental History Review* (Spring 1994): 117-139, pp. 121-122.
[19] "Denies Smog Zinc Blame," *New York Times*, November 17, 1948, p. 29.
[20] Snyder, "'The Death-Dealing Smog over Donora, Pennsylvania,'" p. 124.
[21] *Ibid.*, 124-125.

blame for the deaths and illnesses in Donora. A professor of physiology at the University of Cincinnati College of Medicine, Kehoe was a leading industrial hygienist and expert on the toxicology of lead. In studies funded in part by affected industries, Kehoe would maintain through the 1950s that it was normal for humans to have a certain level of lead in their bodies due to "natural" background sources, that levels of lead in humans were in equilibrium with the environment through intake and output, and that low levels of exposure below a "threshold" were harmless. The experimental methodologies employed by Kehoe reflected these theories. Under the toxicological paradigm of industrial hygiene, Kehoe searched only for the classic symptoms of acute poisoning, rather than the effects of chronic exposure. And reflecting the workplace origins of industrial hygiene, Kehoe used healthy adult males as test subjects. [22]

Kehoe's group brought this approach to its study of the Donora incident. A health effects survey conducted by the Kettering researchers looked for symptoms of acute toxicity among workers, not chronic effects from lower level exposures. The Kettering researchers also focused on workers at the Zinc Works, working-age men, rather than the general population around the mill. "Mill workers, rather than community residents," observes historian Lynn Page Snyder, "served as research subjects, in accordance with Kehoe's theory that permanent damage from industrial poisons would first be seen in the more highly concentrated exposures of the workplace."[23] The investigation by Kehoe's group ultimately supported the position held by American Steel & Wire from the start that weather conditions and topography were the principal causes of the smog incident, not the Zinc Works. Both the Kettering researchers and industrial hygienists with the U.S. Public Health Service, who conducted a separate study, concluded that weather and topography were the cause of the incident. The recommendations of the industrial hygienists, according to Snyder, included "a warning system which tied weather forecasting and air quality sampling to cutbacks in mill production, as well as the permanent curtailing of production." Fearing that the company would shut down the

[22] Markowitz and Rosner, *Deceit and Denial*, pp. 35, 108-112; Sellers, *Hazards of the Job*, 217.
[23] Snyder, "'The Death-Dealing Smog over Donora, Pennsylvania,'" 129.

plant if the city passed a pollution control ordinance, local officials ultimately accepted these recommendations "as a compromise to preserve the local economy."[24]

The postwar preeminence of industrial hygienists in air pollution science coincided with the increased participation of affected industries in the issue and new corporate sponsorship for air pollution research. By the late 1940s, trade associations representing the chemical and petroleum industries had established special committees to gather and disseminate information on air pollution issues. In 1949, one year after the Donora smog incident, the Manufacturing Chemists' Association (MCA), the chemical industry's top trade association, formed an Air Pollution Abatement Committee. Throughout the 1950s the MCA was involved in efforts to oppose strict air pollution control legislation at the state and local level and to prevent any federal intervention. The MCA also positioned itself as a leading source of information on both the legislative and technical aspects of air pollution during the 1950s. In 1951, the MCA began publishing an "Air Pollution Abatement Manual" that became a leading resource on various aspects of air pollution in the 1950s.[25] Published throughout the 1950s, the manual was distributed to state, local, and federal officials charged with air pollution control. Reviewing the literature on air pollution in 1954, the top pollution official at the U.S. Bureau of Mines, Louis C. McCabe, began his survey with a discussion of the MCA's manual. "The manual," wrote McCabe, "defines types of air pollution, outlines legislative requirements, describes technical procedures, and gives suggestions for enlisting community cooperation."[26] The MCA also began sponsoring conferences on air pollution beginning in 1948 and workshops beginning in 1958.[27] Another part of the MCA's information gathering efforts was the close monitoring of ongoing air pollution research. In 1956, for instance, the MCA participated, through member company B.F.

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[24] Snyder, "'The Death-Dealing Smog over Donora, Pennsylvania,'" 132.
[25] See Manufacturing Chemists' Association, *Manufacturing Chemists Association, 1872-1972, A Centennial History* (Washington, D.C.: Manufacturing Chemists' Association, 1972).
[26] Louis C. McCabe, "Air Pollution Review 1949-1954," *Industrial and Engineering Chemistry* 46 (August 1954): 1646-1650.
[27] Manufacturing Chemists' Association, *Manufacturing Chemists Association, 1872-1972, A Centennial History*.

Goodrich, in a joint federal-state study of air pollution in the heavily industrialized Rubbertown area of Louisville, Kentucky.[28]

Trade associations and large corporations also became major sponsors of scientific and engineering research on air pollution during the 1950s. Corporate-sponsored work focused on developing analytic techniques to sample air pollutants, tracing the reactions and formation of pollutants in the atmosphere, and identifying the sources of pollutants. The American Iron and Steel Institute, the lead trade association of the steel industry, for instance, established a research program on air pollution after Allegheny County in Pennsylvania, home to Pittsburgh's steel industry, passed an ordinance in 1949 mandating research by local steel firms.[29] Another leading corporate sponsor of air pollution research in the 1950s was the American Petroleum Institute (API), the principal trade association of petroleum refiners. By the mid-1950s, the API's Smoke and Fumes Committee was sponsoring ten ongoing projects. The API funded work at several universities and research institutes, including the Universities of Illinois and Cincinnati, the Franklin Institute in Philadelphia, and the Industrial Hygiene Foundation of America. The work included research on analyzing and measuring various industrial pollutants, observing the products and kinetics of atmospheric reactions between pollutants, and tracing the path of polluting gases after their release from a source.[30]

As affected companies and industries sponsored pollution research in the 1950s, trade associations such as the API and MCA consistently maintained that air pollution was a mere nuisance and did not cause chronic respiratory disease. Similarly, scientists at the API maintained through the late 1950s that there was no link between air pollution and chronic respiratory illnesses. Air pollutants only posed a health hazard, API experts asserted, at very high atmospheric concentrations as had occurred in Donora. Chronic exposure to levels that people normally encountered in the environment, they maintained, posed no health risks. As the chair of the API's Sub Committee on Atmospheric Pollutants told his colleagues in 1959, there was no proof linking air pollution to the

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[28] Markowitz and Rosner, *Deceit and Denial*, 142-143.
[29] Snyder, "'The Death-Dealing Smog over Donora, Pennsylvania,'" 128.
[30] Louis C. McCabe, "Air Pollution Review 1949-1954," *Industrial and Engineering Chemistry* 46 (August 1954): 1646-1650.

"aggravation of such diseases as asthma, tuberculosis, bronchitis, etc., nor does air pollution particularly affect the aged or very young."[31] The chemical industry, meanwhile, opposed institutional linkages between air pollution and health. In 1954, for instance, the MCA's Air Pollution Abatement Committee opposed legislation in New Jersey that would have placed a state air-pollution control agency within the state Department of Health. The MCA sought instead to have the agency placed within New Jersey's Department of Law and Public Safety.[32] Leading industrial hygienists, meanwhile, agreed that air pollution posed no health risk at levels ordinarily found in American cities. Robert Kehoe urged the point at the first National Air Pollution Symposium in 1949 in California. Kehoe argued that there was no justification for the fear that chronic respiratory diseases "are either excited or accelerated in a highly significant manner by the general pollution of the air of industrial cities."[33]

By funding much of the early research on air pollution—often by industrial hygienists—corporate patrons at times influenced the course of the scientific debate. At Harvard's Department of Industrial Hygiene, Philip Drinker's lab received funding during the 1950s from the American Smelting and Refining Company (ASARCO), a major emitter of sulfur oxides. By the early 1950s, Drinker had begun a new line of research with Mary Amdur, an assistant professor in his lab, on the health effects of sulfur dioxide and sulfuric acid mists. Some scientists believed that sulfur oxides had played a role in the deadly smog episodes in Donora and Meuse. Drinker himself was initially skeptical. A 1951 article he co-authored stated that there was "little sound evidence of substantial damage by this gas to the human respiratory tract" and that the evidence linking it to the deadly smog incidents was only "circumstantial."[34] But a series of studies by Amdur and Drinker soon suggested that even low levels of exposure to the

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[31] John C. Ruddock, "Proceedings," Meeting of the Sub Committee on Atmospheric Pollutants, Medical Advisor Committee, American Petroleum Institute, September 23, 1959, as quoted in Markowitz and Rosner, *Deceit and Denial*, 145.
[32] Markowitz and Rosner, *Deceit and Denial*, 143.
[33] Robert Kehoe, as quoted in Gladwin Hill, "Smog Discounted as Disease Cause," *New York Times*, November 12, 1949, p. 8.
[34] J.C. McDonald, Philip Drinker, and John E. Gordon, "The Epidemiological and Social Significance of Atmospheric Smoke Pollution," *American Journal of the Medical Sciences* 221 (1951): 325-342, p. 336.

pollutants could cause a respiratory response and possibly lung damage. In experiments on guinea pigs, Amdur and Drinker found that exposure to even low levels of sulfuric acid mists over a longer period of time could damage the lungs of the animals. This study suggested that it was not just acute exposure that could cause lung damage, but rather the damage was proportional to both the amount of time the animals were exposed and the concentration of the pollutant. Drinker and Amdur also began testing human subjects to assess the physiological effects of the inhalation of sulfuric acid and sulfur dioxide. In a 1953 study published in the British medical journal the *Lancet*, they reported that even very low exposure to sulfur dioxide in "healthy men aged 28-58" could "produce shallow rapid respiration and increased pulse-rate."[35] The long-term effects of such exposure were not explored in the study, but Amdur and Drinker had now shown that sulfur dioxide—previously considered just a "nuisance"—induced a measurable physiological response in humans.[36]

Following these studies, Amdur began new experiments on guinea pigs to examine the possibility of synergistic effects between sulfuric acid mists and particulate matter, another major industrial pollutant. She found thickening and scarring of the lining of the animals' lungs that was proportional to the level of acid in the air and the smallness of the particles. According to a historical account by epidemiologist Devra Davis, when Amdur presented these results at the 1953 annual meeting of the American Association for the Advancement of Science (AAAS), she pointed to significant implications for human health. According to Davis, Amdur "argued that people exposed to levels like those in the Donora smog could suffer permanent damage." The implications of the study, writes Davis, were significant: "Regular breathing of acids and particulates in the air of Donora and dozens of other mill towns throughout the country could damage the ability of the lungs to function, forcing them to work harder and faster

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[35] Mary O. Amdur, Walter W. Melvin, and Philip Drinker, "Effects of Inhalation of Sulfur Dioxide by Man," *Lancet* 265 (October 10, 1953): 758-759.

[36] For a discussion of the animal and human studies by Amdur and Drinker, see Devra Davis, *When Smoke Ran Like Water: Tales of Environmental Deception and the Battle Against Pollution* (New York: Basic Books, 2002), 67-69. The study on the effects of sulfuric acid mist on human subjects is Mary O. Amdur, L. Silverman, and Philip Drinker, "Inhalation of Sulphuric Acid Mist by Human Subjects," *Archives of Industrial Hygiene and Occupational Medicine* 6 (1952): 305-313.

than usual."[37] According to former colleagues of Amdur interviewed by Davis, after Amdur's AAAS presentation there was a concerted effort to suppress her findings, which were slated for publication in the *Lancet*. Drinker soon asked that his name be removed from the paper, told Amdur to withdraw the paper, and, when she refused, eliminated her position. Ultimately, the paper was never published by the *Lancet*.[38] After losing her position, Amdur received a note from pioneering occupational health researcher and the first female member of Harvard's faculty, Alice Hamilton. A longtime colleague of the Drinkers on Harvard's industrial hygiene faculty, Hamilton noted the difficulties of independent research in the field and the financial pressures faced by Drinker. "The trouble with this branch of medical science," wrote Hamilton, "is that it is always tied up more or less with somebody's pocketbook—Maybe the companies, maybe the insurance people, maybe the doctor in charge…Looked at that way, realize that Philip Drinker has wife and children who are 'hostages…to fortune, an impediment to all great enterprises, whether good or evil.'"[39]

Even as affected industries worked to refute linkages between air pollution and respiratory illness in the 1950s, the expert community with which industrial interests had the greatest ties and the most influence—industrial hygiene—began to lose its authoritative position over the study of the health risks of air pollution. Industrial hygiene's toxicological paradigm, with its focus on clinically-discernible signs and symptoms, was steadily displaced by new research aimed at elucidating the links between air pollution and chronic respiratory diseases such as bronchitis, emphysema, and lung cancer. During the 1950s and 1960s, scientists and medical professionals studying the health effects of air pollution in the United States and Europe increasingly focused on chronic respiratory disease with approaches geared toward discovering the effects of relatively low level exposures, long latency periods, and the particularized impacts on subgroups such as children, older individuals, and those with preexisting heart or lung disease. This research paralleled and sometimes intersected with studies on the health

[37] Davis, *When Smoke Ran Like Water*, 71-72.
[38] Davis, *When Smoke Ran Like Water*, 74-77.
[39] Alice Hamilton to Mary Amdur, Mary Amdur Papers, private collection, quoted in *Ibid.*, 76.

effects of tobacco smoke, where epidemiological researchers were developing ever more sophisticated analytical and statistical techniques to withstand intense scrutiny by the tobacco industry and the biomedical community. While laboratory studies were part of the mix, the most important evidence on the health impacts of air pollution came from epidemiological studies that correlated incidences of death and disease with levels of exposure to air pollution. Epidemiologists also began documenting significant associations between air pollution and mortality and morbidity from respiratory disease. By comparing data on populations exposed to different levels of pollution, for instance, these studies documented stark differences in respiratory disease between different countries, between different cities, between city and countryside, and between less and more polluted areas of individual cities. This growing body of research on the health effects of air pollution would later provide the empirical basis for the "criteria documents" used by the EPA to set standards for sulfur dioxide and other pollutants under the Clean Air Act of 1970.

Some of the most important evidence linking air pollution to health effects came from retrospective epidemiological studies of the episodes of intense pollution that had occurred in cities in Europe and the United States. Using data on the times and causes of death drawn from death certificates, these retrospective studies compared death rates during severe air pollution episodes to the death rates several days or weeks before and after. Researchers consistently found increased death rates during the severe "smog" or "fog" episodes that had been documented since the 1930s: the deadly fog of the Meuse Valley in Belgium in 1930, the Donora smog incident of 1948, the London fog of 1952, and a 1953 air pollution incident in New York City. These studies suggested that older people, particularly those with preexisting heart or respiratory disease, were particularly at risk. Meanwhile, studies of the London fog of 1952, which killed some 4,000, found increased death rates in all age groups.[40]

[40] J. Firket, "Fog Along Meuse Valley," *Transactions of the Faraday Society* 32 (1936): 1192-1197; H.H. Schrenk et al., *Air Pollution in Donora, Pennsylvania. Epidemiology of the Unusual Smog Episode of October 1948*, Public Health Bulletin 306 (Washington D.C.: U.S. Public Health Service, 1949); W.P.D. Logan, "Mortality in the London Fog Incident," *Lancet* 1 (1953): 336-338; L. Greenburg et al., "Report of an Air Pollution Incident in New York City, November 1953," Public Health Reports 77 (1962): 7-16.

Other retrospective epidemiological studies conducted by British and American researchers in the 1950s and 1960s looked for correlations between air pollution and mortality not by examining severe episodes but by comparing mortality and pollution data in a particular area over several years, or by comparing mortality data on groups of people of similar socioeconomic status exposed to different levels of pollution. A study conducted in New York City in the 1960s, for instance, found a high correlation between death rates from respiratory and heart disease and levels of air pollution measured at a monitoring station. Meanwhile, a series of studies conducted in Buffalo and surrounding Erie County in the 1960s found a correlation between the deaths of older males from chronic respiratory disease and the levels of particulate matter in the air. Dividing the county into different pollution categories based on monitoring data, the researchers found higher death rates among those living in more polluted areas.[41]

American and European epidemiologists in the 1950s and 1960s also explored the relationship between air pollution and respiratory tract morbidity. Instead of mortality data, these studies used a variety of other techniques to estimate the frequency of respiratory diseases such as bronchitis and emphysema in particular communities. These included: questionnaires, clinical testing of respiratory function, work absence rates, and pathological examinations of lungs obtained from autopsies. Researchers then compared data on the prevalence of respiratory disease for those who lived or worked in high pollution areas to those in less polluted areas. Among the most important findings, first made by British researchers in the 1950s, was the existence of a strong urban-rural gradient for chronic respiratory disease.[42] Other studies sought to control for the possibly confounding factors of socioeconomic status and population density. Several used uniform occupational groups—with workers of similar pay—as subjects in order to

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[41] On the British studies, see A.E. Martin, "Mortality and Morbidity Statistics and Air Pollution," *Proceedings of the Royal Society of Medicine* 57 (1964): 969-975. For a discussion of early mortality studies by the PHS, see J. Rumford, "Mortality Studies in Relation to Air Pollution," *American Journal of Public Health* 51 (1961): 165-173. The New York City study is T. A. Hodgson, Jr., "Short-term Effects of Air Pollution on Mortality in New York City," *Environmental Science and Technology* 4 (1970): 589-597. On the Buffalo studies, see, e.g., W. Winkelstein et al., "The Relationship of Air Pollution and Economic Status to Total Mortality and Selected Respiratory System Mortality in Men. I. Suspended Particulates," *Archives of Environmental Health* 14 (1967): 162-171.

[42] See, e.g., W.W. Holland and D.D. Reid, "The Urban Factor in Chronic Bronchitis," *Lancet* (1965): 446-448.

minimize socioeconomic differences. Studies of British postmen and London transport workers in the 1950s, for instance, found an association between air pollution exposure and the incidence of bronchitis. Similar links between air pollution and respiratory disease were found in American studies of occupational groups in the 1960s, including one of Bell Telephone employees on the east coast and in California.[43]

The PHS became a major participant in the new air pollution research. While its early initiatives were dominated by the approach of industrial hygiene, later PHS studies employed epidemiological methods. After its involvement in a survey of health effects from the Donora episode in 1948-49, officials in the Industrial Hygiene Division of the U.S. Public Health Service (PHS) cited the "health aspect" air pollution as they requested some $750,000 from Congress for additional surveys.[44] By 1954, the PHS had launched a $175,000 program to analyze air pollutants in twenty-four cities including New York and Washington using rooftop air samplers to collect airborne particles and gases in filters, which were then gathered and analyzed at a new laboratory facility in Cincinnati.[45] The PHS—located after 1953 in the Department of Health, Education, and Welfare (HEW)—received more significant funding for air pollution research beginning in 1955 with passage of the first federal air pollution law. Extended in 1959, the Federal Air Pollution Control Act of 1955 appropriated $25 million over five years for a program administered by HEW to fund federal air pollution studies and provide technical assistance to state and local agencies.[46] In 1957, the PHS began an extensive series of

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[43] See discussion and citations to these studies in David P. Rall, "Review of the Health Effects of Sulfur Oxides," *Environmental Health Perspectives* 8 (1974): 97-121, p. 113. The British studies are S.A. Fairborn and D.D. Reid "Air Pollution and Other Local Factors in Respiratory Disease," *British Journal of Preventative and Social Medicine* 12 (1958): 94-103 and J.C. Cornwall and R.A.B. Raffle, "Bronchitis—Sickness Absence in London Transport," *British Journal of Industrial Medicine* 18 (1961): 24-32. The studies of Bell Telephone workers are W.W. Holland and R.W. Stone, "Respiratory Disorders in U.S. East Coast Telephone Men," *American Journal of Epidemiology* 82 (1965): 92 and M. Deane, J.R. Godsmith, and D. Tuma, "Respiratory Conditions in Outside Workers," *Archives of Environmental Health* 10 (1965): 323.

[44] "U.S. Official Warns on Air Pollution," *New York Times*, January 6, 1950, p. 17.

[45] "U.S. to Assay Air in Urban Centers," *New York Times*, July 5, 1954, p. 13.

[46] Richard Andrews, *Managing the Environment, Managing Ourselves: A History of American Environmental Policy* (New Haven: Yale Univ. Press, 1999), 208; Bess Furman, "$25,000,000 Study of Smog Proposed," *New York Times*, June 12, 1955. The Department of Health, Education, and Welfare was formed in 1953 when the Federal Security Agency was elevated to cabinet status. See John L. Parascandola, "Public Health Service," in ed. George Thomas Kurian, *A Historical Guide to the U.S. Government* (New York: Oxford University Press, 1998), pp. 387-93.

epidemiological studies in Nashville, Tennessee. Dividing the study area into nine categories on the basis of socioeconomic status and pollution levels, the researchers compared mortality data from 1949 to 1960 with levels of pollution measured by a monitoring system. Although subsequently criticized for failing to take into account smoking habits and occupations of its subjects, the study documented an association between exposure to sulfur dioxide and an increased incidence of death from respiratory diseases.[47]

As epidemiologists displaced industrial hygienists as the central expert community concerned with the health affects of air pollution in the 1950s and 1960s, they brought with them an increasingly sophisticated set of methodological and statistical tools developed for the study of chronic disease. Previously focused on outbreaks of infectious diseases, after World War II epidemiologists increasingly turned to the study of chronic diseases with the aid of rapidly growing federal funding. Two key areas of research for the new chronic disease epidemiology were studies of the links between smoking and lung cancer and studies of coronary heart disease. As they studied the links between smoking and lung disease, British and American researchers in the 1940s and 1950s developed increasingly sophisticated methods for retrospective "case-control" studies and also developed new, more rigorous "prospective" methodologies. Challenged by the tobacco industry, and by many in the medical community who remained skeptical of the evidentiary power of epidemiology, epidemiologists increasingly expressed their findings with quantitative precision and sought to demonstrate cause-and-effect relationships.[48] As public health historian Gerald Oppenheimer has observed, "During

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[47] L.D. Zeidberg, R.J.M. Horton, and E. Landau, "The Nashville Air Pollution Study: V. Mortality from Diseases of the Respiratory System in Relation to Air Pollution," *Archives of Environmental Health*, 15 (1967): 214-224. Congress continued increasing federal funding for research on air pollution as it expanded HEW's budget and role in the 1960s. In the 1963 Clean Air Act, Congress increased funding for the air pollution programs at HEW to some $95 million over four years and established a grant program to subsidize the creation of state and local air pollution control agencies. By 1970, funding for federal air pollution R&D came out of an overall HEW budget of more than $134 million for air pollution programs, which now included significant regulatory responsibilities. See Public Law 88-206 (December 17, 1963); Public Law 90-148 (November 21, 1967).

[48] See generally Colin Talley, Howard I. Kushner, and Claire E. Sterk, "Lung Cancer, Chronic Disease Epidemiology, and Medicine, 1948-1964," *Journal of the History of Medicine and the Allied Sciences* 59 (2004): 329-374; Christopher Sellers, "Discovering Environmental Cancer: Wilhelm Hueper, Post-World

the 1950s and 1960s government and university-based statisticians and epidemiologists carefully crafted intellectually rigorous positions on issues of research design, analyses of association, the validity of population-based data, the relations of epidemiological to laboratory and clinical studies, and the criteria of causal thinking."[49] At the same time, postwar research on coronary heart disease led to other key innovations in chronic disease epidemiology, as researchers developed the concept of "risk factors" that elevated the risk of disease.[50]

Like other key areas of research relevant to the often subtle, long-term harms of industrial pollution and toxic chemicals, chronic disease epidemiology was a significant beneficiary of the dramatic postwar expansion of funding for biomedical science. The National Cancer Institute (NCI), for instance, became a major patron of epidemiological research on the relationship between smoking and lung cancer in the 1950s and 1960s. This included both extramural grants and in-house studies, such as a major prospective study of U.S. veterans in 1953. As its budget grew from some $19 million in 1950 to $91 million in 1960, the NCI was a major beneficiary of the rapid rise in funding for biomedical research directed at chronic disease.[51] Significant federal support for biomedical research had begun in the aftermath of World War II as the PHS transformed a wartime contracts program for medical research into a growing extramural grant program. With support from the research community and Congress, by 1947 the extramural grants program administered by the National Institute of Health (located within the PHS) was responsible for more than half of all federal funding for medical

War II Epidemiology, and the Vanishing Clinician's Eye," American Journal of Public Health 87 (November 1987): 1824-1835. On the tobacco industry, see Richard Kluger, *Ashes to Ashes: America's Hundred-Year Cigarette War, the Public Health, and the Unabashed Triumph of Philip Morris* (New York: Vintage Books, 1997) and S.A. Glantz et al., *The Cigarette Papers* (Berkeley: University of California Press, 1996).

[49] Gerald M. Oppenheimer, "Profiling Risk: the Emergence of Coronary Heart Disease Epidemiology in the United States (1947–70)," *International Journal of Epidemiology* 35 (2006): 720-730

[50] See *Ibid.*

[51] NCI Appropriations, NIH 2006 Almanac, *Appropriations* <http://www.nih.gov/about/almanac/appropriations/index.htm> (August 1, 2006); Mark Parascandola, "Cigarettes and the US Public Health Service in the 1950s," *American Journal of Public Health* 91 (February 2001): 196-205.

research.[52] Renamed the plural National Institutes of Health (NIH) in 1948 to reflect the addition of a variety of new disease- and organ-specific institutes such as the National Institute of Mental Health (1946) and the National Heart Institute (1948) to the existing NCI (1937), the NIH budget grew rapidly during the 1950s and 1960s—from some $52 million in 1950, to $81 million in 1955, $399 million in 1960, and more than $1 billion by 1970.[53] Much of the budget increases went to extramural grants to researchers at medical schools and universities, with NIH obligations to universities rising from $72 million in 1958, to $399 million in 1964, and $615 million in 1970. By the late 1950s, the NIH was the leading funding agency for biological research in the U.S., dominating federal funding for research at both medical schools and university life science departments.[54]

The NCI also played a central role in the development and standardization of another key tool for studying chronic harms from industrial pollution—the long-term rodent bioassay for identifying carcinogens. Animal studies had been used to identify chemical carcinogens and to study carcinogenesis since 1915, when two scientists at the University of Tokyo succeeded in inducing cancers by painting coal tars on the ears of rabbits.[55] But in the 1940s researchers at the NCI began developing a new experimental system that involved feeding groups of mice or rats carcinogens or suspected carcinogens for longer experimental periods. Originally used to study the causes and mechanisms of carcinogenesis, the NCI's long-term animal-feeding bioassay became the standard means of screening chemicals for carcinogenicity during the 1960s.[56] When the NCI began a carcinogen screening program in the early 1960s, it formalized a set of procedures to identify potential human carcinogens using this animal bioassay. Researchers first

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[52] Daniel M. Fox "The Politics of the NIH Extramural Program, 1937-1950," *Journal of the History of Medicine and Allied Sciences* 42 (1987):447-466; D.C. Swain, "The Rise of a Research Empire: NIH, 1930–1950," *Science* 138 (1962): 1233–35.
[53] NIH 2006 Almanac, *Appropriations* <http://www.nih.gov/about/almanac/appropriations/index.htm> (August 1, 2006).
[54] Roger Geiger, "Science, Universities, and National Defense, 1945-1970," 44; Toby A. Appel, *Shaping Biology: The National Science Foundation and American Biological Research, 1945-1975* (Baltimore: Johns Hopkins University Press, 2000), 144-147.
[55] Mark E. Rushefsky, *Making Cancer Policy* (Albany, NY: State University of New York Press, 1986), 73.
[56] Rushefsky, *Making Cancer Policy*, 73-74.

identified a “maximum tolerated dose” (MTD), the level at which experimental mice or rats could be exposed to the chemical without suffering signs of obvious acute toxicity. Next, groups of experimental animals were fed the substance at the MTD, and at one-half the MTD, for two years (or sometimes for a full lifetime). Finally, researchers conducted postmortem pathological examinations of the animals, comparing the incidence of tumors in the experimental groups to the control groups.[57] The rodent-feeding bioassay soon became a fixture of regulatory science. After passage of the Delaney amendment to the Food, Drug, and Cosmetic Act in 1958, which prohibited the use of any food additive found to be carcinogenic, the FDA began banning chemical additives on the basis of just one positive rodent study.[58] And in the 1970s, new regulatory agencies including the EPA and OSHA would draw upon the NCI’s growing database of results from standardized rodent-feeding studies as they marshaled evidence for actions against toxic chemicals.[59]

As federal support for cancer research underwrote the development of new techniques and new tools for understanding the chronic effects of pollution and toxic chemicals, research on the mechanisms of carcinogenesis also cast doubt on a central tenet of industrial hygiene and traditional toxicology—the concept of a threshold. As historian Robert Proctor has observed, a central challenge to the threshold concept in the 1960s came from the transplantation of the “one-hit” carcinogenesis model developed in studies of radiation to the broader field of chemical carcinogenesis. Research on the biological effects of radiation had suggested that there was a *linear* dose-response curve between radiation exposure and the genetic mutations believed to cause cancer. Accordingly, even a tiny dose of radiation, or “one hit,” could in theory cause genetic damage leading to cancer. If this were the case, there could be no “threshold” below which exposures would be harmless. When studies suggested that many chemical carcinogens were, like radiation, also mutagens, many leading scientists such as Umberto Saffiotti at the NCI argued that the model developed for radiation carcinogenesis should

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[57] John H. Weisburger and Gary M. Williams, “Carcinogen Testing: Current Problems and New Approaches,” *Science* 214 (October 23, 1981): 401-407.
[58] Rushefsky, *Making Cancer Policy*, 73.
[59] By 1980 an estimated 245 chemicals had been tested using the long-term animal bioassay procedures formalized by the NCI. See *Ibid.*, 401.

also apply to chemical carcinogens. This linear, no-threshold model, Proctor notes, gained additional support from epidemiological studies on smoking and lung cancer, which had found a "close correlation between numbers of cigarettes smoked and the odds of contracting cancer."[60] When the newly-created OSHA and EPA moved against suspected carcinogens in the workplace and the environment in the 1970s, both adopted variations of the linear, no-threshold model to extrapolate from the results of animal studies to predict cancer risks in humans.[61]

The rise of chronic disease epidemiology and the development of standardized experimental systems in chronic toxicology were part of a broader challenge to the paradigm of chemical and environmental hazard assessment that emphasized clinically-discernible symptoms and acute toxic effects. By the 1960s, scientists from a growing array of disciplines—some identifying as "environmental scientists"—were documenting how industrial chemicals and pollutants entering the environment at even relatively low levels could cause an array of subtle, sometimes hidden, ecological and health effects. Often there were long latency periods between exposures and harms. Sometimes the latent effects emerged after accumulation of contaminants to higher levels in ecosystems or the human food supply. And the harms, whether to humans or wildlife, were often not acute toxicity but chronic disease, reproductive damage, or developmental disorders. The new "environmental science" or "environmental health" science of the 1960s would also pose a radical challenge to the theoretical and observational approach of industrial hygiene and traditional toxicology. One telling clash between the traditional toxicological approach and the newer focus on a variety of subtler, longer-term harms came during hearings in 1968-69 before the Wisconsin Department of Natural Resources on whether the pesticide DDT was a water "pollutant" under state law. As Thomas Dunlap relates in his history of DDT, the hearings pitted expert witnesses called by Victor Yannacone and the recently formed Environmental Defense Fund (EDF), on one side, against experts for pesticide manufacturers on the other.

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[60] Proctor, *Cancer Wars*, 159.
[61] Proctor, *Cancer Wars*, 158-160.

Testimony by EDF's scientific witnesses, who came from a wide range of disciplines, aimed to give a holistic perspective on the DDT problem. Two professors of botany from the University of Wisconsin, Madison, described basic principles of ecology and the ecosystem concept. Another witness, EDF's expert on pesticides in the environment, described the chemical properties of DDT, its mobility and persistence in the environment, its ability to accumulate to higher levels up the food chain, and how it disrupted hormonal levels to cause thin shells and low hatch rates in birds. One key witness for EDF was Robert Risebrough, a molecular biologist at the University of California, Berkeley, whose laboratory work had identified both DDT and polychlorinated biphenyls (PCBs) in peregrine falcons along the Pacific coast. Risebrough's work had also suggested a biochemical mechanism—disruption of estrogen levels controlling calcium storage—through which these chemicals caused thin eggshells and led to declines in bird populations. A key part of Risebrough's testimony involved his work in analytical chemistry that had identified DDT in wildlife samples and showed that it accumulated to higher levels in ecosystems. Seeking to discredit this research, the pesticide industry's attorney not only argued that it was impossible to distinguish DDT from PCBs in the samples, but also questioned Risebrough's qualifications, pointedly asking him whether he was in fact a molecular biologist or an analytical chemist. "Risebrough replied," writes Dunlap, "that he did not 'believe in pigeonholing people. I consider myself . . . as an environmental scientist. And I think it's precisely because people have considered themselves specialists that very few people realize what's going on in the environment.'"[62]

The star witness for the pesticide manufacturers, meanwhile, and their only witness to speak to health issues, was Wayland J. Hayes, former chief of toxicology at the PHS from 1949 to 1968 and a professor of toxicology at Vanderbilt University. Hayes had directed two studies on DDT exposure in humans that the pesticide industry claimed proved that DDT was "safe." One was a study of workers at a DDT-manufacturing plant who had been exposed to high levels of the chemical for periods of up to eighteen years; the other was a study where "volunteer convicts" were intentionally exposed to DDT for

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[62] Dunlap, *DDT*, 155-176. Testimony of Robert Risebrough, as quoted in *Ibid.*, 169.

up to a year. Like the Drinker brothers' earlier studies of PCBs and other workplace chemicals, these studies of DDT looked for clinically discernible signs and symptoms. Finding no signs of DDT poisoning in either study, Hayes testified that DDT was safe. Experts called by the environmentalists, however, had raised the possibility that DDT caused subtler physiological and biochemical effects in wildlife and humans that might be invisible to the clinical gaze of Hayes' studies. As Thomas Dunlap relates, Yannacone, the EDF attorney, raised these pointed questions during cross-examination:

> The tests, Yannacone said, showed only that occupational exposure to or ingestion of large amounts of DDT would not produce clinical symptoms of poisoning in healthy, adult males. The test groups included no infants, old or sick people, women or others who might react differently to DDT than did the test subjects. Had Hayes run tests to see if DDT affected the production of hormones, or if it had affected neuro-physiology? Had he tested the relation of dosage to storage, checked the possibility of mutagenic and enzymatic effects? Was he aware that even low levels interfered with the biochemical functions of the body? What about the detoxification of DDT by the liver, particularly in infants?[63]

The traditional toxicological paradigm, espoused by toxicologists such as Hayes and by industrial hygienists, was under assault from a variety of angles by the emerging "environmental" science embodied in the work of scientists such as Risebrough.[64]

The new "environmental" researchers who emerged in the 1960s generally operated outside of the network of institutional, professional, and financial linkages to industry that had shaped industrial hygiene and other previously dominant expert communities such as economic entomology in the field of pesticides. Like biomedical researchers, they too benefited from the dramatic postwar expansion of federal funding for science. Federal support for basic research grew steadily after World War II and then increased dramatically after the Soviet launch of Sputnik in 1958. With basic research viewed as a key to meeting the Soviet challenge, federal support for basic research at universities more than quadrupled between 1958 and 1964 from $242 million to $895 million. By 1970 federal support for basic research at universities had grown to nearly

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[63] Dunlap, *DDT*, 181.
[64] Dunlap, *DDT*, 180-183.

$1.3 billion and applied research to $268 million. The National Science Foundation (NSF) became a major supporter of university research during this period with obligations to universities growing from just $16 million in 1958, to $116 million in 1964, and $201 million in 1970.[65] Among the beneficiaries were key areas of research that would lay the foundation for the recognition of "environmental" problems and the expansion of federal regulation in the 1970s. Biomedical research in fields ranging from epidemiology and biometry to chronic toxicology and molecular biology were nurtured through the towering budgets of the NIH in the 1950s and 1960s. Though its budgets were dwarfed by the NIH, the NSF became a significant sponsor of basic research across a range of life science disciplines, from molecular biology and genetics, to plant biology, ecology, and systematic biology. Through its Division of Biological and Medical Sciences, formed in 1952, the NSF funded basic research in biology largely through project grants, totaling some $25 million in 1960 and rising to $43 million in 1965.[66] The field of ecology, meanwhile, gained significant support from the Atomic Energy Commission (AEC) from the early 1950s through the early 1970s. AEC funding helped create the new field of "ecosystem" ecology and contributed to the development of new techniques for ecological research, including the use of radionuclides.[67]

By the mid-1960s the new chronic disease epidemiology, chronic toxicology, and the evolving field of "environmental" science (the interdisciplinary contours of which were suggested by EDF's experts at the Wisconsin hearings) radically challenged the traditional toxicological approach of industrial hygiene and the longstanding corporate control of scientific information on toxins and industrial pollution. Whether their subjects were human air pollution breathers or DDT-laden peregrine falcons, the emerging chronic disease and "environmental" researchers raised the possibility that even extremely low levels of exposure to chemicals or pollutants could cause harms. As new expert communities displaced the toxicological paradigm of industrial hygiene, they gained institutional footholds under the interdisciplinary banners of "environmental science" or "environmental health." In 1960, the *A.M.A Archives of Industrial Health*,

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[65] Geiger, "Science, Universities, and National Defense, 1945-1970," 43-44.
[66] Appel, *Shaping Biology*, 64-69.
[67] Stephen Bocking, "Ecosystems, Ecologists, and the Atom: Environmental Research at Oak Ridge National Laboratory," *Journal of the History of Biology* 28 (1995): 1-47, pp. 1-2.

the successor to the Drinker brothers' *Journal of Industrial Hygiene*, was rechristened the *Archives of Environmental Health*, and a new journal, *Environmental Science and Technology*, was first published in 1967.[68] The emerging field also gained institutional recognition at the NIH. A Division of Environmental Health Sciences was created at NIH in 1966, headed by Paul Kotin, a pathologist whose research had emphasized the role of air pollution in lung cancer.[69] In 1969, this was elevated to institute status as the National Institute of Environmental Health Sciences (NIEHS), which began publishing *Environmental Health Perspectives* in 1972. With funding of some $17 million per year in the late 1960s, rising to $35 million by 1975, research on the environmental causes of disease sponsored by the NIEHS frequently informed the regulatory initiatives of OSHA and the EPA in the 1970s and beyond.[70]

As the industrial hygiene paradigm was extended outside of the occupational setting after World War II, it remained deeply enmeshed within the framework of corporate funding and corporate self-interest—in minimizing liability, forestalling government regulation, and protecting corporate images. By exercising significant influence over this central expert community, industries implicated in new "environmental" hazards were initially able to control much of the relevant scientific and technical information and to dominate the boundary work demarcating what did and what did not constitute a hazard to public health. Mobilizing this expertise and its toxicological paradigm focused on short-term acute effects, corporate sponsors were able to plausibly argue into the 1960s that air pollution represented merely a "nuisance" and that various chemical products, including DDT, posed no hazard to the public health at ordinary exposure levels. Only with the ascendance of new expert communities operating outside of this elaborate web of industry ties, and the creation of new federal agencies to mobilize this expertise toward the implementation of the new precautionary

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[68] See S. Jonas, "From Journal of Industrial Hygiene to Archives of Environmental Health: A Survey of Changing Scope," *Archives of Environmental Health* 14 (1967): 634-639.

[69] On Paul Kotin, see Talley, Kushner, and Sterk, "Lung Cancer," 353-354.

[70] National Institute of Environmental Health Sciences, *A Brief History of NIEHS* <http://www.niehs.nih.gov/external/history.htm> (August 2, 2006); NIEHS, History of Research Highlights <http://www.niehs.nih.gov/external/hilights.htm> (August 2, 2006); NIH 2006 Almanac, *Appropriations* <http://www.nih.gov/about/almanac/appropriations/index.htm> (August 2, 2006).

health and environmental laws of the 1970s, did industry control over the assessment of workplace and environmental hazards begin to seriously erode. Although affected industries often continued to have significant advantages in technical resources and the ability to control information relevant to regulation, they increasingly entered a pluralistic arena of scientific debate in which their experts encountered competing experts from the EPA and other federal agencies and a variety of environmental and public interest organizations.

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PART II – Partners in America's Progress

Not only did industrial interests control or influence much of the relevant scientific expertise on pollution and chemical hazards through the early postwar decades, pollution-intensive industries also appealed to a vision of science-based technological progress to offset any nascent quality of life concerns about the effects of rapid industrial growth. As industrial hygienists continued to characterize pollution as largely a "nuisance" or aesthetic concern, rapidly expanding postwar industries disseminated a steady stream of advertising and publicity associating the corporate lab and the smokestack with improvements in the quality of American life. Entering the postwar economic boom, large corporations drew upon the cultural prestige of science as they expounded upon their roles in bringing Americans rising standards of living, new domestic "wonders," and economic and technological "progress." Throughout the 1950s and 1960s, these themes informed the PR and institutional advertising of three industries that would later be most affected by the new environmentalism—steel, electric power, and chemicals. Linking their images to the prosperity of the postwar economic boom, firms in each industry identified national "progress" as synonymous with material abundance achieved through the application of science and technology by the modern corporation.

The vision of corporate-led and science-based progress that framed postwar corporate imagery was forged during the economic crisis of the Great Depression. Amid fears about growing labor agitation, New Deal liberalism, and public disaffection with the prevailing economic order, American corporations mobilized for a broad defense of the American "free enterprise system." In what Roland Marchand has called the "public relations craze" of the 1930s, large corporations such as Du Pont, U.S. Steel, and General Motors launched expansive PR programs to explain their value to the public and to "humanize" their corporate image through populist rhetoric and imagery.[71] American corporations also began selling a vision of a better tomorrow in which the modern corporation would mobilize science and technology to bring about a new era of material abundance.

This vision was crystallized in the corporate-fashioned scientific idealism of America's depression era world's fairs and exhibitions, such as the Chicago Century of Progress Exposition in 1933-34, the Texas Centennial Exposition of 1936 in Dallas, and the New York World's Fair of 1939-40. Largely underwritten by corporate sponsors, which now dominated the exhibition spaces, the fairs of the 1930s drew an estimated one hundred million visitors. As historian Robert Rydell has shown, the trope of science-made progress in the fairs reflected the active participation of leading academic and industrial scientists. Organized under the auspices of the National Research Council, scientists acted as "intellectual underwriters of the fairs, helping to design and implement the 'century-of-progress' and 'world-of-tomorrow' themes presented at the Chicago and New York fairs respectively."[72] Drawn largely from within industry or from industry-funded university programs, the participating scientists shared the vision of fair underwriters in national progress driven by corporate-led scientific and technological advance. The exhibits they helped design, Rydell argues, encouraged visitors to leave decisions about what constituted progress to farsighted corporate sponsors and their experts. "Visitors to science exhibits at the fairs," writes Rydell, "were not expected to enter intellectually into science, but to become consumers of science through mass production. By encouraging visitors to believe that any application of science to the environment automatically leads to progress, scientists, in essence, were saying that

[71] See Roland Marchand, *Creating the Corporate Soul: The Rise of Public Relations and Corporate Imagery in American Big Business* (Berkeley: University of California Press, 1998), chapter 6.
[72] Robert W. Rydell, *World of Fairs: The Century-of-Progress Expositions* (Chicago: University of Chicago Press, 1993), 93.

judgments about these matters were best left to themselves and their corporate patrons."[73] As an epigram printed in the official guidebook to the Chicago exposition put it, "Science Finds—Industry Applies—Man Conforms."[74]

Even as fears within the business community of fundamental threats to the "American system" ebbed during the postwar boom, corporations continued to build their images around themes of corporate-led scientific and technological progress. Defining national "progress" as synonymous with material abundance, postwar corporate image advertising urged that America's rising prosperity was the fruit of a marriage of science and technology to corporate capitalism. For steelmakers, corporate image advertising aimed at linking a staid smokestack industry with the nation's buoyant technological progress. From automobiles and appliances to office towers and houses, steel advertising told the industry's story of expansion into new markets through vicarious stories highlighting the achievements of steel's prestigious customers. Electric utilities also built their corporate images around vicarious stories of the economic and technological progress achieved by major customers, thereby highlighting the role of abundant, low-cost electricity to industrial growth and economic diversification in their regional service areas. But as utilities promoted consumer demand as part of their postwar "grow and build" strategy, they also extended the theme of technological progress into the home—urging consumers to "live better electrically" by embracing domestic conveniences for the "all-electric home." The postwar chemical industry, meanwhile, emphasized the essential role its products played in technological innovation and industrial growth and highlighted the role of chemical products in everyday life. But with the industry enjoying an unmatched reputation as a source of new consumer and industrial "wonder" products, chemical firms often employed more dramatic imagery—of Promethean, science-based technological advance that harkened back to the world-of-tomorrow themes of the 1930s world's fairs. In the 1950s, the industry appealed to its prestigious image as a science-intensive wellspring of technological innovation as it mobilized to counter nascent public concerns about pollution and chemical hazards.

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[73] Rydell, *World of Fairs*, 215.
[74] Rydell, *World of Fairs*, 98-99.

Steel Progress

As the American steel industry transitioned to domestic production after World War II, it enjoyed robust growth to meet the demands of burgeoning consumer industries, such as autos and appliances, and of infrastructure developments, such as oil and gas pipelines and high rises. In the 1950s, the American steel industry was not only the world's largest (accounting for an estimated 45 percent of total world output in 1951), but also enjoyed a reputation as among the most technologically-advanced and most efficient. The industry was dominated by a dozen vertically-integrated firms that represented some 80 percent of domestic capacity, with U.S. Steel alone representing some 30 percent of domestic production. Postwar corporate image advertising by U.S. Steel and other steelmakers reflected an optimistic vision of the industry's continued prospects for rapid growth and its vital role in the American economy. Steel firms, which largely sold steel to other manufacturers, typically explained their value to the public by emphasizing the importance of steel to the overall "progress" of the nation or particular regions, and by highlighting the role of steel in prestige infrastructure projects and the technological advances made by other companies.[75]

Steel firms had built their corporate images around linkages between steel and national technological progress since the 1930s. In 1935 advertising executive Bruce Barton convinced U.S. Steel executives to join other major corporations in institutional advertising that would build the company's corporate image while simultaneously helping defend the American system. The first advertisements designed by Barton's agency—Batten, Barton, Durstine, and Osborn (BBDO)—told stories of U.S. Steel's contributions to the nation's economic and technological progress by explaining the centrality of steel products to automakers, oil companies, and other industries. According to Marchand, the ads "familiarized the public with U.S. Steel by glamorizing its big customers—a tactic that avoided direct self-praise while revealing how both the steel corporation and those it wished to flatter (and to whom it wished to sell its products) had

[75] Judith Stein, *Running Steel, Running America: Race, Economic Policy, and the Decline of Liberalism* (Chapel Hill, NC: University of North Carolina Press, 1998), 7-36.

contributed to the progress of the nation."[76] To support its new corporate image building efforts, U.S. Steel soon created an in-house Public Relations Department and began publishing a company magazine, *U.S. Steel News*.[77]

Postwar institutional advertising by U.S. Steel continued to build the company's image by portraying it as a partner in America's progress. A 1955 ad showed how "Steel keeps pace with America" through a vast new mining operation in Venezuela and a new Research and Development Center in Pennsylvania. The company touted its central role in building the nation's infrastructure with an image of the towering five-mile Mackinac Bridge, a two-tower suspension bridge connecting the upper and lower peninsulas of Michigan, then being built by U.S. Steel's American Bridge Division. Elsewhere, U.S. Steel noted, it was building the State Thruway Bridge in Nyack, New York and skyscrapers in New York City, Philadelphia, Chicago, and San Francisco. To meet the needs of American industry, said the company, it was modernizing its plants to increase capacity and building new facilities such as the Fairless Works in Pennsylvania, which it called "the largest fully integrated steel mill ever to be built at one time." The company said that its 265,000 workers and 277,000 investors were "cooperating with energy, enterprise and faith as your partners in America's progress."[78]

California-based Kaiser Steel, which had expanded its facilities to meet wartime production demands, drew upon similar themes as it explained how Kaiser was helping "build the West." A 1955 Kaiser ad explained how Kaiser had helped make possible the rapid postwar growth of the West by supplying steel products to "hundreds of western manufacturers." Like U.S. Steel, Kaiser familiarized the public with its contributions to economic progress by praising large customers of its products. The ad told, for instance, how Pacific Gas and Electric, the California utility, was hard at work "helping to provide better living for Northern California homemakers" with the help of steel products. Snapshots in the ad highlighted other Kaiser customers—a disc harrow made by a Los Angeles farm equipment manufacturer and a "Tuna Clipper" made by a San Diego

[76] Marchand, *Creating the Corporate Soul*, 225.
[77] See Marchand, *Creating the Corporate Soul*, 223-229.
[78] U.S. Steel, "Steel Keeps Pace with America," advertisement, *New York Times*, January 23, 1955, p. 57.

shipbuilding company. "The manufacturers of the products shown here," said Kaiser, "are making important contributions to the remarkable growth of the West."[79]

By 1960 U.S. Steel would similarly link its corporate image to the postwar growth of the American West in institutional ads targeted at a western readership. A 1960 ad, "New Western ideas in steel," highlighted the company's role in building western infrastructure and harnessing natural resources. In four snapshots, U.S. Steel explained the role of its products in a new dam on the Columbia River in Washington, an underground pipeline bringing water to Eugene, Oregon, an atomic power plant in California, and a bank building in San Francisco's Chinatown. The latter, said the company, was an example of "East Meets West in Modern Steel." Underneath the bank's ornate exterior, or "colorful curtain of Oriental charm" as the company put it, was "a modern Western metal…steel!" Harnessing its image to the rapid growth of the West and the progress of the nation, U.S. Steel ads now carried the slogan: "Lightens your Work; Brightens your leisure; Widens your world."[80]

By selling a vision of steel-driven technological progress and economic growth, steel firms helped nurture a postwar political environment in which the industry's massive environmental impacts would be accepted as the price of progress. As Andrew Hurley has shown, for instance, local political leaders in Gary, Indiana, refused to challenge U.S. Steel's rising toll of pollution in the early postwar era in part because of the belief that any interference with the industry could jeopardize the city's economic growth. Even as residents increasingly complained about "factory odors and 'murky and unpalatable' drinking water," political and civic leaders shared in the general view that the smoke billowing from U.S. Steel's mills was a symbol of prosperity. "Most residents," writes Hurley, "believed that despite the inconvenience, dirty air and water was the price one paid for industrial prosperity."[81] Hurley notes that the association between pollution and economic progress persisted in Gary into the early 1960s. A 1961

[79] Kaiser Steel, "Helping to Build the West…With Kaiser Steel," advertisement, *Los Angeles Times*, December 15, 1955, p. A18. On Kaiser Steel, see Ric Dias, "'Built to Serve the Growing West': Kaiser Steel Corporation, the Federal Government, and Regional Development," *Journal of the West*, 38 (Fall 1999): 57-64.

[80] U.S. Steel, "New Western ideas in steel," advertisement, *Los Angeles Times*, March 22, 1960, p. 23.

[81] Andrew Hurley, *Environmental Inequalities: Class, Race, and Industrial Pollution in Gary, Indiana, 1945-1980* (Chapel Hill, NC: University of North Carolina Press), 38-43.

Chamber of Commerce publication, for instance, described Gary as a "lusty symbol of American enterprise" by praising its "mighty blast and open hearth furnaces in her horizon-long sweep of mills with their up-thrust stacks and her flame-lit nights pulsing with the reflected fires of hot coke and molten steel."[82] With expert opinion still dominated by industrial hygienists who held air pollution to be more of a nuisance than a health risk, the steel industry would avoid significant local regulation of air pollution in Gary and many other cities into the 1960s.

Power for Progress—Electric Utilities

Like the steel industry, the electric utility industry entered a period of robust growth in the decades after World War II. By the early 1950s, some 90 percent of U.S. electricity was produced by privately-owned firms (including a number of holding companies) that had been granted "natural monopolies" over their service areas in exchange for state regulatory oversight over pricing and service. In what historians of the industry have called its "golden years," utilities roughly doubled the amount of electricity produced each decade during the postwar economic boom. As they did so, utilities adopted a "grow and build" business model of continual expansion based upon technological innovation, economies of scale, and vigorous promotion of electricity usage. By promoting consumer and industrial demand within their service areas, utilities could justify building ever larger power plants that incorporated the latest technological advances. As these more productive plants came on line, they reduced the cost of producing electricity. Utilities then passed some of the savings on to customers in the form of lower rates. Ever lower prices for electricity, in turn, helped sustain rising consumer demand, which could justify another round of expansion with increasingly productive power plants. Postwar PR and advertising by utilities thus aimed to prime the pump of this grow-and-build cycle by stimulating consumer and industrial demand for electricity within their service regions.[83]

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[82] Quoted in *Ibid.*, 60.
[83] See Richard F. Hirsh, *Technology and Transformation in the American Electric Utility Industry* (Cambridge: Cambridge University Press, 1989); Richard F. Hirsh, "Post World War II 'Golden Years,'" in

To stimulate increased consumer demand, utilities across the country launched advertising campaigns in the 1950s and 1960s aimed at encouraging consumers to "live better electrically" or to buy an "all-electric home." As they simultaneously courted potential industrial customers, utilities echoed steel industry advertising in linking their product to overall technological progress and economic growth in their service regions. But utilities cultivated increased consumer demand by domesticating technological progress. They brought "progress" into the American home through imagery associating the increased use of electrical appliances with rising standards of living. Utilities urged that the adoption of an array of new electric appliances and a complete electrification of the home—or "full housepower" in advertising terms—was the key to a better quality of life. With new electric-powered technologies fully integrated into the postwar home, cheap and abundant electricity—available at the turn of a switch—promised to lighten the burdens of domestic chores and improve the quality of family leisure.

Utility advertising in the 1950s and 1960s urged that the modernization of the household with electric-powered appliances would bring liberation from burdensome domestic labor. As the Los Angeles Department of Water and Power told its customers in a 1957 ad, the "modern magic of electricity" allowed you to "accomplish more with less time and effort." "In the home," said the ad, "electricity cooks your meals quickly and cleanly. It washes and dries your clothes without drudgery. It polishes floors, washes dishes, does the family sewing."[84] Similarly, a 1957 ad by the New York City utility, Consolidated Edison (Con Edison), explained to readers how they could get "work-saving Con Edison electricity" to wash and dry their laundry through new combination electric washer-dryers. Through the folksy voice of Uncle Wethbee, a cartoon sidekick of New York television weatherman Tex Antoine, Con Edison contrasted the modern labor-saving world of electricity to the "'good old days' before electricity." "When I was a boy," said Uncle Wethbee, "it seemed I spent most of my time supplying boy power to one crank or another. If I wasn't helping Ma by working

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Powering the Past: A Look Back, Smithsonian Institution, Powering a Generation of Change < http://americanhistory.si.edu/powering> (August 20, 2006).

[84] Los Angeles Department of Water and Power, "You Can Live Better in Los Angeles," advertisement, *Los Angeles Times*, September 24, 1957, p. 12.

the handle of the old laundry wringer, I was twisting the coffee grinder."[85] Utilities argued that the biggest beneficiary of the domestic technological revolution made possible by cheap electricity was the modern housewife. "The queens of history would envy Susan Smith," declared a 1964 ad by a group representing privately owned utilities. "You know Susan Smith!" it continued. She represents every modern housewife in America." Below a picture depicting Queen Elizabeth and Marie Antoinette marveling at an electric kettle and an electric iron in a modern kitchen, the ad said that "No queen in the past ever had such a wonderful servant as the electricity that she uses in her home every day."[86]

To promote the "all-electric" home, utilities established a program in the 1950s to certify newly-built homes as fully equipped with modern electrical appliances and properly wired for "modern electric living." Under this "Live Better Electrically Medallion Home Program," utilities told customers to look for the "Medallion" home insignia before buying a new home. As Southern California Edison explained to its customers in ads in the late 1950s and early 1960s, "Medallion" homes were guaranteed to have a built-in "ultra-modern electric range" and "at least three other major appliances," to be properly wired with outlets and switches for "full housepower," and designed with enough "light for living" to not only illuminate but also to "beautify and decorate" the home.[87] The Potomac Electric Power Company (PEPCO), whose service area included Washington, D.C., described in 1964 how one couple—Mr. and Mrs. Smith—benefited from their recently purchased "Medallion" home in Maryland. "Flameless" or "matchless" electricity provided clean and dependable heating and hot water for "total electric living" year round. Mrs. Smith, meanwhile, now did a "minimum of housework" as her "work-saving electric kitchen" eliminated such chores as dishwashing and garbage disposal." As utilities promoted the all-electric home in

[85] Con Edison, "About Cranks," advertisement, *New York Times*, August 14, 1957, p. 14.
[86] America's Independent Electric Light and Power Companies, "The Queens of History Would Envy Susan Smith," *Reader's Digest*, March 1964.
[87] Southern California Edison Company, "Questions to Ask Before You Buy that Home," advertisement, *Los Angeles Times*, April 6, 1958, p. L12; "When the Future is All-Electric, Why Buy Anything but a Medallion Home?" advertisement, *Los Angeles Times*, June 4, 1961, p. P28.

advertising, they also put five model "medallion" homes on display at the New York World's Fair of 1964-65.[88]

While urging Americans to electrify their homes, utilities also sold a broader vision linking electric power to science-based progress and "world of tomorrow" technological marvels. The Investor-Owned Electric Light and Power Companies, a group representing some 300 private utilities, drew upon these themes in the mid-1960s for both its advertising efforts and for a major exhibit at the New York World's Fair. While highlighting contemporary electric-powered domestic conveniences, the group's advertisements predicted a future where technological wonders would transform Americans' recreational pursuits. Whether staying in an "undersea vacation home" or traveling in a "flying mobile camper of the future," Americans could expect an array of new conveniences and opportunities made possible by cheap and abundant electricity.[89] The group also sponsored a major exhibit at the New York World's Fair in 1964-65—the Electric Power & Light Pavilion. With walls constructed of hundreds of shimmering aluminum prisms, the building housed a powerful searchlight that pointed straight up into the night sky. Visitors to the pavilion could learn about electric wonders of tomorrow, such as electric autos and climate-controlled cities. But the main attraction was a seven-act musical, "Holiday of Light," which explained the benefits of electricity in American life. "The show," writes a historian of the fair, "used three-dimensional animated figures. The scenes included a research laboratory of flashing lights, whirling turbines and sparking coils; a 'beauty parlor' in which an animated 'Madame Cow' extolled the pleasures of warm electric milkers on icy mornings; a house filled with modern electric appliances; and a dazzling Christmas sequence."[90]

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[88] Potomac Electric Power Company, "Signs of Matchless Living," *Washington Post*, August 12, 1964, p. A10.
[89] Investor-Owned Electric Light and Power Companies, "Looking Ahead? So Are We," advertisement, *Time*, October 22, 1965.
[90] Jeffrey Stanton, *Electric Power & Light Pavilion*, New York 1964 World's Fair <http://naid.sppsr.ucla.edu/ny64fair/map-docs/electricpower.htm> (August 20, 2006).

Chemical Progress

Few in the postwar era took up the task of explaining their value to the public with as much energy as chemical companies. Postwar institutional advertising and PR by chemical manufacturers not only highlighted the array of new domestic products and conveniences made possible by chemical research but also told of how public-spirited companies were contributing to the nation's progress by bringing revolutionary improvements in agriculture and health care and supplying vital products for the Cold War space and atomic energy programs. Like steel firms, chemical companies frequently explained their value to the nation through institutional advertisements that profiled prestigious customers of their products. In so doing, chemical companies urged that they were hard at work serving the public interest, solving pressing national and international problems, and playing an essential role in bringing about rising standards of living. But chemical companies went beyond even electric utilities in mobilizing striking imagery of science-based progress, at times by glamorizing the Promethean exploits of scientists and engineers. Fresh from the lab, a steady stream of "chemical wonders" promised to weave progress into everyday life. By the early 1950s, the industry was mobilizing this prestigious image as a science-based engine of progress in order to counter the stirrings of public concern over its sizeable contributions to air and water pollution.

By the 1920s chemical companies had begun building their corporate images around themes of public service through chemical progress. In the early 1920s, Du Pont launched a short-lived institutional advertising campaign linking its image to the figure of the public-spirited "hero-engineer." In this campaign, observes historian Ferdinando Fasce, the company "appropriated . . . an image widely used in novels, movies, and car-makers' ads."[91] Du Pont's aim, writes Fasce, was to create a "positive identification between the company and this unselfish 'today's Prometheus . . . who has brought to mankind comforts and conveniences that a century ago were only wishes.'"[92] But with

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[91] Ferdinando Fasce, "Family, Big Business, Public Sphere: Public Relations at Du Pont in the Interwar Years," in *Public and Private in American History: State, Family, Subjectivity in the Twentieth Century*, ed. R. Baritono, D. Frezza, A. Lorini, and E. Vezzosi (Turin: Otto, 2003), 435-458, p. 441.
[92] *Ibid.*, 441.

little support among Du Pont managers, the campaign ended within a year.[93] Du Pont returned to institutional advertising in 1935 in response to criticism of its profiteering off munitions sales during World War I. The company launched an expensive PR and advertising campaign designed by Bruce Barton's agency, BBDO, that included a new radio program, *The Cavalcade of America*, institutional advertisements in magazines, and a new corporate slogan, "Better Things for Better Living…through Chemistry." As Roland Marchand has observed, Du Pont's campaign aimed to "humanize" the company by explaining its role in the nation's progress through simple populist rhetoric and themes. Its institutional ads, for instance, featured the voices of "plain and folksy" characters who discussed the unexpected benefits of chemicals in everyday life. Du Pont's *Cavalcade* radio program, meanwhile, often involved historical narratives that explained how "Americans had achieved progress by exercising conventional virtues and carrying out scientific research." "[W]ith the aid and encouragement of Barton's agency," writes Marchand, "Du Pont searched for a new language in which to talk chemistry, progress, and free enterprise to the common man."[94]

These themes also animated Du Pont's participation, for the first time, in great expositions: the Texas Centennial Exposition of 1936 and the New York World's Fair of 1939-40. At its "Wonder World of Chemistry" exhibit at the Texas Centennial, Du Pont used colorful displays to explain how it turned raw materials such as cotton and wood into a cornucopia of products enjoyed by consumers such as cellophane, rayon yarn, and plastics. As historian Jeffrey Meikle relates, a souvenir booklet from the exhibit explained that visitors would learn about the "partnership between farming and chemistry" and "how du Pont chemists take Nature's raw materials and convert them into articles we all know and enjoy today."[95] Du Pont continued its "Wonder World of Chemistry" theme at the New York World's Fair in displays housed within its dramatic "Tower of Research," a 100-foot-tall tower designed by Walter Dorwin Teague. At Teague's urging, Du Pont simplified its exhibits and focused on entertaining visitors with dramatic displays aimed at leaving visitors with a general impression of the company and

[93] See Marchand, *Creating the Corporate Soul*, p. 414, n. 47.
[94] Marchand, *Creating the Corporate Soul*, 218-223.
[95] Jeffrey Meikle, *American Plastic: A Cultural History* (New Brunswick, N.J.: Rutgers University Press, 1995), 135.

its wide-ranging activities. As Roland Marchand explains, "Du Pont conveyed messages about its scientific prowess through such diverting but instructive amusements as a marionette show and a magic trick that had a company chemist pluck a woman in nylons out of a test tube."[96]

Du Pont's institutional advertising in the early postwar era continued its 1930s themes of partnership in America's progress. Paralleling the ideological crusade of the NAM and other business lobbies, Du Pont also joined in the campaign to defend the free enterprise system, though with subtler rhetoric than was typical of the business lobbies. A 1947 ad, for instance, explained how both Du Pont and American business in general played critical roles in providing for the "American way of living." Du Pont first explained its own "never-ending search for new products and for improvements in existing products." This innovative spirit, said Du Pont, would "give people everywhere more and better things for better living." Du Pont went on to explain that its own vision of "vigorous research, considered expansion, faith in America's future" was shared by American business in general. This American system, urged the company, guaranteed jobs and investment opportunities and ever better and less expensive products. The ad concluded by hinting of threats to the free enterprise system: "When someone comes along with a substitute for the American way of living—it is a good thing to ask a simple question about that economic system. 'How's it doing at supplying its people with . . . better things for better living.'"[97]

Buoyed by the rapid postwar growth of the industry, Du Pont and other large chemical corporations took their stories to the public through a steady stream of corporate image advertising in the 1950s and 1960s. Whether the sponsor was Union Carbide, Monsanto, or American Cyanamid, much of the industry's image advertising mirrored the themes elaborated by Du Pont—linking chemical research and "progress" to "better living," celebrating scientific and technological expertise, and depicting the chemical corporation as an indispensable partner in the nation's progress. As a 1956 Du Pont ad succinctly put it: "Chemical Progress: Key to Better Living." Even where companies diverged sharply from the often reserved, "just-the-facts" tack of Du Pont's 1950s ads,

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[96] Marchand, *Creating the Corporate Soul*, 292-294.
[97] Du Pont, "A Good Thing," advertisement, *Wall Street Journal*, September 15, 1947, p. 6,

there remained striking thematic consistency. In a sappy December 1953 ad, American Cyanamid asked Americans to join it in seeing the world with the bright-eyed optimism of a child on Christmas—"big, and kind, and candy-good, and peaceful!" It was the challenge of industry, and particularly the chemical industry, said Cyanamid, to "shape this modern world of ours more to a child's image of Christmas." But the ad concluded with more prosaic language that could have graced any Du Pont ad: the chemical industry was "charting progress in many fields and helping to bring about new developments and discoveries that make life better, healthier and happier for young and old everywhere."[98]

The modern Prometheus or hero-engineer theme made a return in Union Carbide ads of the early 1960s. Carrying the slogan "A Hand in Things to Come," the ads were illustrated with images of hands cupping or capturing mysterious forces of nature. Union Carbide's stories of chemical progress highlighted the work of its scientists and engineers—"the people of Union Carbide"—in cutting-edge research to develop new technologies to meet "the growing needs of tomorrow's world." "Instant portable power . . . any time, any place" was the goal of the company's research on batteries and fuel cells. The ability "to catch an atom," meanwhile, had been achieved at Oak Ridge National Laboratory in Tennessee with the help of Union Carbide scientists and engineers who designed facilities for the uranium separation process. Another ad said Union Carbide was "creating a strange world of cold" as it used the science of cryogenics to create pure gases for industrial uses. The ads mixed images of chemical mystery and promethean harnessing of nature's energies with *Scientific American*-like explanations of Union Carbide's R&D efforts. Like Du Pont and Cyanamid, Union Carbide explained its essential role in promoting the nation's economic and technological progress on a variety of fronts—"chemicals, carbons, gases, metals, nuclear energy, and plastics"—and offered additional information in free booklets such as "Union Carbide's Twenty Years in Nuclear Energy" and "The Exciting Universe of Union Carbide."[99]

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[98] Du Pont, "Chemical Progress: Key To Better Living," advertisement, *Wall Street Journal*, April 26, 1956, p. 9; American Cyanamid, "As a Child Believes," advertisement, *Wall Street Journal*, December 10, 1953, p. 11.
[99] See Union Carbide advertisements, *Business Week*, November 9, 1963 and *Newsweek*, February 27, 1961.

One sign of the success of postwar chemical industry PR was the enthusiastic treatment of the industry by the press. Feature stories and editorials in the 1950s frequently mirrored the themes of industry publicity. Typical was a 1950 *Christian Science Monitor* story that enthused, "New and exciting food items, wearing apparel that's 'out of this world,' and lighter household tasks are all possible because of chemistry. Snow-white laundry without the use of soap, fresh water from the ocean, artificial rain when and where needed, and an almost endless array of plastics for every conceivable purpose also might be listed."[100] Equally generous with its praise, if less effusive, was a 1951 *Washington Post* editorial in honor of the seventy-fifth anniversary of the American Chemical Society. "[T]he chemical industry and profession in this country," said the *Post*, "have grown from infancy to an integral and indispensable part of living, with their influence felt in items varying from nylon to atomic energy. The diamond jubilee is an occasion not only for congratulations, but also for reflection on what is possible under a free science and on what useful fellows the chemists are to have around."[101] In 1953 the editor of the *Christian Science Monitor's* financial page, George Ericson, observed a wave of enthusiasm among his journalistic colleagues toward the chemical industry. The industry's progress, wrote Ericson, had led "ordinary matter-of-fact writers to use superlatives in its description." Ericson then joined the bandwagon. If previous eras could be described as the brass age or the steel age, he wrote, then the current era could justifiably be called the "chemical age." "Hardly a day passes," he continued, "without the announcement of some new chemical product, some advancement in the field of organic or inorganic chemistry, which affects the lives of all of us directly or indirectly."[102]

Alongside the widespread identification of chemicals as the "integral" or "indispensable" industry, the press also looked to the industry as a convenient measure of general economic prospects. News stories in the 1950s frequently looked to the health of

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[100] Everett M. Smith, "Chemical Industry Prods Progress in New England," *Christian Science Monitor*, July 3, 1950, p. 4.
[101] "Chemical Anniversary," editorial, *Washington Post*, September 3, 1951, p. 4.
[102] George Ericson, "Chemistry's Industrial Impact Ever Greater," *Christian Science Monitor*, July 15, 1953, p. 14.

the chemical industry to assess the economic trends of both particular regions and the nation as a whole. In 1950s, for instance, the *Christian Science Monitor* cited dependence of other industries and the overall economic growth in New England on the region's chemical industry. According to the piece, "practically every industry today is dependent in one way or another on the chemical industry."[103] The *Wall Street Journal*, meanwhile, treated the chemical industry as a bellwether for the entire national economy. A booming chemical industry signaled healthy growth elsewhere according to a 1952 story headlined "Barometric Business Signals a Faster Pace in Most of the Economy." The *Journal* returned to chemical sales as a barometer for the nation's economic prospects in 1956. "Looking for clues to the pace of industrial output early next year?" the piece asked rhetorically. "Glance at a usually-reliable barometer, the nation's chemical industry."[104]

So strong were the positive associations evoked by the chemical industry that regional banks and electric utilities—joined at times by state and local officials—sought to promote investment and attract industry to their areas by publicizing the local strength of chemical firms. Given the industry's status as "essential," "integral," or an economic "barometer," those seeking to attract new industrial customers or job providers frequently cited a healthy chemicals sector in their area to symbolize a generally healthy business climate. "New Jersey's Number One Industry is Chemicals" declared a 1955 ad by New Jersey's electric utility, Public Service Electric and Gas Company (PSE&G), which invited manufacturers to inquire about locating facilities in the state. Similarly, when a group of utilities from Arkansas, Louisiana, and Mississippi joined to promote the advantages of the "Middle South" for industries seeking plant sites, they pointed to the construction of more than 100 new chemical plants over the past decade in the region as a sign of its prosperity. "Chemical progress," said a 1951 ad by the group, "has helped build a fertile industrial and consumer market in the Middle South." State development agencies also publicized strong chemical sectors in efforts to attract new industry and investment. In 1959, for instance, the Florida Development Commission ran a

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[103] Everett M. Smith, "Chemical Industry Prods Progress in New England," Christian *Science Monitor*, July 3, 1950, p. 4.
[104] Sydney Self, "Barometric Business Signals a Faster Pace in Most of the Economy," *Wall Street Journal*, October 2, 1952, p. 1.

newspaper-style ad titled "The Florida Industrial Newsletter." The ad's faux-news stories profiled the state's increasingly diversified economy and its ample energy and transportation infrastructures. But the top headlines were reserved for features on the state's booming chemical industry, which had recently become Florida's second largest sector behind food processing.[105]

In the 1950s the Manufacturing Chemists' Association (MCA), the industry's top trade association, began a long-term PR program to complement the efforts of individual firms. Some MCA officials had urged the group to begin a PR program in the late 1940s in response to public concerns about air pollution. In 1949, one year after the deadly smog incident in Donora, Pennsylvania, a member of the MCA's new Air Pollution Abatement Committee urged his colleagues to recommend that the MCA launch a new PR program that could address the threat of new air pollution regulations. A report by A.B. Petit of the Davison Chemical Corporation urged that a new PR capacity within the MCA could work "(1) to offset the adverse affects caused by the activities of irresponsible headline hunters and trouble makers, (2) to prevent the development of public demand for drastic and impractical air pollution and smoke control legislation, and (3) to educate the public as to the difficulty of eliminating and controlling air pollution and what the chemical industry is doing about it in order to gain member companies the time necessary to solve their problems in the most practical manner." Petit's colleagues on the committee, however, urged lower-key communications efforts focused on telling employees and plant communities what the industry was doing about air pollution. If the industry were "over-zealous" on air pollution, committee members feared, "it might be singled out as the principle contributor."[106]

The MCA was ultimately convinced of the need for an industry-wide PR program by a 1952 poll conducted by the Opinion Research Corporation. The survey suggested

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[105] PG&E, "New Jersey's Number One Industry is Chemicals," advertisement, *New York Times*, May 15, 1955, p. E7; The Middle South, "Expanding Chemical Industries Make the Middle South Prosper," advertisement, New York Times, November 6, 1951, p.48; Florida Development Commission, "The Florida Industrial Newsletter," advertisement, *Wall Street Journal*, November 6, 1959, p. 9.
[106] Manufacturing Chemists' Association, Air Pollution Abatement Committee, "Minutes of Meeting," November 9, 1949, MCA Papers.

both a lack public understanding and generally negative perceptions of the industry. The MCA soon approved a new PR program. According to a later MCA report, chemical executives were motivated by concerns that if the industry's image were not improved it "would never be free of the threat of restrictive and oppressive action that could reduce earnings and make effective functioning difficult." The new program would have both "positive" and "defensive" functions. On the positive side, it would tell the industry's story by "fostering adequate public appreciation of the industry's contributions to the health, employment, income, standard of living, and general well-being of the public." On the defensive side, the program would be directed at "attacking the misconceptions that tend to undermine the standing of the industry in the public mind." The program targeted three key messages at the nation's opinion leaders: first, the industry's importance "in everyday life and in improving future standards of living"; second, the industry's contributions to protecting the public "in matters of defense, health, and the use of natural resources"; and third, the "economic conditions" necessary for the industry to continue serving the public.[107]

The first major PR venture by the MCA was the organization of an annual "Chemical Progress Week" that began in 1954. Modeled on "Oil Progress Week," a yearly event sponsored by the American Petroleum Institute, Chemical Progress Week in 1954 was organized around the theme "A Better America through Chemical Progress." Planners of the event told the MCA's directors that it would "emphasize the contributions of chemistry to individuals in their communities" and would be "keyed to a community approach in chemical plant localities through schools, clubs, miscellaneous speeches, etc." The nation-wide program would also be "tied in with member advertising programs as much as possible." The MCA soon enlisted the energies of member companies across the country and successfully petitioned the governors of several states, including New York, to officially recognize a "Chemical Progress Week" in May. The week's events included speeches by chemical executives at schools, chambers of commerce, and women's clubs, radio and television interviews, exhibits in storefronts and hotel lobbies,

[107] Arthur Smith, Jr. to MCA Board of Directors, "A Report on MCA's Public Relations Program," February 7, 1958, MCA Papers; Jack R. Ryan, "Chemical Industry Opens 'Week' To Help Public Appreciate Enormous Progress," *New York Times*, May 16, 1954, p. F1.

and advertising campaigns jointly sponsored by groups of chemical firms in some cities. To combat perceived public misperceptions and lack of appreciation, executives told the industry's story by emphasizing its rapid growth since World War II, its research spending of some $300 million annually, and its investments of $7 million each year in developing new equipment to control air and water pollution.[108]

With Chemical Progress Week as its centerpiece, in the late 1950s the MCA's PR program expanded into a broad range of activities. By 1958 the MCA had distributed some 300,000 copies of a "Chemical Industry Facts Book" to a variety of audiences including the press, banks and investment houses, schools, and members of Congress. In 1954, the MCA began publishing *Chemical News*, "a bimonthly newspaper-style publication on the industry." Originally targeted at editors, by 1958 its circulation of 32,000 had spread to government officials, educators, and other "opinion leaders." The MCA also set up a centralized Information Service to provide positive publicity on the industry to the press. In 1957-58, according to a MCA report, it provided "favorable industry information for stories in Life, Saturday Evening Post, Fortune, Readers Digest, the Associated Press and other wire services, and many others." Finally, in plant communities, the MCA began coordinating a year-round community relations program through the local committees that organized events for Chemical Progress Week. Retired General John E. Hull, president of the MCA from 1955 to 1963, described the local program as a crucial piece of the group's overall PR efforts. "By speeches, publicity, and work with schools and similar opinion moulding [sic] groups," he explained at a 1958 MCA meeting, "it is our hope first to establish more firmly in the minds of the American public the significance of chemistry and the chemical industry and secondly, by continuing this work year round, steadily build up our industry as a good place in which to work, a good industrial neighbor, a valuable member of the community, and a vital segment of the economy."[109]

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[108] MCA, Board of Directors, "Minutes of Meeting…on February 9, 1954," February 16, 1954, MCA Papers; Ryan, "Chemical Industry Opens 'Week' To Help Public Appreciate Enormous Progress," *New York Times*, May 16, 1954, p. F1.

[109] Arthur Smith, Jr. to MCA Board of Directors, "A Report on MCA's Public Relations Program," February 7, 1958, MCA Papers; MCA, "Remarks by General John E. Hull, USA (Retired), Regional Board of Directors' Meeting," March 26, 1958, MCA Papers; Manufacturing Chemists' Association, *Manufacturing Chemists Association, 1872-1972, A Centennial History*.

By the time the MCA spearheaded the chemical industry's response to the publication of Rachel Carson's *Silent Spring* in 1962, it had already created a substantial set of PR programs and had established special committees to monitor evolving concerns about air and water pollution. Designed in part to counter negative public perceptions of the industry as a major polluter, the MCA's "chemical progress" campaigns mobilized the industry's image as an innovative, science-based engine of national progress. In so doing, the MCA aimed to offset any nascent concerns about the quality of life costs posed by the industry by presenting an overwhelming case for its benefits to the nation—whether in furnishing vital products for the Cold War defense and space programs or in providing better things for better living to American consumers. As industry executives described new research efforts on pollution control, who could doubt that this innovative industry, with its Promethean scientists and engineers, would soon solve the problem of pollution.

Conclusion

Environmental historian Adam Rome recently asked why modern environmentalism only became a major political force in the 1960s. Standard narratives of the environmental movement, he noted, explain why it was a post-World War II phenomenon but not why it emerged specifically in the 1960s. For historian Samuel Hays, for instance, environmentalism emerged as postwar affluence led Americans to pursue new quality of life issues that included demands for a clean and safe natural environment. Others have pointed to the unprecedented scale of the environmental impacts by American industry after World War II—from the rapid expansion of older polluting industries such as steel and electric utilities to the novel risks posed by nuclear power and synthetic chemicals. Rome's answer focused on three developments in the 1960s that helped mobilize political support for environmental protection: "the revitalization of liberalism, the growing discontent of middle-class women, and the explosion of student radicalism and countercultural protest." According to Rome, the growing environmental concerns of liberals, women's groups, and young activists helped explain why the environmental movement appeared in the 1960s and not before.[110]

This chapter suggests two additional reasons why the environmental movement only came together in the 1960s. First, by the 1960s the status of industrial hygiene as the central approach to understanding the risks of industrial chemicals and pollution was in steep decline. Supported by a rising tide of federal science funding, new expert communities applied concepts and techniques more sensitive to the often subtle and long-term health and ecological harms caused by environmental pollutants. As the preeminence of industrial hygiene eroded, so too did the ability of affected industries to effectively manage and control information about the potential harms of their products and byproducts. As new "environmental" hazards emerged in the late 1960s and early 1970s, industry experts increasingly entered a pluralistic arena of adversarial scientific debate that included not only government experts but also experts representing new public-interest groups and environmental organizations.

Second, after World War II American corporations erected an impressive edifice of corporate imagery in which the smokestack and the corporate lab symbolized economic and technological "progress" and rising standards of living for American consumers. Within this vision of corporate-led and science-made progress, the "externalities" of economic growth such as air and water pollution could more readily be seen as merely the price of progress. Even as new environmental concerns appeared in the 1950s and 1960s, affected industries could mobilize their prestigious images as citadels of science to reassure the public that, through research and technological advances, any pollution problem would soon be fixed. Only in the late 1960s—as a growing number of Americans viewed the nation's environmental problems as a "crisis" caused largely by careless industrial polluters—would these themes of unabashed technological enthusiasm and corporate-led progress begin to lose their persuasiveness.

[110] Adam Rome, "'Give Earth a Chance': The Environmental Movement and the Sixties," *Journal of American History* 90 (September 2003): 525-554.

Chapter Two: Telling Industry's Story: The Environmental Crisis and the Greening of the Corporate Image

Introduction

In March 1967 the chemical industry's top public relations advisor, Dan J. Forrestal, made a rare appearance before the board of directors of the industry's trade association. "Previous chairmen of this committee,"[1] he said, "in looking back on their efforts and their successes, are inclined to say they were on deck during the food additives era; or the pesticides era or Rachel Carson era, or whatever. I can say, for better or worse, that I have been on deck during the pollution era." Pollution of the nation's air and water had become a hot-button national political issue. As part of his Great Society programs in 1967, President Lyndon Johnson sought clean air legislation that included federal emissions standards for air pollutants. Senator Edmund Muskie's Subcommittee on Air and Water Pollution would soon open hearings on the administration's bill.[2] With the threat of federal legislation on the horizon, Forrestal presented a slide show to this group of top chemical industry executives on how the industry's pollution problems were fouling the image of chemicals. "What," he asked, "might you wonder, do people—in general—think of the chemical industry in light of the hundreds and hundreds of millions of dollars spent in [sic] behalf of pollution control in recent years?"[3]

His slides told a grim story. A new poll by the Opinion Research Corporation showed the chemical industry "at the top of the hit parade—Public Enemy No. 1" when it came to air pollution. It found the industry "cast firmly in the role of the villain…villainous in the areas where the respondents live…even more villainous 'over the hill' in areas beyond the sights and smells of the local inhabitants." Forrestal urged

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[1] The Public Relations Committee of the Manufacturing Chemists' Association (later the Chemical Manufacturers' Association).
[2] See Richard H.K. Vietor, *Environmental Politics and the Coal Coalition*, 1st ed. (College Station: Texas A&M University Press, 1980), 143-144.
[3] Dan J. Forrestal, "Report to the Board of Directors of the Manufacturing Chemists' Association," March 14, 1967, MCA Papers.

the board to continue funding public-relations programs to get the industry's story across to "appropriate audiences" about its "massive efforts undertaken for pollution control." This "pipeline" for the industry's messages on pollution would convey such points as: "We recognize our responsibilities; our long efforts have produced progress; we will do even more; we'll work with government and with others; practicalities must be considered (and how!)."[4]

The concerns voiced by Forrestal would have been familiar in dozens of other corporate boardrooms in the late 1960s. Faced with mounting public alarm over environmental degradation, some of America's most powerful industries perceived a looming crisis. At a time when public-opinion polls showed an overall decline in public trust and confidence in corporations and their leaders, the chemical, energy, and manufacturing sectors, in particular, also faced much of the blame for what many commentators were calling the "environmental crisis." The responses of these industries combined maximum feasible opposition to new environmental laws with public-relations and lobbying postures stressing voluntary industry initiatives as the most effective means of tackling the nation's pollution problems.[5]

Within the business community, public-relations staff and consultants increasingly urged firms and trade associations to communicate to the public about voluntary pollution-control programs and other clean-up efforts—and to begin such programs if they had not already done so. PR men argued that it was crucial for polluting industries to tell the public that steady progress was being made in voluntarily curbing industrial environmental impacts. Dozens of firms and industry groups, hoping to forestall new environmental regulation of their products and processes, were soon implementing energetic programs to show that they were eager partners in the nation's

[4] *Ibid.*

[5] On the general responses of industry to the new environmentalism, see Samuel P. Hays, *Beauty, Health and Permanence: Environmental Politics in the United States, 1955-1985* (New York: Cambridge University Press, 1987), 287-328; Samuel P. Hays, *A History of Environmental Politics since 1945* (Pittsburgh: University of Pittsburgh Press, 2000), 109-121; Robert Gottlieb, *Forcing the Spring: The Transformation of the American Environmental Movement* (Washington, D.C.: Island Press, 1993), 109-111; Gerald Markowitz and David Rosner, *Deceit and Denial: The Deadly Politics of Industrial Pollution* (Berkeley: Univ. of California Press, 2002), 168-233. On the language and culture of "environmental crisis," see Frederick Buell, *From Apocalypse to Way of Life: Environmental Crisis in the American Century* (New York: Routledge, 2003).

environmental clean up. By the early 1970s, these environmental PR programs had established a set of images and themes that would inform such "greening" of corporate imagery for decades to come. In the public-relations profession, meanwhile, a new sub-discipline emerged—environmental public relations—populated by specialists in the techniques of communicating around volatile environmental issues. Critics of such practices soon coined the term "greenwashing" to describe the use of advertising and public relations to win companies images of environmental responsibility that were not justified. But by pigeonholing these practices into a singular pejorative category, critics have often failed to fully appreciate the diverse array of evolving techniques, themes, and imagery fashioned by PR practitioners and advertising creatives who sought to sell their clients' environmental stories to an often skeptical public.[6]

Affected industries implemented a wide variety of environmental PR programs in response to the new environmentalism. The goals of these programs ranged from deflecting criticism of environmental impacts and forestalling new environmental laws to promoting voluntary alternatives to regulation and gaining market share among ecologically-conscious consumers. This chapter explores the environmental PR programs and advertising efforts of electric utilities, the natural gas industry, and the manufacturers of glass and aluminum containers. Each of these industries had different motivations for telling its environmental story and each crafted different messages for their target publics. Electric utilities "greened" their corporate images largely in response to criticism of their heavy environmental impacts. They aimed to portray electricity as an environmentally "clean" energy that was essential to the nation's environmental clean up. Partly in response to the advertising of utilities that portrayed electricity as environmentally "clean," the natural gas industry sought to reposition gas as the "clean"

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[6] A classic text in the field of environmental public relations is E. Bruce Harrison, *Going Green: How To Communicate Your Company's Environmental Commitment* (Homewood, IL: Business One Irwin, 1993). For the environmentalist critique of "greenwashing" see John C. Stauber and Sheldon Rampton, *Toxic Sludge is Good for You: Lies, Damn Lies, and the Public Relations Industry* (Monroe, ME: Common Courage Press, 1995); David Helvarg, "Perception is Reality," *EMagazine*, November/December 1996, <http://www.emagazine.com/view/?781> (June 16, 2006); Joel Bleifus, "Covering the Earth with 'Green PR,'" *PR Watch* 2 (First Quarter 1995); Andy Rowell, "Greenwash Goes Legit," *The Guardian* (London), July 21, 1999 <http://www.andyrowell.com/articles/greenwash.html> (June 16, 2006). On the greening of the image of British Petroleum, see Darcy Frey, "How Green is BP?" *New York Times Magazine*, December 8, 2002, p. 99.

energy through a series of advertising campaigns beginning in the early 1970s. As it did so, the industry aimed not only to continue to grow its marketshare during a period of rising environmental concern, but also to push for relief from longstanding federal price controls that it blamed for the supply shortages of the 1970s. Finally, both glass- and aluminum-container manufacturers sponsored large-scale recycling programs as part of PR efforts in the early 1970s. These programs aimed to promote recycling as an effective alternative to the deposit-return systems then being promoted by environmentalists at both the state and national levels.

Blaming Business for the "Environmental Crisis"

That industry would be the blamed for the "environmental crisis" and directly targeted by the new environmental laws of the 1970s was never as inevitable or straightforward as it would appear in retrospect. In other industrialized countries, similar environmental concerns were emerging, but the responses of governments did not always lead to the direct regulation of industry. As political scientist David Vogel has observed, given other circumstances, the intense public interest in environmental clean-up and protection could have led to other environmental policies, such as "increased government subsidies for pollution-control equipment or laws mandating changes in individual and household patterns of consumption." Rising environmental concern in the United States, however, coincided with (and perhaps contributed to) a decline in public trust in the major institutions of American society, a "confidence gap" that eroded trust in both government and in the business community. A Harris Poll in 1966, for instance, found that 55 percent of the public expressed "a great deal of confidence" in America's business leaders. But by 1975 this figure had dropped to only 15 percent. A Gallup poll conducted in 1975, meanwhile, found that among the major institutions of American society—including government, organized labor, organized religion, the military, and education—the public expressed the least confidence in big business.[7]

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[7] David Vogel, *Fluctuating Fortunes: The Political Power of Business in America* (New York: Basic Books, 1989), 70; Seymour M. Lipset and William Schneider, "How's Business? What the Public Thinks," *Public Opinion*, 1 (1978), 41-47. On the growing public distrust of corporations and other large institutions in the late 1960s, see Seymour Lipset and William Schneider, *The Confidence Gap: Business, Labor, and*

The business community attracted much of the blame for the nation's environmental problems. Public opinion polls suggested that the public blamed a handful of industries—including the steel, chemical, and energy industries—for the nation's environmental degradation. One poll found that by the mid-1960s, a majority of Americans identified "factories and plants" as "the most important causes of air pollution" in the part of the country where they lived. Meanwhile, citizens' groups organizing to combat urban air pollution and smog problems blamed industry for fouling the air. Many anti-air pollution demonstrations in the 1960s targeted local industries for the poor state of urban air quality. "Big Business Monopolyzes our Air, Death Rate Rising, Kill the Smog before it Kills You," said one protester's sign at a "Crusade Against Smog" rally. Protests on the first Earth Day in 1970 included the picketing of the headquarters of major corporations in New York City, a mock funeral service for the internal combustion engine in Minneapolis, and the disruption of a speech by an electric utility spokesman at the University of Illinois by students "throwing soot on each other and coughing vigorously." The new rhetoric of environmental protest—"Stop Pollution," "Stop Ecocide," "Kill the Smog Before it Kills You," and "GM Takes Your Breath Away"—made for potent symbols in the image politics of the environment.[8]

The national media helped solidify the linkage of industry and pollution problems through striking images of environmental degradation. After a blowout at a Union Oil platform on January 29, 1969 caused a major oil spill off the coast of Santa Barbara, a steady stream of print and broadcast coverage brought the American public images of oil-soaked beaches and devastated wildlife. The June 22, 1969 conflagration of an oil slick and debris on the Cuyahoga River in Cleveland also attracted national media attention, with stories on the blaze appearing in both *Time* and *National Geographic*. In Cleveland the fire had not been a major story, since the Cuyahoga had caught fire several times before, and the short-lived blaze of 1969 was extinguished before local photographers

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Government in the Public Mind (New York: Free Press, 1983), pp. 31-35; Patrick J. Akard, "Corporate Mobilization and Political Power: The Transformation of U.S. Economic Policy in the 1970s," *American Sociological Review* 57 (October 1992): 597-615.

[8] See Vogel, *Fluctuating Fortunes*, 70; Gottlieb, *Forcing the Spring*, 111; photo of protest sign reproduced in Hal Rothman, *The Greening of a Nation?: Environmentalism in the United States since 1945* (Fort Worth: Harcourt Brace College Publishers, 1998), 99.

could capture it on film. But *Time*, which misleadingly ran a photo from a more severe blaze in 1952, helped make the event a symbol of the nation's environmental crisis and the failure of existing state and local regulation.[9]

Catching much of the blame for the environmental crisis that these events came to symbolize were a handful of major polluting industries—the "big polluters" in media terms. A 1969 cartoon by Pulitzer Prize-winning editorial cartoonist Pat Oliphant captured the popular sentiment that big business was responsible for the nation's environmental crisis. It depicted a fat-cat business tycoon, cigar in hand, looming next to ominous smokestacks and pipes that bellowed pollution into the air and water. The businessman looks upon a bedraggled man, stuck in a muck of industrial effluents, who held a sign reading "Pollution Latest: Science Foresees End of Life on Earth in 35 Years!"[10] In a widely cited 1972 essay, policy analyst Anthony Downs observed that the plausibility of blaming big business was one of the structural strengths of the environmental issue, protecting it (at least for a time) from the rapid decline in public attention typical of what he called the "issue-attention cycle." Because "much of the 'blame' for pollution can be attributed to a small group of 'villains' whose wealth and power make them excellent scapegoats," wrote Downs, environmentalists could "'courageously' attack these scapegoats without antagonizing most citizens." While clearly wary himself of pinning all of the blame on industry for the nation's environmental ails, Downs nonetheless observed that "at least in regard to air pollution, that small group actually has enough power to greatly reduce pollution if it really tries." "If leaders of the nation's top auto-producing, power-generating, and fuel-supplying firms would change their behavior significantly," he wrote, "a drastic decline in air pollution could be achieved very quickly."[11]

By 1970 many in the business community viewed these developments as a major public-relations crisis. A story by *New York Times* environment-beat reporter Gladwin Hill observed that "environment" had become a new watchword for business. "Not since

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[9] On the Cuyahoga River fire, see Jonathan H. Adler, *National Review Online*, June 22, 2004 <http://www.nationalreview.com/adler/adler200406220845.asp> (June 26, 2006).
[10] Pat Oliphant, cartoon, 1969, reproduced in *Science News*, December 27, 1969, p. 14.
[11] Anthony Downs, "Up and Down with Ecology: The Issue-Attention Cycle," *The Public Interest* 28 (Summer 1972): 38-50.

the trust-busting days of Theodore Roosevelt," he wrote, "has the force of public opinion intruded so emphatically on the business community's patterns of operation. People are palpably fed up with filth, noise, ugliness and contamination of the—there's that word again—environment."[12] Business leaders, meanwhile, warned that industry perspectives on environmental issues had been drowned out amid the groundswell of criticism and protest. In 1971 C.B. McCoy, president of DuPont, observed, "Our critics often try to reduce issues to a few words on a placard: 'Stop Pollution!' 'Save our cities!' We object, and rightly so, because the placards never get down to the obvious problem, which is how to reach these goals, on what timetable, with what sacrifices elsewhere."[13]

On the defensive, major polluting industries targeted public opinion as a crucial battleground in their war against stronger environmental laws. By the early 1970s, a growing number of firms and trade groups were seeking to counter negative perceptions of their pollution problems by implementing public relations campaigns to explain what they were doing to clean up pollution and protect the environment. As industries raced to put a green face on their corporate images, they sometimes coordinated PR efforts and frequently borrowed ideas and themes from the successful campaigns of their peers. In the late 1960s, for instance, the chemical industry cooperated with the steel, pulp and paper, and petroleum industries to coordinate PR programs, prevent the duplication of efforts, and minimize "finger-pointing" among industries. Information sharing also took place within public-relations profession. In the early 1970s, several PR campaigns on environmental issues were honored as models of public relations practice with top awards from the Public Relations Society of American (PRSA), the professional organization for public-relations practitioners.[14]

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[12] Gladwin Hill, "Industrialists Get Word: Environment," *New York Times*, January 11, 1970.

[13] Quoted in *Public Relations Journal* (June 1971): 27.

[14] The extent of inter-industry coordination in the response to the new environmentalism is suggested by the comments of Dan J. Forrestal, Chairman of the Public Relations Committee of the Manufacturing Chemists Association, in a 1967 report to the group's board of directors. "As a basic piece of strategy," he said, "the MCA public relations effort is conducted on the basis of cooperating with a wide variety of other industrial associations, particularly in the pollution areas. We are currently meeting with steel, with pulp and paper, with petroleum, and with coal, in an effort to coordinate and—importantly—to minimize duplication. And to show you what optimists we are, we are even trying to minimize finger-pointing." Dan J. Forrestal, "Report to the Board of Directors of the Manufacturing Chemists' Association," March 14, 1967, MCA Papers. On the Public Relations Society of America's awards program see: Public Relations Society of America, Silver Anvil <http://www.prsa.org/_Awards/silver> (June 16, 2006). Given annually to top public

Substantively, the voluntary efforts of corporations in pollution control and waste reduction often fell far short of what was claimed by industry PR. Many industry advertisements and press releases portrayed *all* ongoing pollution-control expenditures, even those mandated by law, as voluntary. Others exaggerated the amount that companies had spent, or planned to spend, on anti-pollution or waste-reduction programs. The end result, said a growing chorus of critics, was that environmental PR and advertising were creating the false impression that various corporate sponsors were eager environmentalists, when in fact they were actively opposing environmental regulations and spending meager amounts on pollution abatement.[15]

Some business leaders, however, did urge their peers to go beyond what was legally required and to reduce pollution to the extent feasible. This, they argued, was an essential precondition for telling their PR stories of progressive environmental clean-up. Writing in 1967, Alcoa president and C.E.O. John D. Harper urged what he called "private enterprise's public responsibility." Harper wrote that "Many of the problems that trouble our society today were created, at least in part, or aggravated by the very same business enterprise system that has made our society the most comfortable and prosperous on earth." The public, Harper argued, was now rightfully demanding that corporations take responsibility for the harmful consequences of their operations. "Business, he wrote, "is involved right up to the neckline in hundreds of public problems, and the public—that is to say our customers, our neighbors, our employees and our stockholders—expects us to accept the responsibility of helping to solve those problems. And in so doing, we protect the very system that permits us all to prosper." A prominent role for the business community in addressing such problems, Harper wrote, would represent the "intelligent exercise of public responsibility." Such a course, he suggested, would not only create a better and more prosperous society, it would also prevent unwanted government intervention in the private sector. Harper warned that firms that

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relations practitioners by juries of their peers, the Silver Anvil awards (symbolizing the forging of public opinion) recognize "complete public relations programs incorporating sound research, planning, execution and evaluation."

[15] See Peter M. Sandman, "Who Should Police Environmental Advertising?" *Columbia Journalism Review* (January/February 1972): 41-47; Charles E. Ludlam, "Abatement of Corporate Image Environmental Advertising," *Ecology Law Quarterly* 4 (1974): 247-278.

refused to act responsibly would bring about unwanted regulation for all industry. "Quite frankly, and unfortunately for all of us," he said, "there are some businessmen who still believe that public responsibility means living up to the letter of the law and not one inch beyond. These are the same fellows whose smokestacks will go right on belching soot into your office windows and on your wife's laundry until the city council passes a law against it. Their disregard for the public interest inevitably leads to public clamor for repressive or restrictive legislation, which may cause problems for all of us."[16]

A similar argument came from Richard L. Moore, director of public relations at the chemical company W.R. Grace & Co. In 1970 Moore argued that industry should voluntarily chart a long-term course toward eliminating pollution while communicating these steps to the public. Moore called the "Environment" a "new PR crisis" and advised systematic planning by companies to respond to public concern about environmental degradation. "Industrial public relations men," he wrote, "particularly those in heavy industries such as chemicals, steel, cement, paper and petroleum—to name a few—will come to think of the 1970's as the decade that focused on every ill, real or imaginary, foisted on man by man's own need for industrial products and by the disposal of the waste materials resulting from their manufacture and use." The long-term goal for business, Moore argued, must be the total elimination of pollution. If the problems were ignored, he warned, public complaints would mount and government would become increasingly involved, with opportunistic politicians building platforms on getting polluting plants shut down. Moore said that this voluntary clean up should coincide with public relations efforts to tell the public what industry was doing. "In cases involving the correction of a problem," he wrote, "it is best to let the public know what is going on through the press, town meetings and any other available avenues. Most people tend to be reasonable if corrective measures are being taken because they don't want industry to be forced to shut down or to relocate."[17]

While some business leaders echoed Harper and Moore in urging substantive pollution-control programs as a necessary precondition to PR efforts, others appeared to

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[16] John D. Harper, "Private Enterprise's Public Responsibility," *Public Relations Journal* (August 1967): 8-10.
[17] Richard L. Moore, "Environment—A New PR Crisis," *Public Relations Journal* (March 1970): 6-9.

start with the presumption that existing industry clean-up efforts were sufficient, and hence the task ahead primarily involved communications. That is, the problem was not that polluting industries had lagged in their environmental performance, but that they had failed to effectively explain their pollution-control efforts to the public. Going forward, said many PR men, industries must focus on telling their environmental stories, amplifying through the media their past, present, and future programs to clean house and minimize environmental impacts. In 1967 Carl Thompson, an executive at the PR firm Hill & Knowlton, argued in the *Public Relations Journal* that it was time for business to begin "*Taking the initiative in telling the positive story of what is being done.*" The problem, according to Thompson, was not a lack of clean-up efforts but a failure of communication. "Most industries has [Sic] been grappling with air, water, and solid waste disposal problems for many years, but have, in general, been remiss in telling the story to the public…As a result, the public now has little conception of the complexities and the unknowns involved in air and water conservation practices. Most companies and industries are now more willing to speak out, frankly and positively." A similar framing of the problem came from Allen Brandt of Bethlehem Steel. Brandt told a 1967 conference on pollution abatement that industries should step up their efforts to communicate environmental clean-up efforts to the public. "If not informed otherwise," said Brandt, "it is simply human nature and common sense for the affected public to assume nothing is being done."[18]

Leading voices in the public relations community pressed industry to tell its story of voluntary clean up or else face the prospect of increased government regulation. In 1971 Richard W. Darrow, president of Hill & Knowlton, told a meeting of the Economic Council of the Forest Products Industry in Phoenix that business faced a "great ecological communications war." The public perception of an "environmental crisis," according to Darrow, had spawned a public relations crisis for major corporations. "The hour is later, Communications Time than it is Mountain Standard Time," Darrow told his audience, "for you and me and our colleagues at the control points of industry." He continued:

[18] Carl Thompson, "Environmental Health: Problems and Priorities," *Public Relations Journal* (October 1967): 62-65.

> We will do those things that earn us attention and gain us understanding, or we will live out the remainder of our professional lives in the creeping, frustrating, stultifying, stifling grasp of unrealistic legislative restraints and crippling administrative restriction. A public that ought to understand us - and thank us for what we are and what we do - will instead clamor for our scalps.

Having established a special unit to provide services on environmental health issues in 1966, Hill & Knowlton became a leading advocate and provider of environmental PR in the 1970s and beyond.[19]

Some PR men argued that effective communication of industry's environmental story was essential not only to ward off new environmental regulations but also to counter broader threats to American business. Chemical firms and other defense contractors, for instance, had come under fire from antiwar protesters and the New Left for their role in supplying weapons and chemical agents such as Agent Orange and Napalm to the military during the Vietnam War. Some business leaders and PR advisers warned that environmentalism might now be seized by "extremists" and the "radical left" to mobilize similar attacks on the entire business community. As PR consultant Clifford B. Reeves put it in 1970, the "environment" issue could become "a basis for a broad general attack on the entire industrial system, as well as individual companies." Although such a broad-based critique of business and industry had not yet gained momentum, according to Reeves, environmental pollution "may be the thing that provides a basis for universal attack against private business institutions." "As things are now shaping up," he wrote, "industry is being cast as the villain of the piece. While its record is not all it should have been, industry has probably done more in a practical way than any other group to conserve resources and protect the environment. That story should be told more widely and forcefully, before adverse public opinion about industry hardens still further. Industry should be recognized as a willing partner in this movement, not an adversary." Reeves urged steady progress in pollution abatement, combined with programs to publicize those voluntary efforts. He expressed hope that the "environment" could thus

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[19] Richard W. Darrow, *Communication in an Environmental Age*, address before the 1971 Economic Council of the Forest Products Industry, Phoenix, January 15, 1971 (New York: Hill and Knowlton, 1971), 11, 18; Robert N. Proctor, *Cancer Wars: How Politics Shapes What We Know & Don't Know About Cancer* (New York: Basic Books, 1995), 103.

become a consensus issue, with industry viewed not as a villain but as a partner in the popular drive for environmental protection.[20]

Air Pollution and Electric Utilities

No issue was as closely linked to the perception of environmental crisis in the late 1960s as air pollution. While urban smoke pollution from the combustion of coal had plagued the nation's larger cities for decades, America's postwar economic boom and the rapid spread of the automobile had brought more frequent and more intense pollution episodes and introduced the novel problem of photochemical smog. One warning of the public health implications came in 1948, when a temperature inversion trapped industrial emissions over the town of Donora, Pennsylvania, killing an estimated twenty people and causing respiratory problems in thousands of others. In the 1950s, severe air pollution episodes afflicted New York City and Los Angeles. Other cities across the country, including Chicago, Washington, and Denver, began to experience smog and other severe air pollution problems for the first time.[21] Meanwhile, epidemiological and toxicological evidence mounted in the 1950s and 1960s that air pollution was not merely a local nuisance but was a threat with nationwide public health implications. Public health officials increasingly warned that exposures to high levels of pollution could kill the elderly, infirm, and seriously ill, while low-level chronic exposure could contribute to the risk of lung cancer and other respiratory diseases. In 1966 Surgeon General Dr. William H. Stewart stated that "air pollution is at least a contributing factor to the rising incidence of chronic respiratory diseases—lung cancer, emphysema, chronic bronchitis and asthma."[22] Researchers at federal agencies and universities also began tallying the

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[20] Clifford B. Reeves, "Ecology Adds a New PR Dimension," *Public Relations Journal* (June 1970), 7-9. On the student protests against Dow Chemical, maker of Napalm, at the University of Wisconsin at Madison in 1967 see: David Maraniss, *They Marched into Sunlight: War and Peace in Vietnam and America October 1967* (New York: Simon & Schuster, 2003).

[21] See Vietor, *Environmental Politics and the Coal Coalition*, 127-141. On the Donora smog incident see Devra Davis, *When Smoke Ran Like Water: Tales of Environmental Deception and the Battle Against Pollution* (New York: Basic Books, 2002); Lynn Page Snyder, "'The Death-Dealing Smog over Donora, Pennsylvania': Industrial Air Pollution, Public Health Policy, and the Politics of Expertise, 1948-1949," *Environmental History Review* (Spring 1994): 117-139.

[22] As quoted in Scott Hamilton Dewey, *Don't Breathe the Air: Air Pollution and U.S. Environmental Politics, 1945-1970* (College Station: Texas A&M Univ. Press, 2000), 230.

economic costs of air pollution, estimating hundreds of millions of dollars of damage to property and crops in heavily polluted regions.

Among the largest sources of the nation's air pollution were electric utilities. Burning coal to create steam that drove electricity-generating turbines, electric utilities were the largest consumers of coal in the United States. In 1958, they consumed some 153 million tons (or 42% of the total); in 1966, their consumption had risen to 264 million tons (or 54% of the total). The combustion of coal released nitrogen oxides, sulfur oxides, particulate matter, as well as numerous toxics in trace amounts. The focus of public health authorities in the 1960s was on particulates and sulfur oxides, which mounting evidence linked to chronic respiratory illnesses. Electric utilities were the leading source of sulfur dioxide emissions in the United States, accounting for some 70% of total U.S. emissions by 1970. Moreover, coal-fired power plants had approximately doubled their sulfur oxides emissions every decade between 1940 and 1970.[23]

Throughout the 1960s electric utilities joined with other coal consumers (and coal producers) in opposing legislative proposals giving the federal government any role in regulating air pollution. Through coordinated lobbying efforts, this "coal coalition" advocated the continuation of local regulatory preeminence, in which weak regulation had prevailed outside of a handful of jurisdictions. The first federal Clean Air Act of 1955 had identified air pollution as a local problem and limited the federal role to supporting research. When Congress considered amendments to the Clean Air Act in 1963, a coordinated lobbying effort by the coal coalition helped ensure that the resulting Act limited the federal role largely to increased funding for research.[24] The coal coalition also succeeded, in 1967, in heading off a push by the Johnson administration for federal emission standards for industrial air pollutants. During hearings on the legislation by Senator Edmund Muskie's Subcommittee on Air and Water Pollution, the coalition presented a coordinated position against national standards (and for retaining local

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[23] Vietor, *Environmental Politics and the Coal Coalition*, 129; Paul W. Spaite and Robert P. Hangebrauck, "Pollution from Combustion of Fossil Fuels," reproduced in U.S. Congress, Senate, Committee on Environment and Public Works, *A Legislative History of the Clean Air Act Amendments of 1970*, Vol. 2, 95th Cong., 2d sess., 1979-1980, pp. 1014-1015; Barbara Freese, *Coal: A Human History* (Cambridge, Mass.: Perseus, 2003), 168.
[24] See Vietor, *Environmental Politics and the Coal Coalition*, 128-150.

regulatory preeminence) with what historian Richard Vietor has described as "consistency, solid data, and clearly delineated goals." Among the coalition members to testify were five electric utilities and the Edison Electric Institute, the electric power industry's trade association. The resulting Air Quality Act of 1967 was widely viewed as a victory for industry that left regulatory and enforcement responsibility primarily with state and local officials and provided for extensive industry participation in policy development.[25]

But in 1970 the coal coalition and electric utilities could not prevent the passage of a strong new Clean Air Act, which finally vested primary authority for controlling air pollution in the federal government. The growth of a broad-based environmental movement in the late 1960s, crystallized by the first Earth Day in April 1970, increased pressure for federal action on pollution. Meanwhile, the Air Quality Act of 1967 had come under fire from environmental and consumer advocates for doing little to address the mounting air pollution problems. Ralph Nader's study group on air pollution issued a stinging report in the spring of 1970 calling the 1967 Act "disastrous" and strongly criticizing Senator Edmund Muskie for backing the weak legislation. Then, President Richard Nixon, hoping to position his administration on the right side of a popular issue in the run-up to the 1972 election, called for dozens of environmental reforms, including "national air quality standards, new-source emission standards, and tougher federal enforcement" to tackle air pollution. After the House passed legislation that was even stronger than the administration's proposals, Senator Muskie's subcommittee began marking up the Senate version. With his image as "Mr. Pollution Control" having suffered from the Nader report, Muskie moved to shore up his environmentalist credentials. "In a contest of legislative oneupmanship with the president," writes historian Richard Vietor, "Muskie and his subcommittee completely rewrote the amendments." After unanimously passing the Senate, Muskie's bill, with minor changes, was passed into law in December.[26]

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[25] See Vietor, *Environmental Politics and the Coal Coalition*, 145, 148-150.
[26] See Vietor, *Environmental Politics and the Coal Coalition*, 156-161. The Nader group report is John C. Esposito, *Vanishing Air: The Ralph Nader Study Group Report on Air Pollution* (New York: Grossman Publishers, 1970).

Far stronger than the original proposals that electric utilities and coal interests had acquiesced to in the face of public opinion, the Clean Air Act of 1970 established a strong federal mandate to improve air quality. The Act required the newly created Environmental Protection Agency (EPA) to establish national ambient air quality standards (NAAQS) for major air pollutants, including nitrogen oxides, sulfur dioxide, carbon monoxide, ozone, and particulate matter (lead was later added). The EPA was to set "primary" standards at a level "requisite to protect the public health" with an "adequate margin of safety," and "secondary" standards sufficient to "protect the public welfare." States were required to submit state implementation plans and emission standards to the EPA administrator for approval, with the ambitious (overly so, as it turned out) goal of achieving the primary standards by 1975 and the secondary standards by 1978. The Act also required the EPA to directly set emission standards for major new stationary sources of air pollutants, such as coal-fired power plants, built after 1970. Other provisions called for air pollution from new automobiles to be reduced by 90 percent beginning in 1975 and established a program to regulate air toxics. As environmental policy historian Richard Andrews has observed, the Act "represented a dramatic policy shift, from ad hoc state negotiation of industrial air pollution control to uniform federal minimum standards and technology-based permits."[27]

For electric utilities, one of most troubling aspects of the new Clean Air Act was that ambient air quality standards were to be set solely on the basis of health criteria, without consideration of economic costs or technological feasibility. As the EPA began setting ambient standards for sulfur dioxide, and states put in place plans to attain those standards, it became clear that implementation of the Act would require "technology forcing." That is, since existing technology was insufficient to achieve the necessary emissions reductions, compliance by utilities would require the development and adoption of new pollution-control equipment. One of the most heated early environmental battles in the 1970s came to involve vigorous opposition by utilities to the installation of expensive flue stack "scrubbers" to reduce sulfur dioxide from stack

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[27] See Richard Andrews, *Managing the Environment, Managing Ourselves: A History of American Environmental Policy* (New Haven: Yale Univ. Press, 1999), 233-234; Vietor, *Environmental Politics and the Coal Coalition*, 160-161.

emissions. As the political battle shifted to administrative implementation in the early 1970s, electric utilities vigorously argued that cost and feasibility considerations must be a key part of the regulatory equation.[28]

As the political waters shifted against them, electric utilities began a transformation of their public relations efforts. These changes could be discerned in two separate trends. First, as environmental concern surged in the late 1960s, utilities began changing in their corporate imagery to portray themselves as essential partners in the nation's environmental clean-up efforts. With a flurry of corporate-image advertising, utilities urged that expanding the supply of electricity—the "clean" energy, in advertising terms—was essential to achieving the nation's environmental goals. Second, as the high compliance costs of the new Clean Air Act became apparent in the early 1970s, utility PR and advertising began warning that new environmental regulations carried a huge price tag that could threaten economic growth and the standard of living enjoyed by Americans.

The Greening of Electric Utilities

For decades the electric power industry had associated itself with images of technological progress, mastery of nature, and the provision of ever higher standards of living. In the late 1960s, utilities began recasting this vision of progress by incorporating the new public demands for a cleaner, safer, and more aesthetically appealing natural environment in their corporate imagery. As historian Samuel P. Hays has observed, modern environmentalism emerged, in part, as a new "quality of life" issue for middle-class Americans in the 1950s and 1960s.[29] The advertising campaigns of electric utilities were among the first to tap into this potent new set of concerns. Utility publicity had long stressed the necessity of an expanding supply of electricity to meet the energy needs of a growing economy and the rising standards of living enjoyed by Americans. Now utilities grafted environmental concerns onto these longstanding themes. By the late 1960s, they were arguing that an ample and expanding electricity supply was essential to

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[28] See Vietor, *Environmental Politics and the Coal Coalition*, 161-193.
[29] See Hays, *Beauty, Health and Permanence*, 13-39.

the nation’s environmental cleanup. Specifically, they portrayed electricity as a “clean” energy that did not degrade the environment and was essential to new environmental technologies to curb pollution and reduce solid waste.

For some companies the shift in imagery was dramatic. In 1968 the Consolidated Edison Company (Con Edison)—the electric utility serving New York City—implemented sweeping changes to its corporate image. Con Edison adopted a new logo, a new color for its trucks (blue instead of orange), and a new slogan, “Clean Energy,” which replaced its longstanding “Power for Progress.” An ad announcing the changes said, “Well, we’re changing a lot of things at Con Edison. We’re changing to cleaner fuels. And cleaner plants. For cleaner energy. And cleaner air. And we’re pretty excited about it. We’ve made Clean Energy kind of a new slogan. We’re putting it on just about everything we own. It’s going on our trucks in clean white letters.” A 1970 ad by Con Edison, appearing just before the first Earth Day on April 22, 1970, said the company was fighting the “Good War” against “our common enemy, pollution.” “Cleaning up and keeping things clean is now a crusade at Con Edison,” claimed the company. “At today’s Con Edison,” concluded the ad, “every day is Earth Day.” So extensive was the image refashioning that Con Edison Chairman Charles F. Luce earned the nickname "Mr. Clean" following the public relations and institutional advertising campaigns that recast the company’s image as a friend of the environment.[30]

During Earth Day demonstrations in New York City in 1970, Con Edison was both a major target of demonstrators and a major participant in the day’s events. Its block-long Manhattan headquarters was located in the midst of a gathering on 14th Street between Third and Seventh Avenues, where auto traffic was closed-off for the day. There, an estimated 250,000 demonstrators converged around some one-hundred exhibitions and booths that were sponsored by both citizens’ groups and industry organizations. The site was chosen by the organizers, in part, to focus attention on Con Edison’s significant role in the city’s air pollution problems. Nonetheless, Con Edison embraced the day as a public relations opportunity to demonstrate its new commitment to

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[30] Con Ed, advertisement, “We’re changing our colors to remind you of everything else we’re changing,” *Life*, June 12,1968; Con Ed, advertisement, *New York Times*, April 20, 1970; *Business Week*, August 16, 1969, p. 42.

cleaning up its environmental act and to promote its new "Clean Energy" slogan. Not only did Con Edison contribute money to one of the organizing groups, the Environmental Action Coalition, it exhibited an electric car at a site near its headquarters, and provided electricity for the educational display booths and for a nighttime light show. Con Edison even provided an electric bus to ferry New York's mayor, John Lindsay, around to the day's many events. As historian Robert Gottlieb notes, "These were rather disingenuous acts, since Con Ed had not pursued any plans to stimulate the development of electric vehicle technologies readily available for investment and support."[31]

Pacific Gas and Electric (PG&E), the California electric utility, also joined the clean-energy bandwagon of the late 1960s and early 1970s. The company's image ads touted its commitment to protecting the quality of the land, water, and air in California, while providing the energy necessary for the state's growing population and booming suburbia. A 1971 ad headlined "Energy and the environment. The good life requires both" juxtaposed a comfortable California home with scenes of outdoor recreation, including horseback riding, and fishing and boating on a pristine lake. "More people in growing California, more homes, new communities, more public facilities, expanding business and industry," said the ad, "all require a lot more gas and electricity to keep the quality of life here and the opportunities, the finest in the world." The ad went on to say that environmental protection, too, would require an expanding energy supply. "The big environmental housecleaning job to be done," it said, "requires a lot more gas and electricity." The company claimed its efforts would "assure you and your neighbors the benefits of both a high quality environment and a reliable supply of clean energy without brownouts." With ads such as this, PG&E connected older electric-utility themes of power for "progress" with the newer themes of "clean" energy and environmental clean up. Both economic growth and environmental quality, PG&E urged, would require a constantly expanding supply of electricity.[32]

Many ads by utilities (as well as electrical device manufacturers) explained in detail how electricity was central to tackling the nation's environmental problems. Such

[31] David Bird, "Earth Day Plans Focus on City," *New York Times*, April 20, 1970, p. 1; Gottlieb, *Forcing the Spring*, 110.
[32] PG&E, advertisement, *Sunset*, June 1971.

ads demonstrated how electricity powered various environmental clean-up technologies, such as stack scrubbers, trash compactors, recycling facilities, and sewage-treatment equipment. Ads by the Investor-Owned Electric Light and Power Companies, a group representing private power companies, detailed various pollution-control devices powered by electricity in an early-1970s ad campaign. "Our country's ability to clean the air, water and land," said the ads, "will depend on an adequate supply of electricity. There's no time to waste. New generating facilities must be built, and built in a way compatible with our environment." One ad by the group, "More power to them," presented headlines from news clippings telling of breakthroughs in industry efforts in recycling, pollution abatement, and waste disposal: "Breakthrough in Water Pollution," "Recycling Smashing Success," and "Electric Furnace Cuts Pollution." The ad urged that electric power was crucial to such technological progress in cleaning up the environment. "More and more effort is going into finding new methods of cleaning up our planet," said the ad. "And it's beginning to happen. Ways are being found." It then asked readers to consider the power necessary for these efforts: "Think about it and, more times than not, somewhere along the line from problem to solution, you'll see where electric power comes into the picture." Similarly, a 1971 PG&E advertisement depicted a variety of pollution-control technologies, from electrostatic precipitators to sewage treatment plants, under the headline "These machines can help clean up the environment. And clean P. G. & E. energy runs them." And the Consumers Power Company, a Michigan-based utility, ran ads such as "You Can't Switch Off Tomorrow," which warned that "to meet the pollution problem head on and beat it will require more and more electric energy."[33]

These advertising campaigns were part of a wave of environmental image advertising in the late 1960s and early 1970s that would draw the scrutiny of the Federal Trade Commission (FTC), Congress, and new consumer groups such as the Center for Science in the Public Interest (CSPI). Critics claimed that the campaigns misled consumers, investors, and public officials, giving the impression that major polluters had

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[33] Investor-Owned Light and Power Companies, advertisement, "The one without the doorbell is the sewage plant," *Time*, December 11, 1972; Investor-Owned Electric Light and Power Companies, advertisement, "More power to them," *Life*, November 5, 1971; PG&E, advertisement, *Sunset*, June 1971; Consumers Power Company, advertisement, "You Can't Switch Off Tomorrow," reproduced in Consumers Power Company, "Programs Directed To Educators," 1973, PRSA Records, Box 106, Folder 9.

"joined the fight against pollution" when in fact they were actively opposing new pollution laws. "A disturbing aspect of corporate image environmental advertisements," wrote one FTC attorney, "is the apparent assumption that creating an appearance of environmental consciousness is an adequate substitute for positive action…many corporations seem to feel that their sole task is to advertise their concern rather than to take action." And the advertising columnist E.B. Weiss wrote in the trade journal *Advertising Age* that "the total disregard for the role the corporation played in bringing about some of our major ecological problems has genuine 'Alice-in-Wonderland' characteristics." In one widely cited article on the subject, San Francisco advertising creative and environmentalist, Jerry Mander, called the new environmental advertising "eco-pornography" and directed particular criticism at the utilities for their leading role in the trend.[34]

Utilities on the Offensive: Attacking Environmental Regulation

Efforts by utilities to green their corporate imagery continued apace through the early 1970s. But as utilities began battling the EPA over implementation of the Clean Air Act, they began new campaigns to publicly attack the expansion of government environmental regulation and to warn of dire economic consequences for the nation if costly regulations hindered the growth of the electricity supply. One reason that utilities had been hit with tough new regulations, according to a growing number of utility executives and PR advisors, was their failure to convey to the public the fundamental economic importance of affordable electricity and the hazards of overzealous environmental controls on power plants. By contrast, they said, environmentalists had succeeded in effectively communicating their messages to the public. The result, said speakers at industry conferences and commentators in industry trade journals, was a false perception of "environmental crisis" that had put power companies on the defensive.

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[34] Charles E. Ludlam, "Abatement of Corporate Image Environmental Advertising," *Ecology Law Quarterly* 4 (1974): 247-278, p. 261; E.H. Weiss, "Management: Don't Kid the Public with Those Noble Anti-Pollution Ads," *Advertising Age*, August 3, 1970, p. 35; Jerry Mander, "Eco-Pornography: One Year and Nearly a Billion Dollars Later, Advertising Owns Ecology," *Communication Arts*, November 2, 1972.

These PR failings were a central topic of discussion at the Edison Electric Institute's 1973 annual convention. One speaker was Hobart Lewis, president and editor-in-chief of *Reader's Digest*. With his magazine having recently run a special advertising section in which corporate advertisers gave their ecology pitches, Lewis proselytized on the virtues of telling industry's story. "Of all the problems facing the electric utility industry," said Lewis, "it would seem that the greatest of all, the most challenging and perplexing of all, lies in the field of communications." Lewis blamed a failure of corporate communications for the unwarranted sense of "environmental crisis" and strict new environmental laws. "Perhaps the most dramatic example of this breakdown in communication," he said, "has been the constricting and counterproductive legislation that found its way onto the books in what I consider a largely spurious and irresponsible atmosphere of crisis over national environmental problems." An effective communications strategy for the industry, said Lewis, would let consumers know that they would be paying the bill for cleaning up the environment. "The public," Lewis told industry executives, "should be told, in terms that are meaningful to him, just what all this legislation has him buying, and what it's going to cost him."[35]

Others at the conference similarly urged the industry to vigorously take its case to the public. William L. Linholm, vice chairman of AT&T, told the conference that the "results of corporate silence of in the face of verbal attacks are hard to quantify, but they are palpable indeed. The confidence of consumers is likely to wane. The suspicions of legislators and regulators grow, and perhaps result in harsh restrictive measures." According to Linholm, it was time for the corporation to "make a greater effort to define its essential place in human affairs because that place generally is misunderstood and will not be understood unless the corporation itself explains it." Another conference speaker, Robert F. Gilkeson, chairman of Philadelphia Electric Company and vice chairman of the Edison Electric Institute, argued that environmentalists had gained an influence on the public debate disproportionate to their numbers. "The outcries against us are loud and strong," said Gilkeson, "but the hard-core opposition represents only a small fraction of our customers. They are influenced by what they read, by what they hear, and by what

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[35] Quoted in *Electrical World*, May 1, 1973, pp. 28-30.

they see. And the influence right now is from this small fraction. I think we can change that influence—by speaking out, honestly, intelligently, and clearly." Gilkeson told the conference that electric utilities had a compelling case to make to the public. "It's time the American people realize how essential electricity is," said Gilkeson. "Why don't we tell them how vital our product is to jobs, food supply, environmental improvement, national security, education, medical care, human comfort, entertainment—all the things that make living possible, and life worthwhile?"[36]

Charles B. Yulish, whose PR firm Charles Yulish Associates frequently advised the industry, also warned in 1973 that utilities were sorely losing the communications battle to environmentalists. Yulish said that utilities needed to shift their communications efforts toward simpler messages that would connect with the public's everyday experiences and concerns. In an interview with *Electrical World*, an industry trade journal, Yulish argued that industry could no longer assume a "rational universe" when it came to dealing with the public. Yulish said that environmentalists knew how to get a "high rise time [fast stimulus response] from the public. Their material reflects an outside world loaded with emotions. They deal with the specter of understandable specifics that people—rightly or wrongly—worry about: radiation, nuclear-waste disposal, and cancer; spent fuel transportation and potential accidents; thermal discharges and dead fish; SO_2, particulates, and lungs." Meanwhile, he argued, utilities disseminated dull, highly-technical reports that were neither of interest to, nor comprehendible by, most consumers.[37]

One avenue through which electric utilities began implementing the type of public outreach urged by Yulish and other industry watchers was through educational programs and materials presenting environmental issues from industry's perspective. In the early 1970s, utility PR consultants warned that children, in particular, were being barraged by educational materials from environmentalists hostile to the industry. To combat this alleged imbalance, utilities began commissioning the design and dissemination of educational materials aimed at shaping school curricula on energy and environmental issues. Utilities soon were successfully placing an array of materials

[36] Both quoted in *Ibid.*, 28-30.
[37] Quoted in *Electrical World*, September 1, 1973, pp. 28-29.

carrying their environmental stories in classrooms across the country. These materials included films on environmental issues with accompanying teachers' guides, pamphlets and other printed literature for classroom discussion, comic books with industry-spun explanations of current environmental problems, home economics demonstrations, and even a classroom game emphasizing trade-offs between the environment and the economy.[38]

The Edison Electric Institute (EEI) worked with member companies to create and promote such educational materials. A 1969 survey by the EEI found that ninety-one member companies were interested in obtaining educational materials from EEI. One of the most ambitious EEI programs was a classroom game developed by Creative Studies, a Boston-based company, for primary and secondary students. Built into the architecture of this "Energy-Environment Game" were industry messages on the necessity of "tradeoffs" between energy production and environmental protection. The game was distributed by utilities in eighteen states in the early 1970s and used in hundreds of classrooms. Designed for social studies and English classes in grades seven through twelve, this role-playing game had groups of students play the role of various "interest groups," including environmentalists, labor leaders, and businessmen. Playing their assigned roles, students were to weigh in on a decision to site a new power plant near a make-believe city. Over a series of six classroom sessions led by their teachers, students were to prepare position statements for or against locating a new power plant at various sites. After students were provided with background information including site-selection criteria, economic considerations, and environmental concerns, they were to participate in a series of mock public hearings and task force meetings leading up to a final decision.[39]

Although accompanying publicity material said the game had no "predetermined answers," some teachers who participated in field tests pointed to inherent biases toward power companies. They said, for instance, that the game failed to adequately represent environmentalist positions and that the materials could be "interpreted as power company propaganda." A basic premise of the game, for instance, was that the generating capacity

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[38] See Edison Electric Institute, "Educational Services Program," 1975, Box 112, Folder 14, PRSA Records; Consumers Power Company, "Programs Directed To Educators," 1973, Box 106, Folder 9, PRSA Records.
[39] Edison Electric Institute, "Educational Services Program," Box 112, Folder 14, PRSA Records.

of the model power company ("Edison Electric Company") would have to "double in the next ten years," and that five new plants needed to be built by the utility in order to provide power to all of its consumers. But no provision was made in the game for advocating conservation measures to reduce the demand for electricity. "How do people change life styles? How can we use less power?" queried some participating teachers. Other teachers questioned why the Teacher's Guide did not deal adequately with the possibility that the class could decide *not* to build a power plant. "Does the game end if the class decides not to build a power plant?" they wondered. Finally, only two options were given for meeting future energy needs: the construction of a new coal-burning plant or of a nuclear power plant. Teachers said the game should include information on alternative energy sources. "If alternative energy sources such as wind, solar, tidal, geothermal, etc. are not feasible," said a report on teacher feedback, "then let the students decide that they are not." The Energy-Environment Game was designed by utilities to tell students their side of the environmental story—that adequate electricity supplies could only be achieved through tough trade-offs between energy generation and environmental protection. But with alternative energy sources and conservation measures left out of the picture, the game limited the trade-offs that students could consider to the narrow range of choices advocated by the industry.[40]

Another elaborate utility-sponsored educational program was launched in 1971 by the Michigan-based Consumers Power Company. According to a statement of objectives by the PR consultants who designed the program, the company believed that its "future decision-makers and utility customers" needed to know more about energy and its relationship to the environment. But the utility feared that "like the general public, teachers and children in school have been hampered by the lack of objective material." "While adversary materials from activists abound," according to the statement, "teachers have deplored the lack of factual, objective materials which are challenging to students." Given the growing power of environmentalists, those accused of being big polluters could not afford to remain silent. "Power companies, especially, have been subject to cries of 'pollution!'" said the PR consultants, "from groups that have not had—or did not

[40] *Ibid.*

bother to learn—all the facts." It was time for power companies, said the PR consultants, to tell their stories of how they were tackling pollution, protecting the environment, and improving the quality of life:

> People see clouds of steam billowing from a stack, for example, and immediately jump to the conclusion that the power company is polluting the environment. Many would be surprised to learn that power companies have been concerned about the environment for years. Ecological effects are carefully considered in plant sitings, in obtaining right-of-way for transmission lines, in design of new plants, and in deciding the type of fuel to be used.

To begin telling this story to the "more than one million Michigan youngsters destined to be the next generation of environmental decision makers—and utility customers," the Consumers Power Company expanded the company's existing "Educational Services Program" to include materials on the relationship between environmental issues and the energy supply.[41]

A team of educational consultants employed by the company—headed by a former employee of Encyclopedia Britannica—produced materials translated into three classroom resource kits targeting students at the upper-elementary, middle-school, and high-school levels. These kits were promoted to schools through meetings with school administrators, promotional films, direct mailings to school principals, exhibits at educational conferences, and ads published in teachers' publications such as *Teachers Voice* and *Today's Education*. The Consumers Power Company then began distributing some 25,000 kits to teachers throughout the company's service area in Michigan. To maximize ease of use in the classroom, the kits took the standard form of classroom teaching resources, with textbooks and workbooks for students and accompanying teachers' manuals, activity guides, and tests for teachers to gauge their students' progress.[42] The major themes conveyed by these environmental resource kits included: the necessity of trade-offs between environmental protection and economic development (or "Progress" as this program put it); the notion that everyone, rather than industry

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[41] Consumers Power Company, "Programs Directed To Educators," Box 106, Folder 9. PRSA Records.
[42] *Ibid.*

specifically, was responsible for pollution; and the assertion that technology was the key to solving problems of air, land, and water pollution.[43]

The trade-offs theme was also at the center of a comic book distributed by the Consumers Power Company aimed at ten- to sixteen-year-olds. Entitled *The Battle for Survival: The War against Environmental Pollution* it featured a teacher instructing a group of students on the twin problems of industrial pollution and “fear of pollution,” which were depicted in the comic as twin heads of a “frightening two-headed monster.” The comic suggested that, although it was time to start fighting pollution itself, the fear of pollution was just as great a threat to society. Irrational fear of pollution, according to the comic, had led to attitudes hostile to economic growth and even to modern society as a whole. “Pollution itself,” the teacher warned the students in the comic, “has frightened many people into thinking we’ve got to do away with modern society—give up many of the good things—even necessities—in order to have a cleaner world. They would have us going back to a very primitive way of life because they have been frightened by pollution.”[44]

The students in the comic were warned that, if not defeated, fear of pollution could lead to a return to pre-modern conditions. This “primitive” way of life to which society might revert was depicted in the comic through images drawn from the mythology of America’s western frontier. One frame showed a man on horseback and a couple steering a horse-drawn wagon. In the caption the teacher warns the students, “’Let’s get back to the good old days,’ some say. But would you like to meet Buffalo Bill when he hadn’t had a bath for three months.” Other scenes depicted a woman hard at work washing clothes by hand, a boy hauling wood for the wood-burning stove, and a team of men at work chopping wood to build a new home. “If you lived in those homes,” asked the teacher in the final caption of the series, “how would you feel about the lack of electric lights, radios, TV and all the other conveniences we take for granted?” Though striking in its suggestion that environmentalists sought to “do away with modern society,” the comic reflected, albeit in extreme terms, the broader themes pushed by electric utility PR in the early 1970s. Elsewhere, utilities were similarly urging that the

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[43] *Ibid.*
[44] Consumers Power Company, *The Battle for Survival: The War against Environmental Pollution* in *Ibid.*

balance between environmental protection and energy production was a zero-sum game, that any increases in environmental regulation involved a corresponding trade-off in reduced energy supplies. Here, that trade-off was portrayed as a polar choice: between a commitment to economic and technological progress or instead a complete abandonment of modern technology and a reversion to a "primitive past." Like other utility PR material circulating in the schools, the comic told students that too much environmental protection could threaten their quality of life and the modern conveniences they enjoyed as a result of abundant electricity.[45]

Natural Gas: "The Clean Energy of the Future"

Following in the tracks of electric utilities, the natural gas industry similarly reshaped its corporate imagery in the early 1970s to integrate environmental themes. But the forces that drove the natural gas industry's mobilization of eco-themed advertising were very different from those that had impelled electric utilities. Unlike utilities, which faced mounting political pressure because of their unrivaled role in air pollution, the natural gas industry largely escaped the battles over air pollution, since its product burned far cleaner than other fossil fuels. Instead the industry viewed the environmental movement as an economic and political opportunity. Hoping to parlay the national drive for cleaner air into increased market share for its product, the industry repositioned its product as ecologically desirable. Meanwhile, it also used the new environmental concerns to push a political agenda after the natural gas shortages hit certain areas of the country in the early 1970s. Pressing for relief from longstanding federal price controls on natural gas, the industry urged increased use of natural gas could help the national drive to clean the air, but first changes had to be made to unwise government policies that were an obstacle to adequate supplies.

The use of natural gas in the United States rose rapidly after World War II. Between 1945 and 1970, production of natural gas in the U.S. had grown some 560%, spurred by technological advances in exploration, transportation and refining, as well as the 1947 conversion of two oil pipelines, built between Texas and the East Coast during

[45] *Ibid.*

World War II, into natural gas pipelines. By the late 1960s, natural gas supplied around one-third of the nation's primary energy needs. In the early 1970s, demand for natural gas outstripped available supplies in some parts of the country. This led federal and state regulators to implement "curtailment" policies in some areas that limited the supplies to certain low-priority large-scale users. The problem was exacerbated by the Arab oil embargo of 1973, which led to substitution away from imported oil and increased demand for natural gas.[46]

The natural gas industry blamed the shortages on the system of federal controls on "wellhead" prices, the price at which producers could sell gas into the interstate market. After the Supreme Court ruled in 1954 that the Federal Power Commission (FPC) had the authority to regulate wellhead prices under the Natural Gas Act of 1938, the FPC implemented price controls based on a "cost-of-service" methodology that aimed to allow producers to recover the costs of production plus a fair profit. At first attempting to set prices on this basis for each individual producer, the FPC subsequently set regional and then national price ceilings. When shortages emerged in the 1970s, the industry argued that they were a direct result of the artificially low price ceilings set by the FPC since 1954. The industry charged that, because of the low price ceilings, natural gas producers had little incentive to invest in costly new exploration and drilling. As a 1971 industry advocacy ad put it, "For years, federal regulations have kept prices at the wellhead unrealistically low—while drilling and other costs have skyrocketed. In some cases it may take higher prices at the wellhead to get the job done." Pushing for relief from these price controls in the early 1970s, the industry linked the issue to new environmental concerns by urging that increasing the supply of clean-burning natural gas through deregulation was essential to cleaning the nation's air.[47]

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[46] David G. Victor, Amy M. Jaffe, and Mark H. Hayes, eds., *Natural Gas and Geopolitics from 1970 to 2040* (Cambridge: Cambridge University Press, 2006), 6 <http://assets.cambridge.org/052186/5034/excerpt/0521865034_excerpt.pdf> (June 26, 2006); NaturalGas.org, "The History of Regulation," <http://www.naturalgas.org/regulation/history.asp> (June 27, 2006).

[47] NaturalGas.org, "The History of Regulation," <http://www.naturalgas.org/regulation/history.asp> (June 27, 2006); Phillips Petrol. Co. v. Wisconsin, 347 U.S. 672 (1954); American Gas Association, advertisement, "The Clean Skies of Tomorrow," *Life*, August 27, 1971.

Although the American Gas Association (AGA), the trade group representing gas and pipeline companies, had run ads in the late 1960s touting gas-fired incineration as a solution to solid-waste problems, the industry largely watched from the sidelines as the electric power industry pushed electricity as "the clean energy." At the AGA's Public Relations Conference in 1970, a "youth panel" assembled for the occasion indicated a preference for the energy that pollutes least, but participants were unsure whether that was gas or electricity. Meanwhile, polls commissioned by the AGA's advertising agency, J. Walter Thompson (JWT), indicated that 74% of respondents disagreed with the statement "Natural Gas is Less Pollutant than Electricity." "Although gas is, of course, less of a pollutant," stated a 1971 JWT report, "the public perceives electricity as the clean air fuel. Undoubtedly, this is a rub-off from the greater amount of electric advertising over the years which has stressed 'cleanliness'–and the growing number of electric ads recently on ecology."[48]

A 1972 JWT report, citing recent data from pollster Daniel Yankelovich, said that pollution ranked just under crime as the single most important public concern (excluding Vietnam and inflation), but that gas was positioned on the wrong side of this critical issue. The report warned that "a giant communication gap" existed "between the actual truth about gas and pollution and what people think is true…the gas industry has a long way to go to convince people that gas is on the side of a clean ecology. With the single exception of water pollution, gas is seen as more harmful than electricity on every type of pollution. Among youth, the pollution image of gas is even more negative." The report said that the main reason for electricity's clean image was the massive amount of environmental advertising placed by the electric industry. JWT estimated that a handful of companies and trade groups in the electric industry—including General Electric, Westinghouse, and the Edison Electric Institute—had spent more than $5 million annually in the early 1970s on advertising to improve electricity's environmental image.[49]

JWT urged the natural gas industry to tell its product's environmental story, which it said was far stronger than that of electricity. In 1971 the AGA launched a

[48] J. Walter Thompson Company, "American Gas Association, Inc., 1971 Residential Advertising Plans and Recommendations," 1971, , Review Board Records, Restricted, Box 4, JWT Archives.
[49] JWT, "Consumerism Research," 1972, Review Board Records, Restricted, Box 4, JWT Archives.

television and print campaign designed by JWT to position gas "as a 'clean' energy and to communicate its ecology story." By 1972 around half of the AGA's print and television advertising was devoted to ecology and other "consumerism" issues. "Putting gas on the right side of ecology" by telling its environmental story, according to JWT, could help the industry win the favor of consumers and potentially increase its market share. Compared to electric utilities, the gas industry had maintained a modest public-relations profile. "It is somewhat out of sight," said a 1971 JWT report, "lost in the middle between the sharply positive attitudes toward the electric industry and strongly negative attitudes toward the oil industry." In the new era of consumerism and environmentalism, however, "there is no haven for industry in being out-of-sight. Its consumer, government and financial relations, as well as consumer sales, all depend on a strong and positive image for the industry as a whole."[50]

Like the electric power industry, the natural gas industry had long associated its product with modernity, technological progress, and domestic consumer wonders. At the 1964 New York World's Fair, the industry sponsored a futuristic Gas Pavilion, designed by Walter Darwin Teague Associates, showcasing, according to an ad, "the latest miracles of Gas—the modern fuel for home, industry and commerce." Throughout the 1960s, AGA ads linked the image of gas to the array of new conveniences and appliances found in the middle-class home. Other ads told of the centrality of natural gas in supplying the energy needs of modern hi-rise apartments and new suburban developments. Slogans included "Live Modern for Less with Gas" and "For the best in modern living, Gas makes the big difference."[51]

Now JWT steered the industry to incorporate emerging environmental concerns into this vision of gas-powered progress. The AGA's new print campaign in the early 1970s included an ad headlined "A sample of tomorrow's clean air." It called gas a "clean energy that doesn't ruin the air" and also pointed to various initiatives to clean up

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[50] JWT, "American Gas Association, Inc., 1971 Residential Advertising Plans and Recommendations," 1971; "1971 Consumerism Advertising Campaign," 1971; "Consumerism Research," all in Review Board Records, Restricted, Box 4, JWT Archives.
[51] Gas Equipment Manufacturers, advertisement, *Time*, December 6, 1963; American Gas Association, advertisement, *Life*, June 17, 1963; American Gas Association, advertisement, *Better Homes and Gardens*, February 1963.

the environment. A JWT report said the ad was "designed to put gas on the right side of ecology," but "carefully avoids promising too much too soon in terms of today's restrictions on supply." The association of natural gas with both domestic cleanliness and clean air was the basis for several television commercials JWT created for the AGA in the early 1970s. One TV spot, "Clean Air of the Future," continued to employ the type of futuristic images used by the industry for years. But AGA advertising now incorporated themes from popular ecology as well. A JWT report described the ad: "Residents in the home of tomorrow (featuring new conveniences from gas industry research) enjoy air that is clean inside and out. The gas industry and government are working to make enough clean gas energy available so it can make a real difference in the years ahead." The ad began with a flying saucer navigating toward a futuristic home, piloted by a father returning home to his family. Meanwhile, a voiceover intoned: "You're traveling through the clean air of the year 2000; toward the home of the future; Notice that it has no chimney; no power lines; It's run in new ways; Entirely by clean natural gas." As the shot cut to the inside of the home, viewers could see the modern conveniences powered by gas, including lighting, heat, and kitchen appliances. Finally, before the father took off again in his saucer, he and his son go outside to enjoy the clean air, un-fouled by clean-burning natural gas. "Indoors and out the air is clean and sparkling," said the voiceover. "Gas is the energy that burns clean so it doesn't dirty the air; That's true right now."[52]

Another AGA TV commercial, "Let's Keep it Clean," similarly portrayed gas as a clean energy that would improve both the indoor and outdoor environments of the suburban home. It began with images of a mother and her children inside a house, as a voiceover said, "This is our breathing space…This is our living place…The natural gas people help keep it clean…Gas is clean energy and that can mean…clean air in our breathing space, clean air in our living place." It then switched to a shot of the children playing outdoors. As a young girl picked a flower, the voiceover intoned, "Gas is clean energy, and that can mean…a million tomorrows of keeping things clean." Next, a butterfly landed on a flower. "Our world's an amazing place…" continued the voiceover,

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[52] American Gas Association, advertisement, *Life*, April 23, 1971; JWT, "1971 Consumerism Advertising Campaign," Review Board Records, Restricted, Box 4, JWT Archives.

"Let's keep it clean." As the spot ended, the slogan "Gas, clean energy for Today and Tomorrow" appeared on screen.[53]

As JWT sought to put gas on the "right side of ecology" through such advertising efforts, it simultaneously linked the ecology issue to the industry's key political goal—the deregulation of wellhead price controls. Advocacy ads by the AGA in the early 1970s such as "The clean skies of tomorrow" and "Natural gas was good for ecology when nobody knew what it meant" combined the message that gas was the "clean energy" or "the immaculate fuel" with calls for relief from price controls to increase the supply of "clean natural gas." "The clean skies of tomorrow," for instance, ran three paragraphs of political advocacy under a simple painting of a sky adorned with a rainbow, clouds, and birds. Under the image, the copy asked, "Why tomorrow? Why not run everything on clean natural gas today?" Discussing the problem of natural gas shortages, the ad blamed federal price controls for the problem, and explained why higher prices would be necessary to assure steady supplies of the "clean, convenient, low-cost energy we all need—for our homes, industries, and a cleaner sky."[54] As a 1973 JWT report explained, "Since adequate supplies of gas do not exist to meet current environmental demands, AGA's ecology message must also include an appropriate statement about gas supply (e.g. limitations of supply, what is being done to develop new sources, government co-operation needed, effect on higher costs, etc.)."[55]

The natural gas industry's institutional advertising of the 1970s mobilized environmental themes to advance a mix of economic and political goals. First, in response to the campaigns by electrical industries to give electricity a clean image, the natural gas industry sought to convince the public that its product was in fact the clean energy. To put its product on the "right side of ecology," the industry grafted the theme of environmental "cleanliness" onto existing themes associating natural gas with technological progress and modern domestic conveniences. Second, the industry's advertising took its political agenda to the public, calling for a lift on price controls that

[53] *Ibid.*
[54] American Gas Association, "The Clean Skies of Tomorrow," advertisement, *Life*, August 27, 1971; American Gas Association, "Natural Gas Was Good for Ecology When Nobody Knew What it Meant," advertisement, *Parents*, October 1972.
[55] J. Walter Thompson, "1973 Strategy," Review Board Records, Restricted, Box 4, JWT Archives.

hindered the development of new supplies and for government initiatives to help develop new sources of supply. The promise of a clean, gas-powered future could soon become a reality, the industry told environmentally-conscious consumers, but only with changes in federal policy. Even as the natural gas industry achieved its goal of deregulation of wellhead prices under legislation passed in 1978 and 1989, the industry continued to use the "clean energy" theme as a consumer marketing tool. AGA ads in the 1980s and 1990s, for instance, presented the increased the use of natural gas as a solution to problems ranging from dependence on foreign oil to acid rain and ozone depletion.[56]

Partners in the Clean Up: The Glass Container Industry and Recycling

In the summer of 1970, a sudden wave of glass bottle recycling appeared in cities across the country. The rising interest in recycling appeared to be an expression of the growing popular concern for the environment highlighted by the first celebration of Earth Day that April. The most enthusiastic participants in the recycling campaigns that summer were children and adolescents, whose collection efforts were channeled through student organizations, ecology clubs, and especially Girl Scout and Boy Scout troops. The cover of *My Weekly Reader Surprise: The Kindergarten Newspaper* later that year pictured one of the participants in the new recycling movement, a smiling young girl delivering glass bottles to one of the redemption centers, where she could receive half a cent per bottle for her efforts. In Los Angeles, the epicenter of the new recycling movement, a number of youth and student groups began recycling campaigns. The Orange County Girl Scouts, for instance, redeemed some 100,000 glass containers in one drive, earning $500 in compensation. One enterprising thirteen-year-old in Beverly Hills founded an ecology group called "CRUD"—Community Recycling and Usage of Disposables—whose efforts in glass bottle collection received the support of local government. University students also took up the cause, with student ecology groups at

[56] See, for example, American Gas Association, "Gas: Clean Energy from Solid Waste," advertisement, Newsweek, June 29, 1981; American Gas Association, "Don't You Wish We Could Just Do This to Acid Rain," advertisement, *Time*, September 13, 1993; American Gas Association, "Don't You Wish We Could Just Do This to CFCs," advertisement, *Newsweek*, May 10, 1993.

the University of Southern California setting up depots for the return of glass bottles on campus.[57]

The glass recycling movement soon spread to cities across the country, as schoolchildren, youth groups, and campus groups redeemed hundreds of thousands of bottles each week at newly created redemption centers. The glass recycling efforts were welcomed by newspaper editorials across the country, with headlines such as “This is Real Recycling,” “Now we Can Turn Glass into Dollars,” “Salvaging our Waste,” and “Pollution Bottleneck Gets Collective Push.” Soon there were more than ninety collection centers established at glass container manufacturing plants in cities in more than twenty states. In some urban areas, the fixed collection centers were supplemented by mobile collection units—trucks provided by the glass container industry—where local communities could redeem bottles collected in their neighborhoods. Those who didn’t participate or hear about the recycling campaign in their local newspapers, schools, or civic clubs, may have found out about it on television. A TV spot, “The Great Bottle Roundup,” was carried by hundreds of local TV stations and all three major networks. It demonstrated how glass containers were collected at centers, then melted down and processed into glass for new containers.[58]

On the surface, the glass recycling movement launched in 1970 had many of the features typically associated with grassroots social movements: local citizens acting to address an important issue, the mobilization of civic groups, and the spread of ideas and practices to similar groups across the country once successfully developed. But the reality of these campaigns was quite different. Far from a grassroots mobilization from the bottom-up, the glass recycling movement launched in 1970 was a concerted campaign from the top-down, launched by an industry under fire for the role its products played in litter and solid waste—two politically charged issues in the new era of environmental politics. The recycling campaign was designed and implemented by the Glass Container Manufacturers Institute (GCMI)—a New York-based trade association representing ninety percent of the nation’s glass-container producers—with help from Carl Byoir &

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[57] Glass Containers Manufacturers Institute and Carl Byoir & Associates, Inc., “Industry-Wide Program for Recycling Glass Containers: Summary and Supplemental Report,” 1970, Box 102, Folders 8-10, PRSA Records.
[58] *Ibid.*

Associates, a major public relations firm. The GCMI and its PR consultants worried that the "glass manufacturing industry faced a serious public relations problem," in the heightened criticism leveled at its products in 1970. "Amateur ecologists and environmentalists joined the industry's perennial critics," according to a PR report detailing the industry's strategy, "adding to the clamor for a legislative crackdown on glass containers, with no-deposit beer and soft drink bottles cast in the villain's role. Bills that would ban or restrict the sale of no-deposit bottles were introduced in community after community and state after state."[59]

The public-relations crisis feared by glass-container makers had been years in the making. Its roots lay in dramatic shifts in the products marketed by the industry over the past three decades as glass makers shifted away from the returnable bottles that had once been the norm. After World War II, glass-container makers began developing less expensive "one-way" bottles as they lost market share to new types of packaging. In the milk-bottle market, for instance, they were losing ground to paper and plastics, while in the soft drink and beer markets disposable aluminum cans gained ground. Glass-container manufacturers soon found it more profitable to churn out larger numbers of one-way bottles than to sell returnable bottles. Meanwhile, many of their clients, especially large brewers and soft-drink bottlers, such as Coca-Cola, found that they could trim costs by forgoing the expensive process of redeeming and washing used containers. In the 1950s, the majority of beer and nearly 95% of soft drinks sold in the U.S. were still packaged in refillable glass bottles for which the customer would pay a deposit on purchase. But by 1970 industry had dramatically expanded the use of "no-deposit, no-return" (or one-way) bottles, especially in the soft drink market. "By 1970," according to the Container Recycling Institute, "cans and one-way bottles had increased to 60 percent of beer market share, and one-way containers had grown from just 5 percent in 1960 to 47 percent of the soft drink market."[60]

Container manufacturers trumpeted the convenience of no-deposit, no-return containers to consumers, who were told in advertisements that they could simply discard

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[59] *Ibid.*
[60] See Container Recycling Institute, *Bottle Bill Resource Guide* <http://www.bottlebill.org> (June 16, 2006).

the can or bottle after use. The industries involved would later argue that consumer demand for convenience was driving the trend toward one-way bottles. But critics said that container manufacturers, large bottlers and brewers, and the grocery industry were responsible. "A number of small bottlers and breweries," noted a *Newsweek* story, "in fact, complain that the shift to non-returnables is due more to pressure from large container manufacturers and supermarket chainstores than to demand from beverage consumers."[61]

The rapid postwar surge in non-returnable containers meant that these throwaway bottles and cans became a highly visible part of the litter cluttering the nation's roads, sidewalks, and parks. In 1953, bottle and can manufacturers joined beverage bottlers and others in sponsoring Keep America Beautiful, an anti-litter group that urged individual and community action to reduce and clean-up litter. Later famous for its "Crying Eyes Cody" anti-litter ads, Keep America Beautiful helped serve the interests of one-way container makers by suggesting that the solution to the blight of America's landscape lay in consumer education and individual responsibility rather than in restrictions on the production of throwaway containers and other sources of litter.[62]

As public environmental concern mounted in the 1960s, glass-container manufacturers, aluminum-can makers, and other packaging industries faced growing criticism of throwaway products. In addition to the problem of litter, a growing number of Americans viewed throwaway packaging as a burden on the nation's landfills and an unnecessary waste of what some feared were rapidly dwindling stocks of natural resources. Beginning in the late 1960s, newly-mobilized environmental groups began pressing for passage of so-called "bottle bills" in cities and states across the country. Bottle bills sought to ensure a high rate of reuse of containers by mandating a minimum refundable deposit on all beverage containers. In effect, the bills aimed to bring back the older deposit-return system that was in place before the rise of one-way bottles and cans. By 1970 nearly one-hundred such bills had been introduced in twenty-six states. In Congress, meanwhile, several bills were pending that would have imposed deposits on

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[61] Glass Containers Manufacturers Institute and Carl Byoir & Associates, Inc., "Industry-Wide Program for Recycling Glass Containers: Summary and Supplemental Report," 1970, Box 102, Folders 8-10, PRSA Records.
[62] *Ibid.*

non-returnable bottles and cans, with one bill calling for an outright ban on aluminum food and beverage cans. Such legislation was fiercely opposed by container manufacturers and beer and soft-drink bottlers. At 1970 House hearings, for instance, GCMI president Richard L. Cheney warned that there was a "temptation to repeal the technical achievements and the conveniences of the 20th Century." "This," he continued, "would mean a return to the cracker-barrel era so far as consumer packaging is concerned."[63]

As its lobbyists resisted the bottle-bill drive in the political arena, the GCMI took its case public with a 1970 PR campaign that had as its centerpiece a nationwide recycling program. The goal was to convince the public that bottle bills and other restrictions on non-returnables were unnecessary and counterproductive. The GCMI took the "position that legislation banning or restricting the sale of no-deposit bottles would not only fail to solve litter and solid waste problems but would actually intensify them." By sponsoring a recycling program, according to a report on the PR program, the GCMI hoped to "show that it is better—ecologically and economically—to recycle no-deposit bottles than to ban or tax them."[64]

The GCMI began with a pilot recycling program in Los Angeles, launched on April 20, 1970, just two days before the first Earth Day. It set up eight collection centers at glass-container manufacturing plants in the Los Angeles area and cultivated interest in the southern California media by inviting journalists and camera crews to opening day events and supplying prepackaged ideas for feature stories. Offering a penny per pound for used glass containers that were brought in, the GCMI spread word of the program to "churches, colleges, schools, youth groups, civic and service organizations, Garden Clubs, PTA's, ecology clubs" and other organizations, inviting them to bring in bottles and jars for recycling. As the recycling program got under way, the GCMI and its PR

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[63] See Container Recycling Institute, *Bottle Bill Resource Guide* <http://www.bottlebill.org> (June 16, 2006); "Cheney Says Ban is No Solution," *GCMI Public Affairs Digest* 4 (January 1971), reproduced in Glass Containers Manufacturers Institute and Carl Byoir & Associates, Inc., "Industry-Wide Program for Recycling Glass Containers: Summary and Supplemental Report," 1970, Box 102, Folders 8-10, PRSA Records.

[64] Glass Containers Manufacturers Institute and Carl Byoir & Associates, Inc., "Industry-Wide Program for Recycling Glass Containers: Summary and Supplemental Report," 1970, Box 102, Folders 8-10, PRSA Records.

team carefully nourished favorable media coverage by supplying journalists with ongoing updates on the number of bottles gathered each day, "a constant flow of human-interest stories," and press-quality feature photos taken at the collection centers that tied in to the human-interest stories. The GCMI and its PR team viewed the Los Angeles test as a ringing public-relations success. Public participation exceeded expectations, with some 250,000 bottles collected each week by mid-May. Media interest was also high, with all three network affiliates in Los Angeles shooting footage of the collection centers. A report by one of the participating glass-container manufacturers lauded the program for "creating a more favorable image" for the industry in Los Angeles and stimulating "hundreds of groups and organizations to consider collection drives for both fund-raising and environment-beautification purposes."[65]

Based on the success of the Los Angeles pilot program, the GCMI soon launched an industry-wide program administered by individual glass-container manufacturers across the country. Ninety-two glass plants in twenty-five states set up collection centers in 1970. The GCMI carefully steered the expanding program. It provided each member company with a "Project Kit" that contained detailed guidance on how to set-up and operate a collection center and how to publicize the results—sample press releases and advertisements were also included in the kit. The GCMI's recycling program was complemented by other glass-container industry projects aimed at maximizing positive public relations. In Chicago, the GCMI collected 100,000 bottles at a "mobile collection center" set up in the North Shore area in order to demonstrate the feasibility of collecting bottles in urban areas where no glass plants were located. According to a GCMI report, "Influential dailies and broadcasting stations in Chicago and its suburbs covered the project in depth." The GCMI also sponsored research on the use of reclamed glass as a material for paving roadways at the University of Missouri (Rolla), reaping significant positive coverage in the *Los Angeles Times* and elsewhere when the first "glasphalt" street was paved in Fullerton, California.[66]

The GCMI's nationwide recycling program took place alongside existing "anti-litter" initiatives sponsored by the group in the early 1970s. The GCMI continued to

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[65] *Ibid.*
[66] *Ibid.*

provide financial support for Keep America Beautiful, which it had helped found in 1953; it sponsored a "National Anti-Litter Week" in 1971; and it sponsored various cleanup events involving the Boy Scouts. Targeting young people as a key audience for its messages, the GCMI also sponsored its own rock-music group. Known at first as "Soda Pop" (or alternatively as the "One-Way Bottles"), the group's initial objective was to sell young Americans on the merits of one-way bottles. Its early songs, according to *Newsweek*, included "such simple ditties as 'My one-way bottle keeps me alive and fit…don't have to go back to town to return it.'" But the group soon drew sharp criticism from environmentalists for such blatant advocacy of throwaway bottles, and the GCMI was forced to refashion the group's image. "We erred," Richard L. Cheney, GCMI's executive director, admitted to *Newsweek*. "We were unprepared for the urgency of the environment as a political issue."[67] Renaming the group "The Glass Bottle," the GCMI spent some $3 million on a national radio and TV campaign featuring the group. One radio spot for the group said: "They tell the story in youth's own language: 'Make Love, not litter.'" According to a GCMI public-relations report, the six-member rock group was "a primary vehicle for communicating anti-litter messages to youthful radio and TV audiences and also to college and high school groups." As it spread the industry's message in concerts across the country, according to the PR report, the group "won widespread media recognition as 'anti-litter ambassadors' to the nation's youth."[68]

The GCMI supported these varied efforts with both paid advertising and PR. Print ads and TV and radio spots sponsored by the GCMI and Keep America Beautiful asked audiences to be a part of the "Great Bottle Roundup" that would not only help clean up the environment but also pay a half-cent for each bottle returned. One TV spot explained the process through which returned bottles were reprocessed to make new glass that could be used both in new bottles and in an array of building materials for homes and surfacing for roads. The GCMI disseminated feature photos publicizing its projects to develop materials made from salvaged waste glass. One press photo, for instance, showed two members of the Boy Scouts inspecting a "glasphalt" street. Another press

[67] "The Return of the Returnables?" *Newsweek*, undated, reproduced in *Ibid.*
[68] Glass Containers Manufacturers Institute and Carl Byoir & Associates, Inc., "Industry-Wide Program for Recycling Glass Containers: Summary and Supplemental Report," 1970, Box 102, Folders 8-10, PRSA Records.

photo demonstrated that salvaged glass could be the basis for both the softest and hardest of everyday materials. It showed a female model wearing a soft neckpiece behind a pile of bricks; both neckpiece and bricks were made from salvaged glass developed by the U.S. Bureau of Mines and the GCMI.[69] The PR impact of the GCMI's campaign could be seen in the positive press that it generated for the industry. Feature articles and editorials in local, regional, and national papers across the country commented favorably on both the recycling program and the potential for turning reclamed bottles into materials such as "glassphalt." A typical editorial appearing in the New York *Daily News* under the headline "This is Real Recycling" called the GCMI's efforts to turn reclamed bottles into new materials a "truly momentous plan." Typical news stories carried by major papers and wire services, meanwhile, discussed the recycling program and the efforts to reuse salvaged glass for new materials.[70]

An internal report on the GCMI's PR program noted two achievements. First, the program was successful at "bridging a credibility gap between the business community and wide segments of an environment-conscious public." While many industry programs had been "greeted with cynical skepticism," said the report, "the public response to the bottle recycling program—as reflected in editorial comment and in the many thousands of unsolicited letters and phone calls—strongly suggests that this particular program is widely regarded as honest and sincere." Second, the program was viewed as successfully demonstrating that the glass-container industry had the "resources, expertise and know-how" to actually carry out a large-scale recycling program. While environmentalist critics of the industry argued that a far larger percentage of glass would be reused under a mandatory deposit-return program, the GCMI's efforts helped convince the public that industry-sponsored recycling was more than sufficient to combat the problems of litter, solid waste disposal, and resource depletion.[71] In the PR community, meanwhile, the GCMI's campaign was lauded as a model of PR practice. In 1971 the GCMI and its PR

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[69] See Carl Byoir & Associates, "The Great Bottle Roundup: Material for TV/Radio" and photographic materials both reproduced in *Ibid.*
[70] See press clippings reproduced in *Ibid.*
[71] *Ibid.*

firm, Carl Byoir & Associates, were honored by the Public Relations Society of America with a Silver Anvil award, a prize given annually to recognize the best PR campaigns.[72]

Aluminum Can Recycling

The glass bottle industry was not alone in sponsoring large-scale publicity campaigns to fight legislation threatening its one-way container products. Aluminum-can makers Reynolds Metals Company and Owens-Illinois launched similar campaigns to counter criticism of their products and to promote voluntary recycling as preferable to restrictive legislation. In the late 1960s, Reynolds began a pilot reclamation programs in Los Angeles and Miami. The Miami program won the praise of Lady Bird Johnson, whose interest in the problem of litter along the nation's roads contributed to passage of the Highway Beautification Act of 1965. Following these early successes, in 1968 the company launched a nationwide PR campaign intended to demonstrate the company's commitment to curbing litter and to promote "aluminum's recycling value and the concept of recycling as a solution to litter and solid waste disposal problems." The company's anti-litter efforts included providing litter bags to its employees, placing anti-litter emblems on Reynolds Wrap cartons, and running anti-litter advertisements. Like the glass industry, Reynolds also cultivated a partnership with the Boy Scouts in order to successfully promote and expand its recycling programs, first in Los Angeles then in other cities. Reynolds' PR team "provided Scouts with plastic bags for collecting cans, magnets to tell aluminum from steel, literature, door hangers, posters and supported their efforts with local advertising, press conferences, speeches and publicity in press, radio and TV." With the Scouts involved, Reynolds was soon able to get sufficient volume of returned cans "to prove that a reclamation program could pay its own way."[73]

The media attention generated by Reynolds' campaign matched that of the glass industry. The company's recycling efforts received nationwide media coverage, with stories appearing in the *Wall Street Journal*, the *New York Times*, *Time* magazine and

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[72] *Ibid.*; Public Relations Society of America, Silver Anvil <http://www.prsa.org/_Awards/silver/index.asp?ident=sil0> (June 29, 2006).
[73] Reynolds Metals Company, "Aluminum Can Reclamation and Recycling Program," 1970, Box 101, Folder 13, PRSA Records.

other major publications. Editorials in dozens of newspapers and magazines praised its efforts. And the program was covered, according to PR material, by “many local and network radio and TV shows including C.B.S. Evening News with Walter Cronkite, NBC’s Today Show, Monitor, The Arthur Godfrey Show and many others.” Thousands of laudatory letters poured in, its PR team noted, “many from conservationists and public officials including the President of the United States.” Reynolds’ award-winning program was also recognized as a model of effective PR, winning, like the GCMI, recognition from the Public Relations Society of America. Most important, the campaign was viewed as a key to the political success that the industry enjoyed in combating legislation restricting aluminum cans. The Reynolds’ PR team observed that “[s]ome 65 anti-packaging bills that might have hurt aluminum were introduced in various states in 1969. None has passed.” Meanwhile, they noted, “sales of aluminum cans have continued to soar and the company has started to build three new can making plants to keep up with demand since the program started.”[74]

Conclusion

The rise of the environmental movement in the late 1960s and early 1970s prompted a rapid response from many of the industries blamed for the nation’s environmental problems. As a growing number of business leaders and PR advisors described the new environmentalism as a public relations crisis, affected firms and industry trade associations began launching integrated PR, advertising, and lobbying campaigns aimed at reshaping their corporate imagery and forestalling the environmental agenda unfolding in state legislatures and in Congress. These campaigns aimed to convince the public that government regulation was unnecessary and that environmental degradation could be more effectively addressed through voluntary corporate programs. At the same time, these early campaigns represented the beginning of a broader transformation of corporate PR and advertising in which environmental themes would be thoroughly integrated into the existing stock of corporate imagery in an array of industrial sectors. By 1980 the imprint of environmentalism could be found in institutional

[74] *Ibid.*

advertising, PR programs, corporate logos, and annual reports across smokestack America, from electric utilities and chemical manufacturers to steelmakers and other manufacturers. And while such efforts were at first largely part of defensive political maneuvering by pollution-intensive industries facing government regulation, the greening of corporate imagery soon became a standard PR practice for putting companies on the right side of sensitive issues of growing concern to existing and potential employees, customers, and investors alike.

Chapter Three: Managing Science in the New Environmental Politics: Monsanto, Electrical Equipment Manufacturers, and PCBs, 1966-1978

Introduction

During Senate debate on the Toxic Substances Control Act (TSCA) in 1976, Senator Gaylord Nelson of Wisconsin, a co-founder of Earth Day, urged his colleagues to adopt an amendment targeting a particular group of chemicals for phaseout—polychlorinated biphenyls ("PCBs"). Nelson said that while it was "preferable not to enact legislation on a substance-by-substance basis but rather generically…the PCB problem shows no sign of abating and it has become so severe that it is necessary to address the problem head on as we were forced to do with DDT." In the House, meanwhile, Representative Gilbert Gude, a Republican from Maryland and co-sponsor of a companion amendment to the House bill, called the chemicals a "mad dog—a known bad actor." It was time, Gude said, simply "to get rid of it." Out of the thousands of industrial chemicals produced in the United States, the TSCA would single out PCBs alone for a near total ban. In less than a decade, PCBs would go from being some of the most widely used industrial chemicals in the world to among the most strictly controlled.[1]

For more than four decades, PCBs—sold in the U.S. as "Aroclors"—had been a lucrative product for the Monsanto Chemical Company. PCBs were first produced commercially in 1929 by the Swann Chemical Company at a plant in Anniston, Alabama. In 1935 Monsanto acquired the Anniston plant and became the exclusive producer of the chemicals in the United States. Because of their unique chemical properties, including high stability and resistance to heat, PCBs were used in hundreds of industrial applications and consumer products. Most important was their use as insulating fluids in electrical equipment, such as the transformers and capacitors made by General Electric and Westinghouse. In 1972, PCBs were used in an estimated ninety percent of all large industrial capacitors. In the absence of safe and commercially-available alternatives,

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[1] U.S. Library of Congress, *Legislative History of the Toxic Substances Control Act* (Washington, D.C.: U.S. Government Printing Office, 1976), 235, 584.

many building codes and insurance policies required PCBs to be used in the electrical equipment of public and commercial buildings, including many high-rises, factories, and schools. They were also incorporated into hundreds of consumer products, ranging from paints and sealants, to adhesives and dyes, as well as the "carbonless" copy paper used in countless offices. Before World War II, according to one Monsanto employee, PCBs had even been used in chewing gum. Between 1927 and 1977, Monsanto produced some 700,000 tons of PCBs, of which some 75,000 tons were exported outside the United States.[2]

In the late 1960s, scientists discovered that PCBs were accumulating in ecosystems across the globe, threatening fish, wildlife, and, potentially, human health. As the sole producer of PCBs in the U.S., Monsanto was put in the spotlight as regulators, environmentalists, and the press drew attention to widespread environmental contamination, leading to calls for restrictions, and later a complete ban. In the midst of a growing popular environmental movement, Monsanto launched a decade-long campaign, from 1966 to 1976, to protect this lucrative product line, which generated $20 million in revenue annually. Monsanto's campaign to defend PCBs—later continued by electrical equipment manufacturers—provides a case study of the intertwining of corporate strategy and the management of science to protect a product attacked as a threat to the environment and public health. Like many other companies whose lucrative products had suddenly been tagged "toxics," Monsanto viewed the effective management of scientific information as a key to winning the unfolding public debate and forestalling government regulation.

Monsanto held a longstanding monopoly not only on the production of PCBs, but also on much of the scientific and medical data related to the chemicals. The company had "the world's best reference file on the PCB situation," wrote a Monsanto employee in 1971. But like many companies in the late 1960s through the 1970s, Monsanto found itself with progressively less ability to control sensitive information related to the toxicity and environmental impact of its product. While it had long been virtually the only

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[2] P.G. Benignus to T.K. Smith, February 29, 1952, PCB Documents; U.S. Environmental Protection Agency, *Binational Toxics Strategy PCB Sources & Regulations Background Report*, <http://www.epa.gov/glnpo/bns/pcb/PCBsources.pdf> (June 19, 2006), 4.

sponsor of research and the sole gatherer of information on PCBs, the company soon entered debates on their hazards as merely one actor among many. University and government scientists now received greater funding to investigate "environmental health" issues, including the health and ecological effects of toxics. New environmental and consumer groups entered the fray as well, wielding data and reports often contradicting the company's reassurances. At the same time, newly minted agencies, particularly the federal Environmental Protection Agency (EPA) created in 1970, began pushing the company to release relevant data on PCBs. Monsanto was soon managing scientific information in a radically different political environment, marked by the pluralistic play of public-interest groups, industry, and government agencies, each assembling bodies of scientific data in support of favored policy positions.[3]

For much of the twentieth century, manufacturers of hazardous products controlled much of the scientific and medical data relating to their products. From tobacco and asbestos to lead and vinyl chloride, such corporate control long forestalled recognition of the scope and nature of chemical hazards. With little public funding for research on toxics and little attention paid to environmental causes of disease until the 1960s, companies and industry groups exerted considerable control in part because they funded much of the research on the health-effects of hazardous products. Through the creation of proprietary research labs, the financial support of researchers, and the commissioning of expert reports, industry obtained private access to data, established long-lasting relationships with scientists, and sometimes used its privileged position to withhold or rewrite unflattering studies.[4]

One example of this type of corporate control was the leaded gasoline industry's decades-long dominance of research on the toxicity of lead. As public health historians have shown, the industry succeeded in influencing the debate on the dangers of lead for

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[3] E. Wheeler to D. Otto, August 6, 1971, PCB Documents.

[4] On the strategic use of science by corporations defending hazardous products, see Robert Proctor, *Tobacco Wars*, 101-132; Samuel P. Hays, *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955-1985* (Cambridge: Cambridge University Press, 1987), 329-362. On tobacco industry science, see Stanton A. Glantz et al., eds., *The Cigarette Papers* (Berkeley: University of California Press, 1996). On the control of science by the lead and vinyl chloride industries, see Gerald Markowitz and David Rosner, *Deceit and Denial: The Deadly Politics of Industrial Pollution* (Berkeley: University of California Press, 2002).

four decades by becoming the principal patron of lead toxicology. Developed as an anti-knock additive for gasoline, tetraethyl lead was first sold in 1924 by the Ethyl Gasoline Corporation in a gasoline formulation called "Ethyl." From the start, public health experts warned of potential dangers. But research on tetraethyl lead was nearly monopolized for the next four decades by General Motors and the Ethyl Corporation, through the patronage of Robert Kehoe, a professor of physiology at the University of Cincinnati and head of the Kettering Laboratory of Applied Physiology. Until the 1960s, Kehoe's claim that it was normal and harmless for humans to have certain amounts of lead in their bodies went largely unchallenged. According to Markowitz and Rosner, for several decades Kehoe acted as a "virtual commissar of lead toxicology." As Kehoe told a Senate committee investigating lead, his lab was the "only source of new information" on lead and had "a wide influence in this country and abroad in shaping the point of view and activities…of those who are responsible for industrial and public hygiene."[5]

Like the lead industry, Monsanto controlled much of the toxicological and exposure data on its own hazardous product for many decades. Outside of a handful of industries, few had even heard of PCBs before the late 1960s, and fewer still were aware of their hazards. Monsanto, however, had gathered extensive data on both the toxicity of PCBs and on worker illnesses caused by the chemicals. A 1971 memo from the company's Medical Department boasted of the depth of these records. "We have probably the world's best reference file on the PCB situation," stated the memo. "This includes reprints from the literature beginning in 1936 to reports issued last week."[6] These records indicated that PCBs had long been known to be highly toxic to lab animals, even at minute concentrations, and that numerous customers had reported illnesses among workers exposed through leaks or insufficient workplace controls. At a 1971 Senate hearing on proposed toxic substances legislation, William Rodgers, a professor of law at the University of Washington and leading authority on environmental law, testified that, under the cloak of trade secrecy, Monsanto continued to overwhelmingly control scientific information on PCBs. "I am told," he said, "that one reason we know so little

[5] Markowitz and Rosner, *Deceit and Denial*, 18-23, 35, 116.
[6] E. Wheeler to D. Otto, August 6, 1971, PCB Documents.

about industrial PCB's is that they are shielded by a perpetual screen of commercialism."[7]

But this industry preeminence was changing rapidly by the late 1960s and early 1970s. Aided by rising levels of federal funding for science, scientists in fields such as epidemiology, toxicology, and ecology contributed to a growing body of research on the ecological and health effects of toxic chemicals. Meanwhile, "environmental health" and "environmental science" were growing fields of interdisciplinary inquiry. As historian Samuel P. Hays has observed, during this period there was a "growing body of knowledge about the pathways and networks in the environment and how they worked," and "the effects of chemicals on both humans and the natural environment." After its creation in 1970, the EPA became a principal locus for information gathering on toxics and other pollutants, as the agency reached out to researchers at universities and other government agencies for the data necessary to back new regulatory initiatives mandated by Congress. In 1975 *Fortune* magazine observed a new constellation of institutions that posed a growing challenge to industry through their mobilization of expertise. This "regulatory-medical complex," said *Fortune*, consisted of a "loose but not uncoordinated network of regulatory agencies, government research institutes, academic medical teams, labor unions, and other groups united by a common commitment to eradicate environmental causes of disease."[8]

PCBs as a Workplace Hazard

Monsanto officials knew as early as the 1930s that PCBs were highly toxic and posed a potential hazard in the workplace. Although public health authorities in some states were familiar with the hazards, most companies using PCBs relied upon Monsanto for information on toxicity and appropriate safety measures. With little input from deferential state agencies, Monsanto's Medical Department recommended exposure

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[7] U.S. Congress, Senate, Committee on Commerce, Subcommittee on the Environment, *The Toxic Substances Control Act of 1971 and Amendment,* 92nd Cong., 1st sess., Aug. 3-Nov. 5, 1971, p. 133.
[8] Samuel P. Hays, *A History of Environmental Politics since 1945*, (Pittsburgh, PA: University of Pittsburgh Press, 2000), 137; Paul H. Weaver, "On the Horns of the Vinyl Chloride Dilemma," *Fortune* 90 (October 1974): 150, p. 202.

thresholds and various measures to keep ambient concentrations below the recommended level. Beginning in the mid-1930s, reports of illnesses caused by exposure to PCBs began appearing in the medical literature. In 1936 physicians in Atlanta reported the case of a 26-year-old worker who had developed a severe skin disease after working for three years in the production of PCB products. An investigation at the plant found that twenty-three of the twenty-four men working there had developed similar eruptions on the face and body. Although it is unclear whether Monsanto was aware of this report, by the following year the company had commissioned animal tests to gauge the toxicity of PCBs.[9]

In 1937 results from animal testing received by Monsanto indicated that prolonged exposure to PCBs could lead to "systemic toxic effects." The tests also showed that repeated skin contact with liquid PCBs could produce an "acne-form skin eruption," later termed chloracne, a form of dermatitis caused only by exposure to certain chlorinated chemicals. Based on these results, Monsanto's medical staff suggested that the company provide safety guidelines to its Aroclor customers advising the installation of ventilation systems and the use of protective garments. In 1938 Monsanto received more detailed results of animal studies in a report by Cecil Drinker, a professor of public health at Harvard University who edited the *Journal of Industrial Hygiene*. In his "Report to the Monsanto Chemical Company," Drinker found liver damage in rats exposed to vapors of two PCB compounds. He said that the particular mixture of PCBs he tested "cannot be given an absolutely clean bill as to health," but reassured the company that the product "if handled with ordinary precautions as to ventilation should be entirely harmless to workmen." Drinker recommended "permissible limits" for the ambient concentration of Aroclors in the workplace.[10]

Investigations by government industrial hygienists also prompted warnings of the high toxicity of PCBs and calls for stringent preventative measures in the workplace. In 1943 Dr. Leonard Greenburg, director of the Division of Industrial Hygiene of the New

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[9] J.W. Jones and H.S. Alden, "Acneform Dermatergosis," *Archives of Dermatology and Syphilology* 33 (1936): 1022-1034.

[10] L.A. Watt, memo, October 11, 1937, PCB Documents; Cecil Drinker, "Report to the Monsanto Chemical Company," September 15, 1938, PCB Documents. Drinker's findings were published the following year in *The Journal of Industrial Hygiene and Toxicology* 21 (May 1939).

York State Department of Labor, reported on workers exposed to PCBs at two cable plants where PCBs were used in electrical equipment. "In this investigation," he wrote, "a large number of cases of dermatitis were found, and several deaths due to liver damage were found." Greenburg wrote that PCBs were "highly toxic compounds" that should be "used with extreme care." "Industrial hygienists," he wrote "should make every effort to see that such exposures are controlled, in so far as humanly possible." Greenburg's warning was echoed by Robert M. Brown, the chief industrial hygienist at the Department of Public Welfare in St. Louis. In 1947 Brown wrote in *The Chemist Analyst*, an industry trade journal, that the "toxicity of these compounds has been repeatedly demonstrated, both from the standpoints of the absorption from the inspired air, as well as from their effects in producing a serious and disfiguring dermatitis when allowed to remain in contact with the skin." Brown called Aroclors a "potential hazard from the health standpoint" and said that industrial hygienists should make sure that the "proper controls have been established wherever these products are used."[11]

Despite the attention of some government industrial hygienists, most companies relied heavily upon Monsanto for information on both the hazards of PCBs and for guidance on appropriate workplace safety measures for the chemicals. But such guidance sometimes fell short of what customers expected. Warnings from Monsanto managers at times came only in response to reports of worker illnesses or to reports of extremely hazardous conditions that caught the eye of Monsanto's medical staff. In 1961, for instance, Monsanto learned that two employees of Hexagon Laboratories, a PCB customer, fell ill after exposure to Aroclors from a leak in a heat-transfer unit at the plant. Both workers reported severe nausea and were hospitalized, where doctors diagnosed dermatitis. The chief engineer at Hexagon later complained that Monsanto had not fully informed his company of the hazards of PCBs. "Since we are dealing with a highly toxic material," he wrote to Monsanto's chief physician, "it is felt that a more thorough and clearly written description of the hazards be described under Safety of Handling."[12]

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[11] Leonard Greenburg, "Chlorinated Napthalenes and Diphenyls," *Industrial Medicine* 12 (August 1943): 520-21; Anonymous, "Process for the Production of Aroclors, Pyranols, Etc. at the Anniston and at the WM. G. Krummrich Plant," April 1955, PCB Documents.
[12] J.P. Allen to R.E. Kelly, February 14, 1961, PCB Documents.

Like Hexagon, Reliance Electric & Engineering Company, an Aroclor customer based in Cleveland, was told of the severity of the hazard posed by PCBs after reporting poisoning symptoms among workers. In 1965, Reliance reported to Monsanto that workers exposed to PCBs had complained of unusual odors, discomfort, and irritation. The company used Aroclor 1242 as a coolant for electrical motors in mining equipment. Around four quarts were lost each day as vapors, but there was no ventilation system to remove the vapors from the mine shaft. In another facility, "hot Aroclor spills on the floor were common," and "employees had complained of discomfort." Responding to these reports, E.P. Wheeler of Monsanto's Medical Department warned Reliance officials that these conditions risked the lives of workers. "I was brutally frank," Wheeler wrote in a company memo, "and told him that this had to stop before he killed somebody with liver or kidney damage—not because of a single exposure necessarily but only to emphasize that 8-hour daily exposures of this type would be completely unsafe." Until the creation of the Occupational Safety and Health Administration (OSHA) in 1970, Monsanto often acted as the primary source for toxicity information and workplace standards related to PCBs.[13]

In the 1950s, Monsanto managers also became increasingly concerned about the potential legal liability arising from the use of PCBs in consumer products. Like the plastics industry, which quietly removed vinyl chloride from aerosol sprays in the 1970s when its high toxicity was discovered, Monsanto moved to phase out uses of PCBs in products that directly exposed consumers such as paints. While the claims of exposed workers would generally be limited by workers' compensation laws, Monsanto managers worried that products exposing the general public could, by contrast, subject the company to virtually unlimited liability. A 1953 memo from Monsanto's Medical Department noted that the company was "watching the use of Aroclors as plasticizers in emulsion paints. We do not recommend that they be used in paints which might be applied in confined or unventilated surfaces."[14] In 1954, company physician Emmett Kelly wrote that animal tests were underway to determine a safe exposure level by inhalation because

[13] E.P. Wheeler to R. Davis, "Aroclor 1242—Reliance Electric and Engineering Company, Cleveland," September 1, 1965, PCB Documents; Monsanto to Celanese Corporation, memo, December 30, 1947, PCB Documents.
[14] E.P. Wheeler to E. Mather, "Aroclors: Toxicity," September 1, 1953, PCB Documents.

of concerns about the use of PCBs in paints. Although Kelly believed that typical exposures from painting were safe, he was concerned "that a man would develop hepatitis…and on questioning recall that he had painted a room with Aroclor paint and state that he had smelled it very strongly. I am afraid that we might be convicted by association even though we were sure one could not get a level high enough to cause trouble." If liver illnesses could be traced to such PCB exposures, Kelly warned that the company could face costly lawsuits. Writing to a colleague in London in 1955, Kelly explained that "our main worry is what will happen if an individual developes [sic] any type of liver disease and gives a history of Aroclor exposure."[15]

Long aware that workers could develop chloracne or liver illnesses after exposure to PCBs, Monsanto officials privately advised customers to limit dangerous exposures when such health problems arose. At the same time, however, the company assured public health authorities that PCBs had a nearly spotless record. Asked for information on PCBs by the U.S. Public Health Service in 1962, Emmett Kelly wrote that "our experience and the experience of our customers over a period of nearly 25 years, has been singularly free of difficulties. To our knowledge, there have been only three instances where chloracne has occurred. In view of the millions of pounds which have been produced and used in many and varied applications, the low frequency of any difficulties has been gratifying."[16]

Until the late 1960s, the hazards of PCBs constituted an occupational health issue that received little attention outside a handful of companies. Much of the information on toxicity and workplace exposure incidents was privately held by Monsanto. Absent other authorities, companies using PCBs turned to Monsanto for information on their hazards and for guidance on proper workplace controls. In the case of lead, Robert Kehoe had described his lab as the "only source of new information," a central clearinghouse for "shaping the point of view and activities…of those who are responsible for industrial and public hygiene."[17] For PCBs, Monsanto's Medical Department served much the same role—at least until 1966. Leaking from countless industrial facilities and landfills, the

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[15] R.E. Kelly to Newman, February 12, 1954, PCB Documents; R.E. Kelly to J.W. Barrett, "Aroclor Toxicity," September 20, 1955, PCB Documents.
[16] R.E. Kelly to Marcus Key, U.S. Public Health Service, March 15, 1962, PCB Documents.
[17] Quoted in Markowitz and Rosner, *Deceit and Denial*, 116.

chemicals were identified as global environmental contaminants. Long confined to discussions on the factory floor, Monsanto's correspondence with customers, and the field of industrial hygiene, PCBs were recast as an "environmental" hazard. They soon attracted sustained interest from the scientific community, the national press, and state and federal regulators. In the new, pluralistic environmental politics, Monsanto evolved new strategies to reassure the public and regulators that its Aroclor products did not pose significant risks to the environment or public health.

"A New Chemical Hazard"

In 1966, Sören Jensen, a chemist at the University of Stockholm, first discovered that PCBs were leaking into the environment and accumulating in wildlife. Two years earlier, Jensen had begun a study of the buildup of DDT and other chlorinated pesticides in wildlife and humans in Sweden. Using gas chromatography, where "peaks" on a graph provided a sort of chemical fingerprint, Jensen discovered peaks that did not match the known fingerprints of any pesticides. Jensen believed that previous studies had misidentified DDT as the source of the unknown peaks. With the help of scientists at the Swedish Museum of Natural History, Jensen collected samples of pike from lakes and rivers across Sweden, ranging from the industrialized south to the less polluted north. He found the unknown chemicals in pike across the country, but at lower concentrations in samples from the north, farther from industry. Jensen at first hypothesized that the chemicals might be unidentified metabolites of pesticides. But then he examined feathers from white-tailed eagles preserved at the Swedish Museum of Natural History dating back to the 1880s. When he found traces of the unknown compounds in feathers dating back to 1942, this eliminated the possibility that the compounds were metabolites of DDT or similar pesticides, since these only came into wide use after World War II. After further tests, he found that the unknown substance matched the gas chromatography peaks produced by a sample of PCBs obtained from a German chemical company. After Jensen announced his findings at a scientific conference in Stockholm in 1966, they were aired widely in the Swedish press and later reported in the British magazine *New Scientist.*[18]

Monsanto learned of Jensen's findings through its Brussels office in November 1966 by way of a letter from the Swedish firm Rising & Strand that reported Jensen's discovery and the significant attention it had received in the Swedish press. The letter warned that "there is no doubt that what has been termed Polychlorinated Biphenyls is equal to Aroclor. There is also no doubt that the published facts will cause considerable unrest in several quarters." The daily paper *Dagens Nyheter*, for instance, had already described the PCB problem as similar in scope to that of DDT. Like DDT, PCBs were described as ubiquitous contaminants "found in salmon and in pike…in sea eagle living on fish…on the surface of the needles of the fir trees…in the hair of a five months baby."[19] Monsanto management was initially skeptical that Jensen had actually detected PCBs. In December 1966, company physician Emmett Kelly, wrote from Monsanto's St. Louis headquarters to the Brussels office expressing doubt that PCBs could be present at such high levels in wildlife. Kelly believed that Jensen may instead have detected pesticide residues, such as the impurities formed during the manufacture of the herbicides 2, 4-D or 2, 4, 5-T. "These compounds," Kelly wrote, "would be much more liable to appear in salmon, pike, and sea eagles than any derived from Aroclors." These herbicides were also manufactured by Monsanto, however, and thus Kelly cautioned his colleague that pointing out this possibility may not be helpful to the company. "Our only problem," said Kelly, "is whether or not we want to bring these facts up and have our herbicide program receive another black eye. This, I will have to leave to your judgment."[20] By January 1967, however, the company received confirmation from a scientist at Shell Chemicals in England that the chemicals detected by Jensen were indeed PCBs.[21]

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[18] "Report of a New Chemical Hazard," *New* Scientist, December 15, 1966, p. 612; Sören Jensen, "The PCB Story," *Ambio* 1 (August 1972): 123-131; Robert Boyle and Joseph H. Highland, "The Persistence of PCBs," *Environment* 21 (June 1979): 6-13, 37-38.

[19] Rising & Strand to D. Wood, Monsanto, "re: Aroclor," November 28, 1966, PCB Documents.

[20] Emmet Kelly to D. Wood, "Aroclor Sweden," December 12, 1966, PCB Documents.

[21] D.V.M. Hardy to P.C. Benignus, "Aroclor-Sweden," January 12, 1967, PCB Documents.

Monsanto managers hoped that the company could exercise control over how Jensen's findings were presented to the public. With its long dominance of scientific and safety information on its products, Monsanto's Medical Department sought to continue to act as a filter for information on PCBs and to reassure workers, government agencies, and the public that the chemicals were safe. Monsanto managers thus sought to persuade Jensen to cooperate with the company in managing public disclosure of the findings. As news of Jensen's discovery trickled out of Sweden, Monsanto dispatched a team from its Brussels office to Sweden to meet with Jensen and assess the public reaction to his findings there. The Monsanto team learned that press coverage of the issue had already spread beyond Sweden to appear in the Danish press, and that the Swedish-American Press Agency planned to publish a story on the findings in "The Swedish American Journal." Several Swedish workers, meanwhile, had approached Jensen already about the potential health effects of PCBs. At a meeting with Jensen, the Monsanto team hoped to win his cooperation in managing the unfolding public debate over his findings. Monsanto's David Wood wrote to St. Louis that he had conveyed to Jensen "the need for care in any future publication of his work which is made." Wood concluded that Jensen was not Monsanto's real problem. Instead, the press had taken his work out of context and drawn alarmist conclusions. "The unfortunate aspect of the situation," Wood wrote, "is the comments which have been added to Jensen's work. He showed what was present and unqualified people have made statements as to the possible effect of what he has found." Jensen, according to Wood, had been cautious in drawing conclusions. Wood urged Monsanto to cooperate with Jensen and grant his request for pure samples of Aroclors for future research. He said such a gesture "would certainly be helpful in gaining his further support." "I am hopeful," he continued, "that we might persuade Jensen himself to write a letter defining the true extent of his own research work and placing his results in their proper perspective."[22]

At Monsanto's headquarters, meanwhile, there were concerns that the issue could cross the Atlantic. At a time of increasing public concern over pollution and the ecological and health effects of DDT and other pesticides, Monsanto managers feared

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[22] D. Wood to G.R. Buchanan, "Sweden, Aroclor," January 26, 1967, PCB Documents.

that the American media would vigorously pursue the PCBs story. "We are very worried," wrote Emmett Kelly to the Brussels office in February 1967, "about what is liable to happen in the states when the various technical and lay news media pick up on the subject. This is especially critical at this time because air pollution is getting a tremendous amount of publicity in the United States." Kelly noted that customers such as National Cash Register (NCR), which used Aroclors in its carbonless carbon paper, were already making inquiries. He asked his colleague in Brussels to send all available information on the situation in Sweden to St. Louis, including original stories from the Swedish press, Jensen's original paper in Swedish, the proceedings of the conference where Jensen presented his results, and the status of proposed toxicological work on PCBs in Europe. "The consensus in St. Louis," wrote Kelly, "is that while Monsanto would like to keep in the background in this problem, we don't see how we will be able to in the United States. We feel our customers, especially NCR, may ask us for some sort of data concerning the safety of these residues in humans." Thus, by early 1967, Monsanto managers were discussing options for responding to the PCBs problem should it spread to the U.S.[23]

"A Menacing New Pollutant"

The discovery of PCBs in the environment in the United States began in 1967 with the work of Monte Kirven, a researcher at the San Diego Natural History Museum, who was studying the peregrine falcon in the western United States. Peregrine falcon populations were declining across the country, and breeding populations had disappeared in both southern Canada and the eastern United States. Scientists suspected that the buildup of DDT and other pesticides in the food chain were a major cause of this decline. Because these compounds bioaccumulated at ever greater concentrations up the food chain, falcons and other birds of prey could be exposed to high levels of pesticides that affected their ability to breed. Kirven discovered an abandoned, unhatched falcon egg, which he brought to the laboratory of Robert Risebrough at the Institute of Marine Resources at the University of California, Berkeley for analysis. Risebrough found that

[23] R.E. Kelly to D. Wood, February 10, 1967, PCB Documents.

the egg contained DDE, a byproduct of DDT and a widespread pollutant. But he also detected unknown compounds, which had previously been found in fish and birds but not yet identified. Soon Risebrough learned of Jensen's identification of PCBs as the DDT-like chemicals found wildlife in Sweden. "With this clue," Risebrough later wrote, "further laboratory work made it clear that the hitherto unknown compounds were polychlorinated biphenyls."[24]

In December 1968, Risebrough, Kirven, and colleagues at Cornell University and the University of California, Davis, published their findings in the prestigious British science journal *Nature*. They reported that PCBs were present in several predator birds throughout the Pacific coast and had likely contributed to declining populations by disrupting essential biochemical signals in the birds' reproductive systems. Two months later, the *San Francisco Chronicle* interviewed Risebrough for a story headlined "A Menacing New Pollutant." The first major story on PCB pollution in the U.S. media, it struck a tone of alarm. It warned that PCBs not only threatened certain species of birds, but might also pose a risk to humans. Depicted as a canary in the coalmine for toxic pollution, the peregrine falcon was said to bear "a bitter warning to man." For humans, according to the *Chronicle* story, the "long-term hazards at low levels…are wholly unknown—although in concentrated gaseous form the chemical is highly poisonous, and chemicals closely related to it are known cancer-causers." Like DDT, it continued, PCBs were decimating the falcon, accumulating up the food chain, and appearing in surprisingly high concentrations wherever researchers looked. Initially, Monsanto remained quiet. "After three days of queries," noted the *Chronicle* piece, "a company spokesman would only say that top Monsanto scientists and sales executives were studying it."[25]

Risebrough's findings, however, did not take Monsanto officials by surprise. As in Europe, the company had an extensive information-gathering network that kept it abreast of important developments relating to its products. Monsanto had obtained

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[24] Robert Risebrough and Virginia Brodine, "More Letters in the Wind," in *Our World in Peril: An Environmental Review*, ed. Sheldon Novick and Dorothy Cottrell (Greenwich, Conn.: Fawcett, 1971), 243-255.

[25] Robert Risebrough et al., "Polychlorinated Biphenyls in the Global Ecosystem," *Nature* 220 (1968): 1098; David Perlman, "A Menacing New Pollutant," *San Francisco Chronicle*, February 24, 1969, p. 1.

prepublication information on the study well before it appeared in *Nature*. In the fall of 1968, a colleague from the National Agricultural Chemicals Association (NACA) gave E.P. Wheeler of Monsanto's Medical Department a copy of a recent presentation Risebrough had made at a toxicology conference at the University of Rochester. Wheeler was told that the presentation should be treated as "confidential" until the results were published because it had been obtained by the NACA from a scientific "source" who might be compromised. In a company memo, Wheeler wrote that "Risebrough has found PCBs along with chlorinated pesticides along the California coast as well as in waters off Baja California and Central America. He further reports PCB in fish from the Channel Islands and Puget Sound." Already looking for potential weak points to attack, Wheeler said that staff would give thorough scrutiny to "the analytical aspects and particularly the validity of some of the assumptions made by the author."[26]

In Sweden, Jensen had been reluctant to draw conclusions about the ecological or health consequences of the buildup of PCBs in the environment. As Monsanto officials put it, he agreed that "generalized statements out of context can only arouse undue public concern." Risebrough, however, had not been hesitant to publicize his alarming findings. In the *Chronicle* interview and subsequent articles he authored, Risebrough urged the pressing nature of the problem and called for tighter controls on PCBs. Officials at Monsanto had sought Jensen's cooperation, but they quickly took a more combative stance toward Risebrough. They viewed Risebrough as a threat to the company and associated his views with those of other chemical industry antagonists, such as environmental groups seeking restrictions on DDT. Monsanto managers hoped to refute the main conclusions of Risebrough's study point-by-point. They treated his findings not as scientific facts, but as contestable claims that could be challenged as uncertain, if not refuted in their entirety. In a March 1969 company memo, W.R. Richard of Monsanto's Research Center dismissed Risebrough's findings as "empty and false claims" that, if left unchallenged, could put PCBs under the same intense scrutiny as DDT.[27]

[26] E.P Wheeler to W.H. Richard, October 21, 1968, PCB Documents.
[27] D. Wood to G.R. Buchanan, "Sweden, Aroclor," January 26, 1967, PCB Documents; Robert Risebrough and Virginia Brodine, "More Letters in the Wind," 245; Perlman, "A Menacing New Pollutant," p. 1; W.R. Richard to E.P. Wheeler, "Aroclor Wildlife Accusations," March 6, 1969, PCB Documents.

Monsanto's scientific defense, as initially planned, had three elements: to determine whether Risebrough had falsely identified PCBs in wildlife samples, to establish tolerance (or "safe") exposure levels for certain species through toxicological studies, and to challenge the suggestion from Risebrough's work that PCBs were enzyme disruptors. The company's own tests soon dispelled doubts among Monsanto managers that PCBs had actually been detected by Risebrough. The focus turned to Risebrough's claim that PCBs were enzyme disruptors that could be harmful even at low concentrations. Like DDT, PCBs were believed to harm bird species by disrupting key enzymes in their reproductive systems. This led to thinner egg shells and lower fertility rates. "Risebrough has taken known Aroclor samples and claims to have evidence of enzyme and hormone change," W.R. Richard wrote his colleagues. Richard urged the company to construct a defensible line against this claim. "Either his position is attacked and discounted," Richard argued, "or we will eventually have to withdraw product from end uses which have exposure problems."[28]

Food Contamination

As Monsanto responded to the discovery of PCBs in fish and predatory birds, even more damaging reports came of PCB contamination of the human food supply. Most alarming was the 1968 "Yusho" incident in Japan, in which PCBs used as a heat-exchange fluid in pasteurization equipment leaked into rice oil (or "Yusho") that was sold for domestic use. More than a thousand people who consumed the oil suffered severe symptoms including skin lesions, temporary blindness, headaches, and skin darkening. Follow-up studies by Japanese researchers reported both miscarriages and symptoms of poisoning in children born to mothers exposed to the PCB-laden Yusho. Later reports also suggested that recovery from the symptoms of the poisoning was extremely slow and that survivors had higher incidences of cancer, particularly of the stomach and liver. In 1976, Tjkeshi Hirayama of Japan's National Cancer Center Research Institute told a conference at the Cold Spring Harbor Laboratory that the rates of liver cancer in Yusho

[28] W.R. Richard to E.P. Wheeler, "Aroclor Wildlife Accusations," March 6, 1969, PCB Documents.

victims were significantly higher among Yusho victims—500 per 100,000 compared to a rate of 31 per 100,000 in the general population.[29]

The first reports of PCB contamination of the U.S. food supply came in the late 1960s. Several separate contamination routes introduced PCBs into the food supply, all of which signaled the ubiquity of PCBs in industrial equipment. First, as in the Yusho incident, PCBs that were used as heat-exchange fluids in pasteurizers at food-processing facilities were leaking into foodstuffs—typically animal feeds. Second, PCBs turned up in paper food-packaging material made from both recycled and virgin stock. Recycled stock was being contaminated by PCB-laden carbonless copy paper and by certain printing inks, while virgin stock was believed to be contaminated by the equipment and water used in production. Finally, freshwater fish in commercial and recreational fisheries were being contaminated at significant levels through the leakage of PCBs from industrial facilities into waterways then bioaccumulation in aquatic food chains.[30]

Reports of PCB contamination of food led to the first federal regulatory response, led by the Food and Drug Administration (FDA) in the early 1970s. The FDA began seizing PCB-laden foodstuffs, to assess the scope and severity of the contamination through "food surveillance" activities, and it began setting temporary tolerance levels for PCBs in some foods. In one of the most serious food-contamination incidents, PCBs leaked from pasteurization equipment at a food-processing facility into fish meal, which was then fed to poultry and catfish. This led to recalls or seizures of poultry, eggs, fish, and feeds by the FDA and the U.S. Department of Agriculture in the early 1970s Dietary studies by the FDA between 1970 and 1972 found that the largest dietary exposure to PCBs came from fish, poultry, and cereal products (from paper packaging), but PCBs were also found in dairy products, eggs, and other packaged foods. Other studies in the early 1970s found that PCBs were accumulating in human fatty tissue. In 1973, the FDA issued regulations aimed at controlling the sources of PCB contamination in animal feed, food, and food-packaging materials and set temporary tolerances on the order of parts-

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[29] See M. Kuratsune, Y. Masuda, and J. Nagayama, "Some Recent Findings Concerning Yusho," in *Conference Proceedings: National Conference on Polychlorinated Biphenyls*, November 19-21, 1975 (Washington, D.C.: U.S. EPA, 1976), 14-29; 42 Fed. Reg. 6532, 6537; Morton Mintz, "Industrial Chemical PCBs is Linked to Liver Cancer," *Washington Post*, September 13, 1976, p. A1.

[30] See 38 Fed. Reg. 18096, 18097 (July 6, 1973).

per-million (ppm) for residues of PCBs in milk and dairy products, poultry, eggs, fish, and baby foods, as well as paper food-packaging and animal feed.[31]

Revelations of PCB contamination of the food supply gained significant traction in the national media in the early 1970s. Many stories compared PCBs to DDT. Stories in the *Washington Post* called PCBs a "new DDT" and a "DDT-like compound." A 1971 *New York Times* backgrounder on PCBs was headlined "If You Think DDT's a Problem, Meet PCB."[32] "Like many another chemical, such as DDT which it closely resembles," said the piece, "PCB has been found to be harmful to the environment, and possibly a peril to man himself." A 1971 story in the *Washington Post* catalogued the contamination: "all over the world—in Arctic polar bears, in house dust in Michigan, in a batch of New York chickens, in Minnesota turkeys, in milk from a West Virginia farm, in rainfall over Britain, in packaged noodles and in human blood plasma and human milk."[33] Like DDT and radioactive fallout, PCBs appeared to be everywhere. The flurry of public attention generated by the contamination incidents also prompted the first calls for a ban on PCBs. Following reports of contaminated fish meal that sickened poultry in twelve states in 1971, Representative William Ryan of New York became the first member of Congress to propose a total ban on PCBs.[34]

Monsanto's Response

Between 1969 and 1972, Monsanto implemented a strategy to respond to the growing public and regulatory pressures. In 1969 the company formed an "Ad Hoc Committee on Aroclors" to develop a comprehensive response aimed at allowing the company to continue sales of its PCB products. As stated at its first meeting, the objectives of the committee were to: "Permit continued sales and profits of Aroclors," "Permit continued development of uses and sales," and "Protect the image of Organic

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31 See Charles F. Jelinek and P.E. Corneliussen, "Levels of PCB's in the U.S. Food Supply," in *Conference Proceedings: National Conference on Polychlorinated Biphenyls*, 147-154; 38 Federal Register 18096 (July 6, 1973); Comment, "Federal Toxics Control: The Patchwork Attack on PCB's," *Environmental Law Reporter* 6 (1976): 10056, n.2.

32 Richard D. Lyons, "If You Think DDT's a Problem, Meet PCB," *New York Times*, September 26, 1971, p. E10.

33 *Washington Post*, December 27, 1971.

34 See also *Washington Post*, April 11, 1970; *Ibid.*, July 25, 1971.

Division and of the Corporation." In its first report, the committee warned that rising environmental concern had radically altered the situation for companies linked to pollution problems. The committee predicted that media coverage of the PCBs issue would be intense and highly alarmist. The "development of 'lunatic fringe' post-Rachel Carson," said a committee report, had led to the "domination of the media by scare publications in the public and scientific press." Reasonable debate, according to the report, would be impossible. Like DDT, the issue would likely become a mobilizing tool for groups pushing an extreme environmental agenda. "Only the most myopic individual in the business world," said the report, "could be unaware of the overwhelming interest and influences being directed at preventing contamination of the environment. The principal groups with an apparent avowed mission of providing a world of pristine pure food, water and air include many in academic and political fields who recognize the headline value of statements supporting these ideals."[35]

The committee considered several options for responding to the problem. One was to "say and do nothing—making the governmental agencies prove their case against Monsanto and its customers." As one committee member jotted in his notes, the company could simply "sell the hell out of them as long as we can and do nothing else." At the other extreme, Monsanto could immediately discontinue manufacture and sales of all PCBs. But the committee recommended instead a middle path that it termed the "responsible approach." This would include cleaning up leak problems at both Monsanto's and its customers' plants, moving away from sales of more chlorinated PCBs that were thought to be more hazardous, and developing and marketing less chlorinated PCBs and other substitute products. By taking these voluntary steps, according to the committee, Monsanto might avoid strict government regulation or an outright ban. "Hopefully," said the committee, "such a course would postpone precipitous action by governmental agencies for a few months and then limit any restrictions to Aroclors 1254 and 1260."[36]

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[35] Anonymous, "Report of Aroclor 'Ad Hoc' Committee, Second Draft," October 15, 1969, PCB Documents.
[36] *Ibid.*

Another central concern for Monsanto was legal liability. The company's "PCB Environmental Pollution Abatement Plan" considered the risk of lawsuits stemming from the presence of PCBs in the environment. Illustrated with graphs plotting profit and liability over time, the plan compared the middle-ground approach to both a "Do Nothing" option and an option to "Discontinue Manufacture of All Polychlorinated Biphenyls." Under the "Do Nothing" approach, the report indicated, profits would eventually decline while liability would grow rapidly in the future because the company would "likely face numerous suits." On the other hand, if Monsanto immediately discontinued making PCBs, profits would disappear but liability would remain as long as the chemicals persisted in the environment. Moreover, implementation of a total phase out, said the plan, would be "admitting guilt by our actions." Under the middle-ground approach, however, profits could continue to grow while liability would steadily decrease as the company replaced the more chlorinated PCBs and implemented new pollution controls and other clean-up measures.[37]

The "Ad Hoc Committee on Aroclors" planned a scientific strategy that would complement the company's other plans for keeping its PCB-containing Aroclors on the market. As Monsanto prepared to move away from more chlorinated PCBs, the committee urged the company to focus on mobilizing scientific data to defend the safety of less chlorinated PCBs. Much of the damaging scientific evidence on the toxicity and ecological persistence of PCBs came from studies involving more chlorinated PCBs. As the committee noted, "Aroclors 1254 and 1260 are the compounds which are found and reported in the literature by the Aroclor trade-names." By contrast, there were few studies on the toxicity and ecological properties of less chlorinated mixtures of PCBs such as Aroclor 1242. As the company began to transition its Aroclor product line to less chlorinated PCBs, the committee recommended that the company focus on the "development of data to protect the continued use of lower chlorinated biphenyls."[38]

Thus, a key argument for Monsanto—and later for electrical equipment manufacturers who used PCBs—was that less chlorinated PCBs were less hazardous than more chlorinated PCBs. More chlorinated mixtures of PCBs, such as Aroclors 1254 and

[37] Anonymous, "PCB Environmental Pollution Abatement Plan," Undated, PCB Documents.
[38] Anonymous, "Report of Aroclor 'Ad Hoc' Committee, Second Draft," PCB Documents.

1260, contained a higher percentage of PCB molecules with five or six chlorine atoms bound to the biphenyl rings (pentachlorobiphenyls and hexachlorobiphenyls). By contrast, less chlorinated mixtures, such as Aroclors 1242 and 1016, contained a higher percentage of PCB molecules with three and four chlorine atoms bound to the biphenyl rings. Monsanto maintained that the high toxicity, high environmental persistence, and low degradability observed in existing studies of PCBs were specific to the Aroclor mixtures that had a greater percentage of more chlorinated PCB mixtures. Less chlorinated mixtures, the company asserted, should be less toxic and less ecologically persistent. A 1970 letter to customers, for instance, stated that "PCBs with a chlorine content of less than 54% have not been found in the environment and appear to present no potential problem in the environment." As the company transitioned to less chlorinated PCBs, it sought to draw a sharp distinction between more and less chlorinated PCBs.[39]

Monsanto turned to laboratory testing of PCBs to support its two strategic scientific claims: that PCBs were not hazardous at low exposure levels and that less chlorinated PCBs were safer than more chlorinated PCBs. Monsanto commissioned toxicological studies from a private testing company with which it had a longstanding relationship, Industrial Bio-Test. Based outside of Chicago, Bio-Test was the nation's largest private testing firm. The firm had tested some of Monsanto's most important products, including its prized pesticide Roundup. Soon after Robert Risebrough's discovery of PCBs was reported in the *San Francisco Chronicle*, in early 1969 staff from Monsanto's Research Center met with top executives and scientists at Bio-Test to discuss Risebrough's findings and plan a response. They not only discussed an animal testing program on PCBs and suitable consulting scientists, but also the broader set of issues facing Monsanto. "We asked," said a Monsanto memo, "for consideration of [the] problem from public relations, DDT Wisconsin hearings, legal actions, and scientific aspects."[40]

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[39] Donald A. Olson, letter, February 18, 1970, PCB Documents. A discussion of the chemistry of PCBs and the different Aroclor mixtures can be found at 42 Fed. Reg. 6532, 6533-6534 (February 2, 1977).

[40] Mary Thornton, "EPA Review Finds Flawed Tests Made by Research Firm," *Washington Post*, May 13, 1983, p. A3; W.R. Richard, "Notes on Meeting 3/6/1969, Industrial Bio-Test Laboratories, Inc., Aroclor Wildlife," March 10, 1969, PCB Documents.

From 1969 through the mid-1970s, Bio-Test tested Aroclors on several species of birds, fish, and mammals. One aim of these tests, according to Monsanto's Ad Hoc Committee on Aroclors, was to create a body of data showing "that some low levels or concentrations are 'harmless' to some species in the environment. This gives Monsanto some defense." The company hoped to establish that at least some PCB products were "OK at low concentration." Monsanto managers expressed hope that the tests would indicate "harmless" or "no effect" levels of exposure on the order of hundreds of parts per million (ppm)—levels that would rarely be exceeded in nature. But already evidence was emerging that PCBs were highly toxic to aquatic species at even lower levels. Researchers in Florida, for instance, had found that shrimp were killed by exposure to PCBs at levels as low as 5 parts per billion (ppb). Because shrimp were the "most limiting species," Monsanto managers urged "biological studies on these species to confirm or deny adverse findings." In addition to closely scrutinizing the findings, Monsanto managers advised dispersing blame by pointing fingers at other chemicals. As one memo put it, "if Aroclor bad, others must be worse." As work began at Bio-Test, shrimp remained the most sensitive "limiting species." However, Monsanto officials soon learned that other species were also sensitive to very low concentrations of both the more and less chlorinated PCBs.[41]

Initial results from the animal studies at Bio-Test were not what Monsanto executives had hoped for. In January 1970, E.P. Wheeler, the company's Manager for Environmental Health, wrote a colleague in Brussels: "Our interpretation is that PCB's are exhibiting a greater degree of toxicity in this chronic study than we had anticipated. Secondly, although there are variations depending on species of animals, the PCB's are about the same as DDT in mammals. We have additional interim data which will perhaps be more discouraging. We are repeating some of the experiments to confirm or deny the earlier findings and are not distributing the early results at this time." In March 1970, Wheeler wrote to Bio-Test's President, Joseph Calandra, to express concern about the results and request that the fish study be repeated. "I think we are surprised (and

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[41] Anonymous, "Report of Aroclor 'Ad Hoc' Committee, Second Draft," October 15, 1989, PCB Documents; W.R. Richard to E. Wheeler, September 9, 1969, PCB Documents.

disappointed) at the apparent toxicity at the levels studied," Wheeler wrote. "I doubt there is any explanation for this but I do think that we might exchange some thoughts."[42]

Studies at Bio-Test also failed to support Monsanto's strategic claim that less chlorinated PCBs were less harmful than more chlorinated PCBs. Monsanto executives had hoped that a high "no effect" or "harmless" level could be established for less chlorinated PCBs such as Aroclor 1242. But instead Aroclor 1242 was found to be harmful to test animals at similarly low concentrations. In a three-generation rat study, for instance, animals fed Aroclor 1242 at a level of 100 ppm experienced significant reproductive problems. And chickens fed diets as low as 4 ppm laid eggs with a decreased hatch rate. Results for catfish and bluegill were even more alarming. A Monsanto official who visited Bio-Test in April 1970 reported that the fish studies were running several weeks behind schedule "because doses which were believed to be OK produced 100% kill."[43] An FDA toxicologist reviewing the results of Bio-Test's tests in 1971 said that there were "several areas of concern," particularly the "apparent effects on reproductive processes of the PCBs." In tests on chicken, he noted, the less chlorinated Aroclor 1242 had reduced the hatchability of eggs at levels as low as 4 ppm.[44]

Monsanto's strategy for defending PCBs, however, rested heavily on the assumption that Aroclor 1242 and other less chlorinated PCBs would be harmless at levels encountered in the wild. The company thus continued making this claim to customers and the public even after its own toxicological studies suggested otherwise. Despite the disappointing findings at Bio-Test, between 1970 and 1972 Monsanto implemented a plan along the lines urged by the Ad Hoc Committee on Aroclors. First, Monsanto began transitioning its Aroclor products away from more chlorinated and toward less chlorinated mixtures of PCBs. In 1971, Monsanto introduced a new less chlorinated mixture, Aroclor 1016, which contained an even smaller percentage of the more highly chlorinated PCB isomers than Aroclor 1242. Before 1971, Monsanto sold

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[42] E.P. Wheeler to D.S. Cameron, "Status of Aroclor Toxicological Studies," January 29, 1970, PCB Documents; E.P. Wheeler to Joseph C. Calandra, March 4, 1970, PCB Documents.
[43] W.H. Hunt to R.E. Kelly, "Aroclors—3 Generation Rat Reproduction and Fish Toxicity," April 29, 1970, PCB Documents.
[44] H. Blumenthal to Leo Friedman, "Updated review of toxicity studies in progress with polychlorinated biphenyls (Aroclor 1242, 1245 and 1260)," July 30, 1971, PCB Documents.

large quantities of Aroclors 1242, 1254, and 1260, among others, but sales of Aroclor 1016 would soon surpass sales of all other Aroclors combined. Second, Monsanto announced in 1972 that it would restrict sales of Aroclors to “closed systems,” thus limiting their use mainly to sealed electrical equipment such as transformers and capacitors, where the risk of leakage was considered lowest. The company had already, for instance, ceased selling Aroclors as “plasticizers,” which had been the largest “open” use of PCBs.[45]

Meanwhile, since little independent animal testing had been completed in the early 1970s, Monsanto still controlled much of the existing toxicological data on PCBs—and its interpretation. As media interest intensified after the food contamination incidents, Monsanto gave reassuring assessments on the results at Bio-Test. A *New York Times* story in September 1971, for instance, suggested that animal studies had found no evidence of high toxicity. Citing a Monsanto spokesman, the piece said “that no ill effects had yet been detected.”[46] Yet the testing underway at Bio-Test had already revealed significant reproductive toxicity in chickens and rats even at very low exposure levels, as well as extremely high toxicity in tests on fish species. The review by the FDA toxicologist who noted the decreased hatch rate in chickens, for instance, had been completed months earlier. Even as scientific evidence accumulated on the high toxicity of PCBs, Monsanto's control over the animal test data allowed it to plausibly downplay the hazards.[47]

With its announcement that it would restrict production and sales of PCBs to closed uses and its reassuring assessments of ongoing toxicity testing, Monsanto succeeded between 1972 and 1974 in convincing many that the problem was in check. A 1972 article in *Science* magazine, entitled “Polychlorinated Biphenyls: Still Prevalent, but Less of a Problem,” suggested that Monsanto had adequately controlled the hazards posed by the chemicals. It cited Monsanto's voluntary withdrawal of PCBs from open-

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[45] 42 Fed. Reg. 6532, 6533 (February 2, 1977); W.B. Papageorge, “PCB Environmental Problem September Status Report,” memo, October 6, 1970, PCB Documents; Comment, “Federal Toxics Control: The Patchwork Attack on PCB's,” 10056, n.2.
[46] Richard D. Lyons, “Panel Organized to Study DDT-Like Compound for Environmental Hazard,” *New York Times*, September 23, 1971, p. 32.
[47] See Blumenthal to Friedman, July 30, 1971, PCB Documents.

ended uses and its overall transition to “the less highly chlorinated PCB’s, which are certainly the least persistent and now appear to be the least toxic.” Monsanto’s actions may also have influenced the 1972 report by the federal Interagency Task Force on PCBs, which had been formed to coordinate regulatory efforts on the chemicals. Calling the task force’s report “optimistic,” a later commentator observed that it may have been influenced by Monsanto’s announcement to restrict sales to “closed systems.”[48]

In the mid-1970s, however, several developments undermined Monsanto’s campaign to keep PCBs on the market and brought new attention to discharges of PCBs from manufacturers of electrical equipment. First, monitoring programs revealed that fish in many important commercial and recreational fisheries had levels of PCBs above what was deemed safe for human consumption. This prompted new regulatory efforts at both the state and federal levels. Second, researchers at universities and government agencies contributed to a growing body of evidence on the high toxicity and environmental persistence of both more *and* less chlorinated PCBs. The proliferation of experts whose findings contradicted Monsanto’s reassurances soon overwhelmed the company’s ability to control the scientific debate. Finally, as information mounted on the health hazards of PCBs and the wide extent of the contamination problems, the EPA launched a new regulatory effort in 1975-77 to control PCB discharges under the Federal Water Pollution Control Act of 1972 (Clean Water Act), and Congress passed new legislation in 1976 mandating a complete phaseout of most uses of PCBs.

Contamination of Fisheries by PCBs

Contamination of the nation’s waterways by PCBs emerged as a major concern in the mid-1970s. Researchers found PCBs in rivers, lakes, and coastal waters throughout the United States: off the southern California coast; the Gulf of Mexico; Lake Michigan; Chesapeake Bay; and major rivers including the Hudson, Ohio, Mississippi, and

[48] Thomas H. Maugh II, “Polychlorinated Biphenyls: Still Prevalent, but Less of a Problem,” *Science* 178 (October 37, 1972): 388; Interagency Task Force on PCBs, *Polychlorinated Biphenyls and the Environment* (Washington, D.C., March 20, 1972); Comment, “Pounds of Cure: General Electric Agrees to PCB Abatement, Cleanup and Research,” *Environmental Law Reporter* 6 (1976): 10225.

Missouri.[49] This contamination rendered fish in important waterways unsafe for human consumption under FDA regulations. A study of fish in Lake Michigan by scientists at the U.S. Fish and Wildlife Service, for instance, detected PCBs in excess of the FDA's five parts per million (ppm) tolerance level in bloaters (an important commercial species) as well as salmon and trout (important sport fishes). Thus, many Great Lakes fishermen found that their catches were now deemed unfit for human consumption by the FDA.[50]

The most striking example of contamination was in the upper Hudson River in New York, where PCBs were first discovered in 1972. For years, General Electric (GE) had used PCBs at two capacitor plants on the Hudson River, at Edwards Falls and Fort Edward, which discharged PCB-laden effluents into the river. Through the early 1970s, both the federal EPA and the New York Environmental Conservation Department approved permits allowing GE to discharge some 30 pounds per day of PCBs into the river from its two plants. In 1975, however, EPA researchers found that rock bass downstream from GE's Hudson Falls plant had accumulated levels of PCBs as high as 350 ppm, a level higher than found in any other fish taken from a U.S. river. After the findings were reported to state officials, follow-up studies found high levels of PCBs in striped bass in the Hudson and salmon in Lake Ontario. When the state warned consumers not to eat these fish, the story on the "toxic peril" made the front page of the *New York Times* on August 8, 1975. The following month, the New York Environmental Conservation Department brought a state proceeding against GE, accusing the company of violating state water quality standards and severely damaging the river's commercial and sport fisheries. In a 1976 settlement with the state, GE agreed to spend $3 million on pollution controls to reduce its discharge levels, phase out PCB use in 1977, and contribute an additional $3 million to a cleanup program for the Hudson. Although the extent of PCB contamination of the Hudson and the ultimate cost of the cleanup would only become apparent much later, the case highlighted the threat PCBs posed to the nation's fisheries and the fact that significant environmental releases could also come

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[49] D. Steve Dennis, "Polychlorinated Biphenyls in the Surface Waters and Bottom Sediments of the Major Drainage Basins of the United States," in *Conference Proceedings: National Conference on Polychlorinated Biphenyls*, 183-194.

[50] Wayne Wilford, et al., "Trends of Polychlorinated Biphenyls in Three Lake Michigan Fishes," in *Conference Proceedings: National Conference on Polychlorinated Biphenyls*, 177-181.

from the manufacture of "closed systems" such as GE's capacitors, which had been touted as the least likely source of leaks.[51]

Not only did PCB contamination of fisheries mean that many fish were deemed unsafe for human consumption, new laboratory research found that PCBs could be highly toxic to fish. Monsanto had hoped to demonstrate that the less chlorinated PCBs were "okay" at modest levels, but research by EPA scientists contradicted this claim. At a 1975 EPA conference on PCBs, EPA researcher Alan Nebeker observed that PCBs were "toxic to freshwater fish and other aquatic organisms at very low levels." Moreover, this high toxicity was not confined to more chlorinated Aroclors 1254 and 1260. Among freshwater fish, crustaceans, and aquatic insects, Nebeker noted, the less-chlorinated "Aroclors 1016 and 1242 have been shown to have similar toxicity."[52] Another EPA scientist at the conference observed that "while increasing chlorine content increases toxicity in warm-blooded animals, increasing chlorine content decreases toxicity of PCB's to aquatic animals. This observation is exceedingly important in determining the future actions on PCB's." The less chlorinated PCBs marketed by Monsanto as the solution to the PCBs problem, government researchers now reported, could be even more toxic to than their more chlorinated cousins.[53]

During congressional debate in 1976 on a proposed phaseout of PCBs, supporters of the proposal focused heavily on the accumulating reports of PCB contamination of waterways and fisheries. On the floor of the House, for instance, Representative John Dingell of Michigan, a co-sponsor of the PCB ban, said that PCBs "are in fish in the Hudson River, they are in fish in the Great Lakes, and they are one of the reasons that the fish caught in the Great Lakes cannot be marketed commercially." In the Senate, meanwhile, Senator Gaylord Nelson backed his call for a ban with articles detailing the effects of PCB pollution on the commercial fishing industry of his home state of

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[51] Boyle and Highland, "The Persistence of PCBs," 6-12, 37-8; Comment, "Pounds of Cure," 10225; Richard Severo, "State Says Some Striped Bass and Salmon Pose a Toxic Peril," *New York Times*, August 8, 1975, p. 1.
[52] Alan V. Nebeker, "Summary of Recent Information Regarding Effects of PCB's on Freshwater Organisms," in *Conference Proceedings: National Conference on Polychlorinated Biphenyls*, ed. Buckley, Kopp, and Ayer, 284-292
[53] Donald I. Mount, "Summary of Session IV," in *Conference Proceedings: National Conference on Polychlorinated Biphenyls*, 462.

Wisconsin. An article from the *Bulletin of the Lake Michigan Federation* titled "PCBs Cost Jobs, Too," for instance, described the economic impact of the FDA's ban of PCB-contaminated fish on small commercial fishermen in Wisconsin. A fourth-generation fisherman from Green Bay quoted by the article said, "As long as little is done to stop the source, not merely the result, many more will suffer."[54]

Monkeys and Rats: The Toxicity of PCBs

Another setback to Monsanto's campaign to keep PCBs on the market came from accumulating data on their toxicity by government and university scientists. A growing body of laboratory research indicated that PCBs were highly toxic to a variety of fish, birds, and mammals, even at very low levels of dietary exposure. And though most of the data still related to the more chlorinated PCBs, several studies now suggested that less chlorinated PCBs (which Monsanto argued would be safe at modest exposure levels) were also highly toxic to test animals at very low levels of exposure. Some studies, for instance, suggested that the less chlorinated Aroclor 1242 might be even more toxic than more chlorinated PCBs to both chickens and rhesus monkeys. New research also began to trace the biochemical mechanisms through which PCBs induced their toxic effects in mammals. Studies now suggested that PCBs interfered with an enzyme system in the liver involved in the detoxification of foreign chemicals. Finally, and most damaging for Monsanto and industrial users of PCBs, government researchers found evidence that both more *and* less chlorinated PCB mixtures were carcinogenic in lab rats, indicating a potential carcinogenic risk to humans.[55]

Among the strongest pieces of evidence on the toxicological effects of PCBs came from chronic feeding studies on rhesus monkeys. Studies conducted in the mid-1970s by James R. Allen at the University of Wisconsin Medical School found that even very low levels of dietary exposure to PCBs could cause poisoning and death in exposed monkeys. He also found significant effects on infant monkeys born to exposed mothers.

[54] U.S. Library of Congress, *Legislative History of the Toxic Substances Control Act* (Washington, D.C.: U.S. Government Printing Office, 1976), 581; *Ibid.*, 234-240.
[55] A summary of the toxicological data on PCBs, as of 1977, was assembled by the EPA at 42 Fed. Reg. 6532, 6534-6538 (February 2, 1977).

In one experiment, Allen and his colleagues fed six female monkeys 25 ppm of Aroclor 1248 for two months. The monkeys suffered severe acneform lesions on their faces, lost hair and eyelashes, and gave birth to underweight infants. The toxic effects were so severe that the experimental feeding of PCBs was discontinued after just two months. One of the monkeys died two months later. Those that survived continued to show signs of poisoning for years after their exposures. In another experiment, female monkeys were fed Aroclor 1248 at dietary doses as low as 2.5 ppm. They suffered similar toxic effects, including hair loss and acne. In subsequent breeding, only five of eight animals fed 2.5 ppm were able to carry their infants to term, the other three spontaneously aborting or having stillbirths. Allen's studies indicated that chronic exposure of primates to PCBs even at very low dietary levels of PCBs—levels already detected in certain foods by the FDA—could cause systemic toxic effects and reproductive dysfunctions. Other studies on rhesus monkeys, conducted by James McNulty of the Oregon Regional Primate Center, found similar toxic effects in tests of a less chlorinated PCB mixture, Aroclor 1242. Results from the monkey studies would figure prominently in Senate debate on a phase out of PCBs in 1976. Pressing for a phaseout, Senator Gaylord Nelson quoted a Library of Congress report stating that "very low PCB levels are dangerous to primates, causing facial swelling, loss of hair, acne lesions within one month, birth defects, miscarriages, stillbirths, and death."[56]

The most severe blow to Monsanto's defense of PCBs, however, came from studies in the early and mid-1970s that tagged PCBs as a suspected human carcinogen. The first evidence that PCBs could be carcinogenic came from studies by Renate Kimbrough, a toxicologist at the Centers for Disease Control (CDC). In the early to mid-1970s, Kimbrough and colleagues studied the potential carcinogenicity of PCBs by feeding commercial mixtures of Aroclors to various strains of mice and rats. In early studies, Kimbrough exposed mice and rats to dietary concentrations on the order of hundreds of parts per million (ppm) of more chlorinated PCB mixtures. Kimbrough reported, for instance, that rats exposed to 100 ppm of Aroclor 1254 developed

[56] J.R. Allen and D.H. Norback, "Pathobiological Responses of Primates to Polychlorinated Biphenyl Exposure," in *Conference Proceedings: National Conference on Polychlorinated Biphenyls*, 43-49; 42 Fed. Reg. 6534-6535; Library of Congress, *Legislative History of the Toxic Substances Control Act*, 235.

precancerous lesions in their livers within eight months, and that mice exposed to 300 ppm of Aroclor 1254 developed precancerous lesions after eleven months. These experiments suggested that PCBs were potential carcinogens.[57]

Kimbrough's work promised to significantly strengthen the case for stringent regulation of PCBs. Monsanto thus looked for ways to challenge this emerging evidence linking PCBs to cancer. Its testing firm, Bio-Test conducted parallel carcinogenicity tests on rats. Bio-Test also worked with Monsanto to challenge Kimbrough's findings in the administrative arena. An April 1975 letter from Bio-Test president Joseph Calandra to Monsanto discussed Kimbrough's findings of precancerous lesions in test animals. One of Kimbrough's studies, Calandra claimed, had been "successfully counteracted by BIO-TEST and Monsanto personnel." Kimbrough later told the *Wall Street Journal* that Calandra and other IBT officials had lobbied federal regulatory agencies against her study in favor of an IBT study finding no evidence of cancer.[58]

In 1975 Kimbrough published the results of a study that provided the strongest evidence yet that PCBs were carcinogenic in lab rats. Unlike earlier studies, which followed smaller groups of animals for shorter periods of time, this study tracked 184 female Sherman rats for twenty-one months. Twenty-six of the 184 rats, fed 100 ppm of Aroclor 1260, developed hepatocellular carcinomas (liver cancer) compared to just one rat in the control group. And 144 of the 184 test rats developed precancerous lesions, compared to zero in the control group. Kimbrough's study provided strong evidence that PCBs caused malignancies at dietary levels as low as 100 ppm. Kimbrough's analysis of the tests was subsequently confirmed by the head of the Tumor Pathology Section at the National Cancer Institute and by two other pathologists. At 1975 Senate hearings on toxic substances legislation, an EPA official would cite Kimbrough's study as strong evidence that PCBs were carcinogenic. And when the agency subsequently issued regulations on PCBs under the Clean Water Act, it stated that because of "this well-

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[57] Renate Kimbrough, R.E. Linder, and T.B. Gaines, "Morphological Changes in Livers of Rats Fed Polychlorinated Biphenyls," *Archives of Environmental Health* 25 (1972): 354-364; Renate Kimbrough and R.E. Linder, "Induction of Adenofibrosis and Hepatomas of the Liver in BALB/cJ mice by polychlorinated biphenyls (Aroclor 1254)," *Journal of the National Cancer Institute* 53 (1974): 547-552.

[58] J.C. Calandra, "Review of PCB Meeting," memo, April 18, 1975, PCB Documents; Bill Richards, "Papers From Trial of Former IBT Officers Raise Many Questions on Product Safety," *Wall Street Journal*, May 13, 1983, p. 31.

conducted and well reported experiment it can be concluded that Aroclor 1260" caused liver cancer in rats.[59]

Kimbrough's new study proved difficult for Bio-Test and Monsanto to attack. "BIO-TEST has no means at its disposal," Calandra wrote to Monsanto, "to dispute the findings of Kimbrough that Aroclor 1260 in female Sherman rats is a liver carcinogen except on the basis of experimental design." The only potential weaknesses that could be attacked, Calandra explained, were that the study used only female rats and that "to our knowledge no one else has reported similar results in rats." Despite the damaging new findings, Calandra assured its important client that Bio-Test would do everything possible to help aid the effort to defend PCBs. "[W]e are prepared," Calandra wrote to Monsanto officials, "to assist Monsanto in any adversary situation in or out of government."[60]

Monsanto management had hoped that the results of animal testing at Bio-Test could be used to rebut Kimbrough's findings. But Bio-Test's studies instead appeared to confirm the finding of carcinogenicity in rats. Bio-Test conducted rat studies on three of Monsanto's products: the less chlorinated Aroclor 1242, and the more chlorinated Aroclors 1254 and 1260. In each case, Bio-Test found hepatomas in the test rats and reported that the product was "slightly tumorigenic." At the urging of Monsanto managers, however, Bio-Test agreed to change the wording of the reports to "does not appear to be tumorigenic." Bio-Test first changed the reports for Aroclors 1242 and 1260. In July 1975, George Levinskas, Monsanto's Manager of Environmental Assessment and Toxicology, wrote to Bio-Test president Joseph Calandra to request that the report on Aroclor 1254 also be reworded. "In 2 instances," wrote Levinskas, "the previous conclusion of 'slightly tumorigenic was changed to 'does not appear to be carcinogenic.' The latter phrase is preferable. May we request that the AROCLOR 1254 report be amended to say 'does not appear to be carcinogenic.'" Calandra later responded affirmatively. "We will amend our statement," he wrote, "in the last paragraph

[59] Renate Kimbrough et al., "Induction of liver tumors in Sherman Strain Female Rats by Polychlorinated Biphenyl Aroclor 1260," *Journal of the National Cancer Institute* 55 (1975): 1453-1459; Testimony of Dr. John L. Buckley, Consultant, EPA Office of Research and Development, October 24, 1975, in U.S. Congress, Senate Committee on Commerce, Subcommittee on the Environment, Hearing, *Toxic Substances Control Act* (U.S. Government Printing Office, Washington, D.C., 1976), 69; 42 Fed. Reg. 6537.
[60] Calandra, "Review of PCB Meeting," April 18, 1975, PCB Documents.

on page 2 of the Aroclor 1254 report to read, 'does not appear to be carcinogenic' in place of 'slightly tumorigenic' as requested." Armed with such reassuring conclusions, Monsanto continued to lobby regulatory agencies against stricter controls. A 1975 Monsanto memo noted that company personnel were "visiting with the staffs of the various interested federal agencies (NIOSH, FDA, EPA, etc.) in the company of the president of Bio-Test to review with those agencies the accumulated data showing the non-carcinogenic conclusions reached by the Bio-Test feeding studies." Monsanto and Bio-Test hoped to "convince these agencies of Monsanto's responsible course of action."[61]

Bio-Test's ability to assist Monsanto, however, soon became a casualty of federal investigations. Beginning in 1976, allegations surfaced that many tests performed at the firm were flawed, and in some cases falsified. Federal investigators found evidence of sloppy lab work leading to inaccurate results and that the company had faked toxicological studies on pesticides and pharmaceuticals. The government prosecuted Calandra and three other Bio-Test officials for fraud in relation to toxicity and carcinogenicity studies on pesticides for the Chemagro Corporation, an arthritis drug for the Syntex Corporation, and an antibacterial agent for Monsanto. Bio-Test's testing results were often flawed, according to government evidence, because rats and mice that died during the course of studies because of neglect or other reasons were not reported in the results. A mistrial was ultimately declared for Calandra. But three former officials of Bio-Test including the former head of toxicology were convicted of fraud in 1983. The disclosure of fraudulent testing at Bio-Test forced the EPA and chemical companies to retest hundreds of chemicals, including 15% of all pesticides approved for use in the United States. While documents filed in court detailed Bio-Test's agreement with Monsanto to reword its report on the carcinogenicity tests of PCBs, no Monsanto officials

[61] George J. Levinskas to J.C. Calandra, "re: AROCLOR 2-year Rat Feeding Studies," July 18, 1975, PCB Documents; Calandra to Monsanto, July 1975, quoted in Susan Saiter, "3 Manufacturers Ignored Unfavorable Safety Test of Chemical," *New York Times*, May 21, 1983, p. 1, 8; Anonymous, "Monsanto PCB Position Paper," January 1, 1975, PCB Documents.

were charged, nor did the allegations of fraud against Bio-Test extend to the PCBs testing.[62]

By 1976 Monsanto's strategy for defending PCBs was increasingly undermined by new data on the toxicity of PCBs, reports that the chemicals were even more widespread than initially suspected, and the realization of government officials that voluntary restrictions had failed to stop their spread. In the debate over the toxicity of PCBs, the studies commissioned by Monsanto had been superseded by a series of findings by government and university researchers that painted a far more damaging picture of PCBs. Meanwhile, as the contamination of the Hudson River by GE capacitor plants made clear, merely limiting the use of PCBs to purportedly "closed system" uses would not prevent their leakage into the environment. In 1975, the EPA estimated that around 10 million pounds of PCBs made their way into the environment each year, mainly through leaks, spills, and vaporization. As a Library of Congress report observed, "Although Monsanto…has voluntarily limited PCB sale to a few companies for use in electrical closed systems, the problem of more PCBs entering the environment through these routes, from existing equipment, and from imported stocks, still exists."[63]

Regulation of PCBs and the Electrical Equipment Industry

Accumulating data on the toxicity of PCBs and rising public concern about the contamination of fisheries prompted renewed demands for federal regulatory action in the mid-1970s. Still, the Environmental Protection Agency (EPA) moved slowly against PCBs. As a 1978 opinion by the Court of Appeals for the D.C. Circuit put it, "the history of EPA's PCBs proceedings is a history of frustration of a congressional mandate for action." Before 1976, the agency's primary authority for regulating PCBs was the Federal Water Pollution Control Act Amendments of 1972 (Clean Water Act). The Act directed the EPA to publish a list of toxic substances and set effluent standards for the

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[62] Kevin Klose, "Ex-Officials of Chemical-Testing Lab Found Guilty of Falsifying Results," *Washington Post*, October 22, 1983, p. A7; Richards, "Papers from Trial of Former IBT Officers Raise Many Question on Product Safety," *Wall Street Journal*, May 13, 1983, p. 31; "Former Lab Worker Queried on Altered Data," *New York Times*, May 15, 1983, p. A34.

[63] Comment, "Federal Toxics Control: The Patchwork Attack on PCB's," 10057; Library of Congress report, reproduced in U.S. Library of Congress, *Legislative History of the Toxic Substances Control Act*, 235.

listed substances by 1974. In 1973 the EPA published a list of nine toxic substances, including PCBs, and the following year held an evidentiary hearing on proposed effluent standards. But after the hearing, the EPA declined to issue final standards for PCBs or the other listed substances. The agency cited a lack of sufficient evidence in the hearing record to support standards that could withstand legal challenges and said that more time was needed to gather additional data. To fill this information gap, the EPA sponsored a national conference on PCBs in Chicago in November 1975, bringing together experts from government, industry, and universities, and it commissioned a "Criteria Document" to gather and synthesize the existing data on PCBs. After a wave of lawsuits by environmental groups challenging the agency's failure to issue toxics standards, the EPA ultimately entered into a consent decree in 1976 in which it agreed to issue effluent standards for toxics including PCBs.[64]

As the EPA prepared to set effluent standards for PCBs under the Clean Water Act, Congress attached an amendment to the Toxic Substances Control Act (TSCA) of 1976 providing for a complete phaseout of the manufacture, processing, and distribution of PCBs (subject to limited exceptions) over a two-and-a-half year period. The only chemicals singled out in the 1976 Act, PCBs were targeted for a phaseout largely because of the mounting evidence of their toxicity—particularly their carcinogenicity—and the discovery of widespread PCB contamination of fisheries. As one commentator observed, "That this subsection was added to both Senate and House versions of the Act by floor amendment despite opposition to singling out one substance to the exclusion of others, is a reflection of the extremely hazardous nature of PCB's."[65] The phaseout also reflected congressional frustration with the failure of existing regulatory efforts to control the problem. After introducing the phaseout amendment on the floor of the Senate, Senator Gaylord Nelson remarked that "the PCB problem shows no sign of abating" and argued that it was thus necessary to tackle the problem with specifically targeted legislation.[66]

By the end of 1977, Monsanto had ceased all manufacture of PCBs and shipped the last of its inventory of Aroclor products. But as Monsanto itself phased out of both

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[64] EDF v. EPA, 598 F.2d 62, 67-69 (D.C. Cir. 1978).
[65] Joel Reynolds, "The Toxic Substances Control Act of 1976: An Introductory Background and Analysis," *Columbia Journal of Environmental Law* 4 (1977): 36-96, p.78.
[66] U.S. Library of Congress, *Legislative History of the Toxic Substances Control Act*, 235.

the business of PCBs and the political and scientific debates on the chemicals, the electrical-equipment industry—a continued source of PCB pollution—took up Monsanto's strategy of seeking to distinguish less chlorinated PCBs from more chlorinated PCBs. Through the industry's trade association, the Electronics Industries Association (EIA), manufacturers of capacitors and transformers challenged both the EPA's effluent standards under the Clean Water Act and, on a parallel track, pushed for various exemptions from the phaseout of PCBs mandated by TSCA.[67]

In 1976 and 1977, the EPA set strict effluent standards under the Clean Water Act for discharges of PCBs into waterways by manufacturers of capacitors, transformers, and other electrical equipment. Electrical equipment manufacturers vigorously challenged the regulations, first in the administrative arena and then in the courts. Their central substantive argument—continuing Monsanto's earlier strategy—was that the EPA should draw a distinction between more chlorinated mixtures of PCBs (such as Aroclors 1248 and 1254) and less chlorinated mixtures of PCBs (such as Aroclors 1016 and 1242). The industry advanced two arguments: that existing studies showed the less chlorinated PCBs to be less toxic and less prone to bioaccumulation and that there was simply too little existing evidence on less chlorinated PCBs to regulate them. Led by the PCB Ad Hoc Committee of the Electronics Industries Association and Westinghouse Electric, the industry advanced these arguments at EPA hearings on proposed standards in 1976, and, after the EPA rejected its arguments, in a legal challenge to the final EPA standards.[68]

In July 1976, the EPA issued proposed effluent standards for discharges of PCBs. The proposed standards included a daily average of no more than one part per billion (ppb) in certain types of discharges by electrical equipment manufacturers and a complete prohibition on PCBs in other types of the industry's discharges. The EPA then began formal rulemaking hearings on the proposed standards. At lengthy hearings in the fall of 1976, both the PCB Ad Hoc Committee of the Electronics Industries Association (EIA) and Westinghouse urged the agency to adopt a less stringent effluent standard of 100 ppb for Aroclor 1016—the most widely used PCB product. Westinghouse also urged a more

[67] See EDF, 598 F.2d at 67-69 (Clean Water Act); EDF v. EPA 636 F.2d 1267, 1271 (D.C. Cir. 1980) (Toxic Substances Control Act).
[68] 42 Fed. Reg. 6532, 6541-6543 (February 2, 1977); EDF, 598 F.2d at 67-69.

relaxed standard of 50 ppb for Aroclor 1242. The EIA presented seven expert witnesses, drawn from within the industry and from consulting firms, in support of its position that less stringent standards should be set for less chlorinated PCBs. But the industry witnesses often lacked relevant expertise or experience in the subject matters upon which they testified. On the other side, by contrast, the EPA presented twenty-two witnesses representing a virtual "who's who" of PCBs researchers. Testimony backing the EPA's case for regulation included, for instance, a presentation on the global contamination of seabirds by Robert Risebrough, extensive testimony on the toxicity and carcinogenicity of PCBs in rats by Renate Kimbrough, and a discussion of findings of severe toxicity of PCBs in monkeys by James Allen of the University of Wisconsin.[69]

Industry witnesses at the hearings urged that the less chlorinated PCBs mixtures, Aroclors 1016 and 1242, were both less toxic and less prone to bioaccumulation in aquatic ecosystems than more chlorinated mixtures of PCBs. At each turn, however, their assertions were strongly rebutted by experts testifying for the EPA—sometimes by the very researchers whose findings were under discussion. Industry witnesses were ill-prepared to effectively challenge the EPA's position that all mixtures of PCBs were extremely toxic even at very low levels. Wolfgang Mueller, the lone EIA expert to challenge the EPA's evidence on the toxicity of PCBs in mammals, was an expert in chemistry and toxicokinetics, but not in the key areas of pathology, toxic effects, and carcinogenesis. Although Mueller gave testimony challenging the toxicity of less chlorinated PCBs in rats and rhesus monkeys, he was unaware of ongoing studies on five other species of mammals. Thus, neither he nor any other witnesses questioned the agency's evidence on the high toxicity of PCBs in dogs, mink, pigs, and humans, among others. Mueller also challenged a study suggesting that the less chlorinated Aroclor 1242 could be more toxic to monkeys than the more chlorinated Aroclor 1248. In that study, several monkeys fed 1242 at 10 ppm died within 60 days, while one monkey fed only 3 ppm also died. Mueller argued at the hearings that the study should be discounted because it was based solely on the death of a single monkey exposed at 3 ppm. The EPA,

[69] 42 Fed. Reg. 6532-6544 (February 2, 1977); EDF, 598 F.2d at 69. Only one environmental group, the Environmental Defense Fund (EDF), presented a witness, an epidemiologist who testified on the preliminary results of a study finding an increased incidence of cancer among workers at Mobil Oil Company's Paulsboro, New Jersey plant who were exposed to PCBs. 42 Fed. Reg. 6537.

however, concluded that Mueller's attack on the study was based on a "false proposition" that the study's conclusions were based solely on the death of that single monkey. The agency noted that the study's conclusions were actually based on a variety of factors, including the deaths of animals fed at 10 ppm and higher doses of 1242, other feeding studies, and observations of all of the exposed animals.[70]

The industry's experts also challenged the conclusions of studies on rats conducted by the CDC's Renate Kimbrough. Mueller, the EIA's witness, argued that Kimbrough's studies indicated that Aroclors 1016 and 1242 had shown less liver toxicity than had the more chlorinated mixtures, Aroclors 1254 and 1260. Mueller pointed, for instance, to the fact that rats exposed to 1016/1242, unlike those exposed to 1254/1260, had not developed "adenofibrosis." But the EPA found that there was no substantial difference in the pathological results between 1016/1242 and 1254/1260 "once one fairly compared the results for male rats at the same dose levels and for the same time period." Mueller sought to draw an additional distinction, based on Kimbrough's studies, between the effects of Aroclor 1016—for which the EIA sought relaxed effluent standards—and Aroclor 1242. Mueller pointed again to differences in the pathological changes induced in the livers of rats exposed to the different Aroclors. But he was rebutted at the hearing by Kimbrough, the author of the study, who "stated that the differences were minor and that the small sizes of the sample groups precluded firm conclusions." Mueller also sought to differentiate 1016 from 1242 by arguing that 1242 would be retained at much higher levels in rat tissues than 1016. In fact, according to the EPA, "Kimbrough found residue levels of Aroclor 1016 in the adipose tissue of rats to be almost double those for 1242."[71]

Another industry witness made the case that the less chlorinated mixture, Aroclor 1016, was less toxic to fish than more chlorinated PCBs. But here, too, the industry expert was vigorously rebutted by EPA witnesses more familiar with the data on PCBs. Gerald Lauer, a scientist with a private consulting firm retained by the industry, testified that "the more recent and, for the most part, the more reliable data indicate that Aroclor 1016 ranges from slightly less toxic to one hundred times less toxic than the more

[70] 42 Fed. Reg. 6535.
[71] 42 Fed. Reg. 6542.

chlorinated Aroclors." Witnesses for the EPA, however, pointed out that Lauer's claim was true only for that species of fish when newly hatched. At all other life stages, the toxicity of Aroclor 1016 was comparable to that of more chlorinated mixtures. Other studies, meanwhile, showed that both Aroclors 1016 and 1242 were just as toxic as 1254 to aquatic species. "In reaching his conclusion," observed an EPA summary of the hearings, "Dr. Lauer apparently overlooked the additional studies…which showed adverse effects from Aroclors 1016 and 1242 at low levels."[72]

After the hearings, the EPA firmly rejected the position of the EIA and Westinghouse that the agency should set separate, less stringent standards for Aroclors 1016 and 1242. The EPA's final regulations made no distinction between less chlorinated and more chlorinated PCBs. Concluding that there was no justification for setting different standards, the final regulations stated: "All PCB mixtures currently in use, including Aroclors 1016 and 1242, are capable of inducing severe toxic effects at low levels, with only minor variations in some instances…" Noting the Clean Water Act's statutory mandate to provide an "adequate margin of safety," the agency said that "any doubts in this area should be resolved in favor of protection, and against making distinctions among Aroclors." The final effluent standards, in fact, were even more stringent that the originally proposed standards, prohibiting PCBs in *all* discharges by manufacturers of electrical equipment.[73]

Defeated in the administrative arena, the EIA and Westinghouse challenged the EPA's prohibition on discharges of less chlorinated PCBs in court. The industry's principal substantive challenge to the standards was that the EPA lacked a sufficient evidentiary basis for regulating less chlorinated PCBs, since much of the record consisted of studies on more chlorinated PCBs. But in 1978 the Court of Appeals for the D.C. Circuit upheld the EPA's standards in *EDF v. EPA*.[74] First, the court rejected the industry's position that the EPA had to demonstrate "a clear line of causation between a particular chemical and harm to public health or the environment." Noting that the Clean Water Act provision required the EPA to set standards requisite to provide an "ample

[72] 42 Fed. Reg. 6541.
[73] 42 Fed. Reg. 6541, 6543, 6554.
[74] 598 F.2d at 90.

margin of safety," the court said that Congress had "authorized and, indeed, required EPA to protect against dangers before their extent is conclusively ascertained."[75] Second, the court said that, given the large number of toxic substances subject to regulation, considerations of administrative feasibility made it necessary for the EPA to sometimes draw inferences from available data on related substances—in this case the studies of more chlorinated PCBs.[76] Finally, the court conducted a detailed review of the EPA's scientific evidence as to the toxicity, persistence, and degradability of less chlorinated PCBs. In each area, the court found that the EPA had permissibly filled gaps in the data on less chlorinated PCBs through inferences from studies on more chlorinated PCBs, including the agency's key evidence on carcinogenicity. Reviewing the EPA's decision under the relatively deferential "substantial evidence" standard, the court upheld the EPA's total prohibition on discharges of all PCBs by electrical equipment manufacturers.[77]

Conclusion

The evolving efforts by the Monsanto Chemical Company (and later by large users of PCBs in the electrical equipment industry) to respond to scientific revelations of the hazards of PCBs provide a window onto how industrial polluters sought to challenge the evidentiary basis for strict regulation during a period of mounting public concern over toxics and a decline in the ability of firms to control data on the hazards posed by their products and byproducts. First, as Monsanto received initial reports that PCBs were leaking into the environment and contaminating wildlife, the company explored how to either keep the findings quiet or discredit the research. When efforts to question the presence of PCBs in the environment faltered, the company began focusing on toxicological studies in hopes of establishing "thresholds," or "safe levels," of exposure to PCBs below which humans and wildlife would not be at risk. But as it became increasingly clear the PCBs had significant toxicity even at extremely low exposure

[75] *Ibid.* at 83.
[76] *Ibid.* at 84-85.
[77] *Ibid.* at 85-90.

levels, Monsanto launched a coordinated plan to keep PCBs on the market. It phased out the most troublesome "open" uses of PCBs and shifted production toward less chlorinated mixtures of PCBs. Like the asbestos industry's claim that there were both safe and dangerous forms of asbestos fibers, Monsanto sought to convince regulators and the public that only the more chlorinated PCBs—already being phased out by the company—were of real concern.[78] As Monsanto left the policy debate after the manufacture of PCBs was banned in 1976, its successors in the electronic equipment industry continued to urge that the less chlorinated PCBs were less toxic, less ecologically persistent, and less prone to bioaccumulation than their more chlorinated chemical relatives. As the EPA put in place strict regulations on discharges of PCBs into waterways in 1976 and 1977, the makers of PCB-filled capacitors and transformers argued that there was insufficient evidence to justify stringent controls on the less chlorinated PCBs that Monsanto had increasingly sold them since the early 1970s.

The failure of these efforts reflected a political and legal environment in the 1970s that demanded precautionary action against toxics—particularly suspected carcinogens—before definitive proof of harm to humans. While the intervention of Congress in specifically targeting PCBs for a near total ban was unique, in other respects the PCBs story paralleled the restrictions placed on DDT and other pesticides that were identified as potential human carcinogens in the 1970s. Both Congress and the courts pushed the EPA and other agencies to give highest priority to suspected carcinogens and to regulate well before there was conclusive evidence that they caused cancer in humans. By necessity, regulators relied heavily on inferences from animal studies. By the mid-1970s, the courts had upheld stringent restrictions on DDT, chlordane and heptachlor, and aldrin and dieldrin, all largely based upon evidence of carcinogenicity in animal studies. As with PCBs, the dossier of evidence assembled by the EPA to back regulation of these pesticides was largely a summary of existing studies from which the agency drew a qualitative inference of a cancer risk to humans.[79]

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[78] On the similar tactics used by the asbestos industry, see Robert Proctor, *Cancer Wars: How Politics Shapes What We Know and Don't Know About Cancer* (New York: Basic Books, 1995), 120.

[79] See Sheila Jasanoff, "Science, Politics, and the Renegotiation of Expertise at EPA," *Osiris* 7 (1992): 195-217 and Sheila Jasanoff, *Science at the Bar: Law, Science, and Technology in America* (Cambridge, Mass.: Harvard University Press, 1995), 78-81

By the late 1970s such actions against economically important chemical products led affected industries to demand ever higher levels of proof of harm both in the administrative arena and in the courts. One key consequence was an effort by both the EPA (and OSHA) to create increasingly detailed and elaborate "cancer principles," which would spell out the chain of assumptions that led from animal test data to conclusions of probable human carcinogenicity. But, as Sheila Jasanoff has observed, what began as an attempt by the agencies to shore up the analytical basis for regulating carcinogens in order to survive scrutiny by the courts, soon provoked even greater controversy. Through the 1980s and beyond, affected industries vigorously challenged the conservative risk assessment guidelines adopted by the EPA, charging that they consistently exaggerated the risks of industrial chemicals. In the case of PCBs, the scientific debate had largely centered on the underlying scientific studies themselves. But as the EPA began making quantitative estimates of risk for chemicals such as dioxin in the 1980s, affected industries would increasingly bring about regulatory stalemate through methodical deconstructions of the complex analytical assumptions that were now on full display.[80]

[80] See Jasanoff, "Science, Politics, and the Renegotiation of Expertise at EPA," 203-205, 216-217.

Chapter Four: "Hungry? Eat an Environmentalist": From Earth Day to Regulatory Reform and the Rise of Cost-Benefit Analysis, 1965-1980

Introduction

On the eve of the tenth anniversary of Earth Day in April of 1980, the editorial page of the *New York Times* weighed the past triumphs and future prospects of the American environmental movement. "The first Earth Day in 1970," said the editorial, "surprised its organizers by attracting millions to teach-ins and clean-ups. Over the decade, this aroused political force produced a revolution in national attitudes and an explosion of new laws and regulations. But now the movement is colliding with problems that seem more urgent. Energy, inflation and recession have become the main political concerns, and efforts to reduce pollution or strip-mine damage are seen, often unfairly, as interfering with the nation's welfare." The editorial went on to ask, "Have the gains been worth the billions spent?" It concluded that the analytic tool that might answer this question, cost-benefit analysis, was "still too primitive to provide definitive answers." This was just the type of question that business leaders like Richard L. Lesher, president of the U.S. Chamber of Commerce, had long been encouraging. Interviewed for a news story that day, Lesher told the *Times* that in the 1970s there had been "a general agreement by all parties on the need to clean up the air and water." But there had also been disputes over the "timetables and costs" of the clean up. "The environmentalists tried to move a little too far and too fast and did not have a proper concern for some of the trade-offs." As a result, he argued, there were "too many regulations." Looking ahead to the 1980s, Lesher said that the nation must "balance environmental needs, inflation and other national priorities."[1]

By 1980, claims that excessive environmental regulation hurt the economy circulated widely in the nation's political discourse. In popular culture, political cartoons

[1] "The Ground is Shifting under Earth Day," editorial, *New York Times*, April 21, 1980, p. A18; Philip Shabecoff, "Earth Day '80 Dawns Tomorrow amid Reflection and Plans for a New Decade," *New York Times*, April 21, 1980, p. A16.

lampooned government regulation as an out-of-control force which stifled the free operations of the market. Bumper stickers blamed environmentalists for job losses with slogans such as “Hungry? Eat an environmentalist for dinner” and “I’ve Never Met an Unemployed Environmentalist.” A flurry of corporate advertisements attacked regulation as a source of the nation’s economic strains. Some declared “overregulation” a threat to the American standard of living. Business leaders, meanwhile, hinted that regulation was akin to “creeping socialism,” a largely invisible, but no less real, threat to economic and personal freedoms. Echoing such sentiments, one corporate ad depicted a frowning Statute of Liberty, strung by a hangman’s noose labeled “regulation.” Calls for reform of the so-called “new social regulation”—implemented under dozens of new environmental, health, and safety laws beginning in the late 1960s—also resonated in policy-making circles, then teeming with talk of “regulatory reform.” Kicked off in 1978 by airline price deregulation and initially targeting old-line “economic regulation” by federal commissions, the deregulatory cause soon cast its broad net over environmental, health, and safety programs as well.[2]

Both the political agenda and the terms of debate in environmental policy had shifted dramatically since the first Earth Day in 1970. Then, the focus had been on how the federal government could best intervene to remedy industry failures to reduce pollution. A decade later the agenda included calls for greater scrutiny of EPA rulemaking, potential market-based alternatives to “command-and-control” regulations, and other policies aimed at reducing the costs of industry’s accumulating regulatory burdens. With talk of uncontrolled urban smog, incidents such as the Santa Barbara oil spill, and a general “environmental crisis” dominating the environmental agenda in 1970, industry complaints about the excessive costs of regulation elicited little public sympathy. But as these claims rippled continuously through the major media during the periods of stagnant growth and high inflation (or “stagflation”) of the 1970s, industry found an increasingly receptive audience. David Vogel and other scholars have documented the broader “political resurgence of business” in the late 1970s, after an earlier period of

[2] Lester C. Thurow, “Clean Air, New Industry: Let’s Compromise,” *New York Times*, November 16, 1980, p. F2; “The Ground is Shifting under Earth Day,” *New York Times*, April 21, 1980, p. A18; Gould, advertisement, *Wall Street Journal,* Nov. 22, 1978, p. 11.

retrenchment and defeat, often at the hands of the new consumer and environmental movements. The focus here is on more specific questions: First, how, by 1980, did otherwise popular environmental protections become rhetorically linked—in policymaking circles and public opinion—to a host of economic problems, including energy shortages, soaring inflation, and high unemployment? And, second, why was an intensified use of the "cost-benefit analysis" of economists the chief policy proposal for striking a new "balance" between the environment and the economy?[3]

The answers are not immediately obvious. For one thing, evidence that environmental regulation contributed significantly to the nation's economic problems—or even to those of specific industries—was exceedingly thin. Few claims linking environmental rules to economic hardships withstood serious scrutiny. When steel companies claimed that pollution controls had cost thousands of jobs and forced numerous mill closures, for instance, subsequent studies showed that actual job losses were few and that most jeopardized mills were uncompetitive and inefficient older plants already facing shutdowns.[4] When chemical firms complained that escalating pollution-control costs threatened the industry's very existence in the late 1970s, the industry's own trade journal published figures showing that pollution-control spending was actually trending downward, from more than $800 million in 1976 to around $550 million in 1978.[5] And when conservative economist Murray Weidenbaum famously estimated that federal regulation of all kinds cost $100 billion annually, the Congressional Research Service dismissed the study as being of "suspect and of doubtful validity" because of its dubious use of data, double counting, inaccurate addition, and a failure to estimate the benefits of regulation.[6] Meanwhile, contemporary estimates of the aggregate costs and benefits of environmental regulation often found a favorable benefit/cost ratio. A study

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[3] On the shifting political fortunes of big business in the 1970s, see David Vogel, *Fluctuating Fortunes: The Political Power of Business in America* (New York: Basic Books 1989).
[4] See Eban S. Goodstein, *Jobs and the Environment: the Myth of a National Trade-off* (Washington, DC: Economic Policy Institute, 1994).
[5] *Chemical Week*, August 10, 1977, pp. 46-48; *Chemical Week*, June 22, 1977, p. 5; Earle B. Barnes, "Chemical Industry Suffering?" *Christian Science Monitor*, December 11, 1975, p. 23; "Dow Chemical's Catalog of Regulatory Horrors," *Business Week*, April 4, 1977, p. 50. On the downward trend in spending by the industry, see, e.g., *Chemical Week,* May 17, 1978, p. 27; *Chemical Week*, May 16, 1979, p. 46.
[6] Timothy B. Clark, "Regulation—The Costs and Benefits of Regulation—Who Knows How Great They Really Are?" *National Journal*, December 1, 1979.

released on Earth Day 1980 by the Carter administration's Council on Environmental Quality (CEQ)—launching a salvo at administration inflation-fighters and industry—estimated that air-pollution controls alone provided benefits of some $21.4 billion in 1978 in the form of improved public health and reduced damage to property, crops, vegetation, and wildlife, a figure several times the estimated annual costs.[7] On the whole, as David Vogel has noted, there was "no evidence that government regulation of business contributed significantly to the nation's economic difficulties during the 1970s."[8] Despite such thin evidential grounding, narratives linking environmental regulation to economic distress had moved to the center of the nation's political discourse by 1980.

The ascendance of these ideas, this chapter will argue, owed much to a decade-long campaign by major corporations. To be sure, other trends were at play: the continued growth and increasing complexity of the regulatory programs themselves, criticism of the inefficiency of "command-and-control" regulation by economists, work on cost-benefit analysis at major policy think tanks, a broader resurgence of faith in "the market," and heightened concerns about government interference with the economy during a period of economic stagnation. But business played a key role in creating the popular perception of inevitable tradeoffs between environmental and economic goals, while vigorously promoting stringent "regulatory review" using cost-benefit analysis as a means of better balancing these tradeoffs. Pushing these ideas, affected industries increasingly operated as a unified political front against the tide of new environmental laws and regulations—a major shift from 1970.

As Congress moved to enact the first of the new environmental laws, the Clean Air Act of 1970, the vast assembly of industries facing stricter air-pollution controls failed to establish a unified political front or to effectively advance common policy positions. Lacking coordination, dozens of trade associations and major corporations each advanced their own narrow proposals at Congressional hearings in 1969-70. The result was a jumble of often conflicting plans and proposed revisions.[9] Affected

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[7] Philip Shabecoff, "Study Finds Savings in Pollution Rules," *New York Times*, April 22, 1980, p. A19.
[8] Vogel, *Fluctuating Fortunes*, 238.
[9] See, generally, U.S. Congress, House of Representatives, Committee on Interstate and Foreign Commerce, Subcommittee on Public Health and Welfare, *Air Pollution Control and Solid Wastes Recycling*, 91st Cong., 1st and 2nd sess., 1970.

industries were also taken by surprise by the final bill that emerged from Senator Edmund Muskie's subcommittee, which was far more stringent than the Nixon administration's proposals. Most important, central provisions in the new Clean Air Act did not allow for consideration of compliance costs or technical feasibility. The Act did permit consideration of economic costs in some provisions, including the setting of "New Source Performance Standards" (NSPSs) for certain new sources of emissions. But it required the EPA to set national ambient air quality standards (NAAQSs) for the most common pollutants (sulfur oxides, nitrogen oxides, carbon monoxide, particulates, and ozone) solely on criteria "requisite to protect the public health" with "an adequate margin of safety," without regard to cost. As Richard Andrews writes in his history of American environmental policy, the Act's "philosophy was that protecting public health was paramount, and that the polluters themselves should pay whatever it cost to achieve this. Air quality standards should therefore be set based on medical science alone, rather than on balancing of health against compliance costs."[10]

Experience with the passage and implementation of the Clean Air Act led to new coordination among polluting industries, and a determination to make costs a central criterion in the federal campaign to clean up pollution. As Congress enacted nearly a dozen major pollution-control statutes during the "environmental decade" of the 1970s, businesses increasingly worked together in political opposition, forging common policy positions through advisory councils and inter-industry business lobbies, from the National Industrial Pollution Control Council in 1970 to the Business Roundtable in 1980. In the process, businesses wove their diverse complaints about the costs of environmental regulation into a capacious and usefully fuzzy idea of "overregulation," a term thrown mainly at environmental, health, and occupational safety rules. They also forged shared commitments to concrete policy proposals to inject cost considerations into environmental policy, vigorously lobbying for statutes and administrative procedures to subject environmental regulations to some form of cost-benefit analysis.[11]

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[10] Richard N.L. Andrews, *Managing the Environment, Managing Ourselves: A History of American Environmental Policy*, (New Haven: Yale University Press, 1999), 234.

[11] See William H. Rodgers, Jr., "The National Industrial Pollution Control Council: Advise or Collude?" *Boston College Industrial and Commercial Law Review* 13 (1971-1972): 719-747; Mark J. Green and Andrew Buchsbaum, *The Corporate Lobbies: Political Profiles of the Business Roundtable & the Chamber*

This abstract concept of "overregulation" was given initial shape during the "energy crisis" of the early 1970s. Sensing a political opening, oil, gas, and electric power companies first blamed rising fuel price increases, then the nation's deeper post-1973 economic strains on unreasonable environmental restrictions. With a steady drumbeat of advocacy advertising, public relations, and lobbying, companies such as Mobil Oil and American Electric Power (the nation's largest electricity provider) charged that environmental rules were contributing to rising energy prices, job losses, and inflation. Others joined with their own stories of the perils of "overregulation": steelmakers cited job losses; chemical firms warned of stifled innovation and flagging international competitiveness; and the National Association of Manufacturers issued nebulous warnings of lost economic and personal freedoms that carried ominous implications for the future of the free market system. As businesses found common cause, they congealed such diverse charges into the amalgamated storyline of "overregulation."[12]

As an organizing theme for the environmental backlash, it drew strength from the sheer fuzziness of its significations. The prime movers behind the backlash were large corporations, companies such as American Electric Power and U.S. Steel, which were locked in disputes with the EPA on standards and timetables. But the public face of the movement against "overregulation" would often be a populist revolt of embattled businessmen everywhere. If relatively few in the business community dealt directly with such matters as the diversion of capital to comply with environmental regulations, many could identify with the varied populist complaints of "overregulation"—out-of-control bureaucracies, unreasonable paperwork and red tape, and the loss of decision-making authority as the prerogatives of business were usurped by regulators. Such rhetoric broadened the appeal of the backlash, allowing major corporations to woo small

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of Commerce (Washington, D.C.: Public Citizen, 1980); Thomas K. McCraw, "The Business Roundtable," Harvard Business School Case Study, 4-379-118 (Harvard College, 1979); Peter Slavin, "The Business Roundtable: New Lobbying Arm of Big Business," *Business and Society Review* 16 (Winter 1975-6): 28-32; Philip H. Burch, Jr., "The Business Roundtable: Its Make-Up and External Ties," *Research in Political Economy* 4 (1981): 101-127.

[12] Herbert Schmertz, "Idea Advertising: Talking to New Audiences," *Electric Perspectives* (June 1976): 1-7; "Donald Cook Takes on the Environmentalists," *Business Week*, October 16, 1974, pp. 66-77; "Warning Signals from Smokestack America," *The Economist*, April 2, 1977, p. 83.

businesses, employees, and investors to their cause. Beyond the business community, meanwhile, the charge of "overregulation" could offer a simple, if misleading, explanation for plant shutdowns, high energy prices, or soaring inflation.[13]

By 1980, affected industries had, in great measure, succeeded in redefining environmental regulation as a costly, sometimes perilous endeavor, one that must always be carefully balanced against economic goals. By rhetorically linking environmental regulation to inflation and other economic strains, businesses had reframed their own cost complaints in terms that would appeal to broader public concerns about the performance of the economy, thus conflating parochial industry interests with the public interest: "Overregulation" hurt not just industry, but all Americans by hindering the efficient operation of the market. To be sure, business interests failed to achieve some of their most coveted legislative goals, such as long sought major revisions of the Clean Air Act. And important new environmental legislation still moved through Congress, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or the "Superfund" law) in 1980. Increasingly sophisticated and professionalized environmental groups proved formidable opponents in Washington. And public opinion remained strongly behind environmental goals. But the point of departure in discussions in environmental policymaking circles was no longer the same—the center had shifted. In language, methodology, and law, the question of how to balance the *costs* and *benefits* of environmental regulation, a concern heard mainly in industry circles in 1970, was now woven deeply into the fabric of environmental policy. As policymakers joined a bandwagon of "regulatory reform" in the late 1970s, business lobbies demanded that reform of the "new social regulation," particularly expensive environmental rules, be part of the broader drive. Asking "Is it worth it?" a growing number looked to economists for answers—and the quantifying precision and apparent objectivity of their techniques of cost-benefit analysis.[14]

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[13] Jane Seaberry, "Small Business Becomes a Force to Contend With," *Washington Post*, December 16, 1979, p. F4; Neil Ulman, "Business Lobby: Companies Organize Employees and Holders into a Political Force," *Wall Street Journal*, Aug. 15, 1978, p. 1.

[14] On environmental politics in the 1970s generally, see Vogel, *Fluctuating Fortunes*; Robert Gottlieb, *Forcing the Spring: The Transformation of the American Environmental Movement* (Washington D.C.: Island Press, 1993). On the evolution of national environmental groups, see Christopher J. Bosso, *Environment Inc.: From Grassroots to Beltway* (Lawrence: University Press of Kansas, 2005). Seymour

The Rise of Cost-Benefit Analysis

In the United States, cost-benefit analysis was first used by the Army Corps of Engineers in the 1920s and 1930s to justify flood control and dam projects.[15] Congress mandated the practice in the Flood Control Act of 1936 by requiring that the benefits of proposed flood control projects outweigh the costs. Faced with increasing challenges to its self-serving calculations in the 1940s and 1950s, the Corps developed more rigorous and standardized methods. In the process, writes historian Theodore Porter, "cost-benefit analysis was transformed from a collection of local bureaucratic practices into a set of rationalized economic principles."[16] In the 1950s, in what Porter calls a "takeover by the economists," cost-benefit analysis became a specialty within the economics profession, its methodology reworked according to the principles of the "new" welfare economics as economists applied it in case studies evaluating water resources projects.[17] A key institutional center for this work was the Washington-based Resources for the Future (RFF), founded in 1952 with Ford Foundation funding after a recommendation by CBS Chairman William Paley, who was fresh from chairing a Presidential commission on America's dependence on foreign natural resources. In the 1950s and 1960s, economists at RFF developed ever more sophisticated methods for quantifying the costs and benefits of multi-use water development projects, including the recreational benefits of protecting free-flowing rivers or wilderness. In the 1970s, RFF would play a leading role in pioneering techniques for assessing the costs and benefits of new environmental, health, and safety regulations.[18]

Martin Lipset and William Schneider documented growing public concern about the economic costs of regulation in "The Public View of Regulation," *Public Opinion* (January/February 1979): 6-13.

[15] Although the term "cost-benefit analysis" (also called "benefit-cost analysis") was given various narrow and formal definitions by economists, I will use the term more broadly, as did its advocates in Washington, to connote any standardized technique to quantify, usually in monetary terms, the costs and benefits of a government action as a precursor to a decision.

[16] Theodore Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton: Princeton University Press, 1995), 149.

[17] Porter, *Trust in Numbers*, 187-89. A seminal early work was Otto Eckstein's *Water Resources Development* (Cambridge, Mass.: Harvard University Press, 1958).

[18] William Cronon, "Past and Prologue: The U.S. in 1950 and 2050," talk delivered at "50th Anniversary Symposium and Gala Dinner," Washington, D.C., October 15, 2002 <http://www.rff.org/Events/50th-Anniversary/Agenda.cfm> (June 19, 2006).

The widespread introduction of cost-benefit analysis into federal management in the 1960s, however, had its origins in Cold War military planning. It was introduced at the Department of Defense (DOD) under Secretary of Defense Robert McNamara's Planning, Programming, and Budgeting (PPB) system and spread with PPB to other federal departments and agencies after 1965.[19] The cost-benefit calculus used in PPB had been developed at the RAND Corporation in the 1950s as a set of techniques called, variously, "systems analysis" or "cost-effectiveness analysis."[20] After President Kennedy appointed McNamara Secretary of Defense in 1960, he brought to the Defense Department a number of enthusiasts of systems analysis from RAND, including Charles J. Hitch, RAND's Chief Economist and co-author with Roland McKean of the seminal text on systems analysis, *The Economics of Defense in the Nuclear Age* (1960). Appointed Assistant Secretary of Defense (Comptroller), Hitch implemented the techniques developed at RAND at the Pentagon beginning in fiscal year 1963.[21] Despite some historical and methodological distinctions between "cost-effectiveness analysis"[22] and "cost-benefit analysis," in practice the terms were used interchangeably by the mid-1960s, along with other synonyms for quantifying the costs and benefits of public expenditures, such as "cost-utility analysis," "program analysis," and "program

[19] PPB involved "program accounting, multi-year costing, detailed description of activities, zero-based budgeting, and quantitative evaluation of alternatives or benefit-cost analysis." Leonard Merewitz and Stephen H. Sosnick, *The Budget's New Clothes: A Critique of Planning-Programming-Budgeting and Benefit-Cost Analysis* (Chicago: Rand McNally College, 1971), 2.

[20] An anthology of this work at RAND in the 1950s is Charles J. Hitch and Roland McKean, *The Economics of Defense in the Nuclear Age* (Cambridge, Mass.: Harvard University Press, 1960). See also, Roland McKean, *Efficiency in Government through Systems Analysis* (New York: John Wiley & Sons, 1958). First applied to military spending, RAND's "systems analysis" was then applied to water resources issues. See Jack Hirshleifer, J.C. DeHaven, and Jerome W. Milliman, *Water Supply: Economics, Technology and Policy* (Chicago: University of Chicago Press, 1960).

[21] Lorentz A. Feltes, "Planning Programming, Budgeting," *Air University Review* (January/February 1976).

[22] This was the terminology/methodology developed at RAND and implanted at the Defense Department. In the 1960s, the terms "systems analysis" and "cost-effectiveness analysis" were sometimes used interchangeably in policymaking circles. See, for instance, Thomas A. Goldman, ed., *Cost-Effectiveness Analysis: New Approaches in Decision-Making* (New York: Frederick A. Praeger, 1967), pp. v-vii. "Cost-effectiveness analysis" was defined broadly by the RAND Corporation's Edward S. Quade as "any analytic study designed to assist a decision-maker in identifying a preferred choice among possible alternatives." Edward S. Quade, "Introduction and Overview," in *Cost-Effectiveness Analysis*, ed. Goldman, p. 1.

evaluation."[23] Whatever the terminology, the cost-benefit methods of McNamara's PPB soon influenced management practices in other agencies.[24]

From its roots at RAND and the Pentagon, cost-benefit analysis was implanted in other parts of the federal bureaucracy after 1965, when the Johnson administration required twenty-two other agencies, including all cabinet-level departments, to adopt PPB. In the same year, the Brookings Institution held a conference at which researchers presented studies that applied cost-benefit techniques to a wide range of public policy issues, from outdoor recreation to urban renewal. According to the author of a 1969 textbook on cost-effectiveness analysis based on lectures given to defense contractors RCA, Boeing, and Lockheed, "As a result of its many accomplishments within the military establishment, the cost-effectiveness approach today is spreading to many other parts of government as well as throughout industry."[25] It was also introduced in state and local governments which embraced variations of PPB, including California under governors Edmund G. Brown and Ronald Reagan. By the mid-1960s, its practitioners were applying the technique to a vast range of public expenditures and agency budgets—including various "War on Poverty" programs, the Post Office, the Peace Corps, the Forest Service, and the Department of Agriculture's "Peanut Program."[26]

Despite a full court press by PPB evangelists, formal PPB practices seldom took root outside of the Pentagon. An investigation by Senator William Proxmire's Joint Economic Committee found that PPB was virtually non-existent in independent agencies, and only four executive departments claimed it as standard practice. In 1971, George Schultz, director of the new Office of Management and Budget, dropped the requirement that agencies and departments use PPB methods in the budgetary process. Nonetheless, one part of PPB, cost-benefit analysis, continued to spread. A compendium of new case

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[23] Harly H. Hinrichs and Graeme M. Taylor, *Program Budgeting and Benefit-Cost Analysis: Cases, Text and Readings* (Pacific Palisades: Goodyear Publishing, 1969), 97.
[24] See U.S. Congress, Joint Economic Committee, *Analysis and Evaluation of Public Expenditures: The PPB System, a Compendium Submitted to the Subcommittee on Economy in Government of the Joint Economic Committee of Congress* (Washington, D.C.: U.S. Government Printing Office, 1969).
[25] Karl Seiler III, *Introduction to Systems Cost-Effectiveness* (New York: Wiley-Interscience, 1969), vii.
[26] Robert Dorfman, ed., *Measuring Benefits of Government Investments: Papers Presented at a Conference of Experts Held November 7-9, 1963* (Washington, D.C.: The Brookings Institution, 1965); Leonard Merewitz and Stephen H. Sosnick, *The Budget's New Clothes*, 4; Hinrichs and Taylor, *Program Budgeting and Benefit-Cost Analysis*.

studies in Proxmire's 1973 report—compiled to "bring policymakers up to date on some advances made by economists"—demonstrated an ever wider use of cost-benefit techniques to evaluate a broad spectrum of government programs. These included assessments of a hydroelectric dam project at Hells Canyon, a small watersheds program, the federal housing program, Medicare, and vocational education programs. Moreover, some cost-benefit practitioners began moving beyond the assessment of public expenditures, developing methodologies for its application to regulatory programs in areas such as auto safety and pollution control.[27]

The Auto Industry and Cost-Benefit Analysis

As cost-benefit analysis spread in federal management, industry increasingly viewed some form of mandatory balancing of costs and benefits as a key tool for restraining new government activism in the areas of environmental, health, and safety regulation. Automakers took the lead. Nearly unregulated before 1966, the auto industry was caught off guard by the frenzied public attention to auto safety that followed the publication of Ralph Nader's *Unsafe at Any Speed* in 1965. As Congress moved forward with legislation, the industry was forced to abandon its position favoring voluntary standards and accept federally mandated safety standards in the National Traffic and Motor Vehicle Safety Act of 1966 (hereafter Motor Vehicle Safety Act). Dropping an initially proposed "voluntary action plan," the Automobile Manufacturers Association (AMA) instead pushed for modifications of the statute to require cost-benefit assessments by regulators. At 1966 House hearings, Ford Vice President John S. Bugas, representing the AMA, called for the inclusion of language in a key section of the bill which would

[27] U.S. Congress, Joint Economic Committee, *Benefit-Cost Analyses of Federal Programs: A Compendium of Papers Submitted to the Subcommittee on Priorities and Economy in Government of the Joint Economic Committee, Congress of the United States*, 92d Cong., 2d sess., (U.S. Government Printing Office: Washington, D.C., 1973); Merewitz and Sosnick, *Budget's New Clothes*, 301; U.S. Office of Management and Budget, "Circular No. A-11, Revised, Transmittal Memorandum No. 38," June 21, 1971. An early application of cost-benefit methods to pollution can be found in Harold Wolozin, ed., *The Economics of Air Pollution* (New York: Norton, 1966).

mandate a "balancing of costs versus benefits."[28] As Bugas put it, "When the Secretary finally decides to set a standard…he should not have in mind such words as 'adequate' and 'unreasonable,' that are subject to application depending on the attitude of the individual. He should look instead at such things as, 'Will this standard that I am going to impose be worth the cost that is required to put it into effect?'"[29] But Congress refused the automakers' demands, and the Motor Vehicle Safety Act made it clear that safety would be the primary decision-making criterion. The Senate report said that, though regulators would "necessarily consider the reasonableness of cost, feasibility and lead-time" in their decisions, "safety shall be the overriding consideration in the issuances of standards under this bill."[30]

Rebuffed by Congress, automakers continued to lobby for a cost-benefit test of auto safety regulations in the administrative arena. They first pressed the case with regulators at the National Highway Traffic Safety Bureau (NHTSB), later Administration (NHTSA). According to journalist Mark Dowie, after passage of the Motor Vehicle Safety Act, the Ford Motor Company began an intensive lobbying campaign that won an informal agreement from regulators to make cost-benefit "an acceptable mode of analysis by Detroit and its new regulators."[31] Despite any agreement, the practice apparently had little impact on early regulations issued by NHTSA in the late 1960s.[32] Automakers turned to the courts, arguing unsuccessfully in *Chrysler Corp. v. Department of Transportation* that the Motor Vehicle Safety Act required a cost-benefit test for auto safety regulations.[33] Not until the early 1970s did the automakers' demands gain traction, when the Ford White House and its Council on Wage and Price Stability (CWPS)

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[28] U.S. Congress, House of Representatives, Committee on Interstate and Foreign Commerce, *National Traffic and Motor Vehicle Safety Act: Hearings Before the House Committee on Interstate and Foreign Commerce on H.R. 13228,* 89th Cong., 2d sess., 1966, p. 251.
[29] *Ibid.*, 300.
[30] Jerry L. Mashaw and David L. Harfst, *The Struggle for Auto Safety* (Cambridge, Mass.: Harvard University Press, 1990).
[31] Mark Dowie, "Pinto Madness," *Mother Jones* (September/October 1977) <www.motherjones.com/news/feature/1977/09/dowie.html> (June 19, 2006).
[32] U.S. Congress, Committee on Interstate and Foreign Commerce, Subcommittee on Oversight and Investigations, *Federal Regulation and Regulatory Reform* (Washington, D.C.: U.S. Government Printing Office, 1976), 175-176 (hereafter cited as *Moss Report* after subcommittee Chair John E. Moss of California).
[33] 472 F.2d 659, 672 (6th Cir. 1972).

pressured NHTSA to conduct more extensive cost-benefit studies of proposed regulations.[34]

One reason for the automakers' warm embrace of cost-benefit studies was that early methodologies consistently placed low monetary values on the benefits of safety regulations. The chief reason for this was the approach used to quantify the economic costs of traffic fatalities. In the 1980s, federal agencies would adopt an approach to valuing life through polling individuals to determine an average "willingness to pay" (or "WTP") to avoid a specified risk of death or illness—a method that would result in around a ten-fold greater dollar value being placed on human life.[35] But early cost-benefit analyses of regulations used what was sometimes called a "human capital" approach. In its most basic form, it involved simply multiplying the average years of lifetime lost in an early death by the *per capita* income of either a particular demographic group or the nation as a whole. The resulting estimate of lost earnings was taken to represent the average cost of a fatality, or in other words, the value of a lost life. Variations on this approach included adding hospital fees and funeral expenses, pushing the final number slightly upward, or subtracting average lifetime consumption expenditures, pushing the figure somewhat downward. But the resulting figures were all relatively low. A 1966 study by Arthur D. Little, commissioned by the Commerce Department, calculated the cost of a death by "figuring the discounted loss in production by the victim and subtracting from that the change in consumption of the household unit." Using demographic data from the Washington D.C. area, the study estimated that the average cost of a fatal accident was only $47,500.[36] Using similar methods, but not subtracting consumption, the National Highway Traffic Safety Administration put the value at $200,000.[37]

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[34] *Moss Report*, 176-180.
[35] On the development and theoretical foundations of the willingness-to-pay approach, see W. Kip Viscusi, "Misuses and Proper Uses of Hedonic Values of Life," Discussion Paper No. 292, Center for Law, Economics, and Business, Harvard Law School, August 2000. <http://www.law.harvard.edu/programs/olin_center/papers/pdf/292.pdf> (July 4, 2006).
[36] Arthur D. Little Co., *Cost-Effectiveness in Traffic Safety*, (New York: Praeger, 1968), 108-114.
[37] The derivation of the $200,000 figure is explained in U.S. National Highway Traffic Safety Administration, *Societal Costs of Motor Vehicle Accidents* (Washington, D.C.: U.S. Department of Transportation, National Highway Traffic Safety Administration, 1972), 3-4.

With human life valued so low, early cost-benefit studies of auto safety regulations tended to be highly favorable to the anti-regulatory positions of automakers. One prominent example was a 1972 study commissioned by the White House Office of Science and Technology Policy and conducted by the Ad Hoc Committee on the Cumulative Regulatory Effects on the Cost of Automotive Transportation (RECAT).[38] Applying cost-benefit techniques to vehicle emission standards and safety regulations, the RECAT study concluded that the Clean Air Act's existing auto emission standards had a highly "unfavorable cost/benefit" ratio.[39] It also found a proposal requiring airbags in new cars suspect on cost-benefit grounds. Echoing industry's line that the public would ultimately bear the costs of regulation, the RECAT committee urged that all agency rulemakings be subject to mandatory cost-benefit analysis.[40] Not surprisingly, according to journalist William Greider, the RECAT study "won cheers from the auto industry because its cost-benefit conclusions cast doubt on two government regulations that Detroit has been fighting."[41]

In its evaluation of airbags, RECAT applied the "human capital" approach to valuing human life. The sixteen-member committee was initially hesitant to monetize the cost of a traffic fatality, but accepted the approach at the urging of Howard P. Gates, a Navy consultant.[42] In its cost-benefit analysis, RECAT simply multiplied the average expected lifetime lost by early death (36.9 years) by per capita personal income ($3,786 in the U.S. in 1970) giving a value of foregone income per death of around $140,000.[43] Combining this number with the average costs of personal injury and property damage per accident yielded an average cost for a traffic accident. Using these numbers and the expected reductions in fatalities and injuries resulting from the introduction of new safety measures, RECAT estimated the benefits of various regulations affecting auto design.[44]

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[38] U.S. Ad Hoc Committee on the Cumulative Regulatory Effects on the Cost of Automotive Transportation, *Cumulative Regulatory Effects on the Cost of Automotive Transportation (RECAT): Final Report Prepared for the Office of Science and Technology* (Washington, D.C.: Office of Science and Technology, Executive Office of the President, 1972) (hereafter cited as *RECAT*).
[39] *RECAT*, xxi.
[40] *RECAT*, x-xiii.
[41] William Greider, "Or, Your Life May Not Be Worth Saving," *Washington Post*, April 9, 1972, p. B1.
[42] Greider, "Or, Your Life May Not Be Worth Saving," p. B1.
[43] *RECAT*, Appendix II-A.
[44] *RECAT*, 42-48.

It characterized airbags as a dubious proposal, with estimated costs of some $370 per car and estimated benefits ranging from just $161 to $384.[45] Although many economists at the time warned that the foregone income approach to monetizing the loss of life produced gross underestimates,[46] the only such qualification offered by RECAT for its $140,000 figure was buried in a footnote, which stated that economist E.J. Mishan "rejects as unsatisfactory <u>all</u> existing methods of evaluating loss of life."[47]

By the early 1970s, the automakers' push for greater use of cost-benefit analysis in auto safety regulation was yielding regulatory victories. A 1976 investigation of federal regulation by Representative John E. Moss's (D-California) Subcommittee on Oversight and Investigation found that increased pressure on NHTSA to produce cost-benefit justifications for safety rules had led to the abandonment or postponement of several important safety rules. In one case, NHTSA Associate Administrator Robert Carter reported that he had ordered the abandonment of a 1971 proposal to require the installation of rear under-ride guards on trucks, after a cost-benefit analysis predicted the costs would exceed the benefits.[48] Under pressure from the Ford White House and its Council on Wage and Price Stability, NHTSA was also forced to delay proposed rules on passive restraints (i.e. airbags), truck air brakes, and other safety rules, until it could demonstrate that the benefits would exceed the costs.[49] Criticizing NHTSA for a "slackened" pace of rulemaking since 1970, the Moss Report said that NHTSA had "needlessly tied itself in knots, partly in response to pressure from the Council on Wage and Price Stability and the White House, by performing benefit/cost studies which prove little and are not required by law."[50] The overall effect of forcing cost-benefit analysis into this regulatory domain, charged the Moss Report, had often been "to induce paralysis by analysis."[51] If a reasonable accounting of *benefits* plagued the use of cost-benefit

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[45] *RECAT,* xxvii.
[46] See, e.g., Lester B. Lave and Eugene P. Seskin, "Air Pollution and Human Health," *Science* 169 (August 21, 1970): 723-733.
[47] *RECAT*, 70.
[48] *Moss Report*, 176; 36 Fed. Reg. 11750 (June 18, 1971).
[49] *Moss Report,* 176-77.
[50] *Moss Report,* 12, 157.
[51] *Moss Report,* 181.

analysis in auto safety regulation, the problems were magnified many times over when the technique spread to environmental regulation.

Cost-Benefit Analysis and Environmental Regulation

As concerns among business leaders mounted about potential costs of new environmental regulation in 1970, polluting industries began coordinating efforts to inject cost considerations into the language and methodology of environmental policy.[52] While the Automobile Manufacturers Association pushed the point in auto safety regulation, here demands for cost and feasibility considerations were spread through an advisory committee with privileged links to the environmental regulatory process—the National Industrial Pollution Control Council (NIPCC). At the urging of Commerce Secretary Maurice Stans, who had strong ties to the business community, President Nixon created the NIPCC on April 9, 1971. The move aimed to reassure the business community after the passage of the National Environmental Policy Act (NEPA) in 1970 and with clean air legislation pending in Congress.[53] "The new Council," said Nixon, "will allow businessmen to communicate regularly with the President, the Council on Environmental Quality and other government officials and private organizations which are working to improve the quality of our environment."[54] Appointed by Stans, the Council's

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[52] In the chemical industry complaints about costs quickly became a running theme. "Beginning in 1971," writes business historian Andrew Hoffman, "articles emerged several times a year [in trade journals] stressing the industry was 'yet again' spending record amounts on the environment." Andrew Hoffman, *From Heresy to Dogma: An Institutional History of Corporate Environmentalism* (Stanford, Calif.: Stanford University Press, 2002), 72. A 1971 editorial in the industry's leading trade journal, *Chemical Week,* headlined "Ecology mows 'em down in chemical land," warned that new environmental rules "will continue as a sometimes controlling factor in corporate affairs—an 'act of God' or force majeure, like an earthquake or hurricane." See *Chemical Week*, February 10, 1971, p. 8.

[53] Executive Order No. 11523, 3 CFR 915 (1966-1970 Comp.). On the role of Stans in the creation of the NIPCC, see J. Brooks Flippen, *Nixon and the Environment* (Albuquerque: University of New Mexico Press, 2000), 139-40. Described by environmental staff in the Nixon administration as a "knee-jerk big business guy," and "always on the other side," Stans believed that industry should be treated as a partner in the environmental cleanup. See Flippen, *Nixon and the Environment*, 84. If the newly-created EPA represented a standard-setting and enforcement model for addressing pollution, Stans' Commerce Department and the NIPCC represented a shadow model of voluntary compliance. The first EPA Administrator William Ruckelshaus recalls, "Stans believed you answered pollution standards with voluntary compliance on the part of industry." U.S. EPA, *William Ruckelshaus: Oral History Interview, by Michael Gorn*, EPA 202-K-92-0003 (January 1993).

[54] Statement by the President on Establishing the National Industrial Pollution Control Council, April 9, 1970, *Weekly Compilation of Presidential Documents* 502 (1970), 6.

membership consisted not of lobbyists or public relations staff, but of top corporate executives from more than fifty of the nation's largest industrial firms, including General Motors, Ford, DuPont, Exxon, and U.S. Steel.[55] As Stans put it at one Council meeting, "Here is a very large part of the industrial might of the country."[56] Operating out of the Commerce Department, the formal activities of the NIPCC and its thirty sub-councils included the preparation of technical reports and policy statements, volumes on industry "commitments" to reduce pollution, case studies of industry cleanup efforts, and a variety of PR endeavors to demonstrate industry's environmental goodwill.[57]

But informal activities were the real crux of the group's energies. The Council forged what one observer called "a broad corporate consensus on environmental policy"[58] It then used its privileged channels to the Commerce Department and the White House to shape both the general framework of environmental policymaking and to influence specific rules proposed by the EPA. As concern rose about the costs of increasingly strict pollution control standards, the NIPCC worked vigorously to inject cost considerations into the basic framework of environmental policymaking and establish requirements for cost-benefit balancing. Foremost on the Council's agenda was the *cost* of increasingly stringent pollution control regulations.[59] The NIPCC began to call for the formal integration of some form of cost/benefit balancing in environmental policy. The issue had been broached by the U.S. Chamber of Commerce during 1969-1970 Congressional hearings on the Clean Air Act, where the Chamber called for allowing states to set regional air quality standards with consideration of "such factors as the public welfare, the existing technology, and the costs and benefits of various air quality levels."[60] But with passage of the Clean Air Act in December 1970, the business community now faced

[55] Henry J. Steck, "Private Influence on Environmental Policy: The Case of the National Industrial Pollution Control Council," *Environmental Law* 5 (1974-1975), 241-281.
[56] Rodgers, "The National Industrial Pollution Control Council," 720.
[57] Steck, "Private Influence on Environmental Policy," 259-266.
[58] *Ibid.*, 266.
[59] *Ibid.*, 266-281; Rodgers, "The National Industrial Pollution Control Council," 733-743.
[60] Statement of Herbert. S. Richey, Chamber of Commerce of the United States, in U.S. Congress, Committee on Interstate and Foreign Commerce, Subcommittee on Public Health and Welfare, *Hearings: Air Pollution Control and Solid Wastes Recycling,* 91st Cong., 1st and 2d sess., (Washington D.C.: U.S. Government Printing Office, 1970), 512-516.

implementation of strict, cost-blind standards under rigid schedules. Beginning in 1971, the NIPCC pushed its concerns about costs and feasibility with a new sense of urgency.

In its February 1971 *Report to the President*, the Council warned that "increasing public concern with the pollution consequences of our affluent society has inspired responses at some levels of government which are incompatible with the economic health of our society. Standards have been established which are unattainable at economically tolerable costs."[61] It soon began sponsoring "a number of studies and position papers elaborating this view in more rigorous cost-benefit terms."[62] As it gathered extensive information on estimated compliance costs from member companies, it forwarded the data to Stans, who then conveyed it to the White House. Until its termination in 1975, the Council spearheaded efforts to gather and disseminate information on the costs of industry compliance, ensuring that cost figures circulated to the upper reaches of the White House. "At a time when environmental policy was still in an early stage," wrote one observer of the Council, "the ability to stimulate and coordinate the provision of hard technical and cost data was a crucial resource that established the context for Administration policy."[63] Armed with new cost figures, the Council took a progressively harder line on environmental regulation in 1971, arguing in an October discussion paper that "unemployment and other economic disruptions" were in the offing. Its positions contributed to a conservative shift in the rhetoric and environmental policy of the Nixon administration.[64]

Channeled through the Commerce Department, industry complaints about escalating costs fell on sympathetic ears in the highest reaches of the Nixon administration. In June of 1971, Nixon's top domestic aide, John Ehrlichman, established a Committee in the White House Domestic Council to study options for Executive Office or interagency review of agency decisions "that affect the balance of many interrelated Quality of Life variables—particularly consumer and environmental interests, industrial requirements, and safety aspects—some decisions working to the

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[61] As quoted in Steck, "Private Influence on Environmental Policy," 272.
[62] *Ibid.*, 268.
[63] *Ibid.*, 269.
[64] *Ibid.*, 268-69.

disadvantage of others."[65] Chaired by the President's Science Advisor, Edward David, the Committee established the broad outlines for a review process and considered whether a permanent "government vehicle" should be established for reviewing environmental, health, and safety regulations.[66] At the time, White House review of regulatory decisions was already being conducted on an *ad hoc* basis, including an Office of Science and Technology Policy task force on automobile standards (i.e. RECAT), a Domestic Council review of proposed EPA regulations to remove phosphate from detergents, and, later that summer, an OMB review of key EPA guidelines for state implementation plans (SIPs) under the Clean Air Act.[67] The Quality of Life Committee argued that the "central problem, whether or not a permanent review group is set up, is to insure that the action agencies make suitable analyses of benefits and costs and that outside viewpoints are taken into account in the decision process." To insure that agencies weighed the costs and benefits of their actions, the task force proposed requiring them to submit some form of "Economic Impact Statement" for proposed actions, modeled on the Environmental Impact Statements (EISs) required under NEPA.[68] It also decided that a formal mechanism was required "to force agencies to do a better job of

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[65] John Ehrlichman to Members, Domestic Council, Knauer, Train, Ruckelshaus and Peterson, memo, June 16, 1971, Folder "Quality of Life, 1971 (1970-1972), 3 of 4," Box 96, John Whitaker Files, White House Special Files, Richard Nixon White House Papers, Richard Nixon Presidential Materials Project, National Archives II, College Park, Maryland (hereafter referred to as JWF).

[66] Edward David to Members, Domestic Council Committee on Quality of Life, memo, June 22, 1971, Folder "Quality of Life, 1971 (1970-1972), 3 of 4, Box 96, JWF; Edward David to Members, Domestic Council Committee on Quality of Life, memo, June 25, 1971, Folder "Quality of Life, 1971 (1970-1972), 3 of 4, Box 96, JWF.

[67] Domestic Council Study Memorandum, no. 15, draft, June 22, 1971, Folder "Quality of Life, 1971 (1970-1972)), 3 of 4," Box 96, JWF. In May of 1971, OMB Director Schultz had argued in a letter to EPA Administrator William Ruckelshaus that OMB had authority to review EPA regulations. See George C. Eads and Michael Fix, *Relief or Reform?: Reagan's Regulatory Dilemma* (Washington, D.C.: Urban Institute Press, 1984), 47-48. OMB invoked this authority that summer as the EPA proposed guidelines for state implementation plans (SIPs) under the Clean Air Act. During the formal comment period on the guidelines, the NIPCC had led an industry campaign calling for language in the guidelines allowing states to consider the costs of control strategies when developing a SIP. As the EPA moved to publish final guidelines which did not include such cost considerations, the OMB initiated a formal review. Under pressure from the Commerce Department and other agencies, major revisions were made to the guidelines, and cost considerations were "sprinkled liberally throughout" the disputed section, significantly weakening the final guidelines. See Steck, "Private Influence on Environmental Policy," 274-75; Richard H.K.Vietor, *Environmental Politics and the Coal Coalition* (College Station: Texas A&M University Press, 1980), 168-178.

[68] Domestic Council Study Memorandum, no. 15, draft, June 22, 1971, Folder "Quality of Life, 1971 (1970-1972), 3 of 4," Box 96, JWF.

obtaining complete information upon which to base decisions and of analyzing alternative courses of action with a comparison of their relative benefits and costs."[69] For the location of a permanent review group, it settled on an office within OMB, thus avoiding the complications of creating a new body.[70] Agencies would be required to keep OMB informed of forthcoming regulatory actions by providing regular briefings and regulatory schedules. They would then submit proposals for new environmental, health, or safety regulations with "important consequences" to OMB for review, which would then consult with relevant agencies affected by the proposal, other White House offices and, if necessary, with the President's top domestic policy advisors.[71]

Warned that the plan would risk "press misinterpretation" as usurping the authority of the agencies and having "an anti-environment or anti-consumer motivation," Ehrlichman chose to quietly initiate the new "Quality of Life Review" program through a brief memorandum by OMB Director George Schultz.[72] In the October 5, 1971 memo, Schultz directed that all agency proposals "pertaining to environmental quality, consumer protection, and occupational and public health and safety" with a significant impact on other agencies or imposing significant costs on the private sector be submitted to OMB for review thirty days prior to their scheduled announcement.[73] Along with each proposal, agencies were required to submit alternatives to the proposed action, the reasons for its selection, and "a comparison of the expected benefits or accomplishments and the costs (Federal and non-Federal) associated with the alternatives considered."[74] At a time when businesses had stepped up complaints about the costs of stricter

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[69] Hubert Heffner to John Ehrlichman, memo, July 9, 1971, Folder "White House, Domestic Council Study Memorandum #15 (1971)," Box 7, Edward David Files, White House Special Files, Richard Nixon White House Papers, Richard Nixon Presidential Materials Project, National Archives II, College Park, Maryland (hereafter referred to as EDF).
[70] Memo, "RE: Domestic Council Study Memorandum #15," June 24, 1971, Folder "Quality of Life, 1971 (1970-1972), 3 of 4," Box 96, JWF.
[71] Edward J. Burger, Jr. and Richard M. Fairbanks to John Whitaker, memo, July 21, 1971, Folder "Quality of Life, 1971 (1970-1972)), 3 of 4," Box 96, JWF.
[72] Heffner to Ehrlichman, July 9, 1971, Folder "Quality of Life, 1971 (1970-1972)), 3 of 4, Box 96, JWF.
[73] U.S. Office of Management and Budget, "Agency regulations, standards, and guidelines pertaining to environmental quality, consumer protection, and occupational and public health and safety," memo, October 5, 1971 <www.thecre.com/ombpapers/QualityofLife1.htm> (December 11, 2004).
[74] *Ibid.*, Appendix A. Regulations would be subject to review if they "have a significant impact on the policies, programs and procedures of other agencies; or impose significant costs on, or negative benefits to, non-Federal sectors; or increase the demand for Federal funds for programs of Federal agencies which are beyond the funding levels provided for in the most recent budget requests submitted to the Congress."

environmental regulations, the Nixon administration created an institutional channel for them to challenge EPA proposals on cost-benefit grounds through the sympathetic offices of the Commerce Department or OMB.

To design and manage the new Quality of Life Review program, the Nixon administration brought in a group from the Pentagon which had gained a reputation for applying strict cost-benefit tests to regulations issued by the Army Corps of Engineers. In the mid-1960s, this Systems Analysis Group, based in the Office of the Secretary of the Army, had been busy applying PPB-style cost-effectiveness criteria to Corps' budgets and civil works projects. A paper circulated to the group by a visiting professor to the Army secretary's office, Alan Schmid, argued that cost-benefit analysis should be applied not just to the evaluation of public expenditures, such as flood control projects, but to rulemaking as well. Schmid wrote that "Government rulemaking is usually analyzed outside of the above formulations [PPB and cost-benefit analysis]. Yet, the issuance of a rule also directs the use of resources which have alternative employment. Can we then conceive of a benefit-cost ratio for a rule change as well as for an item in the Federal budget?"[75] Schmid's article prompted Jim Tozzi, Director of the Systems Analysis Group, to begin applying the group's cost-benefit reviews to regulations issued by the Corps as well. Later abolished by Congress after accusations of interference with Corps' prerogatives, Tozzi's group found a new home for their work at OMB in 1971, where they began applying their methods to the burgeoning field of environmental regulation.[76] Recalling the move, Tozzi has said, "[Nixon adviser H.R.] Haldeman said, 'What did we let out of the box?' And at the time I was in the Office of Secretary of the Army and Haldeman said, 'There's a nerd over at Army…'"[77] Tozzi became chief of OMB's environmental branch and was the career official in charge of Quality of Life Review during both the Nixon and Ford administrations.

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[75] A. Allan Schmid, "Effective Public Policy and the Government Budget: A Uniform Treatment of Public Expenditures and Public Rules," reproduced in Joint Economic Committee, *The Analysis and Evaluation of Public Expenditures,* 579-591.
[76] Jim Tozzi, "Commentary on Dr. Alan Schmid's Paper," <http://www.thecre.com/ombpapers/TozziAnalOfEconomicsOfRulemaking.htm> (December 11, 2004).
[77] "Jim Tozzi: Nixon's 'Nerd' Turns Regulations Watchdog," *Federal Times*, November 11, 2002 <http://federaltimes.com/index.php?S=1285338> (December 11, 2004).

Although Quality of Life Review was supposed to apply to all environmental, health, and safety programs, in practice OMB singled out EPA proposals for scrutiny. From the start, many in Congress expressed concern that the process would weaken environmental regulations, in part through industry influence. The Conference Report on the Clean Water Act of 1972, for instance, explicitly stated that decision-making authority under the Act would rest solely with the Administrator of the EPA, "and not with such other agencies as the Office of Management and Budget and the National Industrial Pollution Control Council."[78] During the Nixon and Ford administrations, the review process created significant tensions between the EPA and OMB, as the White House and other departments used it to pressure the EPA to weaken proposed rules. Successful interventions by OMB included moderating the regulation of a Montana copper smelter in 1971-2, delaying the target date for the phase-out of leaded gasoline, and weakening requirements for municipal waste treatment.[79] By the mid-1970s, EPA officials increasingly complained that the process had led to lengthy delays and weaker regulations due to pressure during the review process, particularly OMB and the Commerce Department. As one anonymous EPA official put it, EPA regulations were "more reserved, more scientifically aggressive, less environmentally aggressive."[80]

During investigations on federal regulatory programs in 1976, Representative John Moss's Subcommittee on Oversight and Investigations charged that OMB "interfered" with the statutory responsibilities and regulatory functions of the EPA, and favored the Commerce Department during the interagency review process by giving it more time to comment on EPA proposals. Lester Brown, a staffer on Moss's Subcommittee, wrote in 1976 that OMB had "provided industry with an opportunity to review, comment on, delay, and change EPA actions behind closed doors. The public has not been afforded this opportunity and consequently faces industry-influenced and weakened guidelines, regulations, and standards difficult to modify."[81] Citing similar

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[78] As quoted in J. Gustave Speth et. al., *OMB and EPA: Who Sets Environmental Policy?* (Natural Resources Defense Council, 1976).
[79] Robert V. Percival, "Checks without Balance: Executive Office Oversight of the Environmental Protection Agency, *Law and Contemporary Problems* 54 (Autumn, 1991): 127-204.
[80] As quoted in "Office of Management and Budget Plays Critical Part in Environmental Policymaking, Faces Little External Review," *Environment Reporter* (1976): 693-697.
[81] As quoted in *Ibid.*

examples, a 1976 report by the Natural Resources Defense Council argued that, from the outset, the primary purpose of Quality of Life Review had been "to protect the business community from the long overdue public interest legislation being enacted by Congress."[82] The manager of Quality of Life Review, Jim Tozzi, later confirmed the broad outline of the critics' charges. A strident critic of environmental regulation, Tozzi acknowledged "watering down" EPA rules through OMB review. "We made a lot of changes," he recalls. "When a regulation went out of OMB, it was lean and mean."[83]

Successive Presidential directives continued "regulatory review" procedures requiring agencies to prepare and consider the costs and benefits of proposed regulation. The Ford administration retained the Quality of Life Review process targeting the EPA. It also extended the scope of regulatory review by requiring all executive-branch agencies to prepare "Inflationary Impact Statements" for major proposals in a process overseen by a new Council on Wage and Price Stability ("CWPS").[84] In practice this process had little impact on the EPA, since CWPS mainly scrutinized regulations by the Civil Aeronautics Board and the Interstate Commerce Commission.[85] OMB's Quality of Life Review process remained the mechanism for applying cost-benefit analysis of EPA rules, until Acting EPA Administrator John Quarles withdrew the Agency from the process in early 1977 following the election of Jimmy Carter.[86]

But in 1978 the Carter administration continued regulatory review by OMB by requiring agencies to prepare a "Regulatory Analysis" for any rule with an estimated annual impact of $100 million or more.[87] A handful of major rules were selected each year for intense scrutiny by a new interagency Regulatory Analysis Review Group ("RARG"), comprised of representatives from every major executive agency, staffed by economists from CWPS, and chaired by the Chairman of the Council of Economic

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[82] Speth et al., *OMB and EPA*.
[83] Megan Twohey, "Jim Tozzi on Jazz and OMB," *The Federal Paper*, November 18, 2002, pp. 1, 12.
[84] Executive Order 11821 (November 27, 1974), 39 Fed. Reg. 41501 <http://www.thecre.com/ombpapers/ExecutiveOrder11821.htm> (December 11, 2004); OMB Circular A-107, January 28, 1975. These were later called "economic impact statements under Executive Order 11949 (December 31, 1976) <http://www.thecre.com/ombpapers/ExecutiveOrder11949.htm> (December 11, 2004).
[85] Created by P.L. 93-387 (August 24, 1974). See Percival, "Checks without Balance," 139-40.
[86] John Quarles to Assistant Administrators, et. al., "Termination of Quality of Life Review," memo, January 25, 1977 <http://www.thecre.com/pdf/QualLifeReview8.PDF> (December 11, 2004).
[87] Executive Order No. 12044, 3 CFR 152, 154 (1979).

Advisors. Unlike Quality of Life Review, which allowed OMB to delay or influence proposed rules before their publication, RARG reviews took place as part of the formal comment period. They also emphasized cost-effectiveness, or least cost alternatives for reaching a stated goal, rather than attempting a strict cost-benefit litmus test.[88] Nonetheless, like Quality of Life Review, the RARG process continued to provide industry with an important channel for influencing environmental regulation. The CWPS economists who reviewed EPA rules for RARG were strong advocates of strict cost-benefit analysis. As then EPA Administrator Douglas Costle recalls, "three out of every four CWPS comments on our rule making were cribbed right from industry brief…partly because it suited their economic biases about these issues, and their own perception that they were the custodians and keepers of the regulatory reform flame."[89] RARG and the White House intervened to weaken several important EPA rules, including the national ambient air quality standard (NAAQS) for ozone, the new source performance standard (NSPS) for coal-fired power plants, and new surface mining rules.[90]

Industry's Environmental Arithmetic

Having won an institutionalized mechanism for entering costs into the process of EPA rulemaking through Quality of Life Review and its spawn, the environmental backlash continued along several interrelated tracks. First, businesses lobbied for intensifying the regulatory review process by imposing stricter cost-benefit standards on proposed regulations, asking, beginning in the late 1970s, for the practice to be codified by statute in proposed "regulatory reform" legislation. The Quality of Life Review process and its successors had opened the door to challenges and delays of EPA rules by OMB on cost-benefit grounds, but with ultimate authority still vested in the EPA Administrator, proposed rules were never required to pass a strict cost-benefit test. Second, businesses lobbied for the inclusion of cost-benefit "balancing" requirements in new environmental legislation considered by Congress. And third, in support of these

[88] Percival, "Checks without Balance,"144-145.
[89] As quoted in Percival, "Checks without Balance," 146.
[90] Percival, "Checks without Balance," 146-7.

policy goals, businesses vigorously took complaints about costs directly to the public, claiming that excessive environmental regulation imposed unreasonable and damaging economic burdens on the nation as a whole.

For each of these efforts, it was useful to have detailed figures on how much the pollution cleanup was costing individual companies and whole industries. With the initial impetus provided by the NIPCC, individual firms continued tallying annual pollution-control costs, and trade groups aggregated industry-wide data. These cost figures were valuable for efforts to weaken or delay proposed regulations on cost-benefit grounds through OMB's regulatory review process. But the results also rippled through press releases, trade journals, and annual reports, often gaining traction in major business publications, and even major papers and newsweeklies. Companies willing to pay for advertising placements, meanwhile, could now give their institutional ads an air of objectivity and empirical weight by citing the new environmental arithmetic. In the chemical industry, for instance, companies including Dow, Monsanto, and American Cyanamid each conducted extensive regulatory-cost surveys—salvos against the rising tide of environmental regulation. Dow estimated that it spent $147 million in 1975, including $63 million on environmental controls and $22 million on health and safety.[91] Announcing the company's study in a 1977 speech, Dow President Paul Oreffice claimed that more than one-third of these expenditures were "excessive," caused by red-tape, inefficiency, and "a state of hysteria." Oreffice said it had been necessary to quantify the costs "because we need some weapons in trying to demonstrate to people in Congress what they are doing with this overregulation."[92]

Steel companies also put cost surveys center stage. Locked in a contentious battle with the EPA in the mid-1970s, U.S. Steel used surveys of regulatory costs to argue that it had "been cleaning up its operations in good faith and at great cost." In 1975 the company estimated that it had spent $114 million on pollution abatement, or 14% of its total capital expenditures that year. Refusing to reduce pollution to the levels demanded by the EPA, U.S. Steel officials argued that any increase in pollution-control spending would divert scarce capital from the expansion of production capacity and leave the

[91] *Chemical Week,* August 10, 1977, pp. 46-48.
[92] "Dow Chemicals Catalog of Regulatory Horrors," *Business Week*, April 4, 1977, p. 50.

company vulnerable to foreign competition.[93] Although its disputes with the EPA were less acrimonious, Bethlehem Steel also aggressively used analyses of cleanup costs to argue for relief. Beginning in 1976, Bethlehem claimed in advocacy ads that, after having already spent $400 million to clean up most of its emissions, it was now being unduly forced to "remove the last increment of pollution." In an ad headlined "Does this kind of environmental arithmetic add up to you?" Bethlehem suggested that it would soon be forced to spend $600 million more to remove just the last one-percent of pollutants from its emissions.[94]

Dozens of other major industrial firms joined Dow, Bethlehem, and U.S. Steel in briskly publicizing the results of their economic analyses. Industry also became adept at rapid-response economic analyses of new legislative and rulemaking proposals, promptly putting a high price tag on unwelcome proposals. In the early 1970s, for instance, the chemical industry argued that proposed OSHA standards for vinyl chloride exposure in the workplace would cost between $65 billion and $90 billion and as many as 2 million jobs, and its trade association stated, "The standard is simply beyond the compliance capability of the industry."[95] Similarly, in 1974, the electric utilities protested proposed EPA rules on thermal and chemical discharges under the Clean Water Act by arguing that the rules would cost the industry some $48 billion by 1983. The president of the Edison Electric Institute, W. Donham Crawford, claimed that the rules would "increase expenditures for electricity by almost $200 per household annually."[96]

Following the tracks laid by the NIPCC, businesses worked to reframe the basic language and methodology of environmental policy. At every level, from general political debate, to the fine details of law and administrative rulemaking, industry sought to reorient discussions toward "balancing" the *costs* against the *benefits* of environmental protection. The question, as trade associations and large corporations framed it, was not whether the nation should seek cleaner air and water, safer use of pesticides, or better control of toxic chemicals, but how far it should push these goals, and how long it should

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[93] Eric Morgenthaler, "Cleanup Clash: U.S. Steel, EPA Fight Long-Running Battles over Plants' Pollution," *Wall Street Journal,* August 9, 1976, p. 1.
[94] Bethlehem Steel, advertisement, *Newsweek*, September 13, 1978.
[95] Mark Green, "The Faked Case against Regulation," *Washington Post,* January 21, 1979, p. C1.
[96] "The Utilities Fight Costly Water Rules," *Business Week*, July 13, 1974, p. 22.

take to reach them. Forcing the removal of the last few percent of a source's pollutants, pursuing "zero discharge" or "zero pollution," or forcing the adoption of untested or unnecessary technology, would inevitably lead to unfavorable benefit/cost ratios.

It was never as clear as it may have seemed that a cost-benefit calculus would favor industry's positions, particularly early on, when air and water pollution levels were high and existing controls weak. The economists' curves predicted low initial incremental control costs coupled with high absolute reductions in pollution. Indeed, early estimates of the costs and benefits of the Clean Air Act of 1970 suggested a quite favorable benefit/cost ratio, greater than 3:1. The White House Council on Environmental Quality (CEQ) estimated in 1971 that the annual cost of the Act would be some $4.7 billion in 1975. On the benefits side, both the CEQ and the EPA cited a 1968 estimate of $16 billion for the total annual toll of air pollution on health, vegetation, materials, and property values. The CEQ thus argued that "even when comparing 1968 benefits with 1975 annualized control costs, the identified benefits are over three times the costs." Leaving aside what fraction of the $16 billion in damages might actually be reduced under the Act, the number itself was widely seen as little better than an educated guess.[97]

From the start, the key problem for environmental advocates and the EPA was producing hard numbers on the benefits side of the ledger. As industry readily plugged reams of cost figures into the regulatory process, calculations of benefits were a much more daunting, painstaking, and uncertain undertaking. By comparison, even the difficult predictions for the benefits of auto safety regulation were on firmer footing. New pollution controls would lead to reductions in property damage, deaths, and illness. But by how much? Before dollar values for illness or death could even be applied by economists, considerable scientific hurdles had to be surmounted. Tracing cause-effect and source-receptor relationships required moving first from predicted cuts in emissions, to predicted reductions in ambient concentrations, and then to the final benefits in public health and reduced property damage. Tracing each step for various pollutants involved an array of complex scientific and medical models, with uncertainties multiplying rapidly along the tortuous paths linking pollution sources, atmospheric chemistry, meteorology,

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[97] Council on Environmental Quality, *Environmental Quality: The Second Annual Report* (Washington D.C.: U.S. Government Printing Office, 1971), p. 120.

materials science, and epidemiology. With much of the relevant science itself in rapid flux, economists in the early 1970s faced daunting challenges in generating reasonable estimates of the benefits in improved public health, reduced property damage, and aesthetic improvements resulting from new pollution controls. Again, too, there was the thorny problem of assigning a monetary value to lost life. As in auto safety regulation, many early studies, by default, used some variation of the "human capital" approach, summing lost earnings with hospital costs and funeral expenses.[98]

Another glitch in the "benefits" calculus involved assessing what, in 1966, economist Ronald Ridker called the "psychic costs" of pollution, such as the "anguish of death" or the unrealized "desire for a more beautiful environment."[99] In legal terms, these were the non-economic costs, or pain and suffering. A pioneer in quantifying the social costs of pollution, Ridker began using household surveys asking people "how much they would be willing to pay to obtain the more pleasant environment." But in a caveat seldom heeded by later cost-benefit true believers, Ridker cautioned that quantification had its limits. "Under the best of circumstances," he wrote, "we may never obtain an accurate measure of what I have called psychic costs. Yet this category may well be the most important, and sufficiently large to warrant increased control measures."[100] Indeed, in surveys conducted for his 1967 study, Ridker found that residents of high pollution areas—lacking information on the nature and extent of the problem—were willing to pay only $10 a year for a "complete" solution to air pollution problems.[101]

Others pointed out that many of the most important benefits of current environmental regulations were intergenerational in nature, a position suggested by the EPA in its 1973 annual "Cost of Clean Air" report. Current estimates of benefits, it suggested, were so uncertain as to not warrant further repetition. "How does one

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[98] Lester B. Lave and Eugene P. Seskin, "Air Pollution and Human Health," in Robert Dorman and Nancy S. Dorfman eds., *Economics of the Environment: Selected Readings*, (New York: W.W. Norton, 1972), 345-355.
[99] Ronald G. Ridker, "Strategies for Measuring the Cost of Air Pollution," in Harold Wolozin ed., *The Economics of Air Pollution* (New York: Norton, 1966), 92-100.
[100] Ridker, "Strategies for Measuring the Cost of Air Pollution," 100.
[101] The 1967 study was Ronald G. Ridker, *Economic Costs of Air Pollution: Studies in Measurement* (New York: F. A. Praeger, 1967).

establish the value of one's health or a work of art imperiled by air pollution? Attempts have been made to answer these questions, but at present the estimates have wide ranges and little reliability." Instead the report argued that a ledger of currently calculable costs and benefits ignored the incalculable benefits of the Act's technology-forcing requirements—a long-term reorientation of industry along a less-polluting technological path. "With population growth and increased industrialization," it said, "future pollution control will rely on the technology and practices being initiated today. This redirection, bringing attention to the need for clean air, may turn out to be the greatest benefit of implementing the Act."[102] Accruing far into the future, such intergenerational benefits typically either did not show up in cost-benefit analyses, or were heavily devalued by "social discount" rates. As legal scholar Robert Percival notes, "the benefits of environmental regulation, though often substantial, typically accrue over long periods of time in ways that are not nearly as visible as the impacts of compliance costs."[103]

Thus while industry disseminated a steady stream of rising cost figures, the benefits side of the ledger was a tangle of scientific uncertainties—human lives equated with foregone income, "psychic costs," and other incalculable figures—with the entire endeavor in constant flux throughout the decade. Citing these problems, a 1980 report by the House Committee on Interstate and Foreign Commerce identified the quantification of benefits as "the single greatest problem with the use of formal cost-benefit analysis."[104] Throughout the decade, the EPA struggled to combat industry figures with ever more sophisticated analyses of benefits. But when it came to justifying or challenging policies on cost-benefit grounds, estimated benefits were far more uncertain and less tangible than costs. The political dynamics also conspired against the benefits side of the ledger. The constituency for assessing costs was clear—regulated industries with great incentive to delay or weaken regulations by aggressively scrutinizing any potential compliance costs. Benefits, on the other hand, accrued diffusely to the public;

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[102] U.S. EPA, *The Cost of Clean Air*, July 1973, reproduced in U.S. Congress, House of Representatives, Committee on Interstate and Foreign Commerce, Subcommittee on Public Health and Environment, *Hearings: Clean Air Act Extension*, February 28, 1973, pp. 59-67.
[103] Percival, "Checks without Balance," 195.
[104] U.S. Congress, House of Representatives, Committee on Interstate and Foreign Commerce, Subcommittee on Oversight and Investigations, *Cost Benefit Analysis: Wonder Tool or Mirage*, 96th Cong., 2d sess., 1980, p. 17.

less immediate and tangible, they lacked a similarly organized constituency. In practice, it fell to the EPA and environmental groups to press the case. As Massachusetts Institute of Technology researcher Nicholas Ashford observed in 1980, the beneficiaries of social regulation—workers, consumers, and the general public—“have not had the resources to study their benefits in detail and, in most cases, have not been organized or motivated to press for such assessments.”[105] It was clear that both the methodology and political mechanics worked to the advantage of regulated industries. The next step for industry was to convince the public that their interests, too, would be better served by balancing the economic costs against the benefits of the nation’s bold environmental initiatives.

The Energy Crisis and Taking the Case Public

As enthusiasm grew within the business community for economic analyses and intensified use of cost-benefit analysis in regulatory review, some in the business community argued that numbers alone were not enough. To be sure, Dow’s catalog of regulatory horrors or U.S. Steel’s capital spending complaints might suffice to persuade sympathetic industrialists of the perils of “over-environmentalism.” Economic analyses might also be useful evidence at congressional hearings or in the venues of administrative rulemaking. But such environmental arithmetic was hardly the stuff to rally public support, said critics such as Charles B. Yulish, a leading consultant to the electric utility industry. “How can the average, hard-working, middle-class, suburban insurance salesman with a BA degree possibly cope when he gets home, with a 50- or 100-page impact statement that is riddled with calculus, graphs, and descriptions of guppy behavior in the fields?” Yulish asked rhetorically in a 1973 interview with the trade journal *Electrical World*. Yulish and other PR consultants urged throughout the early 1970s that the business community was losing the communications war to environmentalists because it had failed to translate its concerns into language and themes that captured the attention of the general public. PR professionals urged business leaders to explain the value of their operations to the public and also to begin calling into question environmental regulations in language that appealed to the pocketbook concerns of

[105] Nicholas Ashford, “In Many Cases, Regulation Pays,” *New York Times*, June 15, 1980, p. F16.

consumers. By the early 1970s, large corporations and trade associations were launching PR and advertising campaigns aimed at linking environmental regulation to higher prices for energy and consumer products, unemployment, and even a general decline in the standard of living.[106]

Polluting industries were given a windfall political opening to take their case public in the "energy crisis" of the 1970s. Entering America's political lexicon in the early 1970s, the term pointed to accumulating stresses in the U.S. energy supply system. With natural gas supplies tight and electric power plants operating at close to capacity in many parts of the country, demand for oil surged at the same time that a twenty-year surplus in world oil markets came to an end. With domestic oil production now lacking any spare capacity, by the early 1970s the U.S. had become heavily dependent on Middle Eastern supplies to satisfy its boundless appetite for petroleum. The energy crisis was most dramatically symbolized by the "Arab oil embargo" of 1973. In retaliation for aid to Israel during the Yom Kippur War of 1973, the Organization of Petroleum Exporting Countries (OPEC) began an embargo on all shipments of oil to the United States and rolling cutbacks of overall production.[107] Within months, crude oil prices nearly quadrupled, gas prices jumped some 40%, and gas lines of queuing motorists appeared in some parts of the country. President Nixon advocated a "Project Independence" to free the U.S. from dependence on foreign energy sources by accelerating the development of domestic fuels.[108] Although the embargo itself ended in March, it augured the end of the era of cheap oil. The oil price shock exacted a heavy toll on the U.S. economy, helping end the long postwar boom and send the economy into deep recession. Between 1973 and 1975, the GNP fell 6 percent, and unemployment doubled to 9 percent.[109]

Led by energy interests, industries reeling from a string of political defeats at the hands of the environmental movement seized upon the energy crisis to proclaim that environmental rules were a fundamental obstacle to meeting the nation's energy needs. As political scientist Eric Smith has observed, "Spokespeople for a wide range of

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[106] *Electrical World,* September 1, 1973, pp. 28-29. See also, generally, chapter 2 of this dissertation.
[107] Daniel Yergin, *The Prize: The Epic Quest for Oil, Money, and Power* (New York: Touchstone, 1991), 589-612.
[108] Yergin, *The Prize*, 615-617.
[109] Yergin, *The Prize*, 635.

business interests joined the debate with a chorus of requests to relax various environmental regulations in order to save energy. To them the energy crisis was an opportunity to beat back environmental advances."[110] The petroleum industry immediately portrayed the crisis as partly the result of restrictive environmental rules and "pressure by environmental groups."[111] The National Association of Manufacturers demanded the "removal of arbitrary restrictions on the development of energy resources."[112] And power-plant operators blamed environmentalists for slowing the development of the nation's abundant domestic energy sources, particularly coal.[113] By late 1973, Gladwin Hill, environmental beat reporter for the *New York Times*, would observe, "From the industrial sector particularly has come a drumfire of suggestions that the energy shortage necessitates broad-gauge repudiation of environmental controls."[114]

For their part, electric utilities and other coal-related industries hoped that the multilayered "energy crisis" would herald a major resurgence of coal. Since the end of World War II, coal use in the United States had dropped by nearly a half. Now, with public opposition growing to nuclear plants, natural gas supplies low, and an oil price shock, many in government and industry agreed with the National Petroleum Council's assessment that coal would again be *the* crucial fuel for U.S. industrial growth. The "energy crisis" appeared to offer "King Coal" a new lease on life, and calls went out to rapidly expand the number of coal-fired power plants to meet the nation's energy needs.[115] For the coal coalition, restrictive new environmental rules seemed the only obstacle to this promising future. Utilities found two policies implemented by the EPA under the Clean Air Act particularly objectionable: "No Significant Deterioration" and stack scrubbers. Both symbolized what utility executives viewed as a flawed cost-blind approach to environmental regulation. The "No Significant Deterioration" controversy emerged after the courts had interpreted the Clean Air Act as requiring that so-called

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[110] Eric R.A.N. Smith, *Energy, the Environment, and Public Opinion* (Oxford: Rowan and Littlefield, 2002), 26.
[111] Laurence Stern, "Energy Crisis is Exploited," *Washington Post*, February 4, 1973, p. A1.
[112] Gladwin Hill, "Environment: Reformers are Undismayed by the Energy Crisis," *New York Times*, December 2, 1973, p. 80.
[113] William H. Jones, "Warnings Issued on Energy," *Washington Post*, May 26, 1973, p. C12.
[114] Hill, "Environment," *New York Times*, December 2, 1973, p. 80.
[115] See Vietor, *Environmental Politics and the Coal Coalition*, 206.

"pure air" regions—areas with cleaner air than required under the Act—not undergo "significant deterioration" of air quality. Utilities and other smokestack industries claimed that this "No Significant Deterioration" rule would virtually halt new plant construction in many parts of the country.[116] The Western Energy Supply and Transmission Associates, a group of western utilities, argued that under this rule "the southwestern US will be denied the opportunity of economic growth, and [our] members will be prevented from meeting their responsibility of providing adequate electric power."[117] The National Coal Association, meanwhile, charged that court decisions outlawing significant deterioration had "thrown the nation into…instant no-growth policy."[118]

An even more acrimonious dispute surrounded the EPA's decision to require coal-fired power plants to install so-called "scrubbers" to remove sulfur dioxide from stack emissions. Throughout the decade, electric utilities vigorously resisted this technology-forcing approach, claiming that workable scrubber technology was not commercially available and that the costs were prohibitive.[119] They argued instead for the use of high stacks to send emissions far from the source and for "intermittent controls," mainly switching to low-sulfur coal when local meteorological conditions prevented emissions from being dispersed. As a 1974 *Electrical World* editorial put it, "Our position is clear. We feel unequivocally that insistence on the use of scrubbers at their present stage of technological maturity represents a squandering of resources that cannot be justified by the debatable benefits derived. When scrubbing technology demonstrates its practicability, let us then evaluate its costs and benefits. Meanwhile, let's do the best we can with what we have."[120] "No significant deterioration" and scrubbers threw a wrench in the coal coalition's plans for a major revival. "Just when the energy crisis had given coal a new lease on the future," writes historian Richard Vietor,

[116] *Electrical World*, December 1, 1972.
[117] *Electrical World*, October 1, 1973, p. 73.
[118] *Electrical World*, September 1, 1973, p. 26.
[119] See for instance *Electrical World*, March 1, 1973, p. 9; *Electrical World,* July 15, 1973, pp. 113-114, *Electrical World*, August 1, 1973, p. 26.
[120] *Electrical World*, May 15, 1974, p. 7.

"it seemed inconceivable that a responsible government could allow air pollution controls to thwart coal's solution to the energy crisis."[121]

Electric utilities viewed the energy crisis as an opportunity to take such complaints public and gain popular support for amendments to the Clean Air Act and other environmental laws, or at least greater consideration of costs by the EPA during their implementation. In 1972, W. Donaham Crawford, president of the utilities' main trade association, the Edison Electric Institute (EEI), blamed a "rapid imposition of severe environmental restrictions" for the current energy shortages and called for President Nixon to create a new National Energy Council to coordinate government energy policies. Reciting the constant refrain of the environmental backlash, Crawford urged the government to strike a "reasonable and cautious balance between the need for energy and the need for a wholesome environment."[122] As the EPA began implementing the strict requirements of the Clean Air Act, utilities would argue that excessive pollution controls contributed to rising consumer energy costs and hindered economic growth. At the time of the first Earth Day in 1970, utilities had joined other industries in using advertising and public relations to "tell industry's story" of voluntary cleanup and corporate responsibility. But by 1973 many were setting aside such environment-friendly image advertising to publicize criticisms of the excessive costs of new environmental regulations. To be sure, narratives of partnership, voluntary clean-up, and environmental responsibility did not disappear, but after 1973 they were increasingly overshadowed by calls for relief from the heavy hand of government.[123]

A 1973 survey of thirty leading privately-owned utilities found they were "investing heavily in corporate advertising to awaken public interest in the power shortage." These campaigns often blamed environmental regulation for rising energy prices, forcing utilities to switch to more expensive low-sulfur coal and install costly scrubbers and precipitators to capture pollutants. The Investor-Owned Electric and Power Companies, a loose association of utilities, hammered away at these themes in a PR campaign that placed articles in *Reader's Digest* such as "Do Electric Rates Have to

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[121] Vietor, *Environmental Politics and the Coal Coalition*, 207.
[122] "Edison Electric Plan," *New York Times*, June 7, 1972, p. 59.
[123] See chapter 2 of this dissertation.

Keep Going Up?" and "Why We Have a Fuel and Power Shortage." In 1972, the Philadelphia Electric Company began a local campaign including two-minute commercials starring TV actor Leslie Nielsen, who explained how environmental regulations had led to higher electricity prices. And in 1974, a group of 37 investor-owned utilities kicked off an "Electric Utilities Clean Air Communications Plan" to influence coverage of clean air policy by the national press and the television networks. A position paper titled "Clean Air and the Consumer: A Statement of Belief by Electric Utilities" established key talking points of the campaign: consumers ultimately paid for cleaner air through higher electricity rates; less-costly alternatives already existed for clearing the air; and the industry's proposals for changing the Clean Air Act could avert otherwise crippling economic impacts. As consumers became aware of these "different options available to them for achieving clean air," utilities would urge them to contact their elected representatives and the EPA with concerns about current programs. In effect, it asked consumers to become a grassroots lobby for the industry in its efforts to weaken the Clean Air Act. Beginning with a series of presentations to the top executives and editors of the national print and broadcast media, utility officials hoped for a top-down injection of their messages into news coverage.[124]

American Electric Power

The most brazen and controversial of the utility campaigns was launched in 1974 by American Electric Power (AEP), a New York holding company which owned seven Midwestern utilities. The nation's largest producer of electric power, AEP spent $3.6 million in 1974 alone to run 36 different advocacy advertisements in major newsweeklies (*Time*, *Newsweek*, *U.S News*), national newspapers (*The New York Times*, *The Wall Street Journal*, and the *Washington Post*), and some 277 local newspapers within its service area. More than half of the ads charged that environmental regulations were an obstacle to meeting the nation's pressing energy needs, singling out mining restrictions on federal

[124] See material reproduced in U.S. Congress, Senate, Committee on the Judiciary, Subcommittee on Administrative Practice and Procedure, *Sourcebook on Corporate Image and Corporate Advocacy Advertising*, 95th Cong., 2d sess., (Washington, 1978), pp. 33-34**;** *Electrical World*, Dec. 1, 1974, p. 74.

land, air pollution standards, and the EPA's scrubber policy.[125] The campaign began in February 1974 with a full-page ad headlined "We Have More Coal Than They Have Oil. Let's Use It!" It featured a cartoon of two wealthy Arab sheiks standing in front of a Rolls Royce—the tycoon beneficiaries of America's dependence on foreign oil. The text argued that domestic coal could be the "major solution to our present energy problems" and urged that it be extracted and burned as quickly as possible. While acknowledging that environmental restrictions might pose obstacles, it said that such problems were "nothing that American ingenuity cannot lick." In subsequent ads, the lampooned sheiks periodically reappeared, becoming familiar mascots of the campaign. According to AEP's 1974 annual report, the main objective of this campaign was to "point out the vital importance of utilizing coal" and criticize the "government policies that were restricting the burning of some coal and the mining of other coal." It argued that greater utilization and availability of coal offered a straightforward solution to the energy crisis, if only unreasonable government restrictions were eased.[126]

AEP's attack on environmental rules ranged from generalized calls for amending the Clean Air Act to biting advertorials focusing specifically on the complex scrubber controversy. Several ads claimed that unreasonable environmental regulations were major drags on the nation's economy and obstacles to energy self-sufficiency. An ad headlined "Generate Less Energy—Sure. And Generate Galloping Unemployment" warned that conservation measures advocated by "no-growth critics" would obstruct growth and lead to "less production, fewer jobs, and lower demand for products." Featuring a pointy-toed dandy in plaid slacks (perhaps meant to suggest an EPA bureaucrat) holding a protest sign reading "Generate Less Energy," the ad urged changes to the Clean Air Act "so that more of our coals can be burned." Another ad depicted a blindfolded Uncle Sam above a caption "Are We Blind to the Real Energy Crisis?" It warned that unless the Clean Air Act was amended "we will have a *real* energy crisis."[127]

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[125] S. Prakash Sethi, *Advocacy Advertising and Large Corporations: Social Conflict, Big business Image, the News Media, and Public Policy* (Lexington, Mass.: Lexington Books, 1977), 115-177.
[126] See American Electric Power advertisements, reproduced in Sethi, *Advocacy Advertising and Large Corporations*, 141-147.
[127] American Electric Power, advertisement, *Washington Post,* April 30, 1974, p. A17.

Perhaps the most controversial ad was titled "We Burn at Those Who Block the Burning of Vast Amounts of America's Coal." This charge was thrown at the EPA. "Will the E.P.A. accept the responsibility for the economic effect their restrictive decision will have on the country?" it asked rhetorically. "Oh no! They'll try to wriggle off the hook by saying you can burn all the coal in America if you'll just install stack gas scrubbers." The ad riled top EPA officials including Administrator Russell Train, who disputed its claims in an August 1974 letter to AEP Chairman and CEO Donald P. Cook that was published in the *New York Times* and *Washington Post*.[128] Train argued that the ad misled the public about EPA policies and neglected the agency's efforts to make reasonable accommodations in implementing air quality goals. Not to be outdone, Cook ran a six-page, point-by-point response to Train, which appeared the following month as a paid advertisement in the *Times* and *Post* under the caption "Half a Story is Worse Than None."[129]

Such aggressive public swipes at environmentalists and the EPA owed much to the leadership of Cook, who signed off personally on each of the 36 ads that ran in 1974. The campaign's themes reflected Cook's strong personal belief that much of the new environmental regulation was excessive. A former chairman of the Securities and Exchange Commission and congressional staffer, Cook began working at AEP in 1953. In the early 1970s, Cook became the electric power industry's most vocal critic of new environmental rules, charging that "our government prevents us from burning the coal we can mine and prevents us from mining the coal we can burn!"[130] Although other utility executives generally shared Cook's views, most shunned public controversy and preferred to work quietly for regulatory relief in Congress, the White House, and the courts. Cook, however, seized upon the "energy crisis" to aggressively take the utilities' case directly to the public. In 1974, *Business Week* described Cook as a "strong-willed and scrappy man," whose style was "to come out fighting rather than work quietly behind the scenes." The result of Cook's media campaign, according to *Business Week*, was that

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128 Russell E. Train to Donald C. Cook, August 23, 1974, published in *New York Times*, September 2, 1974 and *Washington Post*, September 5, 1974.
129 *New York Times*, October 22, 1974; *Washington Post*, October 22, 1974.
130 "Donald C. Cook of American Electric Power," *Nation's Business*, September 1975, pp. 46-48.

AEP was "increasingly identified in the public eye as the leading critic of environmental rules."[131]

Observers split on the impact of the AEP campaign. EPA officials argued that the campaign had actually strengthened the agency's hand by stirring a backlash. Major papers, including *The Washington Post* and *New York Times*, ran editorials criticizing the claims of specific ads, and some observers, including an Arab-American stockholder of AEP, objected to the campaign's offensive stereotyping of Arabs.[132] Marlin Fitzwater of the EPA observed that "people who saw those ads and then read the editorials probably thought that big business was trying to shaft the public interest."[133] But AEP officials said that they had succeeded in attracting public attention to the plight of utilities. Although no polls tracked the ads' impact, AEP claimed that the majority of the mail, telephone, and media responses had been favorable.[134] More important, according to some observers, was the company's move to conflate the industry's parochial interest in regulatory relief with the economic interests of consumers. John O'Toole, president of the prominent New York advertising agency Foote Cone & Belding, and coiner of the term "advocacy advertising," told the *Wall Street Journal* that the "best way to present any ad is to make it in terms of the reader's selfish interest, and that's the way [AEP's ads] were presented."[135]

Petroleum Industry

The petroleum industry also invested heavily in linking environmental rules to the energy crisis. In 1972 the American Petroleum Institute (API), the major oil industry trade association, issued a first-ever policy statement on energy at its annual meeting in Chicago. It suggested that environmentalists would have to compromise on issues such as exploration on federal lands and offshore drilling. Industry executives at the meeting

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131 "Donald Cook Takes on the Environmentalists," *Business Week*, October 26, 1974, pp. 66-73.
132 Sanford L. Jacobs, "Firm's Ad Campaign 'Isn't Very Bright' Arab Holder Asserts," *Wall Street Journal*, April 25, 1975, p. 18.
133 Quoted in Sethi, *Advocacy Advertising and Large Corporations*, 133.
134 *Ibid.*, 123.
135 Edwin McDowell, "Donald Cook and Those Funny Ads," *Wall Street Journal*, February 7, 1975, pp. 10, 20.

said that a new balance must be struck between energy needs and environmental protection in order to protect the American standard of living. The vice president of Continental Oil, C. Howard Hardesty, for instance, said in a speech that because "environmental concerns are more deeply rooted than our energy concerns. So far we are not willing to accept the fact that some tradeoffs, some compromises will be needed to keep theses inconsistencies from destroying our way of life."[136] With growing talk of an "energy crisis," the oil industry moved to link its own agenda to the new energy concerns via campaigns in the national media. Getting in first, the industry hoped to shape the initial terms of political debate according to its own policy preferences. Urging a more aggressive public presence, API's president, former Texas Congressman Frank Ikard, told the 1972 conference, "it is vital that we sharpen our communications with the public so that the issues are clear and not hazy."[137]

API took the industry's ideas public through a costly advertising campaign in the early 1970s. In 1972 alone, the group spent an estimated $4.2 million targeting the general public through television commercials and newspaper ads. And in 1973, it budgeted $2.5 million to target "thought leaders" via ads in magazines.[138] Among other things, the campaign blamed environmental restrictions for preventing the development of adequate supplies of domestic oil. In the summer of 1971, for instance, API ran an ad in twenty-two major newspapers illustrated with an oil can whose nozzle was twisted into a knot. It was captioned "No one can live without air and water. But have you tried living without oil."[139]

But API's efforts were just the tip of the iceberg for the oil industry. In May of 1974, Rep. Benjamin Rosenthal (D-New York) estimated that over the last eighteen months the industry as a whole had spent "about a third of a billion dollars on advertising, most of it on politically oriented messages rather than product promotion."[140] The majority of this came from individual firms, which joined the API in urging a new balance between environmental protection and energy needs. Gulf Oil, for example,

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[136] William D. Smith, "Oil Group Warns on Ecology Issue," *New York Times,* November 14, 1972, p. 65.
[137] As quoted in Laurence Stern, "Energy Crisis is Exploited," *Washington Post*, February 4, 1973, p. A1.
[138] Philip H. Dougherty, "Wooing the Energy Crisis," *New York Times*, November 7, 1972, p. 46.
[139] Reproduced in Laurence Stern, "Energy Crisis is Exploited," *Washington Post,* February 4, 1973, p. A1.
[140] Benjamin S. Rosenthal, "Big Oil's Energy-Crisis Blitz," *New York Times,* May 25, 1974, p. 29.

warned in 1973 advocacy ads that, unless the nation fully tapped its domestic energy resources, its national security and standard of living would suffer. A June 1973 Gulf ad argued that the pendulum had swung too far in favor of environmental protection, leading to unreasonable standards and unreasonable costs. Like American Electric Power, Gulf told consumers that they would ultimately pay these costs through higher energy prices. The company urged a relaxation of rules for strip mining and offshore drilling, immediate construction of the Trans-Alaska pipeline, and an end to delays in building nuclear power plants.[141] Commenting on this medley of oil industry efforts in 1973, the *New York Times* said, "The industry is portraying the crisis as a by product of unfriendly policies by government regulators, pressure by environmental groups and anti-industry propaganda by spokesman [sic] for consumer organizations."[142]

But by far the most ambitious campaign to grow out of the energy crisis was that by Mobil Oil. Kicked off in 1972, it unleashed a continual stream of advocacy advertisements and similarly-themed television commercials. For its controversial advertorials (or "Op-Ads"), Mobil purchased prominent space in major papers, including placements on the influential Op-Ed page of the *New York Times*, opened to advertisers in 1970. At a cost of many millions of dollars over the course of the decade, Mobil's advertorials began appearing weekly in the *Times*, as well as leading papers in Boston, Chicago, Los Angeles, and Washington. Among other things, Mobil's advertorials defended oil industry profits, criticized energy conservation as an unworkable policy, and claimed that excessive environmental regulation had exacerbated energy shortages. Like other oil companies, Mobil also alleged that environmental rules were a major factor in America's energy problems by stifling the expansion of domestic energy supplies.

Herbert Schmertz, Mobil's vice president for public affairs and the architect of the campaign, said that the ads targeted "opinion leaders and decision makers" who helped "set the tone for the thinking of others." The goal was to make the public "understand the different options open to them, and the trade-offs that each demand: between the needs of the economy and environment, for example. Both can be satisfied, but there must be some give on both sides." Mobil was forced to turn to paid advertising, Schmertz argued,

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[141] Gulf Oil, advertisement, *Wall Street Journal*, June 6, 1973.
[142] Stern, "Energy Crisis is Exploited," p. A1.

because of the failure of the media to tell its side of the story. TV coverage of energy matters had been "simplistic, and often inaccurate," he said, while print reporters often "displayed a distinctly anti-business bias." Mobil's battle with the media peaked in 1974, when CBS and NBC refused to air a commercial promoting off-shore drilling for oil and gas in spite of the environmental risks. Mobil quickly responded with advertisements in newspapers across the country which reproduced frames from the commercial and blasted the networks for restricting free speech.[143]

Mobil's campaign drew heavy criticism throughout the decade. Environmentalists charged that Mobil opportunistically made a scapegoat out of environmental protections. The Federal Trade Commission investigated the accuracy of the ads, and a top environmental official in the Carter administration called the campaign the "imMOBILization of truth."[144] Nevertheless, Mobil's persistent and highly-visible advertorials ensured that a huge audience of "opinion leaders" in the 1970s would repeatedly encounter claims that environmental regulation carried a heavy price for the nation's economy. In the decade-long construction of a narrative linking environmental rules to the nation's stubborn economic problems, few played a more important role than Mobil and Herbert Schmertz. In Schmertz's view, Mobil's patient, yet forceful approach offered vital lessons for other companies planning to "put more muscle into public affairs." With "big government" increasingly interfering with the operations of business, wrote Schmertz in 1976, it was time for "the entire business community to join together in defense of certain basic economic principles." Business could not hide from controversial political issues, but like Mobil "must play its part in helping to shape the ideological and philosophical currents that underly social policy."[145]

Others who used the energy crisis to demand relief from environmental rules included natural gas companies, banks, and chemical firms. Columbia Gas System, a natural gas provider, argued in a 1972 ad titled "The Gas Shortage" that Congress should amend the National Environmental Policy Act (NEPA) because it had "obstructed efforts

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[143] Herbert Schmertz, "Idea Advertising: Talking to New Audiences," *Electric Perspectives* (June 1976): 1-7.
[144] Merrill Brown, "Regulation Critics Assailed," *Washington Post*, February 28, 1980, p. B1.
[145] Schmertz, "Idea Advertising," 7.

to supply the American people with clean burning natural gas."[146] The First National Bank of Chicago warned that, unless opposition to the Trans-Alaska pipeline, offshore drilling, and nuclear power plants was overcome, the country could face a disastrous power shortage leading to blackouts that winter.[147] And PPG Industries of Pittsburgh, owner of the Houston Chemical Company, a maker of tetraethyl lead for gasoline, used the crisis to publicly challenge the EPA's phasedown of leaded gasoline. A November 1973 PPG ad argued that as much as "1 million barrels of crude oil every day" could be saved by keeping octane-boosting tetraethyl lead in gasoline at current levels. Depicting a barrel of oil wrapped in the Stars and Stripes and labeled "1,000,000 Oil" which was being poured down a drain, the ad urged Congress to allow present levels of lead in leaded gasoline to be maintained.[148] John Quarles, EPA Deputy Administrator, and Senator Edmund Muskie, a principal architect of the Clean Air Act, both publicly criticized the ad, with Muskie calling it a "blatant falsehood." All the same, said Muskie, just "mentioning 1 million barrels is enough to get a Congressman drooling."[149]

Muskie and Quarles joined a chorus of top environmental officials, members of Congress, and environmentalists to publicly denounce the broad corporate advertising blitz. Russell Train, then chairman of the Council on Environmental Quality, told the Washington Rotary Club in the summer of 1973 that the environment had become the "whipping boy for our energy problems."[150] Representative Benjamin Rosenthal derided the massive advertising campaigns by the oil industry as an "informational brownout on the truth behind the energy crisis." Along with sixteen other members of Congress, Rosenthal unsuccessfully petitioned the television networks to give free air time to public-interest advertising under the Federal Communications Commission's Fairness Doctrine, to counterbalance industry's vastly superior economic resources and media access.[151] Environmental leaders also cried foul. Stewart Brandborg, president of the

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[146] Columbia Gas System, advertisement, *New York Times*, June 29, 1972, p. 13.
[147] First National Bank of Chicago, advertisement, *New York Times*, July 7, 1972, p. 7.
[148] PPG, advertisement, *Washington Post*, November 27, 1973, p. A21.
[149] George C. Wilson, "Environmental Gains Threatened by Crisis," *Washington Post*, December 11, 1973, p. A1.
[150] "Nixon Aide Denies Energy Gap is Caused by Ecological Effort," *New York Times,* June 14, 1973, p. 34; George C. Wilson, "Environment Link in Fuel Crisis Hit," *Washington Post*, June 14, 1973, p. A4.
[151] Benjamin S. Rosenthal, "Big Oil's Energy-Crisis Blitz," *New York Times*, May 25, 1974, p. 29.

Wilderness Society, observed in late 1973, "The moneymaking interests are obviously mounting a massive strategy to undo all the constructive environmental programs."[152] And Elvis Stahr, president of the National Audubon Society, warned of "broadside assaults upon the environmental safeguards enacted in recent years."[153]

Muskie and Quarles, meanwhile, pushed back in the national media against industry claims of an environmental link to the energy crunch through a series of speeches and press interviews in 1973-74.[154] Both Muskie and Quarles warned that the blitz of corporate advertising and public relations by regulated industries was beginning to sway the political debate in favor of rollbacks of environmental protections. Muskie observed a "real move away from the environmental cause," in part because the "oil companies can shape the political attitude so quickly, and we have no resources to counter them."[155] Quarles charged that industry had successfully exploited the energy crisis to recast the political agenda. When Congress was under pressure to act quickly, he said, "Any false information that is widely publicized is not likely to be effectively challenged." With a "near-panic atmosphere" during the energy crisis, Quarles warned that "one big blast of false advertising could send this country down the wrong path."[156]

But the influence of this corporate media blitz went well beyond its one-sided advertising messages. It also helped convert industry-spun positions into a calcified conventional wisdom espoused by the media. Despite some critical coverage of oil industry advertising and periodic editorials debunking ads by American Electric Power or Mobil, the national media often failed to challenge the claims of industry. For instance, the first story in a *Washington Post* series on the energy crisis in late 1972 asked "Why and how did a fuels crisis strike the world's richest country so quickly?" Citing a former Federal Power Commissioner, John O'Leary, the story said that the "straw that really broke the camel's back" was the environmental movement, which hit the "*energy industries like a blitzkrieg*." Failing to offer alternative explanations, the story suggested

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[152] As quoted in Gladwin Hill, "Environment: Reformers are Undismayed by the Energy Crisis," *New York Times*, December 2, 1973, p. 80.
[153] Elvis J. Stahr, "Challenge and Opportunity," Letter to the Editor, *Wall Street Journal*, February 7, 1974.
[154] Wilson, "Environmental Gains Threatened by Critics," p. A1.
[155] *Ibid.*, A1.
[156] *Ibid.*, A1.

that O'Leary's faulting of environmental "extremism" for the energy crunch reflected conventional expert opinion on the issue.[157] At other times, news stories simply reproduced industry-spun positions as uncontroversial statements of fact. An April 1973 backgrounder on the energy crisis in the *New York Times*, for example, introduced without further explanation the claim: "It is by no means a coincidence that the energy crisis and the environmental crisis have arisen almost simultaneously. Restrictions stemming from the new concern for the environment exacerbated the energy situation."[158]

Industry-spun claims also gained traction on editorial pages. Editorials in the major papers began backing changes in environmental rules to tackle the energy crisis. The proposals ranged widely—from temporary variances and extended deadlines (*New York Times*) to fundamental reforms that would give priority to cost considerations (*Wall Street Journal*). Whatever the prescription, though, this rhetorical turn had the effect of ratifying the claim that environmental rules were a major factor in the energy crunch. The editorial page of the *Wall Street Journal* took a predictably strong line in a January 1974 editorial titled "Environmentalists at Bay." It said the crisis would augur in a new era for environmental policy—the end of the period in which environmentalists had been "politically absolved of the need to fit their timetables and cost-benefit ratios to the total framework of national priorities." Now, they would be forced to "refine and justify the standards they want the nation to accept" and to "give way on energy supply" to allow development of domestic resources.[159]

The editorial page of the *New York Times*, although highly critical of attempts to make environmental rules a scapegoat for the energy crisis, nonetheless gave credence to the notion that environmental restrictions were at least a partial factor in the nation's energy problems. As a November 1973 editorial put it, "Most conservationists will surely recognize the necessity for some limited environmental compromises, but only if it is clear that these are temporary."[160] A *Times* editorial the following month said, "It would be unrealistic—even irresponsible—to argue that the nation's energy problems can

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[157] Thomas O'Toole, "Energy-Starved U.S. Seeks Sustenance," *Washington Post*, November 26, 1972, p. A1.
[158] John Noble Wilford, "The Long-Term Energy Crisis," *New York Times*, April 19, 1973, p. 53.
[159] "Environmentalists at Bay," *Wall Street Journal*, January 3, 1974, p. 10.
[160] "Energy and Ecology…" *New York Times,* November 25, 1973, p. 46.

be met without some setbacks to the cause of environmental protection and other socially oriented policies. Compromises between what is ultimately desirable and what is momentarily necessary must be accepted."[161]

By 1974, allies of industry were cheering this ascendance of narratives linking environmental protection to the nation's energy problems. *Electrical World*, an electric power industry trade journal, reckoned that much of the mainstream press was now blaming the environmental movement for the energy crisis. "Yesterday, the environmental person was a hero. But Americans are always finding chinks in the armor of yesterday's heroes. So today, the environmentalist is rapidly becoming, as they used to say in Brooklyn, a 'bum.' Why? Rightly or wrongly, the energy crisis is being laid at his (or her) feet by much of the nation's press."[162] Conservative political analyst Ben Wattenberg surmised that the energy crisis and the return of "dollar politics" had "undermined much of the whole windmill-tilting of the ecological movement."[163]

Opinion polls, however, indicated that most people did not blame environmentalists or environmental regulation for the energy crisis. In fact, many respondents believed that the "crisis" was actually a contrivance of the oil companies to drive up profits. A 1974 Roper poll found that 73 percent agreed that "there is not a shortage of gasoline and fuel oil and the big companies are holding it back for their own advantage." A Gallup poll conducted in December 1973 found that only 2 percent held "Ecologists" responsible for the energy crisis, whereas 25 percent blamed oil companies and 20 percent blamed the government.[164] As for environmental regulation, a January 1974 survey by the Opinion Research Corporation found that only 40 percent thought that pollution controls and environmental restrictions were a "very important" or "fairly important" reason for the energy shortage.[165] Roper surveys conducted during 1973 and 1974, meanwhile, consistently found a roughly equal split on the question, "Are you

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[161] "Moral Profiteering…" *New York Times*, December 18, 1973, p. 40.
[162] *Electrical World*, February 1, 1974, p. 71
[163] "New Issues, Old Politics," *Washington Post,* January 27, 1974, p. C1.
[164] Survey by Gallup Organization, December 7-December 10, 1973. Retrieved November 13, 2004 from the iPOLL Databank, The Roper Center for Public Opinion Research, University of Connecticut. <http://www.ropercenter.uconn.edu/ipoll.html>.
[165] Survey by Opinion Research Corporation, January 24-January 27, 1974. Retrieved November 13, 2004 from the iPOLL Databank, The Roper Center for Public Opinion Research, University of Connecticut. <http://www.ropercenter.uconn.edu/ipoll.html>.

more on the side of adequate energy or more on the side of protecting the environment?"[166]

On the other hand, when asked by pollsters whether they would support specific measures to increase supplies of energy, a majority of respondents often favored the proposed measure. In a Roper survey conducted in December 1973, for instance, a majority of respondents said that the nation "should" take the following steps: "Relax pollution standards so that fuels which don't meet these standards like coal, high sulfur oil, etc., can be used" (54 percent); "Allow more strip mining to produce more coal supplies" (57 percent); and "Increase off-shore exploration for oil reserves under the ocean" (72 percent).[167] More broadly, as Eric Smith has observed, "During the 1970s—the years of the brownouts, the OPEC boycott, and the gas lines—the public looked quite favorably on both increased offshore oil production and nuclear power, and it was warming to the idea of strip-mining coal."[168]

Inflation and Trickle-Down Costs

Fresh from some success in linking the "energy problem" to environmental rules, business leaders began to make the same connection to the new crisis dominating the national agenda—inflation. By late 1974, inflation was doing the same rhetorical work for regulated industries done a year earlier by "the energy crisis." After 1973, inflation rates soared and remained high for the remainder of the decade. "Inflation, which had averaged 4.8% between 1966 and 1973, increased at an average annual rate of 9.3% between 1974 and 1981," writes David Vogel.[169] Business would later blame "overregulation" for other macroeconomic problems, but inflation was the key opening. As policymakers cast about for explanations—and straw men—during confusing

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[166] Survey by Roper Organization, September 28-October 6, 1973; Survey by Roper Organization, May 2-May 11, 1974; Survey by Roper Organization, September 27-October 5, 1974; Retrieved November 13, 2004 from the iPOLL Databank, The Roper Center for Public Opinion Research, University of Connecticut. <http://www.ropercenter.uconn.edu/ipoll.html>.
[167] Survey by Roper Organization, December 1-December 15, 1973. Retrieved November 13, 2004 from the iPOLL Databank, The Roper Center for Public Opinion Research, University of Connecticut. <http://www.ropercenter.uconn.edu/ipoll.html>.
[168] Smith, *Energy, the Environment, and Public Opinion*, 71-72.
[169] Vogel, *Fluctuating Fortunes*, 113.

confluences of high inflation, stagnant growth, and high unemployment in the 1970s, business launched a flurry of rhetorical salvos and publicity tagging the new "social" regulation as a major cause. By the late 1970s, there was evidence that these efforts were paying off. Policy-making circles looked to reforms of environmental regulation as a central part of "regulatory reform" initiatives to relieve inflationary pressures. The link also gained traction in public opinion. As Seymour Lipset and William Schneider observed in 1979, "A majority of the public consistently says that government regulation of business increases inflation." And more specifically: "The proportion believing that 'government activity to protect the environment and consumers' increases inflation has hovered around 50 percent from 1975 to 1978, while less, between 14 and 23 percent, feel it does not do so."[170]

The link between inflation and environmental regulation was broached by Richard Nixon in a July 25, 1974 speech on the economy. Nixon said it was time to "reevaluate the trade-off" between economic goals and "certain other objectives that are worthwhile, such as improving the environment and increasing safety." "Those goals are important," he said, "but we too often, recently, have had a tendency to push particular social goals so far and so fast that other important economic goals are unduly sacrificed."[171] The *New York Times* reported that Nixon's comments were "widely construed as an 11th-hour effort to woo conservative support in his Watergate troubles." Their most likely source was thought to be Roy Ash, Nixon's director of the Office of Management and Budget.[172] In 1970, he had headed the Ash Commission, which originally recommended the creation of the EPA. But Ash later became a leading critic of the agency and of the economic costs of environmental regulation, claiming in 1977 that it had "probably contributed two to three percentage points to our inflation rate" over the past few years.[173]

Corporate executives responded by linking environmental regulation to inflation at a series of regional conferences in September of 1974. Preparatory to a nationwide

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[170] Lipset and Schneider, "The Public View of Regulation," 6-13.

[171] Richard Nixon, "Address to the Nation About Inflation and the Economy," July 25, 1974, *The Public Papers of President Richard Nixon* <http://www.nixonfoundation.org/index.php?src=gendocs&link=PublicPapersofPresidentNixon&category=Research%20Center> (January 6, 2005).

[172] Gladwin Hill, "U.S. Aide Defends Ecological Costs," *New York Times*, September 17, 1974, p. 56.

[173] "The Tricks of the Trade-Off," *Business Week*, April 4, 1977, p. 72.

"summit" on inflation, the conferences were attended by the chairmen and CEOs of most of the nation's major corporations, as well as top trade association officials. Participants used the "anti-inflation" meetings as a springboard to link environmental rules to inflation in the national political discourse. Headlines out of the meetings in Detroit and Los Angeles included: "Executives Oppose Any New Pollution Rules,"[174] "Big Industries Say Letup Would Slow Price Increases,"[175] "High Costs of Transport Tied to U.S. Regulations,"[176] and "Transport Chiefs Propose Environmental Law Curbs."[177] Most delegates held that environmental, health, and safety regulations were a major cause of inflation, requiring capital investments in pollution-control technologies that were non-productive and thereby increasing the price of goods. Henry Ford II, chairman of Ford Motors, called for a five-year freeze on new regulations in order to "get inflation under control" by "releasing capital needed to expand capacity and improve productivity."[178] Others called for the creation of a formal policy mechanism—"cost-benefit analysis" or "inflationary impact statement"—to weigh the costs of regulatory actions.

For the business community, these meetings helped crystallize a consensus language for expressing the shared regulatory grievances of diverse industries. The new public language was articulated at the Detroit anti-inflation meeting by Donald Gaudion, chairman of the National Association of Manufacturers. "While the objectives of such [regulatory] programs are indisputably desirable," he said, "they should be balanced against the burdens they place on the economy to determine where the true public interest lies."[179] Or, as Dupont Chairman Irving Shapiro put it, excessive social regulation had "hampered productivity and increased the cost of production to a degree that has negated the intended benefits to the public."[180] While some delegates called for a suspension of

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174 James L. Rowe, "Executives Oppose Any New Pollution Rules," *Washington Post,* September 20, 1974, p. A2.
175 Peter T. Kilborn, "Big Industries Say Letup Would Slow Price Increases," *New York Times*, September 20, 1974, p. 51.
176 Robert A. Wright, "High Costs of Transport Tied to U.S. Regulations," *New York Times*, September 21, 1974, p. 30.
177 Richard Witkin, "Transport Chiefs Propose Environmental Law Curbs," *New York Times*, September 21, 1974, p. 30.
178 Kilborn, "Big Industries Say Letup Would Slow Price Increases," 51.
179 *Ibid.*, 51
180 *Ibid.*, 51.

all environmental regulation,[181] most echoed Shapiro's moderate language of balancing *costs versus benefits*. After taking office in 1974, President Gerald Ford responded to stepped up industry complaints by expanding the purview of regulatory review with "inflationary impact statements." But Quality of Life Review remained industry's primary channel for influencing environmental regulations, now in part based upon charges of inflationary impacts.

To be sure, business leaders had argued since before 1970 for a "balancing" of the costs and benefits of environmental regulation. This was also an early corporate policy consensus framed by the NIPCC. After 1973, however, it increasingly became a predominant theme in messages for public consumption as well. Widely used in 1974 in relation to the inflationary impacts of environmental regulation, the message of balancing costs and benefits proved equally compatible with other macroeconomic concerns, such as high unemployment, declines in productivity growth, and economic recession. During the mid and late 1970s, this costs/benefits theme became the principal media-frame used by the business community—and its allies at conservative think tanks—in seeking regulatory relief. Its keywords—"balance" and "tradeoffs"—staked out a symbolic ground of fairness and moderation. On the other hand, environmentalists' positions were tagged with phrases like "zero-risk," "no growth," and "zero-pollution," suggesting unreasonableness or extremism. What environmentalists wanted, as Dupont Chairman Irving Shapiro put it, was "Too Much"—"Too Soon"—and "Too Extravagant."[182] If "overregulation" was the problem, as many business leaders phrased it by mid-decade, then a rebalancing of costs and benefits was the cure.

"Balancing" costs against benefits became a constant refrain in business meetings, executive speeches, and testimony before Congress, and it was woven into countless press releases, trade journals, business magazines, and advocacy advertisements. Throughout the decade the theme was a key talking point for business leaders. Interviewed in 1975 about a new Arthur D. Little study on the economic impact of pollution controls in the steel industry, U.S. Steel Chairman Edgar Speer argued that the

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[181] See statement of E. Mandell de Windt, chairman of Eaton Corporation, in Kilborn, "Big Industries Say Letup Would Slow Price Increases," 51.

[182] Irving Shapiro, as quoted in *Enterprise: Journal of the National Association of Manufacturers* 1 (August 1977): 17.

study "indicates that there are tradeoffs that should be made" between environmental cleanup and regulatory costs.[183] Blaming environmental rules for slowing down the development of pesticides the chairman of the National Agricultural Chemicals Association, H.L. Straube, told the group's 1976 annual meeting, "The revolution against government overregulation and for objectivity and reasonableness in interpreting benefits versus risks must continue."[184] And calling for a "revolution on regulation" in a 1978 commentary in *Business Week*, Willard C. Butcher, president of Chase Manhattan Bank, wrote, "Our society's task, it seems to me, is to find the best balance between the benefits of improving the quality of life and the costs to each of us for making those improvements."[185]

The theme also framed messages for corporate advertisements and public relations. Facing heightened scrutiny of toxics, the chemical industry appealed to the language of risks versus benefits. It urged that consumers weigh the benefits of chemicals in everyday life against their potential risks and that policymakers should balance the environmental benefits of regulations against their economic costs. In a 1975 publicity campaign to defend pesticides, manufacturers sought to "educate" the public that "all substances, natural or man-made, represent intermingled benefits and risks." [186] The Monsanto Company made risk/benefit tradeoffs the central message of its "Facts of Life" advertising campaign, launched in 1977 with the slogan "Without Chemicals, Life Itself Would Be Impossible" at a cost of $4.5 million.[187] And the theme was echoed in a major public relations campaign launched in 1979 by the Chemical Manufacturers Association (CMA)—the industry's main trade group—which sought to "build a more balanced perspective in the public mind" toward chemicals and the industry and gain "a more realistic approach to regulation and legislation."[188] Balancing costs versus benefits would also be the stated aim of a variety of industry-funded "councils" founded in the

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[183] David T. Cook, "Steelmakers Add Up Costs of Clean Air," *Christian Science Monitor*, May 16, 1975, p. 20
[184] *Chemical Week*, October 6, 1976, p. 25.
[185] Willard C. Butcher, "The Stifling Costs of Regulation," *Business Week*, November 6, 1978, p. 22.
[186] National Agricultural Chemicals Association and Palucszek & Leslie Associates, Folder 8, Box 121, PRSA Records.
[187] *Business Week,* October 8, 1979, p. 73.
[188] "Outline of Industry Communications Plan," presented to Executive Committee, Chemical Manufacturers' Association, September 5, 1979, MCA Papers.

late 1970s, including Elizabeth Whelan's American Council on Science and Health and the American Industrial Health Council.[189]

As they had done during the energy crisis, companies framed the evolving narrative of "overregulation" in terms with the broadest potential public appeal. Environmental rules meant higher costs for industry, but these costs were ultimately passed along to consumers through increased prices for goods and services. In other words, the costs of environmental and other social regulation "trickled-down" to all consumers, the heaviest burden falling on the poorest. The most influential evangelist of this trickle-down theory of regulatory costs was Murray Weidenbaum, a conservative economist with posts at the Center for the Study of American Business in St. Louis and the American Enterprise Institute. Before dropping his $100 billion figure (for the total cost of federal regulation) into the political debate in the late 1970s, Weidenbaum argued in a 1975 study, "Government-Mandated Price Increases," that regulation was a major source of worsening inflation. By imposing additional costs on the private sector, regulation led to across-the-board price increases. Weidenbaum called this a "hidden tax," which was ultimately shifted to consumers and exacted an especially heavy burden on the poor. Citing Weidenbaum's study, the *Wall Street Journal* editorialized that "earlier tolerance toward controls is no longer economically defensible," while the *Washington Post* called social regulation a "significant component of the inflationary spiral" that could eventually "produce a stagnant economy."[190]

After Weidenbaum introduced his controversial figures for the total cost of regulation—some $60 billion in 1977 and $100 billion in 1979—corporations and business lobbies began attaching numbers to the purported trickle-down effect. The National Association of Manufacturers claimed that regulation cost each family $2000 annually.[191] Bethlehem Steel ads in 1978 said that the cost of regulation "for every man, woman, and child in the U.S." was $300.[192] The electronics manufacturer Gould put the

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[189] "Public-Interest Pretenders," *Consumer Reports* 59 (May 1994): 316.
[190] "The Cost of Regulation," *Wall Street Journal*, March 19, 1975, p. 20; "It's Time for Economic Impact Statements," *Washington Post*, March 5, 1975, p. A14.
[191] "Special Report: The Cost of Regulation," *Enterprise: Journal of the National Association of Manufacturers,* July 1978, p. 15.
[192] Bethlehem Steel, advertisement, "Steel Must Comply…" *Wall Street Journal*, May 22, 1978, p. 3.

number at $440 per person in its ads.[193] Some blamed the indirect impact of overregulation for an even greater squeeze on consumer pocketbooks. A 1980 Chase Manhattan Bank ad, for example, argued that, by contributing to slower growth in productivity during the 1970s, overregulation had cost American households an average of $4000 annually in lower wages.[194] Such efforts appear to have made some headway in convincing the public of the trickle-down costs of regulation. In 1979, Lipset and Schneider observed, "A large majority (over 80 percent) believes that conforming to government standards involves extra spending for business and that these costs are passed along to consumers."[195]

Strangulation by Regulation

By the late 1970s, businesses were tagging environmental, health, and safety regulation as a principal source of the decade's economic strains. It wasn't just inflation, or just energy shortages, now social regulation was portrayed as a general drag on the efficient operation of the market system as a whole. As Henry Ford II, chairman of Ford, put it in 1978, "Maybe it's only a coincidence that the recent period of rapidly rising government spending and roughshod regulation also has been a period of high unemployment, slow productivity, slow growth in personal income, soaring government deficits and unprecedented peacetime inflation. But I don't believe it's a coincidence at all…Despite a mounting record of failure and frustration, our leaders have failed to grasp the fact that too much government inevitably leads to economic decay."[196] For a growing number of business leaders, the economic drag of "overregulation" meant a creeping threat to the entire free enterprise system. National Association of Manufacturers President Heath Larry warned in speeches that overregulation had taken the place of socialism as a "new flanking attack" against democratic capitalism. "Every misstep," he told a 1978 conference, was "the excuse for another law or regulation…The result will be

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[193] Gould, advertisement, "Technology and Overregulation," *Wall Street Journal,* November 22, 1978, p. 11.
[194] Chase, advertisement, "How Long…" *Wall Street Journal,* January 22, 1980, p. 21.
[195] Lipset and Schneider, "The Public View of Regulation," p. 9.
[196] Henry Ford II, as quoted in *Enterprise: Journal of the National Association of Manufacturers* 2 (April 1978): 26.

to superimpose government and bureaucratic management over private management sufficiently to accomplish the aims of the original plans—and with the original planners very much in charge. Best of all, neither business nor the public may be fully aware of what is happening."[197]

As businesses stepped up attacks late in the decade, the concept of "overregulation" was increasingly depicted as a strangulation of the entire free enterprise system. The new visceral metaphors were of overgrown vegetation or the hangman's noose: "impenetrable jungles of regulation and expense,"[198] a "federal thicket of overregulation,"[199] or a "noose of overregulation."[200] A flurry of advertisements, beginning in 1978, depicted regulation as a force strangling the free enterprise system and overburdening American industry. A 1978 ad by Bethlehem Steel, headlined "Steel Must Comply with 5,600 regulations from 27 federal agencies. It's a Wonder We Get Anything Done," was illustrated with a cartoon showing a web of tape (presumably red) emanating from Capitol Hill, wrapping up unsuspecting workers, secretaries, and businessmen alike. Analogizing overregulation to the tyranny of King George, it called for urgent "regulatory reform" to "reduce the burden and high cost of red tape."[201]

Impact on Environmental Legislation

As affected industries waged a decade of publicity campaigns tagging new environmental regulations as too costly, a central political goal was to persuade Congress to include provisions in new environmental statutes requiring the EPA to balance the economic costs of regulation against the health and environmental benefits. Although businesses had only limited success in forestalling new environmental legislation by Congress, by demanding statutory cost considerations they were highly successful in weakening several important new laws. Both of the major laws enacted in the 1970s

[197] R. Heath Larry, "Washington—1980 and Beyond," speech delivered at the Iron Castings Society Meeting, Hilton Head, South Carolina, September 25, 1978, Box 203A, Series XIV, NAM Files.
[198] Richard P. Nalesnik, "Environmental Roadman: Time to Get Out the Compass, *Enterprise* 1 (December 1977): 17.
[199] Willard C. Butcher, "The Stifling Costs of Regulation," *Business Week*, November 6, 1978, p. 22.
[200] Gould, advertisement, *Wall Street Journal*, November 22, 1978, p. 11.
[201] Bethlehem Steel, advertisement, *Wall Street Journal,* May 22, 1978, p. 3.

dealing specifically with toxic chemicals required the EPA to balance the costs and benefits of regulation, and both proved far weaker than the "health-based" Clean Air Act. When Congress rewrote the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) in 1972, it gave the EPA the authority to cancel approved uses of pesticides found to cause "unreasonable adverse effects" on the environment. Unlike the Clean Air Act, which set air quality standards solely on the basis of health criteria, FIFRA has been described as a "risk-balancing" or "balancing" statute. Under FIFRA, writes Richard Andrews, "EPA had to weigh the environmental and health risks against the economic benefits of agricultural production, and even repay the manufacturer and users for any stocks left unsold if a product was deregistered."[202] The EPA was slow to review the hundreds of existing pesticides "grandfathered" in under FIFRA. A 1986 report by the General Accounting Office found that the EPA had failed to fully test any of the active ingredients in older pesticides, and tested none of the potentially harmful inactive ingredients.[203] And bearing the burden of proof for finding that a pesticide posed an unreasonable risk, the EPA canceled or suspended only a small number of pesticides.[204]

Similar problems plagued the EPA's implementation of another "balancing" statute, the Toxic Substances Control Act (TSCA) of 1976. TSCA gave the EPA the authority to restrict the use of any chemical found to present an "unreasonable risk of injury to health or the environment." But it required the EPA to use the "least burdensome requirements" to protect against an unreasonable risk, and it directed the EPA, when determining whether a substance posed an "unreasonable risk," to consider other factors, including the substance's benefits and "the reasonably ascertainable economic consequences" of regulation. When Congress enacted the legislation, both the House and Senate Committee reports suggested that the balancing provisions of TSCA were not intended to require a formal cost-benefit analysis of EPA regulations.[205] In practice, however, the EPA was forced to provide detailed cost-benefit calculations for

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202 Andrews, *Managing the Environment, Managing Ourselves*, 243.
203 U.S. General Accounting Office, *Pesticides: EPA's Formidable Task to Assess and Regulate their Risks* (Washington, D.C.: General Accounting Office, 1986).
204 Robert V. Percival et. al., *Environmental Regulation: Law, Science, and Policy*, *4th ed.* (New York: Aspen, 2003), 386; Andrews, *Managing the Environment*, *Managing Ourselves*, 243.
205 Percival et. al., *Environmental Regulation*, 408.

proposals to restrict or ban chemicals. After the EPA spent a decade developing a rule to ban most remaining uses of asbestos, the asbestos industry successfully challenged the rule on the grounds that the EPA had failed to prepare an adequate cost-benefit analysis.[206] With proposals to regulate even such well characterized toxics as asbestos taking more than a decade, the EPA's apparently broad authority to control toxics under TSCA shriveled under the burdens of cost-benefit balancing. By 1986, only four chemicals had been regulated under TSCA. In 1990, a General Accounting Office report found that, of the more than 2,000 chemicals in commercial use that the EPA had identified as potentially posing unreasonable risks, toxicity testing had been completed for only six.[207] Richard Andrews expresses a broad consensus about TSCA when he writes that it "appeared at face value to be a potent new policy tool, but in practice it was one of the least effective EPA programs."[208]

Balancing language was also inserted into provisions establishing the "Prevention of Significant Deterioration" (PSD) program in the Clean Air Act Amendments of 1977. Superseding the EPA's controversial "No Significant Deterioration" rules, the PSD program was designed to maintain the air quality of "clean air regions," areas of the country with air quality better than the national ambient air quality standards (NAAQS). In PSD areas, major new sources of pollution were required to install the "Best Available Control Technology" (BACT). Under oversight by the EPA, each state with a designated PSD area issued permits for new pollution sources and determined what type of pollution-control technology constituted BACT for particular pollution sources. The provisions of the PSD program allowed states to take costs into account when determining BACT. Industry has appealed to this cost balancing provision to press for weaker BACT requirements, arguing that economic considerations justified the use of less costly and less stringent pollution control technologies. In some cases, sympathetic state officials have accepted even vague and undocumented complaints about costs and

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[206] U.S. Environmental Protection Agency, "Asbestos: Manufacture, Importation, Processing, and Distribution in Commerce Prohibitions," 54 Fed. Reg. 29,460 (1989); Corrosion Proof Fittings v. EPA, 947 F.2d 1201 (5th Cir. 1991).

[207] U.S. General Accounting Office, *Toxic Substances: EPA's Chemical Testing Program Has Made Little Progress* (Washington, D.C.: General Accounting Office, 1990).

[208] Andrews, *Managing the Environment*, *Managing Ourselves*, 244; Percival, *Environmental Regulation*, 407-425.

economic impacts as grounds for allowing companies to use far less stringent control technologies than what the EPA considered the "best available" for a particular pollution source.[209]

Regulatory Reform

Although the Carter administration continued regulatory review, the results proved unsatisfactory to the business community. "Inflation fighters" in the Carter administration—led by Alfred Kahn, Chairman of the Council on Wage and Price Stability, and Charles Schultze, Chairman of the Council of Economic Advisors—had pressed the case for stricter economic analysis, but met stiff resistance from officials at the Occupational Safety and Health Administration (OSHA) and the EPA, who argued that cost-benefit studies should not be a "decision rule" trumping other criteria. Under Carter, regulatory review emphasized the "cost-effectiveness" of proposed rules, or finding the least-cost alternative to a particular end, and the OMB did not have the power to overrule agency heads. Regulatory reviews by Carter's Regulatory Analysis Review Group virtually ceased after a public controversy erupted with top officials at the EPA threatening to resign. In 1979 the *National Journal* would observe that "the requirement for regulatory analysis has had little impact." Businesses lobbied for a stricter requirement that proposed rules pass a formal cost-benefit test, in which the benefits of a proposed rule were required to exceed its costs.[210]

Proponents of regulatory overhaul turned to Congress, which considered a medley of omnibus "regulatory reform" bills between 1979 and 1983. The proposals included cost-benefit tests of proposed rules, "Sunset" laws requiring periodic reauthorization of regulatory programs by Congress, and a Congressional veto over new regulations.[211]

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[209] See, e.g., Ala. Dep't. of Envtl. Prot. v. EPA, 540 U.S. 461 (2004).

[210] See Margot Hornblower, "Environmentalists on Hill Confronting Economizers," *Washington Post*, February 26, 1979, p. A2; Edward Walsh, "If You Don't Like it, Get Out, White House Tells EPA Staff," *Washington Post*, Februrary 23, 1979, p. A14; Steven Rattner, "Regulating the Regulators," *New York Times Magazine*, June 10, 1979, p. SM26; "Cost-benefit Analysis," *Environmental Science and Technology* 14 (December 1980): 14-15.; Timothy B. Clark, "Regulation—The Costs and Benefits of Regulation—Who Knows How Great They Really Are?" *National Journal*, December 1, 1979.

[211] James E. Anderson, "The Struggle to Reform Regulatory Procedures, 1978-1998," *Policy Studies Journal* 26 (1998): 482-98.

Fresh from killing the proposed Consumer Protection Agency, a coalition led by the Business Roundtable, the National Association of Manufacturers, and the U.S. Chamber of Commerce pressed for statutory codification of cost-benefit tests of regulation. Strained by committee rivalries, competing bills, lukewarm administration support, and controversial provisions, no such legislation made it out of Congress. But as the legislation floundered in Congressional committees, business found a new ally in Ronald Reagan, who promised on the campaign trail in 1980 to get government off the back of business, in part by rolling back costly environmental rules and other regulations.[212]

On February 17, 1981, the new Reagan administration implemented a regulatory review program far stricter than its predecessors. Under Executive Order 12291, agencies were required to submit all proposed and final rules to OMB's new Office of Information and Regulatory Affairs (OIRA) for review before their publication and to include a detailed cost-benefit analysis for "major" rules, costing more than $100 million annually. Unlike Quality of Life and RARG reviews, which applied only to significant regulatory proposals, the new program applied to all rulemaking proposals. It also gave the OMB, headed by David Stockman, near veto power over regulations, by allowing it to indefinitely delay regulations until it had completed its review. Whereas the Carter administration's program had only directed agencies to seek the most cost-effective alternative in developing a regulatory proposal, the Reagan program subjected regulations to the strict cost-benefit tests long demanded by the business community. As legal scholar Robert Percival observes, the program dictated "that agencies should not issue regulations unless their benefits exceed their costs, that agencies should choose regulatory alternatives that involve 'the least net cost to society,' and that regulatory priorities should be set to maximize 'aggregate net benefits to society.'"[213] Critics charged that the Reagan program amounted to regulatory "relief" rather than regulatory" reform," opening the door to undue industry influence of regulations during OMB review, delaying EPA rulemaking proposals for months, and weakening the final regulations by focusing solely on the reduction of costs to industry. A powerful tool for

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[212] Robert G. Kaiser, "Disagreeing on Most Fundamental Issue,--The Role of Government," *Washington Post*, October 15, 1980, p. A2; "The Environment and the Stump," *New York Times,* October 22, 1980, p. A30.
[213] Percival, "Checks without Balance," 149.

opponents of regulation, the Reagan program established the model for the regulatory review process and the use of cost-benefit analysis that continues today.

Conclusion

Scholars have tended to underestimate the success of regulated industries in constraining the reach of environmental regulation during the “environmental decade” of the 1970s. To be sure, regulated industries failed to win many of their most coveted changes to environmental law, such as a major rollback of the Clean Air Act, often settling instead for legislative compromises such as additional time to meet standards.[214] As Congress rebuffed calls for overhauling the Clean Air Act, it continued passing major new environmental laws: to control toxic chemicals (1976), to regulate strip mining (1977), and to clean up and prevent hazardous waste sites (1980). But businesses succeeded in making the *costs* of environmental protection a central issue. In the process, they reshaped environmental politics, moving law, federal management, and even the terms of debate toward quantitative cost-benefit balancing, an ascendance which continues today. Most important was the legacy of cost-benefit analysis. Injected into administrative rulemaking by the Nixon administration in 1971 to appease the business community, the practice was woven into the fabric of environmental policymaking during the 1970s through “balancing” statutes and White House regulatory review.

The language and methodology of cost-benefit balancing has come to dominate much of environmental policymaking and many other federal regulatory programs. As legal scholars Frank Ackerman and Lisa Heinzerling have observed, “The new trend toward economic critique of health and environmental protection has caught on in every branch of the federal government—within the White House, in Congress, and even in the courts.”[215] For environmental advocates, the triumph of economic analysis has frequently crippled the pursuit of effective regulation. While regulated industries never

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[214] Vogel, *Fluctuating Fortunes*, 132.

[215] Frank Ackerman and Lisa Heinzerling, *Priceless: On Knowing the Price of Everything and the Value of Nothing* (New York: New Press, 2004), 8.

gained support for outright rollbacks of environmental laws in the 1970s, by reorienting the language and methodology of environmental policymaking toward a balancing of costs and benefits, they set in motion powerful legal and institutional mechanisms for containing the bold agenda envisioned by Congress in the 1970s.

Chapter Five: More and Better Science: Dioxin, Risk Assessment, and the Management of Scientific Doubt, 1965-1995

Introduction

As part of its "Contract with America," the new Republican majority in Congress in 1995 promised to renew the fight for "regulatory reform" and rein in excessive environmental, health, and safety regulation. Uniting behind calls for "sound science," these regulatory reformers charged that the Environmental Protection Agency (EPA) and other agencies had exaggerated environmental and public health hazards by relying upon flimsy models and uncertain science. As a result, they charged, the public had been unnecessarily alarmed about problems that were only hypothetical. In 1995 a subcommittee of the House Committee on Science held a series of three hearings entitled "Scientific Integrity and the Public Trust" to examine alleged distortions of the scientific evidence on global warming, stratospheric ozone depletion, and the health risks of the chemicals known as dioxins. What precisely constituted "sound science" was never clearly defined. But some equated it with purely empirical science, excluding the mathematical and computer modeling routinely used by regulators to understand and estimate environmental risks. During the ozone hearing, for instance, Representative John Doolittle of California equated "sound science" with "a clear scientific conclusion that there is a definite cause for the problem and that so-called problem is producing definite effects. Theories or speculation about it are not sufficient. We need science, not pseudo-science. I think we've been in an era of pseudo-science where these dire consequences are portrayed in order to achieve a certain political objective" Similar charges of unsound science were leveled against the computer models used to understand climate change and the risk assessment models used to assess the risks of dioxin.[1]

[1] U.S. Congress, House of Representatives, Committee on Science, Subcommittee on Energy and Environment, *Scientific Integrity and the Public Trust: The Science Behind Federal Policies and Mandates: Case Study 1 - Stratospheric Ozone: Myths and Realities*, 104th Cong., 1st Sess., September 20, 1995, as quoted in George E. Brown, Jr., *Environmental Science Under Siege:*

In some ways the new "sound science" debates were merely the latest incarnations of battles over the science underpinning new environmental, health, and safety regulation since the 1960s. For decades, American corporations defending against alleged environmental and public health impacts had seized upon traditional norms of scientific skepticism and open-ended inquiry to question links between their products or byproducts and alleged harms. As public environmental concern grew in the 1960s, public relations consultants urged that effective management of science would be crucial for deflecting new regulatory initiatives and creating a defensible line in litigation. In 1966, for instance, Hill & Knowlton became the first PR firm to create a special environmental unit to help corporate clients monitor and respond to scientific developments that linked them to new "environmental health" hazards. The head of the firm's new Environmental Health Unit, Carl Thompson, urged affected industries in 1967 to launch programs to monitor the vast and evolving relevant scientific and medical literature, sponsor scientific meetings, and quickly respond "to what is being done and said about products, substances, or practices that may have an effect on health." Just as he would advise another Hill & Knowlton client, the Tobacco Institute, Thompson said that companies linked to environmental hazards should exploit the inherent uncertainties of science to challenge studies linking them to alleged harms. "Most environmental health subjects," wrote Thompson, "involve discussion of complex and sometimes conflicting scientific studies…The fact is there are very few black and white 'rights' and 'wrongs' in this intricate problem."[2]

Fringe Science and the 104th Congress, report to the Democratic Caucus of the Committee on Science, U.S. House of Representatives, October 23, 1996 <http://democrats.science.house.gov/Media/File/Reports/environment_science_report_23oct96.pdf> (August 12, 2006).

[2] Carl Thompson, "Environmental Health: Problems and Priorities," *Public Relations Journal*, (October 1967): 62-65. The Tobacco Institute was a Hill & Knowlton client that had been created by tobacco companies to challenge research on the health hazards of smoking. In a 1968 memo, for instance, Thompson urged that the Tobacco Institute should run stories in *Tobacco and Health Research*, a newsletter it distributed to doctors and scientists, that cast "doubt on the cause and effect theory of disease and smoking" with headlines that "strongly call out the point—Controversy! Contradiction! Other factors! Unknowns…" See Richard Kluger, *Ashes to Ashes : America's Hundred-Year Cigarette War, the Public Health, and the Unabashed Triumph of Philip Morris* (1997), 324. According to historian Robert Proctor, Hill & Knowlton subsequently "handled Du Pont's worries about ozone depletion; Ashland Oil's spill into the Monongahela River…the Alar scare for the Washington Apple Commission and the International Apple Institute…" See Robert Proctor, *Cancer Wars: How Politics Shapes What We Know & Don't Know About Cancer* (New York: Basic Books, 1995), 103.

During the 1970s, debates on the science underpinning environmental regulation generally centered on the control, production, and immediate interpretation of scientific studies. Monsanto's defense of PCBs, for instance, focused largely on creating a body of evidence from animal studies that the company hoped would indicate a "safe" level of exposure for humans and wildlife. By the early 1980s, however, in part due to litigation by affected industries demanding higher levels of proof of harm, the EPA and other federal regulatory agencies increasingly developed formalized quantitative risk assessment techniques to estimate the risks of pollutants and chemical hazards. One consequence was that battles over the science that informed environmental policymaking increasingly centered not on the underlying data, but rather on the models and assumptions used to extrapolate risk estimates from the data. To be sure, the underlying science often remained fiercely contested by affected industries. But many key battles were increasingly fought instead over the risk assessments used to derive policy-relevant results. For affected industries, this meant continual challenges to the "conservative," or risk-averse, assumptions and models that had generally been embraced by the EPA and other federal agencies. Whether it was environmental groups urging the use of more "protective" assumptions and models, or, more commonly, industry pushing for deviations from the so-called "worst case" scenarios used by regulators, the 1990s "sound science" debates were often not about "science" but rather about risk assessment methodology.

Few cases better illustrate this shifting ground and its implications for environmental policy than the debates over the risks of dioxin, which have now spanned more than four decades. Named for the two oxygen bonds connecting a pair of benzene rings, the "dioxins" included dozens of different chemicals whose degree of toxicity was determined by the number and position of chlorine atoms bound along their rings. Most potent and best understood was the tetra-chlorinated 2,3,7,8-tetrachlorodibenzo-p-dioxin ("TCDD"), or simply "dioxin." Among the most toxic and carcinogenic chemicals ever tested, dioxin first gained notoriety as a contaminant of Agent Orange and other defoliants used during the Vietnam War and soon earned a reputation as "one of the most toxic chemicals known." Dioxins were present in the notorious cocktail of hazardous wastes at Love Canal, New York, and soon began turning up in other residential areas, notably the Missouri town of Times Beach, where dioxin contamination led to a government buyout. As dioxins entered the pantheon of toxics with a household name in the 1980s, new research implicated other major industrial sources in the nationwide problem—including medical and municipal waste incinerators and pulp and paper mills.[3]

As successive industries were linked to dioxin contamination, each challenged the EPA's assessment of the health risks posed by low-level exposure to the chemicals. Into the early 1980s, Dow Chemical Company, the largest producer of dioxin-tainted herbicides, took the lead in the chemical industry's efforts to challenge evidence on the health risks of dioxin. Relying largely upon research by in-house scientists at the company's own toxicological laboratory, Dow sought to prove that the trace levels of dioxin present in it its herbicides posed no health hazard. In the late 1970s, however, Dow's own studies turned up evidence of dioxin's extraordinary carcinogenicity that would not only help undermine the company's own efforts, but also provide crucial data for the regulation of dioxin in the United States and around the world. By the mid-1980s, the pulp and paper industry and chlorine manufacturers were also linked to dioxin contamination. Unlike Dow, the newly-implicated industries did not typically engage in the production of raw experimental data in order to dispute the hazards of dioxin. Instead, they focused largely on advocating alternatives to the models and assumptions used by the EPA to assess dioxin's risks.

In a landmark 1985 quantitative risk assessment, the EPA would effectively tag dioxin as one of the most potent carcinogens known. Using its "conservative" risk assessment principles, the EPA estimated that exposure to just 0.006 picograms (or one-trillionths of a gram) of dioxin per kilogram of body weight per day could pose an increased lifetime cancer risk of one in one million, the level taken by the agency to be "acceptable" or *de minimis*. This was around one-thousand times lower than the levels deemed acceptable by environmental agencies in Europe and Canada working with the same data. Affected industries feared that the EPA's result would entail stringent cleanups of contaminated sites, justify costly regulations to control dioxin sources and provide fodder for plaintiffs' attorneys representing clients exposed to dioxin. They thus

[3] A recent survey of the scientific literature on dioxins is Arnold Schecter and Thomas A. Gasiewicz, eds., *Dioxins and Health*, 2nd ed., (Hoboken, NJ: Wiley-Interscience, 2003).

began a concerted effort to challenge the agency's risk assessment model and assumptions. Through a mix of scientific, lobbying, and public relations efforts, dioxin-linked industries succeeded in securing two "reassessments" of dioxin's risks by the EPA—the first completed in 1988 and the second ongoing as of 2005. To date the reassessments have essentially confirmed the EPA's original severe cancer potency estimate, while also highlighting serious non-cancer risks from dioxins and various "dioxin-like" compounds. But for affected industries, the unending debates over risk assessment methodologies, regardless of the eventual result, often served their political and legal goals by inducing useful regulatory stalemates and creating a defensible shadow of doubt over the health risks of dioxin.[4]

Dow and Dioxin

In 1964, some forty workers at Dow Chemical Company's Midland, Michigan plant who worked with the herbicide 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) developed the occupational skin illness chloracne. One of the so-called phenoxy herbicides developed by the United States military during World War II, 2,4,5-T had found a wide range of postwar domestic uses in agricultural crops such as rice, in forest and rangeland management to kill broad-leaved plants, and in consumer lawn products. In 1962 U.S. forces began using 2,4,5-T in defoliant mixtures such as Agent Orange to clear the dense jungle brush of Vietnam. As the military intensified its use of 2,4,5-T, Dow scientists traced the outbreak of chloracne to an impurity in the herbicide produced during the manufacturing process—TCDD, or dioxin. Subsequent tests of dioxin on rabbits at Dow's toxicology lab found that the chemical could be lethal even at relatively low doses and could cause severe liver damage. In a 1965 letter to a colleague at Dow's Canadian division, V.K. Rowe, head of Dow's Biochemical Research Laboratory, called

[4] The first cancer potency estimate was made in U.S. EPA, *Health Assessment Document for Polychlorinated Dibenzo-p-Dioxins* (Cincinnati, OH: U.S. EPA, Environmental Criteria and Assessment Office, 1985). See generally Barry Commoner and Thomas F. Webster, "Overview: The Dioxin Debate," in *Dioxins and Health*, 2nd ed., ed. Schecter and Gasiewicz (Hoboken, NJ: Wiley-Interscience, 2003), 1-53. On the results of the first reassessment, see "Dioxin Risk: Are We Sure Yet?, Special Report," *Environmental Science & Technology* 29 (January 1995): 24A-35A; U.S. EPA, *Health Assessment Document for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds*, *External Review Draft* (Washington D.C.: U.S. Government Printing Office, 1994).

dioxin “exceptionally toxic” and said that it had “tremendous potential for producing chloracne and systemic injury.” Rowe worried that consumers who used 2,4,5-T on a regular basis could, like the Dow workers, develop chloracne. If this happened, he warned, the “whole 2,4,5-t industry would be hard hit and I would expect restrictive legislation, either barring the material or putting very rigid controls on it.” Rowe said that if the company could gain the cooperation of other producers and those who handled the herbicide, the industry might “avoid restrictive legislation.” After learning of the dioxin contamination, Dow acquired the rights to a production process developed by the German chemical firm Boehringer Ingelheim that had reduced the dioxin level in its herbicide to 1 ppm. At this level, according to Rowe, dioxin was not believed to “present an appreciable hazard to consumers.”[5]

Still, Dow managers worried about potential problems arising from the higher levels of dioxin present in the 2,4,5-T manufactured by other U.S. chemical companies. In 1965 Dow invited executives from other 2,4,5-T manufacturers to its Midland headquarters to confidentially discuss its finding of dioxin contamination and to urge them to adopt the process change to reduce dioxin levels. At the 1965 meeting in Midland, Dow officials welcomed representatives of the Hercules Powder Company, Diamond Alkali Company, and Hooker Chemical Corporation, while another competitor, Monsanto, was later provided with details. Dow scientists briefed the visitors on the dioxin-contamination problem, even taking them to Dow’s toxicology laboratory to see rabbits that had been exposed to dioxin. Fearing that the situation could “explode” and prompt demands for new regulation, Dow asked that its dioxin findings not be made public. Instead, Dow urged voluntary action, asking the other makers of 2,4,5-T to join Dow in using the German process that could reduce dioxin to a less than 1 ppm. While

[5] V.K. Rowe to Ross Milholland, “2,4,5-Trichlorophenol, The “T” Acids, and Associated Alkaloids,” June 24, 1965 < http://www.safe2use.com/ca-ipm/02-03-08.htm> (August 9, 2006); Janice Long and David J. Hanson, “Dioxin Issue Focuses on Three Major Controversies in U.S.,” *Chemical and Engineering News*, June 6, 1983, pp. 23-36; Blustein, “Poisoned Image,” *Wall Street Journal*, June 28, 1983, p. 1; David Burnham, “1965 Memos Show Dow’s Anxiety on Dioxin,” *New York Times*, April 19, 1983, p. A1; Ralph Blumenthal, “Files Show Dioxin Makers Knew of Hazards,” *New York Times*, July 6, 1983, p. A1

some heeded Dow's advice, others continued to produce 2,4,5-T with dioxin levels as high as 18 ppm.[6]

From this early stage forward, Dow's strategy for defending 2,4,5-T would center on creating a defensible line that the low-levels of dioxin present in its herbicide posed no hazard to humans or wildlife. The risk was reduced further, Dow urged, because the herbicide would be widely dispersed and degraded in the environment. As federal regulators sought restrictions on 2,4,5-T beginning in 1970, Dow argued that the levels of dioxin to which people would be exposed from its commercially sold 2,4,5-T were so low as to fall below a biological "threshold" for adverse effects. Like Monsanto in its defense of PCBs, Dow would defend its dioxin-laden pesticides by seeking to create a body of evidence, largely on the basis of animal testing, to demonstrate the existence of this threshold. But as scientific evidence mounted during the 1970s that dioxin was not only highly toxic but an extremely potent carcinogen, Dow's claim of a "safe" threshold level butted up against an incommensurable model applied by the EPA to carcinogens. This postulated no threshold and a linear dose-response curve, even at extremely low levels. By the late 1970s, Dow's appeal to the traditional toxicological approach—and the "no effect" threshold that it provided for—proved progressively less effective as a line of argument in a regulatory arena where new models were taking hold. As other industries were linked to dioxin in the mid-1980s, they would continue Dow's quest for a dioxin "threshold," but through radically different modes of argument, articulated within the new paradigm of quantitative risk assessment.

Amid reports of birth defects among children born to Vietnamese women exposed to defoliants, the U.S. government had commissioned its own studies of 2,4,5-T by Bionetics Research Laboratories in Bethesda, Maryland beginning in 1966. Results of a study by Bionetics released in 1969 found significant birth defects in rodents exposed to 2,4,5-T.[7] Although Dow knew by 1965 that commercially manufactured 2,4,5-T was contaminated with dioxin, Dow argued that the Bionetics study was not germane because

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[6] Long and Hanson, "Dioxin Issue Focuses on Three Major Controversies in U.S.," 23-36; Blustein, "Poisoned Image," p. 1; Burnham, "1965 Memos Show Dow's Anxiety on Dioxin," p. A1; Blumenthal, "Files Show Dioxin Makers Knew of Hazards," p. A1.

[7] J.R.M. Innes et al., "Bioassay of Pesticides and Industrial Chemicals for Tumorigenicity in Mice: A Preliminary Note," *Journal of the National Cancer Institute* 42 (1969): 1101.

2,4,5-T samples tested had been found to be contaminated—with dioxin. A subsequent study by researchers at the National Institute of Environmental Health Sciences (NIEHS) in 1970, however, found that 2,4,5-T contaminated with very low levels of dioxin still produced significant reproductive defects in mice. As the Senate Subcommittee on Energy, Natural Resources, and the Environment, chaired by Senator Philip A. Hart, investigated the health hazards of 2,4,5-T in 1970, both the Department of Defense and the Department of Agriculture announced actions to restrict use of the herbicide. On April 15, 1970, one week before the first Earth Day, the Department of Defense announced that it would phase out the spraying of 2,4,5-T in Vietnam. The same day, Surgeon General Jesse L. Steinfeld announced domestic restrictions being implemented by the Nixon administration. This included the decision by the Department of Agriculture, which then had regulatory authority over pesticides, to cancel the registrations of 2,4,5-T in food crops and home lawn-care products. (The order did not restrict the significant domestic use of 2,4,5-T in managing forest and rangelands.)[8]

Dow, the largest producer of 2,4,5-T, joined other manufactures of the herbicide in an immediate appeal of the decision to cancel its use on domestic rice crops—the largest agricultural market for 2,4,5-T. Litigation ensued from 1970 to 1973. On one side were public interest groups, including Ralph Nader associate Harrison Wellford and the Consumers Union, pushing for quicker action against 2,4,5-T. On the other side, Dow challenged the cancellation, contending that there was no health risk from use of its herbicide in rice fields and that this use was of significant economic importance. Dow's principal claim was that dioxin posed no health hazard when present at just one ppm in 2,4,5-T, the level to which it had reduced the contamination through engineering changes. The EPA, which now had regulatory authority over pesticides, countered in 1971 that Dow "had not established that 1 part per million of this contaminant—or even 0.1 ppm—in 2,4,5-T does not pose a danger to the public health and safety." The agency observed that the "dose-response curves for 2,4,5-T and dioxin have not been determined and the possibility of 'no effect' levels for these chemicals is only a matter of conjecture at this

[8] Thomas Whiteside, *The Pendulum and the Toxic Cloud: The Course of Dioxin Contamination* (New Haven: Yale University Press, 1979), 1-6.

time."[9] After rebuffing Dow's challenge in the courts in 1973, the EPA announced that it would begin proceedings to cancel all remaining registered uses of 2,4,5-T, including on rice crops and in forest management.[10] But the following year the agency reversed course, saying that it was postponing action because it lacked adequate analytical technologies for detecting the minute levels of dioxin present in the environment and the food chain.[11]

In 1976-77, however, a new spotlight was placed on the health risks posed by continued widespread use of 2,4,5-T. It began with the efforts of a grassroots citizens' group called Citizens Against Toxic Sprays, formed by residents of the Five Rivers Valley on Oregon's central coast who were mobilized by concerns about the Forest Service's spraying of 2,4,5-T in the nearby Siuslaw National Forest. Opposition to the spraying was first raised in a letter to a local paper by Steve and Carol Van Strum, a young couple who had recently relocated from California. The Van Strums had begun investigating the herbicide incidents in which the Forest Service's sprays had drifted onto their farm. They reported that wayward clouds of spray had led to illnesses in their children, caused deformities in their animals, and damaged their crops. The Forest Service's sprays, they said, contained the herbicide 2,4,5-T and the highly-toxic contaminant dioxin, which had been linked to birth defects and cancer. Their letter spurred interest in the community, and other residents soon came forward with similar stories of ill effects. After a series of public meetings, opposition to the spraying was coordinated by the newly-formed Citizens Against Toxic Sprays—whose members included loggers, mill workers, schoolteachers, farmers, as well as college students from Eugene, Oregon. The group brought a lawsuit against the Forest Service challenging the

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[9] 36 Fed. Reg. 14777 (August 1971).

[10] See Whiteside, *The Pendulum and the Toxic Cloud*, 6-11; Dow Chem. Co. v. Ruckelshaus, 477 F.2d 1317, (8th Cir. 1973); 38 Fed. Reg. 19860 (1973).

[11] The EPA withdrew its cancellation order at 39 Fed. Reg. 24049 (June 28, 1974). An account by an attorney with the Environmental Defense Fund involved in the case, however, suggests that the EPA postponed action because it was outmatched by Dow and its significant resources. According to an account by William Butler, counsel for EDF, given to New Yorker writer *Thomas Whiteside*, the EPA had only one lawyer and one staff scientist, who worked just part time on the case. EDF similarly had just one scientist working part time on 2,4,5-T. By contrast, Dow had "enormous scientific and financial resources." Dow also organized opposition to the EPA's position within the administration by cultivating allies at the Department of Agriculture and the Department of Transportation. See Whiteside, *The Pendulum and the Toxic Cloud*, 12.

adequacy of its Environmental Impact Statement (EIS) and in 1977 obtained a temporary injunction on the use of 2,4,5-T until it filed a proper EIS. The group also began distributing a fact sheet on the health effects of the dioxin-tainted herbicide. When Bonnie Hill, a schoolteacher from nearby Alsea, picked up one of the fact sheets in 1977, she began collecting information on whether the spraying was linked to the recent miscarriages suffered by several former students. Her investigation resulted in a letter documenting eleven miscarriages, all of which occurred during times of the year when the Forest Service conducted its spraying.[12]

One copy of Hill's letter made its way to the EPA in 1978, just as the agency announced it would reopen proceedings to cancel the registration of remaining uses of 2,4,5-T. After a researcher at the environmental group Friends of the Earth who had learned of the letter pushed the agency for an investigation, the EPA began its own study of miscarriages in Alsea. Instead of informal testimony from residents, EPA researchers assembled medical records from local hospitals and compared high-spray areas to control groups from un-sprayed areas. The EPA's epidemiological study also found a correlation between miscarriages and spraying. Although its Alsea study was heavily criticized for methodological shortcomings, the agency used the study to back an emergency suspension of 2,4,5-T for all uses except on rangelands and rice crops in 1979. In legal challenges to restrictions on its herbicides in the late 1970s and early 1980s, Dow not only challenged the epidemiological study but also redoubled its efforts to prove that low-level exposure to dioxin was harmless. The company backed this claim with the results of ongoing animal studies conducted at its toxicological laboratory. At stake was not only the future of these lucrative products but also litigation related to Vietnam veterans exposed to Agent Orange. If the company could show that exposure to dioxin below a certain level posed no hazard, it might not only forestall restrictions on its herbicide, but also cast doubt on the claims of plaintiffs' lawyers representing hundreds

[12] Sylvia Noble Tesh, *Uncertain Hazards: Environmental Activists and Scientific Proof* (Ithaca, NY: Cornell University Press, 2001), 13-15; Citizens Against Toxic Sprays, Inc. v. Bergland, 428 F. Supp. 908 (D. Or. 1977).

of Vietnam veterans and their families alleging premature deaths and a range of health problems due to exposures to Agent Orange.[13]

Dow's claim that there was a "safe" level of exposure to dioxin ran directly counter to the EPA's position that no safe level had been demonstrated—and indeed that no safe level may exist at all for chemicals identified as carcinogens. Although Dow and the EPA relied upon the same animal studies in their analyses, they used fundamentally different approaches in their interpretations of the results. Dow scientists adhered to a conventional toxicological approach, which assumed that, below some biological "threshold," toxic chemicals would have no adverse health effects. Under this approach, scientists first sought to pinpoint a "no-observable-effect level" (or NOEL) in test animals—the highest dose at which no adverse effects could be identified. Next, they applied a so-called "safety factor," usually 100 or 1000, to the no-effect level to estimate a reasonable "acceptable" level for humans. A good summary of this traditional toxicological approach, quipped Umberto Saffiotti of the National Cancer Institute in 1977, was, "Find a no-effect level, divide by 100, and pray."[14]

As Dow waged a vigorous effort to prove that dioxin was safe at low levels, the company employed this traditional no-observable-effect-level/safety-factor approach to both non-cancer and cancer data alike. Fighting proposed bans on 2,4,5-T in legal proceedings between 1979 and 1981, Dow argued that a no-effect level in test animals could be pinpointed at 1,000 picograms of dioxin per kilogram of body weight per day (pg/kg/day). If typical safety factors were applied, a safe dose for humans would be set somewhere in the range of 1 to 10 pg/kg/day.[15] If this result were accepted, Dow could argue that the lower levels of dioxin to which Vietnam veterans and others were exposed had been harmless. Dow's claim for a no-effect level came from animal studies, including two rodent studies by Dow researchers, one on dioxin's reproductive toxicity and the other on its carcinogenicity. In both studies, Dow scientists fed dioxin to groups

[13] Tesh, *Uncertain Hazards*, 16; United States v. Allen., 494 F. Supp. 107, (W.D. Wis. 1980); Dow Chem. Co. v. Allen, 672 F.2d 1262 (7th Cir. 1982). On the Agent Orange litigation, see generally Peter H. Schuck, *Agent Orange on Trial: Mass Toxic Disasters in the Courts*, revised edition (Cambridge, Mass.: Belknap Press of Harvard University Press, 2006).
[14] Quoted in 45 Fed. Reg. 5002, 5023 (January 22, 1980).
[15] See Allen, 494 F. Supp. at 110.

of rats at three experimental dose levels: 100,000 pg/kg/day, 10,000 pg/kg/day, and 1,000 pg/kg/day. In the reproductive toxicity study, rats fed at the two highest dose levels suffered clear declines in fertility, survival, and body weights. At the lowest dose level, however, the results were disputed, with Dow scientists claiming a no-effect level and EPA scientists arguing that there were in fact significant reproductive effects.[16] In the carcinogenicity test, meanwhile, Dow scientists again argued that they had found a no-effect level in the lowest dose group. Led by Dow scientist Richard Kociba, this landmark 1978 study found significant increases in malignant tumors—the most sensitive site being the liver of female rats—in both the high and intermediate dose levels. But in the low-dose group, Kociba's group concluded that there was "no carcinogenic response." In a disputed interpretation of this data, the Dow scientists maintained that both studies pointed to a no-effect level of 1,000 pg/kg/day.[17]

As the EPA disputed Dow's interpretations of the rat studies, the company sought additional confirmation for its claim in a species more closely related to humans. At the University of Wisconsin, studies of dioxin's reproductive effects on rhesus monkeys were underway. Led by James Allen and John Van Miller, the researchers fed dioxin to female monkeys, observed their ability to conceive and carry infants to term, then evaluated effects on infants such as learning and behavioral abnormalities. Initial studies at doses of 20,000 pg/kg/day and 2,000 pg/kg/day had found clear evidence of reproductive toxicity. And in 1978 the group began tests at two lower doses: 1,000 pg/kg/day and 200 pg/kg/day. As Dow battled the EPA, it hoped results from these tests would add support to its claim of a no-effect level of around 1,000 pg/kg/day. But final results of the studies, not expected for at least five years, would come too late for Dow's purposes. So Dow took the unusual step of asking an administrative law judge to subpoena all records related to the ongoing monkey tests, including raw data, laboratory notebooks, correspondence, and charts and papers of any kind. Although the administrative law judge agreed, the courts refused to enforce the subpoenas, saying that the records would

[16] F.J. Murray et al., "Three-generation Reproduction Study of Rats Given 2,3,7,8-tetrachlordibenzo-p-dioxin (TCDD) in the Diet," *Toxicology and Applied Pharmacology* 50 (1979): 241-251.
[17] R.J. Kociba et al., "Results of a Two-year Chronic Toxicity and Oncogenicity Study of 2,3,7,8-tetrachlorodibenzo-p-dioxin in rats," *Toxicology and Applied Pharmacology* 46 (1978): 279-303.

only have "probative value" to Dow after they had continued long enough for an evaluation of whether a no-effect level existed.[18]

Meanwhile, from the perspective of the EPA, Dow's aggressive quest for a no-effect level was irrelevant. Once dioxin had been identified as a carcinogen, a completely different interpretive model applied. During earlier actions against DDT and other pesticides in the early and mid-1970s, the EPA had adopted the linear, no-threshold model of carcinogenesis that had been developed for radiation carcinogenesis. Since many carcinogens were believed to have their effects by acting as mutagens that directly damaged a cell's DNA, in theory just one molecule ("one-hit") could initiate the irreversible process of carcinogenesis. Under this approach, any exposure to a carcinogen was assumed to pose some non-zero risk of cancer. As EPA Administrator Russell Train put it in a set of interim cancer guidelines in 1976, the no-threshold concept implied that "there is no such thing as a completely safe dose; in other words any exposure, however small, will confer some risk of cancer on the exposed population."[19] The "no-effect level" claimed by Dow, meanwhile, might only be a statistical artifact, resulting from the fact that the number of test animals was too small to detect carcinogenic effects at low levels. Dow's approach, therefore, could not be used to set an acceptable exposure level in the case of a carcinogen. One dioxin was identified as a carcinogen, the EPA would argue that exposure to even very low levels of dioxin-tainted herbicides posed a risk that was too great to justify their continued use.[20]

But how great was the risk? In 1980 the EPA took a first stab at this question with a quantitative estimate of human cancer risks from exposure to dioxin. Although this early assessment was subsequently largely ignored, its alarming results foreshadowed the severe risk estimates to come. Applying a linear no-threshold extrapolation model to the 1978 Kociba study, the EPA's Carcinogen Assessment Group concluded that dioxin

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[18] See Allen, 494 F. Supp. at 108-113.
[19] 41 Fed. Reg. 21402 (May 25, 1976).
[20] See Blustein, "Poisoned Image: Dow Chemical Fights Effect of Public Outcry over Dioxin Pollution," *Wall Street Journal*, June 28, 1983, p. 1. On the development and application of the no-threshold concept at EPA, see Mark E. Rushefsky, *Making Cancer Policy* (Albany, NY: State University of New York Press, 1986), 9-12, 51-54, 78-83. See also Brickman et al., *Controlling Chemicals*, 207-211; Thomas O. McGarity, "Substantive and Procedural Discretion in Administrative Resolution of Science Policy Questions: Regulating Carcinogens in EPA and OSHA," *Georgetown Law Review* 67 (February 1979): 729-810.

was "one of the most potent carcinogens known." The assessment focused on exposures from 2,4,5-T and other herbicides, estimating the increased lifetime cancer risks for several high-risk groups exposed to dioxin: herbicide applicators (one in a thousand); local populations near spraying areas consuming highly contaminated beef (two in ten-thousand); and local populations eating highly contaminated deer or elk meat (one in ten-thousand). This assessment did not attempt to define an "acceptable" exposure level for dioxin. But it did estimate an upper limit risk for the general population exposed to dioxin through average levels in beef—2.4 excess cancer deaths in every one-million persons. From just this one exposure route, this early assessment suggested, dioxin posed an increase risk to the general population that already exceeded the one-per-one-million level often considered "acceptable."[21]

In the early 1980s, Dow began phasing out production of 2,4,5-T and abandoned ongoing challenges to EPA restrictions. But its efforts to question the risks of dioxin had helped delay regulatory action for years as it challenged the EPA at each turn. Going forward, Dow could now mobilize its body of dissenting expert opinion on dioxin's risks as it defended itself against Agent Orange lawsuits and against demands for cleanups of dioxin that had leaked from its plant in Michigan. With the help of the PR firm Hill & Knowlton, Dow launched a media campaign in the early 1980s designed to persuade the public that dioxin was not a proven hazard and that there was no evidence that Vietnam veterans had been harmed by exposure to Agent Orange. Dow dispatched its scientists on multi-city media tours to dispute the health risks posed by low level exposures to dioxin. As the head of Hill & Knowlton's environmental unit, Jim Callaghan, later explained when asked about Dow's campaign, "It's a battle of opinions, but there is a basic body of science buried under those opinions. There is a body of information that says dioxin is bad; there is another body of information that says it is not so bad."[22]

As Dow phased out the manufacture of 2,4,5-T, the environmental legacy of the herbicide not only continued to plague the company but also indirectly tied other major

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[21] U.S. EPA, Carcinogen Assessment Group, *Risk Assessment on (2,4,5-Trichlorophenoxy) Acetic Acid (2,4,5-T), (2,3,5-Trichlorophenoxy) Propionic Acid (Silvex), 2,3,7,8-Tetrachloro-p-Dioxin (TCDD),* EPA-600/6-81-003, (Washington, D.C.: National Technical Information Service, 1981).

[22] Quoted in Jeff Blyskal and Marie Blyskal, *PR: How the Public Relations Industry Writes the News* (New York: William Morrow and Company, 1985), 165.

industries to dioxin problems. In 1978, the company reported that it had found fish contaminated with dioxin in the Tittabawassee River, which flowed past Dow's Midland plant before emptying into Saginaw Bay on Lake Huron. U.S. and Canadian officials soon began receiving reports of dioxin contamination in Great Lakes fish. As Dow worked to cast doubt on charges that it was to blame for the problem, Dow scientists proposed a novel "Trace Chemistries of Fire" theory, which cast a broader net of blame for the problem. Combustion of any kind, according to Dow scientists, produced small quantities of dioxin, so that even forest fires added to natural background levels of dioxin.[23] Although Dow's responsibility for downstream dioxin pollution was never seriously in doubt, subsequent research did confirm that the burning of certain wastes sent significant amounts of dioxin into the atmosphere. This ultimately implicated medical and municipal waste incinerators (as well as open-barrel trash burning) as major sources of dioxin pollution. Meanwhile, Dow's problems in Michigan, along with the discovery of dioxin contamination in residential areas in several states, led Congress to mandate a National Dioxin Study to identify contaminated areas and track down the sources of dioxin. Dramatically raising the political and economic stakes, by 1985 the EPA had identified pulp and paper mills as major sources of dioxin pollution. Led by the paper industry and its chlorine suppliers, the newly-implicated industries soon launched their own efforts to downplay the risks of dioxin, now largely focused on influencing the crucial risk assessments that would inform future regulatory actions.[24]

The Political Malleability of Risk Assessment

Due in part to increased evidentiary burdens imposed by the courts, by the early 1980s federal agencies increasingly employed quantitative risk assessments to support the control of cancer-causing chemicals.[25] When a chemical was identified as a likely carcinogen, risk assessors sought to quantify the risk it posed to public health in a process

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[23] See R. Bumb, et al., "Trace Chemistries of Fire: A Source of Chlorinated Dioxins," *Science* 120 (October 24, 1980): 385-90.
[24] Blustein, "Poisoned Image: Dow Chemical Fights Effect of Public Outcry over Dioxin Pollution," *Wall Street Journal*, June 28, 1983, p. 1.
[25] See Frank B. Cross, "Beyond Benzene: Establishing Principles for a Significance Threshold on Regulatable Risks of Cancer," *Emory Law Journal* 35 (1986): 12-43.

that involved estimating exposures to the chemical via various routes among population subgroups and assessing its "cancer potency." The latter usually involved making a high- to low-dose risk extrapolation from available animal data and then making an adjustment for differences in body weight or surface area to go from animal to human. Finally, the end result was expressed in terms of either individual risk (e.g., a lifetime increased cancer risk of one in a thousand) or population risk (e.g., 200 additional cases of cancer per year). In a second step, sometimes distinguished as "risk management," regulators determined whether exposures to the chemical posed an unacceptable risk and, if so, what measures should be taken to reduce exposures. As a matter of policy, by the early 1980s agencies took certain levels of risk to be de minimis or "acceptable." In the case of dioxin, for instance, the EPA would take a one-in-one-million lifetime increased cancer risk to be "acceptable" for the purposes of regulation.[26]

Quantitative risk assessments were highly sensitive to the assumptions made by risk assessors at each stage, from exposure estimates, to the choice of models for the extrapolations from high- to low-dose, and from animal to human. As a result, political battles over environmental carcinogenesis increasingly centered on what assumptions would be made about exposure and which extrapolation models would be used to estimate cancer potency. Since the usual goal of risk assessors was to place a plausible upper-bound on risk, they typically made default assumptions that were "conservative" or risk-averse, for instance by using "high-end" exposure estimates and linear no-threshold models to draw the dose-response curve from high (observed) doses to low doses. Industry groups generally supported the use of quantitative risk assessments and the notion of "acceptable" risk, but were highly critical of the use of such conservative "default options" and high-end exposure data, arguing that the results were "unrealistic" and overestimated risks. In the case of dioxin and other carcinogens, efforts by affected industries to slash estimates of risk often focused on achieving a more favorable dose-response curve by working to convince regulators to adopt alternatives to the default linear no-threshold approach. But uncertainties, absences of information, and

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[26] Elizabeth L. Anderson and the Carcinogen Assessment Group of the U.S. Environmental Protection Agency, "Quantitative Approaches in Use to Assess Cancer Risk," *Risk Analysis* 3 (1983): 277-295.

assumptions at a variety of other points in the complex risk calculation could be exploited to push risk assessments toward desired end results.

In the early 1980s, both the Centers for Disease Control (CDC) and the Food and Drug Administration (FDA) conducted quantitative risk assessments on dioxin. Both appear to have used the inherent malleability of the risk assessment process to reach outcomes that aligned with predetermined targets chosen by policymakers. The first case involved a CDC risk assessment used to justify a "level of concern" of 1 part per billion (ppb) for dioxin in residential soils. By 1983, dioxin had been discovered at elevated levels in the soils of a number of communities in Missouri, Illinois, and New Jersey. In Times Beach, Missouri, dioxin contamination spread by a waste-oil dealer ultimately led to a $33-million government buyout and evacuation. This 1 ppb level of concern guided decisions on evacuations of residents from contaminated areas, and, though it was not a formal standard, served as a de facto cleanup level for dioxin at Superfund sites for years. The history of this number suggests that it was chosen largely on the basis of cost and political considerations, and was subsequently supported by a risk assessment conducted by the CDC. Lacking key pieces of information to guide the exposure assessment (e.g., how much dioxin were residents of contaminated areas exposed to?), the CDC made a series of necessarily uncertain assumptions about the duration of exposure, exposure mechanisms, and the concentrations of dioxin in contaminated soil. Several of these assumptions appear to have deviated from what would have been expected had the CDC adhered to the conservative assumptions typically used by federal agencies. Had more conservative assumptions been used, the CDC could have arrived at a far lower and more protective level of concern.[27]

The 1 ppb number originated in 1982 in the EPA office of the Assistant Administrator for Solid Wastes and Emergency Response, Rita Lavelle. A Reagan appointee, Lavelle headed this so-called Superfund Office until being forced out in 1983

[27] Anonymous, "Health-Risk Estimates for 2,3,7,8-Tetrachlorodibenzodioxin in Soil," *Morbidity and Mortality Weekly Report* 33 (January 27, 1984): 25-27; Renate D. Kimbrough, Henry Falk, and Paul Stehr, "Health Implications of 2,3,7,8-Tetrachloro-dibenzodioxin (TCDD) Contamination of Residential Soil," *Journal of Toxicology and Environmental Health* 14 (1984): 47-93.

amid charges of conflicts of interest and political manipulation of the program.[28] In September 1982, Lavelle was briefed on three options for a preliminary cleanup level for dioxin in the soil at hazardous waste sites: .01 - .05 ppb, 1 ppb, and 100 ppb. The key considerations were cleanup costs and feasibility. Lavelle was told that the "intermediate cost" 1 ppb level had the advantage of allowing "immediate action for Agency, and good press" and that such a cleanup level was "easily implemented" since "sampling is relatively inexpensive and easy." The briefing suggested that the number might not hold up under the EPA's current cancer risk assessment policies, but that it might nonetheless "buy time" while the public could be prepared for a possible change in policy, including a "reassessment of Agency risk analysis methods and policies, SAB [Science Advisory Board] review, and other scientific review." The briefing paper acknowledged that a 1 ppb level would be "based on cost and need for immediate action, not total health protection."[29]

While Lavelle's Superfund Office had settled on 1 ppb as the action level in 1982, a risk assessment to justify that number was not completed until the following year. Scientists at the CDC completed an initial risk assessment of dioxin in residential soils in 1983, a version of which was published 1984. Applying a linear no-threshold extrapolation model to the 1978 Kociba data, the CDC made an estimate of cancer potency that was within an order of magnitude of that reached by the EPA in its assessments in the 1980s. From this, a "virtually safe dose" of dioxin (for a one in a million lifetime increased cancer risk) was estimated to be .028 picograms per kilogram of body weight per day (pg/kg/day). Next, the CDC scientists made a series of assumptions about exposure to dioxin in the soil from which they were able to conclude

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[28] David Hoffman and Mary Thornton, "2 Officials Forced Out in 'Fresh Start' at EPA," *Washington Post,* February 24, 1983, p. A1. Justice Department and Congressional committees investigated charges that Lavelle showed favoritism toward her former employer, Aerojet General, in hazardous waste cleanup matters and that she improperly discussed pending enforcement actions with corporate officials. See Andy Pastor, "Lavelle, Fired EPA Aide, Denies Contacts with Polluting Companies were Improper," *Wall Street Journal*, February 24, 1983, p. 4. Lavelle was later sentenced to six months in prison for lying to Congressional investigators and obstruction of justice. See Philip Shabecoff "Rita Lavelle Gets 6-Month Term and is Fined $10,000," *New York Times*, January 10, 1984, p. A1.

[29] Conrad O. Kleveno to Rita M. Lavelle, "Briefing Document for September 27, 1982, at 11:00am on Region VII, Dioxin Issues," reproduced in Carol Van Strum and Paul Merrell, *No Margin of Safety: A Preliminary Report on Dioxin Pollution and the Need for Emergency Action in the Pulp and Paper Industry* (Greenpeace USA, 1987), X-4-X-5.

that soil contaminated with 1 ppb of dioxin would lead to cumulative exposures to dioxin that fell below this "virtually safe dose."[30] These assumptions appear to have deviated from the protective approach typically favored by regulators to place an upper bound on risk. To be sure, the task of estimating exposures to a chemical from soil contamination was complex and highly uncertain. Unlike exposures from air, water, or food, where a single route could be assumed, for soil three different exposure routes had to be considered: direct absorption through the skin, ingestion of soil, and inhalation of dust with attached dioxin molecules. To estimate ingestion and skin exposure to dioxin in the soil, the CDC drew upon studies on the uptake of lead from contaminated soils in which researchers had found that children of different ages tended to ingest or come into contact with soils at different rates. But in contrast to its use of mathematical modeling and experimental data to estimate these route-specific exposures, the CDC made two other key exposure assumptions without supporting data. First, the CDC asserted that all of the exposures "would be likely to take place only 6 [months] of the year because of seasonal influences and varying activity patterns." Offering no evidence to justify this assumption, the CDC scientists had immediately cut the exposure estimate in half. Second, the CDC assumed that just one percent of the soil in a contaminated area would be contaminated at the peak level and that the remaining soil would have zero contamination. Again the CDC risk assessors offered no supporting evidence. These assumptions allowed for a significantly higher "acceptable" level of dioxin in the soil than would have resulted had more protective assumptions been used. For instance, if just ten percent of the contaminated area were assumed to be at the peak level, then the CDC would not have been able to justify 1 ppb as the concern level given its cancer potency estimate and other assumptions.[31]

Together these assumptions alone had driven up the concern level for dioxin in residential soils by some two orders of magnitude (or 100 fold). As a result, the risk

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[30] Anonymous, "Health-Risk Estimates for 2,3,7,8-Tetrachlorodibenzodioxin in Soil," 25-27; Kimbrough, Falk, and Stehr, "Health Implications of 2,3,7,8-Tetrachloro-dibenzodioxin (TCDD) Contamination of Residential Soil," 47-93.

[31] Anonymous, "Health-Risk Estimates for 2,3,7,8-Tetrachlorodibenzodioxin in Soil," 25-27; Kimbrough, Falk, and Stehr, "Health Implications of 2,3,7,8-Tetrachloro-dibenzodioxin (TCDD) Contamination of Residential Soil," 47-93.

assessment backed a policy in which cleanup levels and other actions would be triggered only when dioxin levels were detected at 1 ppb. Of course, each of the exposure assumptions made by the CDC may indeed have been reasonable best guesses based on the available evidence. But the perfect match between the CDC's end-result and the EPA's earlier number raised suspicions among some observers that these assumptions had been used to massage the risk assessment toward the pre-selected target of 1 ppb. After the concordance between the level identified by the Superfund Office and the subsequent CDC assessment was subsequently discovered in documents obtained under the Freedom of Information Act request, a 1987 Greenpeace report charged that the CDC assessment was "no more than a post-hoc rationalization for EPA's economic-based decisions," in which "CDC scientists juggled and excised available data on TCDD [dioxin] to fit Rita Lavelle's cost-effective 1 part-per-billion level."[32]

25 Parts Per Trillion

The malleability of risk assessment assumptions also appears to have been used by the Food and Drug Administration (FDA) to avoid actions that could have proven extremely costly to affected industries. When dioxin was discovered in several species of Great Lakes fish in the early 1980s, Michigan and other states turned to the FDA for guidance on whether the levels in fish posed a threat to public health. The FDA appears to have tailored its guidance to ensure that there would not be a significant impact on commercial fishing in the Great Lakes. While some species of sport fish collected in Lake Ontario had dioxin levels as high as 30 parts per trillion (ppt), most commercial species tested, such as bullhead, perch, and catfish, had levels below 25 ppt. Similar to the EPA/CDC's setting of an action level for contaminated soils, the FDA settled on a level that would limit the economic impact of its decision. In 1981, the FDA set 25 ppt as the "concern level" for dioxin in Great Lakes fish, saying that fish with dioxin levels above 50 parts per trillion (ppt) should not be consumed, that fish with levels between 25 and 50 ppt should be consumed no more than twice a month, and that fish with levels below 25 ppt posed no public health concern. Although the FDA's "concern level,"

[32] Van Strum and Merrell, *No Margin of Safety*, IV-12.

unlike a "tolerance" level, was not legally binding, if the FDA had set the level much lower than 25 ppt, Great Lakes states could have faced pressure to limit consumption of several important commercial fish species.[33]

In support of its 25 ppt concern level, the FDA cited quantitative assessments showing, according to the agency, that consumption of fish with dioxin levels below this level would not pose an unacceptable health risk. Like the EPA/CDC policy for residential soils, the FDA appears to have steered its risk assessment toward a pre-selected target, chosen to minimize any potential economic fallout. In 1981, the FDA completed its first risk assessment for the consumption of dioxin-tainted fish. Using data on the consumption of Great Lakes fish by residents of surrounding states, the FDA estimated that the heaviest consumers (the 99th percentile) of contaminated fish ate some 36.8 grams per day. If the fish they ate were uniformly contaminated with dioxin at 25 ppt, these high-end fish consumers would ingest some 13 picograms of dioxin per kilogram of body weight per day.[34] Next, the FDA proceeded to argue that exposure to dioxin at this level would not pose an unacceptable level of risk. This exposure level was some three orders of magnitude (1000 times) higher than what other U.S. regulatory agencies would deem acceptable.[35] The FDA's lower estimate of dioxin's risks was the result of its use of the conventional toxicological approach—applying a safety factor to the no-effect level from animal studies—instead of the linear, no-threshold approach typically used by other agencies for carcinogens. The FDA's approach mirrored the approach that had been advocated by Dow, including the company's controversial claim of a 1,000 pg/kg/day "no-effect level." Applying a safety factor of 70 to the 1,000 pg/kg/day number, the FDA then concluded that 13 pg/kg/day was an acceptable level. Given its exposure estimates and the traditional toxicological approach, the FDA

[33] Frank Cordle, "The Use of Epidemiology in the Regulation in the Food Supply," *Regulatory Toxicology and Pharmacology* 1 (1981): 379-387; Nat'l Wildlife Fed'n v. Sec'y of Health and Human Servs., 808 F.2d 12, 13 (6th Cir. 1986).
[34] Consumption of 36.8 grams of fish at 25 ppt would give a total daily intake of dioxin of 0.92 nanograms, or 920 picograms. 920 pg/day divided by 70 kg (average adult body weight) gives an intake of 13 pg/kg/day.
[35] The CDC, for instance, posited a "virtually safe dose" (one excess cancer per one million) of .027 pg/kg/day.

concluded that even the heaviest consumers of Great Lakes fish would be protected so long as dioxin levels in fish were below 25 ppt.[36]

But in a demonstration of the political malleability of quantitative risk estimates, just two years later an FDA official testifying before Congress cited a completely different approach to arrive at the same 25 ppt number. In a second iteration of its risk assessment, the FDA now used the more widely accepted linear, no-threshold approach instead of the conventional toxicological approach. If other assumptions in the assessment had remained the same, therefore, this more risk-averse approach would have indicated a far lower acceptable daily dose of dioxin than 25 ppt. But the FDA again arrived at the same 25 ppt number. It did so by changing several key assumptions: the statistical group taken to represent the heaviest fish consumers; the average level of dioxin in the contaminated fish they consumed; and the proportion of the consumed fish assumed to be contaminated.[37] First, the agency changed the statistical group of Great Lakes fish consumers that it took to represent the heaviest fish consumers for its calculations. Instead of using fish consumers at 99th percentile of consumption (who were exposed to an estimated 920 picograms of dioxin per day), the agency used those at the 90th percentile (exposed to an estimated 392.5 pg/day). Second, the FDA made the assumption that, if it set the concern level at 25 ppt, the average level of the fish in a state's fishery would have to be lower than this number—the agency guessed around one-third lower or 8 ppt. Previously the agency had used 25 ppt as the average contamination level for its calculations. Now it assumed that the statistical high-end fish consumers in its calculations would on average be eating fish contaminated with dioxin at a level of 8 ppt. This again reduced the the exposure estimate, from 392.5 pg/day down to around 131 pg/day.[38] Finally, since only certain fish species were believed to be contaminated, the FDA assumed that only a certain proportion of the the total Great Lakes fish that were consumed would actually be contaminated. The FDA guessed that just one-tenth of the

[36] This number was considered acceptable, according to the assessment, since it was "1/70th of the no-effect level, less than 1/700th of the lowest-effect level, and less than 1/7000th of the carcinogenic level." Cordle, "The Use of Epidemiology in the Regulation in the Food Supply," 386.
[37] See statement of Sanford A. Miller, in U.S. Congress, House of Representatives, Committee on Science and Technology, Subcommittee on Natural Resources, Agriculture Research and Environment, *Hearings: Dioxin—The Impact on Human Health*, 98th Cong., 1st Sess., June 30, July 13, 28, 1983, pp. 78-88.
[38] 1/3 * 392/5 pg/day = ~131 pg/day

total fish consumed by high-end consumers would be contaminated. This reduced the exposure level by one-tenth, from 131 pg/day to 13.1 pg/day. In its previous assessment, the FDA's "worst-case" or high-end estimate of exposure to dioxin in contaminated fish was 920 picograms of dioxin per day. Now the agency's high-end exposure level was just 13.1 picograms of dioxin per day.[39]

Using these new exposure assumptions, the FDA was able to conclude that 25 ppt level was a reasonable concern level even under the more conservative linear, no-threshold approach. The agency had derived a cancer potency estimate by applying a linear, no-threshold model to data points from the 1978 study conducted by Kociba at Dow. Using the resulting dose-response curve, the FDA concluded that exposure to 13 pg of dioxin per day—the exposure level it had estimated for its statistical high-end consumers—would produce an increased lifetime cancer risk of three-per-one-million. This was close to the one-per-one-million level often considered "acceptable" by federal agencies. FDA scientists could now justify the 25 ppt level of concern to Congress on the basis of the linear, no-threshold model that was now typically used for carcinogens. In the course of just two years, the FDA had justified the same 25 ppt number using two radically different methodologies. To do so, FDA risk assessors had made dramatic changes in exposure assumptions and made a less protective choice about which statistical group would represent the heaviest consumers in its calculations. The FDA's 25 ppt concern level and its decision not to set a legally-binding "tolerance" level was subsequently challenged in a lawsuit brought by the National Wildlife Federation. But after the FDA prevailed in the courts, its 25 ppt "concern level" would remain the *de facto* acceptable level for dioxin in fish through the 1980s and beyond.[40]

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[39] Statement of Sanford A. Miller, in Subcommittee on Natural Resources, Agriculture Research and Environment, *Hearings: Dioxin—The Impact on Human Health*, pp. 78-88; Cordle, "The Use of Epidemiology in the Regulation in the Food Supply," 386.

[40] See Statement of Sanford A. Miller, in Subcommittee on Natural Resources, Agriculture Research and Environment, *Hearings: Dioxin—The Impact on Human Health*, pp. 78-88. In *National Wildlife Fedn.*, 808 F.2d at 15 the Sixth Circuit upheld the FDA's decision not to establish a tolerance or action level for dioxin in fish. In a 1984 petition, the National Wildlife Federation (NWF) had asked the agency to set an interim action level of 5 ppt and a tolerance based upon a one in a million lifetime risk. The NWF also asked that the agency use a linear/no-threshold risk assessment model in setting a tolerance level. The court held that the FDA had the discretion not to set a tolerance based on its assessment that "consumption of Great Lakes sports fish would not result in significant dioxin exposure to the general population" and

Dioxin and Paper

As a flurry of media coverage swirled around the dioxin problems at Times Beach, the Tittabawassee and Saginaw rivers in Michigan, and the Great Lakes, Congress mandated a "National Dioxin Study" to survey the problem nationwide. When the EPA began the study in 1983, its premise was that the most important source of dioxin in the environment was the manufacture and disposal of 2,4,5-T and a handful of other pesticides. As the head of the agency's Chlorinated Dioxins Work Group, Donald Barnes, told a Congressional hearing in 1983, "If you look around the country and you say where are the dioxin problems, at nearly every site you can identify it…you can link it to the previous manufacturing of chemicals that contain 2,3,7,8-TCDD [dioxin]."[41] The study thus prioritized sites with suspected links to dioxin-tainted chemicals, including former manufacturing and disposal sites and downstream waterbodies. But it also sought to establish how much dioxin was present as "background," or "natural," levels, in part to provide a set of control data for its other measurements. Dow scientists had posited that wildfires and other sources of combustion would contribute to detectable natural background levels. Thus, samples were tested for very low levels of dioxin (low parts-per-trillion) at a number sites that were "not suspected of being directly influenced by known sources of 2,3,7,8-TCDD."[42]

By 1985 results had emerged from these "background" sites that would radically recast the national dioxin problem and heighten the political and economic stakes. Fish samples gathered at supposed background sites in Wisconsin, Maine, and Minnesota showed heightened dioxin levels, some with levels as high as contaminated fish in the Great Lakes. But here no upstream chemical plants or disposal sites were present that could explain the problem. Instead these fish had been caught downstream from pulp and

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that a "tolerance would not effectively protect sports fishermen because FDA does not have the regulatory resources to control the consumption of sports fish."

[41] See testimony of Donald Barnes, in Subcommittee on Natural Resources, Agriculture Research and Environment, *Hearings: Dioxin—The Impact on Human Health*, 107.

[42] U.S. Environmental Protection Agency, *Dioxin Strategy* (Washington, D.C.: U.S. Environmental Protection Agency, Office of Water Regulations and Standards and the Office of Solid Waste and Emergency Response, 1983), 11.

paper mills.[43] By late 1985 the EPA had gathered evidence that dioxin was present in the sludges of certain pulp and paper mills. It later confirmed that dioxin was a byproduct of bleaching processes using chlorine.[44]

For the paper industry this discovery carried the prospect of stringent regulation, and a potential public relations crisis if dioxin were found in such sensitive consumer products as diapers and coffee filters. The first step in damage control for the American Paper Institute (API), the industry's principal trade association, was a joint agreement with the EPA on a joint study of dioxin pollution at five mills whose use of chlorine-based bleaches were suspected of causing dioxin contamination. As part of the agreement, data from the study would be subjected to a "quality assurance review" by both EPA and industry scientists, the EPA would guarantee confidential treatment of effluent data under trade secrets rules, and the EPA would not release most data from the study prior to the final report. The API was also guaranteed "input to the development of the final report" and the option of providing "separate views regarding the data for inclusion in the final report."[45] As API president Red Cavaney explained to the group's executive committee in 1986, by agreeing to the joint study "the industry was able to forestall major regulatory and public relations difficulties." The study also bought precious time, Cavaney noted, during which "the industry's communications experts…came together to prepare responses to inquiries."[46]

By early 1987 a draft report on the five mills study confirmed the dioxin problem. In anticipation of the public release of the results by the EPA later in the year as part of the National Dioxin Study, the API allocated some $300,000 for a "Dioxin Public Affairs Plan." Its main objectives were to "keep allegations of health risks out of public arena," to "avoid confrontations with government agencies which might trigger concerns," and "to achieve an appropriate regulatory climate." These goals were pursued through a

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[43] See U.S. Environmental Protection Agency, *National Dioxin Study Tiers 3,5,6, and 7* (Washington, D.C.: U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Monitoring and Data Support Division, 1987).

[44] Van Strum and Merrell, *No Margin of Safety*, VI-1–VI-22. "USEPA/Paper Industry Cooperative Dioxin Screening Study," June 20, 1986, reproduced in Van Strum and Merrell, *No Margin of Safety*, X-19-X22.

[45] "USEPA/Paper Industry Cooperative Dioxin Screening Study," June 20, 1986, reproduced in Van Strum and Merrell, *No Margin of Safety*, X-19-X22. Alec McBride to Patricia K. Hill, January 13, 1987, API Documents.

[46] Red Cavaney to API Executive Committee, draft memo, December 30, 1986, API Documents, III-11.

wide-ranging PR campaign to reassure the public on the safety of paper products and to influence the EPA's assessment of dioxin's health risks. The media campaign aimed to "minimize speculation about the human health effects by clearly communicating to key audiences, thereby lessening public fears and overreaction." With the help of the PR firm Burson-Marsteller, the paper industry launched a coordinated campaign at the national, state, and local levels. For local-level responses, the API trained a nationwide network of spokespersons, largely industry employees. With the help of briefing materials, mailing lists, and videotapes produced by public relations talent, they reassured "key audiences"—including workers, consumers, customers, state regulators, and local communities—that the trace levels of dioxin from paper mills posed no risk to the environment or public health.[47]

Another key element of the API's plan called for getting "EPA to 'rethink' dioxin risk assessment." In 1985 the EPA had completed a risk assessment that tagged dioxin as one of the most carcinogenic substances known. The agency applied its standard linear, no-threshold assumptions as embodied in the so-called "linearized multistage" (LMS) mathematical model. Like earlier risk assessments, the key data points for the extrapolation to low doses were provided by the 1978 Dow study on rats. The EPA risk assessors estimated a "risk-specific" dose for a one-in-one-million excess cancer risk (the "acceptable" level of risk) of just 0.006 picograms of dioxin per kilogram of body weight per day (pg/kg/day).[48] If regulations were based on this number, they would be far stricter than anything proposed in Canada or Europe. Regulators in European countries, for instance, had used a threshold model and applied the conventional no-effect-level/safety-factor approach. The resulting acceptable daily intake levels for dioxin ranged from between 1 and 10 pg/kg/day. This was some one-thousand-times higher than the EPA's number. Dioxin-linked industries complained that the EPA's strict assessment was out of line with the rest of the world. Fearing that the agency's result would justify extraordinarily stringent regulations, these industries began intensively lobbying for changes to the risk assessment. The stakes were high: if the EPA could be

[47] American Paper Institute, "Dioxin Public Affairs Plan," March 2, 1987, API Documents, III-15-III-39.
[48] The cancer potency was similar to that estimated by the EPA in 1981 using the same underlying data and assumptions of linearity and no threshold.

persuaded to deviate from its default linear no-threshold assumptions then the acceptable exposure level could be up to a thousand times higher.[49]

By 1986 the agency had begun an internal review of this landmark risk assessment. With the working relationship it had established with the EPA in the joint five mills study, the API pressed the agency for changes in the risk assessment, particularly a deviation from the default linear no-threshold approach. The API's Dioxin Coordinating Committee observed that the existing assessment could lead the EPA "to question the levels of dioxin detected in some of the industry's sludge, effluent, pulp, and possibly in the future, some products." But "if the assessment were to be changed," observed the committee, "the basis for questioning the industry's dioxin levels could cease to exist." The committee warned that it would not be easy to get the EPA to change its approach. With many mid-level agency staff against changes, "the industry could find itself in the very position it wanted to avoid—a public debate with EPA."[50] API officials instead made their case privately to EPA Administrator Lee Thomas at meetings in 1986 and 1987. Prior to one meeting, EPA staff described industry officials as "very anxious to learn the results" of the review and concerned that Thomas needed to "know what's at stake in the re-evaluation since dioxin is turning up in paper products." At the 1986 meeting, API officials urged Thomas to establish "strong national direction vs. States" through its risk assessment and to consider the implications of "initiators vs. promoters," the principal theory then being advanced by industry to claim a threshold for dioxin. API officials also asked that the industry be allowed to participate in the agency's review of its assessment and discussed with Thomas a "framework for participation in establishing extent of risk." In a 1987 meeting with Thomas, top paper industry officials again emphasized "the importance of EPA's ongoing re-evaluation of its views of the

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[49] U.S. Environmental Protection Agency, *Health Assessment Document for Polychlorinated Dibenzo-p-Dioxins* (Cincinnati, OH: U.S. Environmental Protection Agency, Environmental Criteria and Assessment Office, 1985); Ontario Ministry of the Environment, *Scientific Criteria Document for Standard Development No. 4-84: Polcychlorinated Dibenzo-p-dioxins (PCDD's) and Polychlorinated Dibenzofurans (PCDF's)* (September 1985); Commoner and. Webster, "Overview: The Dioxin Debate," 1-53; H.P. Shu, D.J. Paustenback, and F.J. Murray, "A Critical Evaluation of the Use of Mutagenesis, Carcinogenesis, and Tumor Promotion Data in a Cancer Risk Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin," *Regulatory Toxicology and Pharmacology* 7 (1987): 57-88.

[50] American Paper Institute, Dioxin Coordinating Committee, "Summary Paper, Meetings of June 16-17, 1987," API Documents, I-8 - I-12.

potency of dioxin." Meanwhile, the API dioxin plan also recommended lobbying key members of Congress to "provide pressure on [the] agency to change current risk assessments" and to "provide assurances" to EPA Administrator Thomas that he could "take appropriate time in resolving [the] issue."[51]

As it urged the EPA to "rethink" its dioxin assessment, the API moved to add scientific muscle to its positions. It began compiling information on the known health effects of dioxin, reviewing studies linking the industry to dioxin, and assembling its own experts. A 1987 API strategy memo recommended spending $150,000 to hire a small "In-House Advisory Panel" and to create a larger "Independent Scientific Advisory Board." It urged the industry to "aggressively advance the legitimate views held by many experts within the scientific community that the U.S. government takes an unduly conservative view with respect to the health effects of dioxin." The goal was to "possibly delay any 'rush to judgment'" by regulators on the "scientifically questionable" risks of dioxin and to "possibly change the assumptions on which current federal government policies are based." A small group of two or three experts would provide scientific advice to the industry and act as expert spokespersons. But "outside assistance" was also necessary, since "internal industry spokespersons will likely be viewed as less credible on this particular issue because of our perceived vested interest in a more favorable point of view from the government and, in turn, the public." This credibility problem would be addressed by forming an independent science panel, composed of five or six experts in toxicology, epidemiology, and risk assessment. This panel would produce a "white paper" examining the "validity of the federal government's scientific policies governing dioxin," which could then "be used as a communications tool in dealing with regulators and elected officials, the media, the public, employees and customers." As the release

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[51] Lawrence J. Jensen to Lee M. Thomas, "September 22 Meeting with the American Paper Institute," September 1986, reproduced in U.S. Congress, House Committee on Public Works and Transportation, Subcommittee on Water Resources, *Hearing: Dioxin Pollution in the Pigeon River, North Carolina and Tennessee*, 100th Cong., 2d sess., July 13, 1988, pp. 251-252; Jim Cummings to Lawrence J. Jensen, "Background Information on July 31, 1987 Administrator's Meeting with American Paper Institute—Dioxin Related Issues," July 28, 1987, reproduced in *Ibid.*, 243-246. Anonymous, "Amendola's Notes on Meeting of API and Lee Thomas," September 22, 1986, reproduced *Ibid.*, 259; Red Cavaney to API Member Companies, August 10, 1987, API Documents, 2; American Paper Institute, "Dioxin Public Affairs Plan," March 2, 1987, API Documents, III-15 - III-39.

date approached for the National Dioxin Study, the API began interviewing outside scientists for positions on its panel.[52]

The API also courted the cooperation of the EPA in hopes of tempering the expected media frenzy when the Agency released the results of the National Dioxin Study implicating pulp and paper mills. The API's Dioxin Coordinating Committee's main goals included: "Get EPA to discuss issue with media in balanced/non-hysterical manner"; "Have the EPA not seek publicity"; and "Get EPA to issue statement, 'No harm to environment or public health.'"[53] To achieve these objectives, the group was to "improve intelligence gathering within EPA," in part by identifying "allies" and "adversaries" within the agency. It also planned to "work on [the] White House" by calling upon officials at the Council on Environmental Quality and the Office of Management and Budget.[54] Most important, the API's public relations concerns were discussed at meetings between paper industry executives and EPA Administrator Lee Thomas. API president Red Cavaney told member companies of one successful meeting between industry executives and Thomas on July 31, 1987. "Thomas," wrote Cavaney, "indicated a willingness to cooperate with the industry to insure that the public not be unduly alarmed about this issue. He felt the cooperative efforts should continue and gave no indication that the Agency felt that the current situation was a crisis warranting immediate regulations.[55]

The EPA's subsequent handling of the release of its landmark National Dioxin Study supports Cavaney's confident appraisal of the meeting. The EPA's communications strategy called for a "low key release of the report" and stated that it would not "dwell on the pulp and paper industry."[56] While the EPA moved toward a quiet release of the study, the paper industry forged a preemptive media plan to manage

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52 American Paper Institute, "Creation of an Independent Scientific Advisory Board and an In-House Advisory Panel on the dioxin issue," undated, API Documents, I-14 – I-16; John L. Festa to Robert L. Sielken Jr., May 12, 1987, API Documents, I-13.
53 American Paper Institute, "Dioxin Public Affairs Plan," March 2, 1987, API Documents, III-15-III-39, p. III-35.
54 *Ibid.*, p. III-37.
55 Red Cavaney to API Member Companies, "Update No. 4: The Industry and Dioxin Studies," undated, API Documents, Table of Contents, p. 1, I-1.
56 Cummings to Jensen, "Background Information on July 31, 1987 Administrator's Meeting with American Paper Institute—Dioxin Related Issues," July 28, 1987, reproduced in Subcommittee on Water Resources, *Hearing: Dioxin Pollution in the Pigeon River, North Carolina and Tennessee*, 243-246.

the issue it viewed as the public relations hotspot—the presence of dioxin in consumer paper products.[57] Anticipating difficult questions about this problem, the API commissioned its own risk assessment of dioxin-tainted paper products from the consulting firm Arthur Little. The results were then used to reassure the public that trace levels of dioxin in paper products posed no health risk. Indeed, by the time the EPA released results from its National Dioxin Study on September 23, 1987, it would be overshadowed by the paper industry's contemporaneous announcement of the results of its own reassuring assessment of dioxin in paper products. "As API announced the findings and played down their public health implications," Michael Weiskopf later observed in the *Washington Post*, "top EPA officials—given only sketchy details of the product tests a few days earlier—had little choice but to agree. Many environmentalists seemed caught off guard."[58]

While the API effectively stage managed the release of the results of the National Dioxin Study to the U.S. media, revelations of the paper industry's dioxin problems had in fact been made public a month earlier on August 21, 1987, when the Toronto regional office of Greenpeace released a report entitled *No Margin of Safety: A Preliminary Report on Dioxin Pollution and the Need for Emergency Action in the Pulp and Paper Industry*. The reports authors were Paul Merrell, an attorney in Oregon, and Carol Von Strum, the co-founder of Citizens Against Toxic Sprays. Following her involvement with the group's successful legal challenge to the Forest Service's 2,4,5-T spraying program, Van Strum began investigating the EPA's delays in banning 2,4,5-T and in responding to newly-discovered industrial sources of dioxin contamination. As she gathered publicly available sources, Van Strum also filed Freedom of Information Act (FOIA) requests for internal EPA documents. By the mid-1980s, the unfolding paper trail led Van Strum to the emerging results from the EPA's National Dioxin Study finding unusually high dioxin levels downstream of paper mills in Wisconsin, Minnesota, and Maine.[59] In December 1986, Greenpeace obtained leaked EPA documents detailing the agreement

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[57] See American Paper Institute, "Communications/Public Affairs Strategy," API Documents, III-32 – III-35.

[58] Michael Weiskopf, "Paper Industry Campaign Defused Reaction to Dioxin Contamination," *Washington Post*, October 25, 1987, p. A23.

[59] See Van Strum and Merrell, *No Margin of Safety*, chapter V.

between the EPA and the API to conduct a confidential joint study of five paper mills.[60] Supplemented with additional memos and correspondence obtained through FOIA litigation, Van Strum and Merrell's report detailed the discovery of dioxin contamination near pulp and paper mills and what they called a "government cover-up" of the findings. The authors said that there "are no 'safe' levels of TCCC [dioxin]. Every dose tested in laboratory animals has resulted in increased levels of cancer, birth defects and other reproductive problems, and in damage to the body's immune system." Calling the discovery of dioxin from pulp and paper mills a "public health emergency in North America," they urged immediate action to "vastly reduce the levels of dioxin emissions in the industry."[61]

When Greenpeace came to the issue in 1987, mainstream environmental groups in the U.S. were pursuing litigation aimed at pressing the EPA to control industrial dioxin emissions. In 1984, the Environmental Defense Fund (EDF) and the National Wildlife Federation (NWF) petitioned the EPA under the Toxic Substances Control Act (TSCA) to regulate dioxins and dibenzofurans (a similar group of organochlorines) as a class or "category" from all known industrial sources.[62] When the EPA denied the petition, the groups pursued litigation against the agency that ultimately resulted in a 1988 consent decree. Under the terms of the agreement, the EPA agreed to propose regulations by April 1991 and to conduct a large-scale study of dioxins and furans in the sludges, effluents, and paper products from all of the nation's bleaching pulp and paper mills. The regulations to be proposed under the agreement later evolved into the so-called "cluster rule" for regulating both hazardous air pollutants and water effluents from pulp and paper mills. Although the EPA put off action until the mid-1990s, the litigation strategy pursued by the groups had set the regulatory process in motion. As legal scholar William

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60 *Ibid.*, VI-1.

61 *Ibid.*, I-1 – I-2. Within weeks of releasing its *No Margin of Safety*, Greenpeace obtained an even more revealing set of leaked documents—from an insider at the API. Released by Greenpeace to the media at the same time that the EPA announced the results of its National Dioxin Study on September 23, 1987, the leaked memos and minutes of meetings detailed the API's comprehensive "Dioxin Public Affairs Plan," its meetings with EPA administrator Lee Thomas, and its strategy for persuading the EPA to downplay the risks of dioxin when it released the results of its study. Though ignored during the immediate wave of press coverage of the dioxin-paper link in September, the documents were the basis of an October 1987 story by *Washington Post* reporter Michael Weiskopf. See Weiskopf, "Paper Industry Campaign Defused Reaction to Dioxin Contamination," *Washington Post*, October 25, 1987, p. A23.

62 See EDF v. Thomas, 657 F. Supp. 302 (D.D.C. 1987).

Boyd points out, "the consent decree not only increased the pressure on EPA (and the industry) to conduct a comprehensive study of dioxin contamination from pulp and paper mills, it also set a timeline for developing appropriate regulations."[63] Outside of the courts, the EDF was also playing a significant role in the evolving debates over the health risks of dioxin. The head of EDF's Toxic Chemicals Program was Ellen Silbergeld, who held adjunct faculty positions at the University of Maryland Medical School and the Johns Hopkins Medical Institutions and was involved in research on the mechanisms of dioxin's actions in nerve and muscle cells. Silbergeld was a regular participant in expert panels on dioxin, serving as a reviewer of the EPA's 1985 dioxin assessment and on a panel convened by the EPA's Scientific Advisory Board to review the agency's 1987 revision of its cancer potency estimate. Through the 1990s, she would be regularly called upon as an environmentalist source in media coverage of the dioxin issue, often rebutting claims by industry experts that dioxin's risks had been exaggerated.[64]

While the EDF and NWF pushed the EPA to take the innovative approach of regulating dioxins and related compounds as a class, Greenpeace began pressing for an even more comprehensive approach. From the start of its involvement with the issue in North America, Greenpeace urged that the problem extended to the vast array of organochlorines discharged by the pulp and paper industry. Since 1985 the group had worked on pulp and paper pollution in Europe. The international director of its new program was Renate Kroesa, a German-trained industrial chemist based at Greenpeace's Vancouver office. As Kroesa explained at a House Subcommittee on Water Resources hearing on dioxin contamination in the pulp and paper industry in 1988, the problem was not a handful of chemicals but the "more than 1000 different chlorinated compounds" found in the effluents of wastes from conventional chlorine-based bleaching of pulp from brown to white. Although only around one-third of these organochlorines had been identified, said Kroesa, they were generally "marked by their toxicity, and resistance to biological breakdown. Many are bioaccumulative. Almost all of the problem chemicals EPA has banned over the last two decades are members of this chemical class." Rather

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[63] William Boyd, "Controlling Toxic Harms: The Struggle Over Dioxin Contamination in the Pulp and Paper Industry," *Stanford Environmental Law Journal* 21 (2002): 345-419, p. 365.
[64] See testimony of Ellen Silbergeld in Subcommittee on Water Resources, *Hearing: Dioxin Pollution in the Pigeon River, North Carolina and Tennessee*, 198-216.

than piecemeal regulation, Kroesa argued, the solution was a complete phaseout of the use of chlorine-based bleaching processes and a greater use of unbleached paper products. Moreover, Kroesa urged, the experience of Sweden's pulp and paper industry showed that inexpensive engineering measures were already available to begin the phaseout. There, organochlorine discharges had already been reduced by 80% through measures that included replacing straight chlorine with chlorine dioxide and adopting a process known as oxygen delignification.[65] By the early 1990s, Greenpeace would move from this initial focus on "chlorine free" paper production to a far broader campaign calling for a global phaseout of chlorine from manufacturing processes and chemical products.[66]

Dioxin as "Promoter"

The paper industry and others linked to dioxin, meanwhile, pushed the EPA to "rethink" its 1985 risk assessment, with its high cancer potency estimate that threatened stringent regulation. Those with a stake in the issue now included chemical companies involved in Agent Orange litigation, manufacturers of chlorine-based bleaches used at pulp mills, operators of waste incinerators, and various companies liable for Superfund cleanups of dioxin. A key goal was to assemble evidence to support the use of alternative *nonlinear* extrapolation models that would demonstrate the existence of a biological threshold. In 1986, a new opening for this line of attack was provided when the EPA issues its new "Guidelines for Carcinogen Risk Assessment." The guidelines allowed for deviations from the agency's conservative default assumptions (including the linear, no-threshold model) in cases where evidence was available about the biological mode-of-action of specific chemicals that justified an alternative approach. While a linear, no-threshold model would still be the default assumption, new evidence about the biochemical mechanisms by which a chemical caused cancer could justify a deviation.

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[65] Testimony of Renate Kroesa, in Subcommittee on Water Resources, *Hearing: Dioxin Pollution in the Pigeon River, North Carolina and Tennessee*, 217-226.
[66] See, e.g., Greenpeace, *The Product is the Poison: The Case for a Chlorine Phaseout* (Washington, D.C.: Greenpeace, 1991); Greenpeace, *Chlorine: An Industry with No Future* (Washington, D.C.: Greenpeace, 1992).

"When pharmacokinetic or metabolism data are available," the guidelines stated, "or where other substantial evidence on the mechanistic aspects of the carcinogenesis process exists, a low-dose extrapolation model other than the linearized multistage procedure might be considered more appropriate on biological grounds."[67] Since the risk assessment process had no defined end point, however, calls for new science to establish a "biologically-based" or "science-based" alternative model soon led to an unending series of reevaluations and reassessments.[68]

With the new opening provided by the 1986 guidelines, dioxin-linked industries began challenging the EPA's default linear, no-threshold model. As they urged an alternative model, they turned to a theory that had been invoked in earlier industry challenges to the linear, no-threshold assumptions adopted by federal agencies in the 1970s. This was the theory that there were two types of carcinogens: "initiators" and "promoters." Unlike initiators, which triggered the process of carcinogenesis by directly damaging a cell's DNA, so-called promoters acted at a later stage of carcinogenesis and did not themselves damage DNA. As such, according to industry groups and some scientists, promoters acted like traditional toxics, which had biological thresholds. For substances identified as promoters, they argued, the linear, no-threshold model—developed in the context of radiation and other mutagenic substances that directly damaged DNA—was inappropriate. This promoter theory had been previously invoked, for instance, by the American Industrial Health Council, a group created by chemical manufacturers to challenge the Occupational Safety and Health Administration (OSHA) attempt in the late 1970s to codify a set of "cancer principles" that included the linear, no-threshold model. In the 1980s, dioxin-linked industries picked up this generalized template to challenge the EPA's linear no-threshold assumption for dioxin.[69]

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[67] 51 Fed. Reg. 33992, 33998 (September 24, 1986).
[68] See Howard Latin, "Good Science, Bad Regulation, and Toxic Risk Assessment," *Yale Journal on Regulation* 5 (1988): 89-148; Frank E. Mirer, "Distortions of the 'Mis-Read' Book: Adding Procedural Botox to Paralysis by Analysis," *Human and Ecological Risk Assessment* 9 (2003): 1129-1143.
[69] See various statements on promoter theory at 45 Fed. Reg. 5149-5151. See also Shu, Paustenbach, and Murray, "A Critical Evaluation of the Use of Mutagenesis, Carcinogenesis, and Tumor Promotion Data in a Cancer Risk Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin," 57-88; James D. Wilson, "Time for a Change," *Risk Analysis* 6 (1986): 111-112.

A key part of industry's dioxin-as-promoter dossier was the body of experimental evidence indicating that dioxin was "non-genotoxic." Genotoxicity was defined by the ability of an substance to directly damage a cell's DNA. In practice, the concept of genotoxicity was tightly linked to the experimental systems used to screen chemicals for mutagenicity—the ability to trigger genetic mutations. Positive mutagenicity tests had a strong correlation with carcinogenicity. But since these systems were typically conducted *in vitro* (in a test tube) and often with non-animal cells, they could fail to detect carcinogens whose effects were mediated only through metabolites, indirect mechanisms, or the specific molecular machinery present in the cells of animals. One widely-used mutagenicity test was the so-called Ames test, named for its inventor, biochemist Bruce Ames. It screened chemicals for mutagenicity by applying them to mutant strains of Salmonella bacteria unable to synthesize the amino acid histidine. If a chemical caused a "back mutation" allowing bacteria to grow in Petri dishes lacking histidine, then it was Ames positive. By 1985, twenty different laboratories had conducted Ames tests and other *in vitro* mutagenicity studies of dioxin. Most were negative. With genotoxicity operationally defined by such mutagenicity data, many scientists thus concluded that dioxin was "non-genotoxic."[70]

Since dioxin did not seem to be classic mutagen, but was carcinogenic, some argued that it must logically act at a later stage in the development of cancer. By the early 1980s, scientists conceived of the development of cancer as a multistage process involving at least three major stages: initiation, promotion, and progression. Under this model, carcinogens could act at two different stages of carcinogenesis: initiation and promotion. Carcinogens that were genotoxic could be "initiators," causing the irreversible DNA damage in a normal cell that primed it for uncontrolled growth. Some

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[70] A. Auletta, "Overview of In Vitro Tests for Genotoxic Agents," in *Handbook of Carcinogen Testing*, ed. H. Milman and E.K. Wisburger, (Park Ridge, NJ: Noyes, 1985); Bruce Ames et al., "Carcinogens are Mutagens: A Simple Test System Combining Liver Homogenates for Activation and Bacteria for Detection," *Proceedings of the National Academy of Sciences* 70 (1973): 2281-2285; J.S. Wassom et al., "A Review of the Genetic Toxicology of Chlorinated Dibenzo-p-dioxins," *Mutation Research* 47 (1977), 141-160; Shu, Paustenbach, and Murray, "A Critical Evaluation of the Use of Mutagenesis, Carcinogenesis, and Tumor Promotion Data in a Cancer Risk Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin," 57-88; R. Kociba, "Evaluation of the Carcinogenic and Mutagenic Potential of 2,3,7,8-TCDD and Other Chlorinated Dioxins," in *Banbury Report 18: Biological Mechanisms of Dioxin Action*, ed. A. Poland and R. Kimbrough (Cold Spring Harbor, NY: Cold Spring Harbor Laboratory, 1984), 73-84.

initiators, known as "complete carcinogens," could also act as "self-promoters" at sufficient doses, producing full-blown malignancies in the absence of other agents. Non-genotoxic carcinogens, on the other hand, were thought to act only as "promoters," triggering the growth of "initiated" cells into pre-cancerous lesions during the second stage of carcinogenesis. Rather than directly causing genetic damage, promoters were thought to cause initiated cells to reproduce faster than normal cells. Although the details remained fuzzy, many believed promoters worked by altering gene expression, interfering with the molecular machinery that turned particular genes on or off.[71]

Like genotoxicity, the concepts of "initiator" and "promoter" were operationally defined by specific experimental model systems. In the 1940s, scientists had first proposed a two-stage model of carcinogenesis (initiation followed by promotion) by applying pairs of chemical carcinogens to the skin of shaved mice in different temporal sequences. Using this "skin painting" model, scientists soon defined classic, or known, initiators and promoters, which were then used as reference points for testing other chemicals. A suspected promoter, for instance, could be tested by first painting the skin of mice with a known initiator, then applying the suspected promoter and tallying the resulting tumors. By the early 1980s, scientists had expanded their repertoire for distinguishing initiators and promoter, including an experimental system for looking at the effects on the livers of rats and a cell culture system making allowing for *in vitro* tests. Using these systems, scientists categorized a number of well known chemicals as cancer promoters, including phenobarbital, DDT, and certain constituents of cigarette smoke. Studies of dioxin in the early 1980s, including a mouse skin-painting test, suggested that it, too, acted like a promoter. In these model systems, dioxin did not initiate tumors when applied before a classic promoter. But when a classic initiator was applied first, subsequent applications of dioxin sped along the proliferation of cells to produce tumors.[72]

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[71] H.C. Pitot, T. Goldsworty, and S. Moran, "The Natural History of Carcinogenesis: Implications of Experimental Carcinogenesis in the Genesis of Human Cancer," *Journal of Supramolecular Structure and Cellular Biology* 17 (1981): 133-146.
[72] Pitot, Goldsworty, and. Moran., "The Natural History of Carcinogenesis: Implications of Experimental Carcinogenesis in the Genesis of Human Cancer," 133-146; Warren E. Leary, "Differing Roles of Cancer Agents are Studied," *New York Times*, January 5, 1988, p. C3; Shu, Paustenbach, and Murray, "A Critical

These results presented a scientific puzzle. Based on the negative results for mutagenicity, dioxin was considered non-genotoxic. Moreover, in initiator-promoter experimental systems, dioxin seemed to act like a promoter. According to prevailing concepts of carcinogenesis, therefore, dioxin should not act as a "complete" carcinogen, one needing no other stimulus to induce cancer. But in a series of convincing studies dating from 1977, including the landmark Kociba study, dioxin alone was found to cause cancer in a variety of different animal species and different organs. A subsequent review of this mounting literature called dioxin a "potent and complete carcinogen." What explained the discrepancy? One theory held that the prevailing concept of "genotoxicity," linked as it was to screens for mutagenicity, was too limited. Perhaps "genotoxicity" should embrace both agents that directly damaged gene structure (DNA damage) and agents like dioxin thought to interfere with gene expression (the turning on or off of particular genes). Interference with gene expression might indirectly cause the genetic mutations that initiated carcinogenesis. Another theory, oft cited by industry representatives, held that the discrepancy was illusory: dioxin merely appeared to act as a complete carcinogen in animal feeding studies but it actually promoted cells that were already primed, either by initiators in the test animals' diet or environment, or perhaps by the tendency of rodent livers to develop spontaneous tumors.[73]

In building the dioxin-as-promoter theory, industry scientists and consultants marshaled evidence from experimental systems that backed the theory (mutagenicity screens, initiator-promoter tests, etc.), while downplaying or attempting to explain away the substantial body of evidence from animal bioassays indicating that that dioxin was a "complete carcinogen." In 1987, for instance, a group of scientists working for the Syntex Corporation, surveyed the scientific literature on dioxin and questioned the EPA's

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Evaluation of the Use of Mutagenesis, Carcinogenesis, and Tumor Promotion Data in a Cancer Risk Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin," 57-88.

[73] James Huff, "2,3,7,8-TCDD: A Potent & Complete Carcinogen in Experimental Animals," *Chemosphere* 25 (1992): 173-176; Testimony of Sanford A. Miller, Director, Bureau of Foods, FDA, in U.S. Congress, House of Representatives, Committee on Science and Technology, Subcommittee on Natural Resources, Agriculture Research and Environment, *Dioxin—The Impact on Human Health*, 98th Cong., 1st sess., June 30, July 13, 28, 1983; Ellen K. Silbergeld and Peter L. deFur, "Risk Assessments of Dioxinlike Compounds," in *Dioxins and Health*, 1st ed., ed. Arnold Schecter (New York: Plenum Press, 1994), 51-78; Shu, Paustenbach, and Murray, "A Critical Evaluation of the Use of Mutagenesis, Carcinogenesis, and Tumor Promotion Data in a Cancer Risk Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin," 57-88.

risk assessment. A pharmaceutical company based in Palo Alto, California, Syntex faced the prospect of millions of dollars in liability for dioxin contamination at Times Beach and other sites in Missouri. Pointing to mutagenicity and initiator-promoter tests, as well as emerging understandings of dioxin's receptor-based mode of action in the cell, the Syntex-sponsored group concluded that dioxin was a "tumor promoter only, and not an initiator." Armed with this conclusion, the authors went on to argue that the EPA's linear no-threshold approach was inappropriate for dioxin. As a promoter, they argued, dioxin would have a biological threshold, a fact which should be reflected in the extrapolation model. U.S. regulatory agencies, they concluded, should either follow the lead of regulators in Canada and Europe in simply using a conventional no-effect-level/safety-factory approach, or they should adopt a biologically-based, non-linear mathematical model that would reflect a biological threshold for dioxin.[74]

As the EPA reassessed dioxin's risks between 1986 and 1988, industry groups promoted the dioxin-as-promoter theory to the agency. Like Syntex, the American Paper Institute had used the theory to urge the EPA to deviate from its default extrapolation model. This issue had been part of the discussion, for instance, in a 1986 meeting between API officials and EPA Administrator Lee Thomas. As industry groups cultivated support for the promoter theory, the EPA circulated a controversial draft reassessment in 1987-88. The document's stated intention was to downgrade the estimate of dioxin risks, declaring conclusively that the default linear no-threshold approach was "likely to have led to an overestimate of risk." Instead of employing an

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[74] The Syntex study is Shu, Paustenbach, and. Murray, "A Critical Evaluation of the Use of Mutagenesis, Carcinogenesis, and Tumor Promotion Data in a Cancer Risk Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin," 57-88. In 1969, Syntex acquired Hoffman-Taff, a company that had produced a constituent of Agent Orange at a plant in Verona, Missouri in 1968 and 1969. A subsequent Syntex subsidiary, NEPACCO continued to produce dioxin-tainted chemicals through the early 1970s. NEPACCO later contracted with a company called Independent Chemical Corporation to dispose of these dioxin tainted wastes, which then contracted the job to Russell Bliss. Bliss disposed of the wastes by mixing them with waste oil and spraying them in more than two dozen sites across eastern Missouri, including Times Beach. In 1990, Syntex and the EPA reached a consent decree requiring Syntex to pay $10 million in cleanup costs. See United States v. Bliss, 133 F.R.D. 559, 561-562 (E.D. Mo. 1990). The meetings between EPA Administrator Lee Thomas and API officials are detailed in Jensen to Thomas, "September 22 Meeting with the American Paper Institute," September 1986, reproduced in Subcommittee on Water Resources, *Hearing: Dioxin Pollution in the Pigeon River, North Carolina and Tennessee*, 251-252; Cummings to Jensen, "Background Information on July 31, 1987 Administrator's Meeting with American Paper Institute—Dioxin Related Issues," July 28, 1987, reproduced in *Ibid.*, 243-246; Anonymous, "Amendola's Notes on Meeting of API and Lee Thomas," September 22, 1986, reproduced in *Ibid.*, 259.

alternative extrapolation model, however, the EPA proposed to simply split the difference between the risk estimates obtained through the two existing incommensurable approaches: the agency's 1985 cancer risk estimate (derived using a linearized multistage model) and the risk estimates of European countries (derived using the conventional no-effect-level/safety-factor approach). Backed by no new risk calculations, the document simply took the mid-point between the two to propose a new acceptable average daily intake of 0.1 picograms of dioxin per kilogram of body weight per day—a level seventeen times higher than before.[75]

This controversial "averaging" proposal immediately put the agency on the defensive for taking a non-scientific approach. Defending the proposal, one EPA scientist told the press that it was "not a mathematical calculation, but the collective judgment of a group of people."[76] Indeed, the proposal had the look of a committee compromise—giving some relief to industry but also acknowledging that no scientific justification existed for choosing an alternative extrapolation model over the default linear no-threshold approach. The potential regulatory relief from the proposal, while not as great as industry had hoped for, would nonetheless have been significant. In lockstep, the Centers for Disease Control proposed revising its action level for dioxin in residential soils up from 1 ppb to 20 ppb.[77] After fierce criticism, however, the EPA abandoned the controversial "averaging" proposal and reverted to its previous risk estimates and acceptable level. In the scientific and trade press, the agency had been roundly criticized, even by scientists who believed the agency had indeed previously overstated dioxin's risks. In an otherwise positive review of the EPA's dioxin assessment, a panel of the EPA's Science Advisory Board (SAB) rejected the proposed revision, saying it was not backed by science. At the same time, the SAB suggested that the EPA might later change its cancer risk estimate if new science justified deviating from the default high- to low-

[75] U.S. Environmental Protection Agency, *A Cancer Risk-Specific Dose Estimate for 2,3,7,8-TCDD*, *Review Draft*, June 1988, pp. 50-51. Se discussion in Adam Finkel, "Dioxin: Are We Safer Now Than Before?" *Risk Analysis* 8 (1988): 161-165.

[76] Nicholas Wade, "Assessing the Risky Job of Risk Assessment," *New York Times*, January 24, 1988, p. E26.

[77] Timothy Aeppel, "Dioxin Debate Revolves Around What is a 'Safe' Level," *Christian Science Monitor*, December 18, 1987; Nicholas Wade, "Assessing the Risky Job of Risk Assessment," *New York Times*, January 24, 1988, p. E26; Laurie Hays, "Proposals from Federal Agencies to Ease Dioxin Standards Renew Debate on Risk," *Wall Street Journal,* January 27, 1988, p. 1.

dose extrapolation model. And it urged the EPA to work on alternative biologically-based extrapolation models which could incorporate new research on dioxin's biochemical mode-of-action, particularly studies showing that dioxin's effects were mediated through binding to a specific receptor in the cell.[78]

Reopening the Dioxin Risk Assessment

By the late 1980s, dioxin-linked industries began new efforts to challenge the EPA's stringent assessment of dioxin's risks. Even if the EPA could not ultimately be persuaded to revise its cancer risk estimate, affected industries found benefits in keeping dioxin science unsettled since doubts about dioxin's risks could then be raised during litigation or regulatory battles at the state level. Soon after the EPA's "averaging" approach was rebuffed by its Science Advisory Board, the paper and chlorine industries launched a campaign to reopen the dioxin risk assessment. The API and the Chlorine Institute, which represented chlorine manufacturers, targeted key pieces of underlying science to push for a new risk assessment. First, they took aim at the crucial 1978 study by Dow pathologist Richard Kociba, whose data on tumors in female rats had become the foundation for nearly all subsequent quantitative risk assessments. Next, they seized upon new findings of dioxin's receptor-based mode of action to launch a renewed challenge to the EPA's risk model. Soon industry experts and spokespersons were arguing that dioxin was merely a "weak carcinogen" whose risks had been wildly exaggerated by EPA. Using a scientific conference at the Banbury Center of Cold Spring Harbor Laboratory that was co-sponsored by the Chlorine Institute as a springboard, by 1991 these efforts would help convince EPA Administrator William Reilly to reopen the assessment and stir a wave of media coverage suggesting that dioxin was far less hazardous than previously thought.[79]

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[78] Environmental Protection Agency, *A Cancer Risk-Specific Dose Estimate for 2,3,7,8-TCDD*, 50-51; Finkel, "Dioxin," 161-165; Aeppel, "Dioxin Debate Revolves Around What is a 'Safe' Level," *Christian Science Monitor*, December 18, 1987; Wade, "Assessing the Risky Job of Risk Assessment," *New York Times*, January 24, 1988, p. E26; Hays, "Proposals from Federal Agencies to Ease Dioxin Standards Renew Debate on Risk," *Wall Street Journal,* January 27, 1988, p. 1.
[79] Hays, "Proposals from Federal Agencies to Ease Dioxin Standards Renew Debate on Risk," *Wall Street Journal*, January 27, 1988, p. 1.

The first salvo came in 1989 as the state of Maine considered a water quality standard for dioxin. Industry groups convinced the Maine Science Advisory Panel that a reevaluation of Kociba's 1978 slides would find fewer tumors than before because new criteria for classifying tumors had recently been adopted by the National Toxicology Program. The API hired the medical consulting firm PATHCO to organize a group of pathologists to conduct a recount. Known as the Pathology Working Group, it included six veterinary pathologists drawn from industry, government, and academia. In March 1990, they convened at PATHCO's headquarters in Maryland to take a new look at Kociba's slides, on loan from Dow. As they counted benign and malignant tumors, the panelists decided discrepancies in the diagnoses of lesions by majority vote.[80] Using the new classification guidelines, the API-sponsored group found some one-half to two-thirds fewer benign and malignant tumors than earlier analyses of Kociba's slides. In addition, the group argued in a journal article that tumors only occurred in animals at doses that also induced liver toxicity. Invoking a theory that had been advanced by toxicologists at Dow in the 1970s, they argued that if tumors formed only in the presence of acute toxicity, then the carcinogenic effect must only be a "secondary" response. Thus, dioxin produced only "a weak oncogenic effect" in rat livers.[81] One member of the group went on to spell out the implications for risk assessment at the Banbury conference in 1990. The finding that tumors only occurred in the presence of acute toxicity, said the pathologist, "contradicts the assumption required in the linearized model that some risk must exist at every dose." The upshot, he said, was that the EPA had made an "overestimate of risk."[82]

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[80] Dawn G. Goodman and Robert M. Sauer, "Hepatotoxicy and Carcinogenicity in Female Sprague-Dawley Rats Treated with 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD): A Pathology Working Group Reevaluation," *Regulatory Toxicology and Pharmacology* 15 (1992): 245-252; Jeff Bailey, "Dueling Studies: How Two Industries Created a Fresh Spin on the Dioxin Debate," *Wall Street Journal*, February 20, 1992, p. A1; Michigan Department of Environmental Quality, July 1990 Toxic Steering Group Meeting, "Carcinogencity Slope Factor for 2,3,7,8-TCDD: Overview and Recent Developments," July 12, 1990, <www.trwnews.net/Documents/MDEQ/deq_slope_factor.pdf> (March 12, 2005).

[81] Goodman and Sauer, "Hepatotoxicy and Carcinogenicity in Female Sprague-Dawley Rats Treated with 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)," 245-252.

[82] W. Ray Brown, "Implications of the Reexamination of the Liver Sections from the TCDD Chronic Rat Study," in *Banbury Report 35: Biological Basis for Risk Assessment of Dioxins and Related Compounds*, ed. Michael Gallo, Robert Scheuplein, and Kees Van Der Heijden (Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press, 1991), 13-18.

With these results in hand, in June 1990 the API wrote to the President's Science Advisor and the heads of the EPA and FDA, asking that federal agencies reassess dioxin's risks. "All of the agencies' analyses," wrote API, "are now out of date in light of the significant new evidence showing that the risk from dioxin has been overstated." While EPA and FDA officials did not dispute the recount itself, they concluded that it would have little effect on cancer risk estimates. Contrary to the claims of the consultant-pathologists and the paper industry, the numbers still indicated that dioxin had extraordinary cancer potency at low-doses. Two senior government scientists, representing the EPA and FDA, wrote in response: "This is still the only one [known carcinogen] that produces measurable responses at these low doses." Indeed, the impact of the recount on the EPA's recommended human exposure level would only be a relatively insignificant 2-3 fold difference, still making dioxin one of the most potent carcinogens known.[83]

The 1990 Banbury Conference

The next round came in October 1990, when the Chlorine Institute and the FDA co-sponsored a conference on dioxin's health risks at the respected Banbury Center of Cold Spring Harbor Laboratory in New York. What few participants realized at the time was that the conference was organized, in part, as a public relations gambit to persuade the EPA to reassess dioxin's risks. At a time when a new understanding was emerging about dioxin's molecular mechanisms, Chlorine Institute officials, according to the group's spokesman, believed that a scientific meeting might be "beneficial to our interests, particularly our interest in the paper industry." From the start, the industry hoped such a conference might reopen the debate on dioxin's risks. "If the conference outcome was favorable," the group's spokesman later told the journal *Science*, "we would take advantage of it and bring it to the attention of key people in the media."[84] In particular, the Chlorine Institute hoped that new knowledge about how dioxin worked at

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[83] Goodman and Sauer, "Hepatotoxicy and Carcinogenicity in Female Sprague-Dawley Rats Treated with 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)," 245-252; Bailey, "Dueling Studies," *Wall Street Journal*, February 20, 1992, p. A1.
[84] Leslie Roberts, "Flap Erupts Over Dioxin Meeting," *Science* 251 (February 22, 1991): 866-867.

the molecular level would support the longstanding claim of industry that a threshold existed for the chemical. An FDA scientist and his co-organizers selected more than thirty experts on dioxin from government, industry, and academia from the United States and Europe. One spot, though, had been reserved for the Chlorine Institute's hand-picked observer, an attorney and epidemiologist who worked as a consultant for the Institute.[85]

Scientists at the meeting agreed that all of the myriad toxic effects of dioxin, from cancer to reproductive effects, appeared to be initiated by one molecular trigger—the binding of dioxin to the so-called Ah (or arylhydrocarbon) receptor in the cell. In the 1970s, researchers had discovered that dioxin bound tightly to this particular receptor.[86] And by the early 1980s evidence was mounting that this binding was a key trigger for dioxin's biological effects.[87] By 1990, new details were emerging on how dioxin's potent toxic effects were mediated through the activation of the Ah receptor. Scientists found that after the binding a dioxin molecule, the dioxin-Ah receptor complex was transported into the cell's nucleus, where it acted as a "transcription factor," which could turn certain genes on or off. When the complex bound to specific DNA sequences, it caused improper expression of certain genes. This was now believed to be the molecular mechanism for dioxin's carcinogenicity and its non-cancer effects.[88]

Several participants of the Banbury conference, including participating industry scientists, concluded that this receptor-mediated mechanism implied a biological threshold for dioxin at low doses. Under standard receptor-occupancy theory, these scientists argued, a certain number of a cell's receptors, perhaps several thousand, had to be occupied before there could be any biological effect. By extension, some participants

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[85] *Ibid.*, 866-867; Leslie Roberts, "Dioxin Risks Revisited," *Science* 251 (February 8, 1991): 624-625.
[86] D.W. Newbert et al., "Aryl Hydrocarbon Hydroxylase by Polycyclic Hydrocarbons: Simple Autosomal Dominant Trait in the Mouse," *Nature New Biology* 236 (1972): 107-110; A. Poland and E. Glover, "Chlorinated Dibenzo-p-dioxins: Potent Inducers of Delta-Aminolevulinic Acid Synthetase and Aryl Hydrocarbon Hydroxylase. II. A Stydy of the Structure-Activity Relationship," *Molecular Pharmacology* 9 (1973): 736-747; A. Poland et al., "Stereo-specific, High Affinity Binding of 2,3,7,8-tetrachlorodibenzo-p-dioxin by Hepatic Cytosol: Evidnece that the Binding Species is a Receptor for Induction of Aryl Hydrocarbon Hydroxylase," *Journal of Biological Chemistry* 251 (1976): 4936-4946.
[87] A. Poland and J.C. Knutson, "2,3,7,8-Tetrachlorodibenzo-p-dioxin and Related Halogenated Aromatic Hydrocarbons: Examination of the Mechanism of Toxicity," *Annual Review of Pharmacology and Toxicology* 22 (1982): 517; H.J. Eisen et al., "The Ah Receptor: Controlling Factor in the Induction of Drug-Metabolizing Enzymes by Certain Chemical Carcinogens and Other Environmental Pollutants," *Biochemical Actions Hormones* 10 (1983): 227.
[88] See Gallo, Scheuplein, and Van Der Heijden, *Banbury Report 35*.

argued, until dioxin was present at a sufficient dose, the Ah receptor would not be activated, and there would be no toxic or carcinogenic effect. If dioxin had a threshold, said these scientists, then the linear extrapolation model used by the EPA was flawed. An alternative extrapolation model suggested at the conference would instead produce a dose-response curve that was sigmoidal. At very low doses, as industry scientists put it, the curve would look like a "hockey stick," with the curve flat like the blade of the stick. Once a dose level sufficient to activate the Ah receptor was reached, the response would increase rapidly until it reached a linear shape on the graph. If such a model were applied in the risk assessment, estimates of dioxin's cancer potency would be significantly lower—and thus far higher exposure levels could be considered acceptable by regulators.[89]

Others at the conference, however, disputed this threshold hypothesis. They warned that a receptor-mediated mechanism did not necessarily imply that dioxin had a threshold, particularly since other receptor-mediated biological responses were known to be linear. Ellen Silbergeld of the Environmental Defense Fund and George Lucier of the National Institute of Environmental Health Sciences (NIEHS) both argued that additional research was needed to understand what this particular molecular mechanism implied for the dose-response relationship. Silbergeld told the journal *Science* that scientists might be rushing to replace "one stupid model with another." As the conference came to a close, there thus remained substantial disagreement over the implications of the Ah receptor for risk assessment. And the conference organizers sought no formal consensus on this or any other issues discussed at the conference.[90]

Some representatives from federal agencies who attended the conference, however, left convinced of the threshold theory and believed it would substantially change the risk assessment. One was Vernon Houk, an assistant Surgeon General and a top official at the Centers for Disease Control in Atlanta. In 1982, Houk had played a key role in the government's decision to order an evacuation of the town of Times Beach, Missouri because of dioxin contamination. At the Banbury conference, Houk had

[89] Richard Kociba, "Rodent Bioassays for Assessing Chronic Toxicity and Carcinogenic Potential of TCDD," in *Banbury Report 35*, ed. Gallo, Scheuplein, and Van Der Heijden, 3-11.
[90] Leslie Roberts, "Dioxin Risks Revisited," 624-625.

expressed his new belief that dioxin's risks had been overestimated. In May 1991, Houk made headlines after he told a conference in Missouri that he had made a mistake in recommending the evacuation of Times Beach. Houk said he now believed that if dioxin were a carcinogen at all "it is, in my view, a weak one that is associated only with high-dose exposures."[91] Houk told the *New York Times* that his reversal owed to new knowledge about "the mechanisms of how these chemicals act in biological systems." "Beginning in about 1986," said Houk, "the information was beginning to accumulate that dioxin's effect on human health was probably not as bad as we had feared in the early 1980s."[92] Houk's comments were soon picked up by conservative commentators, pleased by the apparent deflation of another chemical hazard allegedly over-hyped by alarmist environmentalists and regulators. In an Op-Ed published in the *Wall Street Journal*, for instance, Reed Irvine, chairman of Accuracy in Media praised Houk for breaking ranks and "debunking the claim that dioxin is a potent human carcinogen."[93]

EPA officials who attended the Banbury conference were more cautious than Houk. Still, some left in favor of a new risk assessment. As one EPA scientist told the journal *Science*, "It's a new way to do risk assessment. We can set a limit below which there cannot be an effect, on a mechanistic basis. Instead of saying we know nothing and have to extrapolate back to zero, we are saying we know a hell of a lot and can make predictions."[94] The EPA scientists believed that the new science on the Ah receptor mechanism might now justify a deviation from the default linear extrapolation model to some biologically-based alternative that reflected dioxin's receptor-mediated mechanism. In March 1991, the EPA attendees briefed EPA Administrator William Reilly on the Banbury meeting. According to the journal *Science*, this meeting helped convince Reilly to reopen the EPA's risk assessment for dioxin in order to develop a new extrapolation model incorporating the latest science.[95] Reilly later commented that, although he did not want to "prejudge the issue," there was "new information that suggests a lower risk

[91] "U.S. Health Aide Says He Erred on Times Beach," *New York Times*, May 26, 1991, p. 20.
[92] Ketih Schneider, "Times Beach Warning: Regrets a Decade Later," *New York Times*, August 15, 1991, p. D23.
[93] Reed Irvine, "The Dioxin Un-Scare—Where's the Press?" *Wall Street Journal*, August 6, 1991, p. A16.
[94] Roberts, "Dioxin Risks Revisited," 624-625.
[95] Leslie Roberts, "EPA Moves to Reassess the Risk of Dioxin," *Science* 252 (May 17, 1991): 911.

assessment for dioxin should be applied."[96] The reassessment was immediately trumpeted by industry groups as evidence that dioxin's risks had been exaggerated. Red Cavaney, President of the American Paper Institute, said that dioxin standards were "too stringent, in light of all the evolving science that has come out."[97] And in September 1991, a report by the National Chamber Foundation, an affiliate of the U.S. Chamber of Commerce, declared that not only had dioxin's risks been "greatly exaggerated" but that dioxin "poses no threat to humans, at either normal exposure levels or elevated exposure levels caused by occupational practices or industrial accidents."[98]

The push for a new risk assessment was aided by a PR campaign sponsored by the Chlorine Institute. With the help of Edelman Medical Communications, a PR firm, the Institute disseminated the story that a "consensus" had been reached by participants at the conference that dioxin was much less toxic to humans than originally believed. Using drafts of the conference proceedings provided by the Chlorine Institute's conference observer, Edelman composed a cover letter, under the observer's name, for media kits widely distributed in the months after the conference.[99] The cover letter called the Banbury meeting a "consensus conference" and said it had "reinforced the notion that dioxin is much less toxic to humans than originally believed."[100] Throughout 1991 the national media echoed the storyline that new science had shown dioxin to be far less hazardous than previously thought. A front page story in the *New York Times* on August 15 by environment beat reporter Keith Schneider headlined "U.S. Backing Away from Saying Dioxin is a Deadly Peril" suggested that there was an emerging scientific consensus that dioxin's risks had been overestimated.[101] Citing statements by Vernon Houk and Reilly's announcement of a review, the story said that "several top Federal health authorities are backing away from the position that the chemical compound dioxin

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[96] Keith Schneider, "U.S. Backing Away from Saying Dioxin is a Deadly Peril," *New York Times*, August 15, 1991, p. A1.
[97] "U.S. to Review Dioxin Risk Given New Studies," *New York Times*, April 16, 1991, p. C5;
[98] As quoted in David Lapp, "Defenders of Dioxin: The Corporate Campaign to Rehabilitate Dioxin," *Multinational Monitor* 12 (October 1991) <http://www.multinationalmonitor.org/hyper/issues/1991/10/mm1091_01.html> (March 12, 2005).
[99] Edelman, according to a report in *Science*, put the consultant's name on the background paper without his permission. See Roberts, "Flap Erupts Over Dioxin Meeting," 866-867.
[100] *Ibid.*
[101] Schneider, "U.S. Backing Away from Saying Dioxin is a Deadly Peril," *New York Times*, August 15, 1991, p. A1.

is toxic enemy No.1." "Exposure to the chemical," it continued, "once thought to be much more hazardous than chain smoking, is now considered by some experts to be no more risky than spending a week sunbathing."[102] The following day, a *Times* editorial titled "Downgrading Dioxin" said that "federal officials now believed they may have overreacted in setting extremely low exposure limits for dioxin and in permanently evacuating all the residents of Times Beach." The editorial praised the EPA for "sensibly considering new evidence that could lead to relaxation of the current strict and costly regulatory standards." New evidence had now convinced "many health experts" that dioxin was only "a moderate threat" to humans, a threat that was "far less risky…than asbestos, radon, nickel, coke, chromium or smoking." The new understanding of dioxin's mechanism (i.e. the Ah receptor), said the *Times*, suggested that dioxin's potency would be limited "at most doses."[103]

Later that year, a similar spin on the dioxin story was heard on National Public Radio's *Morning Edition*. Host Bob Edwards introduced a story on a dioxin conference in North Carolina by saying that "recent studies suggest the dangers of dioxin may be overrated." In the piece, NPR science reporter Richard Harris interviewed Linda Birnbaum of the EPA and Michael Gough of the Office of Technology Assessment. Birnbaum, both of whom left the Banbury conference in favor of a new look at the dioxin assessment. Gough, who had long held that dioxin risks were overstated, said that the general public's risk of cancer from dioxin "may be zero." On the other side, the story introduced a dissenting opinion from the Environmental Defense Fund's Ellen Silbergeld. She warned that presumptions of a lower risk estimate for dioxin were premature. But the story's lead and tone implied that a new scientific consensus was emerging that dioxin was not as hazardous as previously believed. "Insiders say what's likely to come out of this debate," it concluded, "is a dioxin standard that's much more lenient than today's regulation yet still tougher than the standards used in Europe and Japan."[104]

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102 *Ibid.*
103 "Downgrading Dioxin," *New York Times*, August 16, 1991, p. A22.
104 "Dioxin May Not Be as Toxic Study Says," *Morning Edition,* September 23, 1991; Charlotte Ryan, "An NPR Report on Dioxin: How "Neutral" Experts Can Slant a Story," *EXTRA!* (April/May 1993).

Putting Scientific Doubt to Work: The Paper Industry

In the late 1980s and early 1990s, the paper industry leveraged the doubt it had manufactured about dioxin's risks to buy time and leniency in the regulatory arena and to fend off a wave of toxic tort litigation. First, the industry highlighted divergences of scientific opinion as it lobbied states to relax regulations affecting discharges from pulp and paper mills. In the mid-1980s, the EPA—based on its risk assessment— had recommended that states adopt relatively stringent water quality standards for dioxin. But states could deviate from this guidance at the agency's discretion. Urged by locally powerful paper manufacturers, by the early 1990s eleven states, including New York, New Hampshire, and nine southern states, had adopted weaker dioxin standards. Several southern states justified relaxed standards by employing the FDA's weaker no-effect-level/safety factor approach recommended by the industry. With its risk assessment for dioxin mired in controversy, meanwhile, the EPA approved state water quality standards up to 90 times weaker than its own recommendation.[105]

A more important immediate concern for the pulp and paper industry, according to a study of the industry's struggles over dioxin by legal scholar William Boyd, was the "potential of substantial asbestos-like liability."[106] In the early 1990s, paper companies faced lawsuits in Mississippi, Tennessee, Alabama, Texas and elsewhere. Plaintiffs sought hundreds of millions of dollars in damages, alleging that dioxin from upstream pulp and paper mills had diminished property values and threatened residents with cancer by contaminating locally-caught fish. A key strategy for corporate attorneys was to highlight scientific uncertainty about dioxin's risks. In part, this was accomplished by using high-profile expert witnesses who were sympathetic to the industry's position on dioxin's hazards. For example, in a case involving Georgia-Pacific in Mississippi, former EPA Administrator Lee Thomas testified that dioxin had not been proven to be a human carcinogen. Another witness called by the company was CDC scientist Renate

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[105] See Boyd, "Controlling Toxic Harms," 369-371. The EPA recommended a water quality standard of 0.013 parts per quadrillion (ppq) of dioxin in waters used for fishing and drinking water. Following Maryland and Virginia's lead, Georgia, Alabama, South Carolina, Mississippi, Texas, Arkansas and Tennessee adopted a revised standard of 1.2 ppq.

[106] Boyd, "Controlling Toxic Harms," 383.

Kimbrough—co-author of the 1983 risk assessment justifying a 1 ppb concern level in residential soils—who testified that there was no scientific evidence that the low levels of dioxin in two contaminated rivers in Mississippi could cause an increased rate of cancer. As William Boyd has observed, "By emphasizing such uncertainty, the industry hoped to cast doubt on some of the arguments being made by the opposition, particularly in the area of causation. Scientific uncertainty, in short, could be exploited as effectively in the courtroom as in the regulatory arena."[107] Partly because of the industry's success in clouding the scientific waters, according to Boyd, by the mid-1990s "the great toxic tort bonanza" predicted by plaintiffs' attorneys "turned out to be somewhat of a bust."[108]

The paper industry still faced the prospect of strict federal regulation as the EPA developed its "cluster" rule for regulating air emissions and water effluents containing dioxins and other toxics from pulp mills. Environmental groups, including the National Resources Defense Council and Greenpeace, had called upon the EPA to move toward completely eliminating dioxin discharges from pulp and paper mills by requiring total chlorine-free bleaching. Since many mills in Europe and at least one in the United States had already switched to chlorine-free processes, they argued, the EPA could reasonably require this as the "best available technology" under the Clean Water Act. The industry, joined by labor unions, warned of job losses and enormous costs if more stringent regulations were required.[109] The final rule, issued by the EPA in 1997, took the approach favored by paper companies, requiring only a shift from chlorine to chlorine dioxide bleaches—a move that would not eliminate dioxin in pulp and paper mill effluent but would reduce it by some ninety-six percent. By this time, the industry was already well on its way to compliance with the modest regulatory requirements, having cut dioxin discharges from some 356 grams per year in 1987 to just 19.5 in 1995. This corporate

[107] Boyd, "Controlling Toxic Harms," 384-385; *Leaf River Forest Prods., Inc. v Ferguson,* 662 So.2d 648 (Miss. 1995).
[108] Boyd, "Controlling Toxic Harms," 382-383.
[109] The so-called "cluster" rule for pulp and paper mills included regulation of hazardous air pollutants at 63 Fed. Reg. 18504 (April 15, 1988) and water effluent standards at 63 Fed. Reg. 42238 (August 7, 1998). See also, "EPA Orders $1.8 Billion Plan to Clean Up Mill's Dangers," *Washington Post*, November 15, 1997, p. A13. On the environmentalist campaign to eliminate dioxin-producing chlorine in pulp and paper production and other industries, see Michelle Allsopp et al., *Achieving Zero Dioxin: An Emergency Strategy for Dioxin*, September 1994 <http://archive.greenpeace.org/toxics/reports/azd/azd.html> (June 20, 2006).

voluntarism not only demonstrated progress on the problem as the industry fought off a wave of toxic tort suits, it also helped demonstrate a commitment to the "cooperative" approach that the industry had cultivated with EPA since the mid-1980s. In the end, according to Boyd, "By working with EPA rather than fighting the agency at every turn, the industry gained a certain access to regulators that it had never enjoyed in the past. Such access allowed the industry to constantly challenge dioxin science and the costs and benefits associated with various regulatory options, thereby shaping the outcome."[110]

Greenpeace's "Chlorine Free Campaign"

Major segments of the chemical industry, meanwhile, faced a far broader challenge arising out of the dioxin controversy. Just as the Chlorine Institute scored a major victory in obtaining a new dioxin risk assessment in 1991, Greenpeace launched a new campaign calling for a phase-out of chlorine from a wide array of chemical products and processes. Joined to varying degrees by a growing coalition of environmental groups by the mid-1990s, the "chlorine free" campaign targeted not only the chlorine-based bleaches used in pulp mills but an array of other products of chlorine chemistry, ranging from polyvinyl chloride (PVC) plastics and chlorine-based paint, to chlorinated pesticides and solvents. The basic rationale of the campaign had been suggested in Greenpeace's earlier call for a phaseout of chlorine in paper production: most of the world's highly-toxic, persistent, and bioaccumulative "problem chemicals" were organochlorines, and whether these were produced intentionally (such as organochlorine pesticides) or as industrial byproducts (such as dioxin) there were safer and economically viable chlorine-free alternatives. Greenpeace's chlorine-free campaign reflected what the historian Robert Gottlieb has called the "hybrid" nature of the organization. The group, writes Gottlieb, was "part mainstream" with its "growing emphasis on research and publication of expert reports," "part campaign-oriented," and "part direct action (with a continuing reliance on stunts, guerilla theater, and imaginative forms of civil disobedience)."[111]

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[110] Boyd, "Controlling Toxic Harms," 397.
[111] Gottlieb, *Forcing the Spring*, 194.

Beginning with its 1991 report *The Product is the Poison: The Case for a Chlorine Phase-Out*, Greenpeace published a steady stream of reports alleging broad health and ecological impacts caused by dioxin and other organochlorines in the environment such as *Breast Cancer and the Environment: The Chlorine Connection* (1993) and *Achieving Zero Dioxin* (1994). The group's publicity campaign included a boat tour of Great Lakes cities, in the run up to a 1991 meeting of the International Joint Commission on the Great Lakes in Traverse City, Michigan, and the distribution of leaflets headlined "What Do Famine, Sterility and Disease Have in Common? Chlorine."[112] Although the "chlorine free" campaign now targeted a much broader class of organochlorine chemicals, Greenpeace mobilized some of its most important publicity-oriented direct action and symbolic events around the dioxin issue. In 1992, for instance, the group organized a mass letter-writing campaign resulting in some 22,000 letters sent to *Time* magazine urging it to switch to chlorine-free paper. *Time* agreed to switch "as soon as it is practical." But after two years passed without a conversion, Greenpeace activists landed the Rainbow Warrior ship at New York's South Street Seaport. During morning rush hour, three activists then climbed the Time-Life Building to unfurl a banner reading "Chlorine Kills—Take the Poison out of Paper."[113] Greenpeace's confrontational tactics also targeted the Dow Chemical Company, which the group tagged as the world's largest source of dioxin because of its heavy production of chlorinated chemicals. In September 1995, the group promoted a new report entitled *Dow Makes You Poison Great Things* at a public meeting held at the Dow Memorial Public Library in Midland, Michigan. The library, as the journal *Chemical Week* observed, was located "midway between Dow's corporate headquarters and Dow High School, just down the street from Dow Gardens and the Dow Michigan Division."[114] As it publicized reports and organized direct action efforts, Greenpeace also began forging an informal coalition with other environmental organizations on the chlorine issue. More than any immediate threat

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[112] PBS, Frontline Online, *Fooling with Nature: Timeline Endocrine Disruption and Man-made Chemicals* < http://www.pbs.org/wgbh/pages/frontline/shows/nature/etc/cron.html> (August 11, 2006); John Holusha, "Greens Pick an Enemy: Chlorine, the Everywhere Element," *New York Times*, December 20, 1992, section 4, p.2.
[113] David Rotman and Allison Lucas, "Antichlorine Tactics Reach New Heights," *Chemical Week*, July 20, 1994; Will Nixon, "Greenpeace Against Time," *E Magazine* 5 (November/December 1994).
[114] Robert Westervelt, "Greenpeace in Dow-land," *Chemical Week*, October 11, 1995, p. 72.

of regulation, this expanding "anti-chlorine campaign," as industry groups termed it, framed the responses of chemical manufacturers and other dioxin-linked industries to the EPA's ongoing assessments of dioxin's health risks over the next decade.

In 1993, the threat posed by the chlorine-free campaign led the Chemical Manufacturers' Association, the chemical industry's principal trade association, to form the Chlorine Chemistry Council (CCC). With a multimillion-dollar budget, the group handled public relations, lobbying, and scientific initiatives related to chlorine chemistry for the chemical industry throughout the 1990s. The CCC's efforts included rebutting the claims of the chlorine-free campaign, publicizing the safety and economic benefits of chlorinated products, and challenging the EPA's assessment of dioxin's risks. From the start, a principal focus of the CCC was to monitor and respond to the efforts of the chlorine-free campaign. To aid this effort the CCC retained the services of Mongoven, Biscoe & Duchin (MBD), a Washington, D.C.-based public relations firm that specialized in gathering intelligence on activist groups. A 1994 "activist update" prepared by MBD for the CCC detailed the growing coalition of "anti-chlorine activists" that had joined Greenpeace. It described a new collaboration between the Natural Resources Defense Council's Clean Water Network (CWN) and Green Corps, a project launched by Ralph Nader's U.S. Public Interest Research Group (PIRG) to train young activists. The CWN, it said, was a "highly active group" that met monthly, published a monthly newsletter, and claimed to have "several hundred groups associated with it." CWN's effort to bring Green Corps into the campaign, said the report, appeared designed to "broaden the anti-chlorine attack by training enthusiastic young activists to carry the anti-chlorine banner on several fronts." According to MBD, it also reflected "a grand strategy" by Greenpeace to recruit new groups for a division of labor on the chlorine campaign, whereby different groups were encouraged "to concentrate on specific aspects of chlorine chemistry where they can be most effective." Greenpeace would still take "a strong lead" in the campaign, but "groups more acceptable to the mainstream" could "appear to lead specific issues." The goal, according to MBD, was to give "the overall campaign the appearance of a widespread, generally accepted grassroots uprising against chlorine chemistry."[115]

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As the EPA moved toward the release of its dioxin reassessment, dioxin-linked industries hoped for a vindication of their view that the agency had previously overstated the health risks of dioxin. But the 2000-page draft reassessment, first circulated in 1994, not only reaffirmed dioxin's extraordinary cancer potency and its status as a "probable" human carcinogen, it also found that dioxin's noncancer effects were far more serious than previously estimated. Specifically, the EPA concluded that most adults and children were already exposed to dioxin at or near levels that had been found in laboratory animals to interfere with prenatal development and cause immune system damage. The EPA also broadened its assessment to include "dioxin-like" compounds, including dibenzofurans and PCBs, believed to exert dioxin-like toxicity by also binding to the Ah receptor. These compounds were quantitatively ranked in relation to TCDD with a "toxic equivalency factor" or TEF. Moreover, the reassessment concluded that current "background" exposures of the general population to dioxins and dioxin-like chemicals were already at levels believed to pose a significant risk of cancer and non-cancer effects. All in all, the reassessment confirmed, as EPA Assistant Administrator Lynn Goldman put it, that dioxin was one of the "most toxic chemicals regulated by EPA."[116]

When EPA Administrator William Reilly announced a dioxin reassessment in 1991, industry groups had urged that the new understanding of dioxin's receptor-mediated mode of action would imply a biological threshold and a non-linear dose-response curve. This, industry experts argued, would justify a departure by the EPA from its default linear model and lead to a lower cancer potency estimate. But subsequent

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[115] Mongoven, Biscoe & Duchin, "MBD Update and Analysis, CONFIDENTIAL, For: Chlorine Chemistry Council, Activist Update: Chlorine," May 18, 1994, reproduced in *PR Watch* 3 (2nd Quarter 1996) <www.prwatch.org/prwissues/1996Q2/update.html> (June 20, 2006).
[116] "Dioxin Risk: Are We Sure Yet?" Special Report, *Environmental Science & Technology* 29 (January 1995), 24A-35A; U.S. Environmental Protection Agency, *Health Assessment Document for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds*, External Review Draft (Washington D.C.: U.S. Government Printing Office, 1994).

studies in the early 1990s cast doubt on the notion that the receptor mechanism necessarily implied a biological threshold. A 1993 study by researchers at the National Institute for Environmental Health Sciences, for instance, found that one of the major known molecular effects of dioxin's binding to the Ah receptor—switching on the gene coding for a protein known as CYPIA1—appeared to be linear at very low doses. In its 1994 draft reassessment, the EPA concluded that "recent studies in several laboratories have indicated no evidence of a threshold for relatively simple responses to dioxin-like compounds." The agency retained its linear no-threshold approach, and thus its key estimate of dioxin's cancer potency changed little. As a result, the acceptable dose, associated with a one in a million cancer risk, also changed only slightly—from 0.006 picograms of TCDD/kg/day in 1985, to 0.01 picograms of TEQ (TCDD equivalents)/kg/day in the 1994 draft reassessment.[117]

Meanwhile, the EPA's new risk assessment significantly increased the estimate of human exposure to dioxin(s). In earlier assessments, the agency had assumed inhalation to be the primary exposure route. But now it focused on the food chain—tracing dioxin emissions into the atmosphere, through deposition onto plant material or waterbodies, and finally to accumulation in the food chain via fish and livestock. The EPA now estimated that human exposure through consumption of beef, fish, dairy, and other animal products was several orders of magnitude higher than through inhalation. As a consequence, the new assessment estimated that upper-bound risk estimates for cancer in the general population could be as high as one-in-ten-thousand for those with average diets and as high as one-in-one-thousand for those eating large amounts of animal products.[118] This focus on the food-chain as the primary exposure pathway stirred the political involvement of powerful new players. According to a report for the CCC by Mongoven, Biscoe & Duchin (MBD), the National Cattlemen's Association (NCA), the trade association representing beef producers, was organizing a coalition of agribusiness interests to challenge the reassessment's suggestion that consumption of meat and dairy

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[117] C. Portier et al., "Ligand/Receptor Binding for 2,3,7,8-TCDD: Implications for Risk Assessment," *Fundamental and Applied Toxicology* 20 (1993), 48-56; Environmental Protection Agency, *Health Assessment Document for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds*.
[118] Environmental Protection Agency, *Health Assessment Document for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds*.

products could significantly increase an individual's cancer risk. The NCA formed a "Dioxin Working Group," which included a dozen major agribusiness trade associations, including the National Milk Producers Federation, the National Turkey Federation, the American Meat Institute, and the American Farm Bureau Federation. One aim of this Dioxin Working Group, according to MBD, was to use the strong ties of its member organizations to the U.S. Department of Agriculture (USDA) "to put pressure on EPA…to make sure the final report is responsible, particularly the last chapter," on dioxin's health risks. The agribusiness coalition also began coordinating strategy with other affected industries, reaching out to the Chemical Manufacturers Association and incinerator operators to "ascertain what each is doing and what messages they are sending out." By the time the EPA officially circulated its draft reassessment in 1994, the "dioxin source industry groups" were already "concentrating on questioning the toxicology data the report relies on."[119]

The dioxin reassessment provided a new opening for Greenpeace's chlorine-free campaign. Greenpeace and other environmental groups immediately called attention to the EPA's finding that serious non-cancer effects on prenatal development and the immune system could result from the very low levels of dioxin at which Americans were already exposed. As the EPA circulated its reassessment in 1994, the chlorine-free campaign was gaining new mainstream support for its framing of the issue—targeting chlorinated chemicals as a class for strict regulation. The Clinton administration, for instance, proposed creating a task force to study the risks posed by chlorinated chemicals used in four industries and to develop a strategy for "substituting, reducing, or prohibiting chlorine and chlorinated compounds."[120] And in the House, legislation was introduced by Congressmen Bill Richardson and Henry Waxman proposing to amend the Clean Water Act to require pulp and paper mills to achieve zero discharge of organochlorine

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[119] Mongoven, Biscoe & Duchin, "MBD Update and Analysis, CONFIDENTIAL, For: Chlorine Chemistry Council, Activist Update: Chlorine," May 18, 1994, reproduced in *PR Watch* 3 (2nd Quarter 1996) <www.prwatch.org/prwissues/1996Q2/update.html> (June 20, 2006).

[120] Ron Chepesiuk, "The Environmental Agenda '94: Where Do Industry and Environmentalists Stand," *Environmental Health Perspectives* 102 (April 1994): 366-369. This proposal was at times tagged by industry spokespersons and the press as a proposal to "ban chlorine" altogether. See, e.g., Keith Schneider, "Fetal Harm is Cited as Primary Hazard in Dioxin Exposure," *New York Times*, May 11, 1994, p. A1; Elise Hoerath, "Clinton Has Called for Dioxin Task Force," Letter to the Editor, *New York Times*, May 17, 1994, p. A18.

and to convert to total chlorine free bleaching processes.[121] Meanwhile, a growing number of mainstream environmental groups increasingly echoed Greenpeace's warnings about the risks of chlorinated chemicals as a class. A 1994 report by the National Wildlife Federation entitled *Fertility on the Brink*, for instance, described a growing risk of reproductive problems in humans and wildlife due to the hormone disrupting effects of the organochlorines entering the environment.[122]

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The CCC soon explored a range of options to counter this increasingly broad-based chlorine-free movement. In August 1994, the group's PR advisor, MBD, presented it with a sweeping list of recommendations "to counter the activists." These included traditional PR efforts, such as coordinating with other trade groups to build a coalition of those with an economic stake in chlorinated products, and meeting with editorial boards in advance of key upcoming conferences. MBD also advised the CCC to cultivate support within the medical community for its position by emphasizing the importance of chlorine-based products in pharmaceuticals and medical devices. To do this, MBD said, it should create panel of physicians whose findings, emphasizing the medical benefits of chlorine, would then be distributed to medical associations and various publications. It should also "stimulate peer-reviewed articles for publication in the [*Journal of the American Medical Association*] on the role of chlorine chemistry in treating disease." Finally, it should set up "carefully crafted meetings" between industry representatives and disease-specific organizations to convey the message that "the cure for their specific disease may well come through chlorine chemistry," and urging the groups "to pass resolutions endorsing chlorine chemistry and communicate their resolutions to medical societies."[123]

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[121] Chepesiuk, "The Environmental Agenda '94," 366-369.
[122] National Wildlife Federation, *Fertility on the Brink: The Legacy of the Chemical Age* (Washington, D.C. : National Wildlife Federation, 1994).
[123] Jack Mongoven to Clyde Greenert/Brad Lienhart, memo, "Re: MBD Activist Report for August," September 7, 1994, reproduced in *PR Watch* 3 (2nd Quarter 1996) <www.prwatch.org/prwissues/1996Q2/update.html> (June 20, 2006).

But MBD's central recommendation was to "mobilize science against the precautionary principle," which it said "dovetails with the long range objectives regarding sound risk assessment." This involved an array of short- and long-term efforts to challenge the EPA's dioxin risk assessment and to push for alternative general risk assessment policies that were more favorable to the industry. MBD urged its client, for instance, to "take advantage of the schisms [within] the Administration, i.e. within EPA and among EPA, USDA and FDA on the risk assessment section of the Dioxin Reassessment." The USDA and FDA had employed less conservative assumptions and models than the EPA in their risk assessments and had therefore made lower estimates of dioxin's risks. MBD thus advised the CCC to "quietly work with the industry coalitions to ensure that USDA and FDA are perceived to have the support of strong constituencies." MBD also advised the CCC to begin cultivating support among scientists for alternative, less conservative risk assessment policies backed by the industry. MBD urged the CCC to: "Engage a broad effort on risk assessment within the scientific community, even in groups which have taken positions against chlorine"; "Accelerate the program to bring about agreed-upon risk assessment policy and the deployment of vehicles of sound science"; and "highlight the need for some established criteria on risk assessment which will be widely accepted by scientists, industry, the people and governments." As the industry developed its own favored risk assessment guidelines, it should have "scientists and Congressmen ready to call for the process on risk assessment CCC and [Chemical Manufacturers Association] would like to see put in place."[124] By late 1994, the CCC announced that it was "shifting to a long range goal of building a science base from which to argue its case." As the chairman of the group's operating committee told the journal *Chemical Week*, "We want to move from firefighting to long-term advocacy of sound science." Among the CCC's scientific efforts—to which one-third of the group's budget was allocated—were research on cancer, endocrine effects, and environmental science, as well as sponsorship of an "independent outside panel to review EPA's Dioxin Reassessment."[125]

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[124] *Ibid.*
[125] Allison Lucas et al., "Health Studies Raise More Questions in Chlorine Debate, *Chemical Week*, December 21-28, 1994, p.26.

The immediate focus of CCC and other industry groups was an upcoming review of the draft reassessment by the EPA's Science Advisory Board (SAB) that began in 1995. In the run up to the SAB review, the American Forest & Paper Association, a paper industry trade group, came forward with its own critical review of the EPA draft. It commissioned the ENVIRON Corporation, an environmental consulting firm, to assemble a group of scientists for an "Expert Panel on Dioxin Risk Characterization." In January 1995, the ENVIRON panel published a summary of its review entitled "EPA Assessment Not Justified" in a leading journal of environmental science. Citing weak epidemiological evidence and uncertainties in the extrapolation from animal tests to humans, the panel disputed the EPA's key findings. "In summary," they wrote, "we do not believe there is sufficient scientific evidence to conclude that adverse human health effects should be expected at or near current background body burdens."[126] When the SAB began hearings, according to *Chemical Week*, the "dioxin reassessment took a drubbing from industry scientists." These included the head of ENVIRON's panel and a CCC scientist, who charged the EPA's report could lead the public to "misinterpret hypothetical risks as real."[127]

Some participants in the SAB review were also highly critical of the EPA's conclusions, questioning the agency's use of conservative assumptions and models. John Doull of the University of Kansas, who had served as an expert witness for the paper company Georgia-Pacific during dioxin litigation in the early 1990s, for excluding the "the possibility of other mechanisms" of action for dioxin's toxic effects, which might have justified a deviation from the linear, no-threshold default approach.[128] SAB consultant John Graham, head of Harvard's Center for Risk Analysis, also questioned the EPA's conservative default assumptions, stating that the risk assessment "overstates the carcinogenic risks that dioxins and related compounds may pose and fails to seriously

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[126] Environmental Dioxin Risk Characterization Expert Panel, "EPA Assessment Not Justified," Special Report, *Environmental Science and Technology* 29 (1995): 31A-32A.
[127] Quoted in Ron Begley, "Environment: EPA Dioxin Study Called Flawed," *Chemical Week*, May 25, 1995.
[128] Quoted in Richard Stone, "Panel Slams EPA's Dioxin Analysis," *Science* 268 (May 26, 1995): 1124.

analyze uncertainties about these chemicals and to show how incremental changes in exposure could affect health."[129]

In the end, the SAB review gave such criticisms significant weight. The SAB ultimately endorsed much of the EPA's draft Dioxin Reassessment, including the agency's expanded focus on noncancer effects, its use of the "toxic equivalency factor" approach, and its position that the "air-to-plant-to-animal" pathway was the primary human exposure route. But the SAB withheld endorsement of two key chapters—dealing with dose-response modeling and estimates of health risks. In doing so, it echoed industry criticism of the EPA's exclusive use of "standard...default assumption of a linear non-threshold model for carcinogenic risk." The SAB committee said the agency should "consider, in future revisions, alternative models, allowing for minimal response at low environmental levels of exposure, and which would be consistent with the body of available physiological (and, with the opportunities now arising, pharmacokinetic) modeling, epidemiological, and bioassay data." Finally, the SAB report charged that the EPA draft had a "tendency to overstate the possibility for danger" and had not fully identified and analyzed the uncertainties associated with its conclusions.[130]

The EPA would now be forced to rework key sections of its dioxin risk assessment. Not until 2000 would the agency submit another draft Dioxin Reassessment for SAB review. Against continued challenges by affected industries, it too would be mired in political controversy. Although the SAB endorsed the new draft in June 2001, the following year Representative James Walsh, the chairman of the House Appropriations subcommittee which oversaw the EPA's budget, requested that the agency delay release of its Dioxin Reassessment pending a review by the National Academy of Sciences. He cited "substantial questions regarding the scientific underpinning of Reassessment's conclusions about the toxicity of dioxin," including "the

[129] Quoted in "Science Advisory Board Questions Major Parts of EPA Dioxin Report," *Air/Water Pollution Report*, May 22, 1995. See also testimony of John Graham in U.S. Congress, House of Representatives, Committee on Commerce, Subcommittees on Commerce, Trade, and Hazardous Materials and on Health and Environment, *Risk Assessment and Cost/Benefit Analysis for New Regulations*. Joint Hearings, 104th Congress, 1st sess., February 1 - 2, 1995.
[130] U.S. Environmental Protection Agency, Science Advisory Board, "Review of the Draft Dioxin Exposure and Health Effects Reassessment Documents," letter to the Administrator, September 29, 1995.

validity of the non-threshold linear dose-response model."[131] As a committee of the National Academy of Sciences began reviewing the EPA's latest draft in 2004, the CCC and its expert consultants continued to push new theories to justify the use of alternative non-linear mathematical extrapolation models and to identify a dioxin threshold, which had now eluded affected industries for some three decades.[132]

Dioxin and the "Sound Science" Debate

By the mid-1990s, the dioxin controversy had spilled over into the broader debate over "sound science" and "regulatory reform." The conservative movement and the business community began using dioxin as a case study of exaggerated environmental fears by pointing to continued doubts about the risks of a chemical once tagged as "the most toxic substance known." The dioxin story was invoked to support two interrelated arguments, one general and the other more specific. The more general storyline held dioxin to be a classic case of misguided public fear of chemicals and other environmental hazards, a fear cultivated by environmentalists and regulators using flimsy scientific underpinnings. This charge was frequently what was implied when the slogan "sound science" was invoked. More specifically, stories about dioxin were told to back explicit policy goals, including specific changes to the risk assessment policies used by the EPA that were backed by the CCC and other groups. One such proposal, considered by Congress as part of unsuccessful "regulatory reform" legislation in 1995-96, would have promulgated statutory guidelines applicable to all risk assessments conducted by federal regulatory agencies, which would have made the results of many risk assessments

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[131] James T. Walsh to Christine Todd Whitman, February 21, 2002 <www.thecre.com/pdf/20020221_epa-congress.pdf> (June 20, 2006).

[132] The NAS Review Draft is U.S. Environmental Protection Agency, *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds National Academy Sciences (NAS) Review Draft* <http://www.epa.gov/ncea/pdfs/dioxin/nas-review> (June 20, 2006). Information on the NAS review can be found at National Academy of Sciences, Project Information <http://www8.nationalacademies.org/cp/projectview.aspx?key=BEST-K-03-08-A> (June 20, 2006). For the Chlorine Chemistry Council's current policy efforts, see Chlorine Chemistry Council, *Chlorine Issues* <http://c3.org/chlorine_issues/index.html> (June 20, 2006).

significantly less protective of public health and more readily open to challenge by industry.[133]

Behind the debates over "sound science" in the 1990s were a growing network of regulated industries and allies in think thanks, industry-sponsored non-profits, and a medley of ad hoc "coalitions" and "institutes." For members of the "sound science" coalition, stories about the exaggerated risks of dioxin were useful as an example of environmental alarmism. The dioxin case was portrayed as an exemplar of the perils of "chemophobia" and a classic case of environmentalists stirring irrational fears in the public. In 1997, for instance, the American Council on Science and Health (ACSH), a group funded by chemical companies and other large corporations, distributed a report to journalists across the country entitled *Facts, not Fears: A Review of the 20 Greatest Unfounded Health Scares of Recent Times*. The report described a growing hall of shame of health "scares" dating back to the "Cranberry Scare" of 1959, including cyclamates (1969), Love Canal (1978), and Alar (1989). Two of the purported "scares" specifically involved dioxin: 2,4,5-T (1979) and Times Beach (1982). The report summarily dismissed health concerns about low-level exposure to dioxin, stating that "an EPA reassessment showed that dioxin exposure at low doses may have no adverse health effects, even in rats."[134]

A similar take on the dioxin story appeared in the writings of conservative journalist and science writer Michael Fumento, whose career in the 1990s included stints at the Competitive Enterprise Institute and the Hudson Institute. In books such as *Science Under Siege* (1988) and *The Myth of Heterosexual Aids* (1990), Fumento positioned himself as a "mythbuster," debunking alleged distortions of science by environmentalists and the liberal media. Writing about alleged unfounded chemical fears in the 1990s, Fumento used dioxin as a central case study. A 1999 article co-authored by Fumento, "The Dioxin Doubts," portrayed dioxin as an example of misguided fear of chemicals. It said that "while dioxin was long touted as 'the most deadly chemical

[133] On the proposed risk assessment reforms proposed by the 104th Congress see Thomas O. McGarity, "A Cost-Benefit State," *Administrative Law Review* 40 (1998): 7-79.
[134] The latest version of the report is Adam J. Lieberman et al., *Facts Versus Fears: A Review of the Greatest Unfounded Health Scares of Recent Times*, 4th ed., September 28, 2004 <http://www.acsh.org/publications/pubID.154/pub_detail.asp> (June 20, 2006), 33.

created by man,' decades of scientific scrutiny have found that its only acute human effect is a form of acne." Like the ACSH report, the article linked dioxin to other purportedly unfounded chemical scares, saying that the "case against dioxin for threatening people is almost as suspect as that against DDT, but this hasn't deterred environmentalists."[135]

The "sound science" debates and the dioxin controversy intersected with the business community's "regulatory reform" legislative agenda in the 1990s. Prominent among the proposed reforms were calls for changes to the risk assessment guidelines of federal regulatory agencies. Just as regulated industries had united behind the slogan of "overregulation" in the 1970s to inject cost considerations into regulatory politics, they now united behind the slogan of "sound science" to lobby for a set of reforms that included statutory changes to federal risk assessment policies. These would have made it more difficult for the EPA and other agencies to tag chemicals as probable or known human carcinogens, required "best estimates" of risks rather than the more protective "worst case" scenarios long used by federal regulators, and made it easier for affected parties to request deviations from conservative default assumptions in risk models. The campaign was mobilized through an assortment of PR firms, trade associations, think tanks, and third-party groups. Some regulatory reformers, including many dioxin-linked interests, faced potential regulatory consequences from unfavorable risk assessments. Others, such as tobacco companies, faced indirect political and economic fallout.[136]

A major impetus for these efforts came from the tobacco industry. In 1992, the EPA had released a risk assessment finding secondhand smoke to be a Group A human carcinogen and a significant health risk, particularly for those who lived or worked with smokers. Although the EPA had no regulatory authority over smoking, the tobacco industry feared that acceptance of the agency's assessment would give momentum to a growing movement to ban smoking in public places and workplaces. Led by Philip Morris, the industry sought to associate secondhand smoke with other purportedly trivial low-dose exposure hazards and to forge a broad coalition of affected industries to help

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[135] Michael Fumento and Michelle Malkin, "The Dioxin Doubts," *Green & Gold* 9 (February 1999).
[136] See Thomas O. McGarity, "A Cost-Benefit State," *Administrative Law Review* 40 (1998): 7-79; Chris Mooney, "Paralysis by Analysis," *Washington Monthly*, May 2004.

challenge the overall risk assessment policies used by EPA.[137] Tobacco companies began rhetorically linking the secondhand smoke issue to other instances of purported "junk science," including Alar, electromagnetic fields, and dioxin.[138] The industry also began supporting efforts to forge a broad coalition of affected industries to challenge the EPA's risk assessment policies. As a 1993 Philip Morris strategy document observed, "The credibility of EPA is defeatable, but not on the basis of ETS [environmental tobacco smoke] alone. It must be part of a larger mosaic that concentrates all of EPA's enemies against it at one time."[139] A top tobacco industry lawyer, for instance, recommended a coalition that involved "foods, plastics, chemicals and packaging"—industries in which dioxin was a major concern.[140] Meanwhile the PR firm Burson-Marsteller recommended that Philip Morris employ efforts to "stimulate non-tobacco industries, anti-regulation groups…in order to portray the EPA as an agency currently under siege."[141]

Several vehicles were used to mobilize industry "sound science" initiatives related to risk assessments. One was The Advancement of Sound Science Coalition (TASSC), created in 1993 by Philip Morris and the PR firm APCO Associates to push the tobacco industry's challenge to the EPA's secondhand smoke report.[142] Among the issues

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[137] Norbert Hirschhorn and Stella A. Bialous, "Second hand Smoke and Risk Assessment: What Was in it for the Tobacco Industry?" *Tobacco Control* 10 (2001): 375-382, p. 376. A 1991 report circulated within Philip Morris accused the EPA of having a "hidden agenda" in its environmental tobacco smoke risk assessment. Calling for "consistency and uniformity in the risk assessment process," the report said, "Aggressive Congressional oversight of the EPA's exercise of its statutory authority to conduct research and gather and disseminate information is clearly called for." Anonymous, "The Risk Assessment Guidelines and Review Procedures of the United States Environmental Protection Agency," draft, February 27, 1991, Bates No.: 2023586414, Philip Morris Documents <http://www.pmdocs.com> (hereafter cited as PMDOCS).

[138] In 1994, for instance, RJ Reynolds proposed a conference that would consider secondhand smoke alongside other examples of issues driven by "flawed science or without scientific support," including "pesticides, asbestos, ozone depletion, acid rain and resource depletion." The proposed conference would include a "discussion of how sensationalism and unjustified media frenzies have effected behavioral or policy changes without scientific support, such as scares over alar, electromagnetic fields, polystyrene and other issues." RJ Reynolds, "Second-hand smoke plan," April 6,1994. Bates No.: 512046746/6749, PMDOCS. See also Philip Morris, hand-written notes, 1994, Bates No.: 2054893642/3656, PMDOCS; Tobacco Institute, "Critical Challenge to EPA Draft Document Outline," press release, July 20, 1992, Bates No.: 2501358077/8078, PMDOCS.

[139] Philip Morris, "ETS Media Strategy," February, 1993. Bates No.: 2023920090/0101, PMDOCS.

[140] C. Lister to D. Reif, "Re: tolerance and junk science," memo, February 2, 1993, Bates No.: 2028359740/9742, PMDOCS.

[141] T. Humber to Ellen Merlo, cc Vic Han, "Subject: ETS," 1993, Bates No.: 2024713141/3156, PMDOCS.

[142] For a detailed account of the activities of The Advancement of Sound Science Coalition, see Elisa K. Ong and Stanton A. Glantz, "Contructing 'Sound Science' and 'Good Epidemiology,': Tobacco, Lawyers, and Public Relations Firms," *American Journal of Public Health* 91 (November 2001): 1749-1757.

highlighted by TASSC members as "examples of unsound, incomplete, or unsubstantiated science" were "Chlorine and Chlorinated Compounds in Pulp and Paper" and "Dioxin."[143] Philip Morris joined the dioxin-linked makers of PVC plastics, among others, in supporting a group called the Coalition for Uniform Risk Evaluation (CURE), whose efforts included "a 1993 proposal of a US Executive Order on regulatory reform that addressed, among other things, risk assessment."[144] Philip Morris also joined other industries in supporting a medley of "sound science" groups linked to organizations created by Jim Tozzi, who had headed up regulatory review at OMB from 1971 through the first Reagan administration and now ran a Washington-based boutique consultancy called Multinational Business Services.[145] A parallel "sound science" campaign to change the EPA's risk assessment policies, meanwhile, had been launched by the CCC.

By the mid-1990s, this growing network of "regulatory reform" coalitions, trade associations, and traditional business lobbies such as the Chamber of Commerce pressed for "sound science" reforms to change the way the EPA and other agencies conducted the risk assessments that informed many regulatory decisions. The campaign came to a head as a Republican majority assumed control of Congress in 1995. As Representative Dana Rohrabacher of California presided over hearings by the House Science subcommittee that used dioxin (along with climate change and ozone depletion) as a case study in bad science at the EPA, the Republican majorities in the House and Senate introduced regulatory reform bills that included the "sound" risk assessment principles backed by industry. Although the specific proposals ultimately died along with the "regulatory

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143 "The Advancement of Sound Science Coalition (TASSC), Member Survey," Bates No.: 2024233662/3663, PMDOCS.

144 Norbert Hirschhorn and Stella A. Bialous, "Second hand Smoke and Risk Assessment: What Was in it for the Tobacco Industry?" *Tobacco Control* 10 (2001): 375-382, p. 379.

145 Sharing an office with Tozzi's consulting shop, Multinational Business Services, was the non-profit Federal Focus, Inc. (both recipients of tobacco industry funding). An offshoot of Federal Focus was the Institute for Regulatory Policy (IRP), headed by Thorne Auchter, a former director of OSHA in the Reagan administration. Burson-Marsteller recommended IRP to Philip Morris as "an existing mechanism that currently is in the best position to assemble and mobilize a wide variety of business groups, corporations, local governments and other parties concerned about or victimized by EPA excesses." See Humber to Merlo, cc Vic Han, "Subject: ETS. Philip Morris," 1993, Bates No.: 2024713141/3156, PMDOCS. By 1993, IRP had already assembled "three different coalitions which support sound science—Coalition for Executive Order, Coalition for Moratorium on Risk Assessments, Coalition of Cities and States on Environmental Mandates." See *Ibid.* For a detailed look at the various coalitions supported by the tobacco industry in the early 1990s, see Hirschhorn and Bialous, "Second hand Smoke and Risk Assessment," 375-382.

reform" bill in the Senate, the muscular campaign that lay behind them continued to work through a variety of legislative, administrative, and legal avenues to create new entry points for industry challenges to agency regulatory science. Business efforts to forestall environmental, health, and safety regulation in the 1990s and beyond increasingly focused on constraining how the EPA and other agencies used, interpreted, and disseminated scientific information.[146]

Conclusion

Years of analysis by the EPA and outside reviews by its Science Advisory Board have so far essentially confirmed the EPA's extremely high cancer potency estimate for dioxin. As the EPA appended other "dioxin-like" compounds to its risk assessment in the 1990s, it also added a disquieting appraisal of various non-cancer effects, including reproductive hazards, posed by the effects of dioxins as endocrine disruptors. Moreover, the agency has suggested that current "background" levels of dioxin—levels to which many Americans were already exposed—were high enough to present significant cancer and noncancer risks, with cancer risks to the general population estimated to be as high one in a thousand.[147] Yet the long perpetuation of controversy in many ways favored dioxin-linked industries. First, it forced the EPA to expend considerable time and resources building an ever tighter case against dioxin. (Its draft dioxin risk assessments

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[146] See U.S. Congress, House of Representatives, Committee on Science, Subcommittee on Energy and Environment, *Scientific Integrity and Federal Policies and Mandates: Case Study 3 - EPA's Dioxin Risk* Reassessment, 104th Cong., 1st sess., December 13, 1995 and U.S. Congress, House Committee on Commerce, Subcommittees on Commerce, Trade, and Hazardous Materials and on Health and Environment, *Risk Assessment and Cost/Benefit Analysis for New Regulations*, Joint Hearings, 104th Cong., 1st sess., February 1-2, 1995. The specific proposals included a requirement that the EPA (and other agencies) make "best estimates" of risks instead of the "worst case," or protective, scenarios typically used to err on the side of safety. This requirement could have forced agencies to move away from making risk estimates using individuals at the "high-end" of exposure toward the less protective practice of using average exposures. Another provision would have made it easier for industries to demand deviations from conservative "default" options, by directing agencies to use defaults only in the absence of scientific data. The proposals also would have made it far easier for industry to challenge unflattering risk assessments—through a newly-mandated peer-review process open to industry participation and provisions opening the door to court challenges of risk assessments.

[147] "Dioxin Risk: Are We Sure Yet?, Special Report," *Environmental Science & Technology* 29 (January 1995): 24A-35A; U.S. EPA, *Health Assessment Document for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds*, *External Review Draft* (Washington D.C.: U.S. Government Printing Office, 1994).

by the 1990s exceeded two thousand pages.) Prompt regulatory action was one casualty. More than a decade passed, for instance, between the discovery of dioxin pollution from pulp and paper mills and EPA regulations to control the problem in the mid-1990s. With regulation in the hands of the states in the interim, the paper industry persuaded more than a dozen states to adopt weaker standards, in part by mobilizing the controversy over dioxin's risks. Second, the cultivation of doubt about the nature of dioxin's health risks proved a valuable resource in the courtroom. Whether in litigation related to pulp and paper mills or to Agent Orange, corporate attorneys could cite a body of divergent scientific opinion and call upon sympathetic experts to testify that the EPA's identification of dioxin as "one of the most carcinogenic chemicals known" had been a mistake. Through 2005, corporate campaigns continued to challenge the EPA's estimate of dioxin's risks, now led by the Chlorine Chemistry Council (CCC). From 1985 to 2005, the central theme of affected industries had remained essentially unchanged. As the headlined story on the CCC's "Understanding Dioxin" website in April 2005 put it: "Dioxin Cancer Potency Lower than Once Thought."[148]

The history of debates over the health risks of dioxin points to a number of shifts in how environmental risks are politically contested since the 1970s. First, debates were increasingly framed within the language and methodologies of risk assessment. By the mid-1980s, challenges by affected industries to the EPA's assessment of environmental risks increasingly focused on the assumptions and models of the risk assessment process rather than the underlying science, except where it had potential implications for risk assessment methodology. As the EPA and other agencies institutionalized quantitative risk assessment practices and risk analysis became an established discipline in its own right in the 1980s, risk assessment provided the overarching framework through which chemical hazards were understood and debated. Beginning in the mid-1980s, industries newly-linked to dioxin waged a series of challenges to the EPA's dioxin risk assessment.

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[148] Chlorine Chemistry Council, Dioxin Cancer Potency Lower Than Once Thought, at <http://www.c3.org/chlorine_issues/understanding_dioxin/potency.html> (April 28, 2005). Information on the EPA's latest draft reassessment can be found at U.S. EPA, National Center for Environmental Assessment, "Dioxin and Related Compounds," <http://www.epa.gov/ncea/dioxin.htm> (June 20, 2006). On the litigation involving U.S. service members exposed to Agent Orange, see Peter H. Schuck, *Agent Orange on Trial: Mass Toxic Disasters in the Courts* (Cambridge, Mass.: Harvard University Press, 1986).

They pushed for general changes to risk assessment policies, such as guidelines allowing deviations from the EPA's "conservative" default assumptions (e.g., the linear, no-threshold dose-response curve) based upon biological evidence. By the 1990s, dioxin-linked industries had joined others with an interest in changing federal risk assessment guidelines in promoting a variety of "sound science" coalitions to push for more favorable policies. At the same time, affected industries seized upon new scientific evidence, such as the "promoter" theory and dioxin's receptor-based mode of action to urge the use of alternative risk assessment models for dioxin.

Second, the dioxin debates point to a dramatic institutional shift in how affected economic interests challenged the science-policy assessments underlying health and environmental regulation. Whereas Dow had almost single-handedly managed all aspects of the 2,4,5-T controversy in the 1970s, dioxin-linked industries in the 1990s worked with a diverse coalition of think-tanks, industry-funded "councils," PR firms, and specialized consultancies to challenge the EPA's risk assessments. Corporate campaigns increasingly consisted of an integrated mix of PR, lobbying, and coalition-building to create apparent shifts in the scientific "consensus" and to cultivate political momentum for new looks at environmental risks. In a pattern found elsewhere in battles over chemical risks, for instance, dioxin-linked industries advanced a succession of different scientific hypotheses aimed at casting doubt on the EPA's risk estimate and demonstrating the existence of a "threshold" for dioxin exposure.[149] More broadly, the dioxin story shows how the business community increasingly took preemptive actions to challenge unfavorable studies and risk assessments, often years before they might be translated into regulatory action. "Paralysis by analysis"—feared by the environmental movement in the 1970s as a consequence of cost-benefit review—was increasingly induced instead by strategically targeted demands for more and better science.

[149] See Franklin E. Mirer, "Distortions of the 'Mis-Read' Book: Adding Procedural Botox to Paralysis by Analysis," *Human and Ecological Risk Assessment* 9 (August 2003): 1129-1143.

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JWT Records	J. Walter Thompson Company Archives, John W. Hartman Center for Sales, Advertising and Marketing History, Rare Book, Manuscript, and Special Collections Library, Duke University, Durham, North Carolina
MCA Papers	Papers of the Manufacturing Chemists Association (later Chemical Manufacturers Association), Chemical Industry Archives, Environmental Working Group <http://www.chemicalindustryarchives.org>
NAM Files	National Association of Manufacturers Files, Hagley Museum and Library, Wilmington, Delaware
PCB Documents	PCB Poisoning in Alabama, Chemical Industry Archives, Environmental Working Group <http://www.chemicalindustryarchives.org>
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