

# ORGANIZATIONAL RESPONSES TO ENVIRONMENTAL ISSUES: OIL REFINING COMPANIES AND AIR POLLUTION

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The point of departure for this study is the contrast described by Post between how the business policy and business and society literatures describe the responses of companies to the social turmoil of business in the late 1960s and 1970s (Post, 1978). In the business policy literature, organizational response is described as a rational process, starting at the top of the organization and moving down through the ranks. The chief executive officer becomes aware of an emerging social issue, commits the organization to a policy response, and over time institutionalizes the response into regular operating procedures (Ackerman, 1973). This pattern has been documented in firms which achieved some success

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in dealing with pollution control, equal opportunity in employment, and minority lending by banks (Ackerman, 1975; Murray, 1976).

Many managers prefer and actively support this process of gradual and relatively harmonious adaptation, but this is not the only response pattern. Business and society researchers have identified another type of response: stop-gap, fire-fighting reactions of many firms in the late 1960s when confronted with crises for which they had developed little knowledge and few strategies. Responses were ad hoc and ritualized to forestall commitment and institutionalization until elements in the firm's external environment forced change and adaptation, usually through government legislation and regulation (Votaw and Sethi, 1969). This response pattern begins with passive and active resistance, followed by bargaining for the least interference with operations, and eventually reluctant capitulation to the minimum required by law (Page, 1971; Mahon, 1982).

These two descriptions of corporate response capture the essence of the two endpoints of a continuum of responsiveness (Carroll, 1979) and emphasize its dynamic nature. As social issues evolve through stages of emerging concern to legislation and regulation, firms are subject to varying external pressures which influence the options available within an overall response pattern. A broad characterization of the two extremes of response is contained in Table 1. The two response patterns are designated "accepting" responses derived from the business policy literature and "resisting" responses from the business and society literature.<sup>1</sup> The primary objective of this empirical study is to apply systematically the concept of patterns of response over time to a group of firms. This

Table 1. Stages in the Evolution of a Social Issue Integrated with the Generic Response Categories

<i>Stages in the Evolution of a Social Issue</i>	<i>Continuum of Responsiveness</i>	
	<i>Resisting</i>	<i>Accepting</i>
Stage 1: Emergence of the Issue	Complete resistance by ignoring the issue, discrediting the issue and its proponents, and shifting responsibility to other parties.	Development of corporate policy and voluntary activities to achieve the social goal.
Stage 2: Legislative Phase	Compromise by offering positive and negative inducements in bargaining for weak legislation.	Technical and administrative learning by specialists and line managers.
Stage 3: Regulatory Phase	Reluctant capitulation by compliance with the minimum requirements as late as possible to avoid heavy fines and close-down, using litigation to delay enforcement.	Institutionalization by incorporating achievement of the social goal into incentive structures of line managers and into capital investment decision-making.

requires the definition of a set of unambiguous and objectively verifiable actions or behaviors which demonstrate either an accepting response or a resisting response at each stage of the development of the social issue.

This study examines the responses of a sample of firms in the same industry, oil refining, to one social issue, air pollution from stationary sources. The study covers the period from the 1940s to 1980 with an emphasis on the period prior to the 1970s when firms had a wide range of choice in how to respond. The oil refining industry was selected because it was identified early as a major contributor to air pollution and was first subject to local regulation in the late 1940s in Los Angeles. The level of awareness about air pollution throughout the industry was high. Trade associations and publications targeted the emerging issue as potentially quite important to refiners throughout the nation. The industry as a whole responded by sponsoring research into the causes, effects, and techniques of pollution control. For the most part, individual companies had a great deal of discretion to select the levels of air pollution control at refineries in other geographic areas. Not until the late 1960s was there a concerted governmental effort to create more uniformity and consistency in pollution control standards and practices.

## METHODOLOGICAL APPROACH

The terms "response" and "responsiveness" are used extensively in the business and society field. "Response" is defined as a reaction to a stimulus, a set of actions taken as a direct consequence of some influence or force. Firms do not initiate the kind of social change treated in this study. As Basil and Cook note:

Business firms are only a mirror of society. Although managers sometimes become enamored with their progressiveness as leaders of industry, all industry lags behind the changes in society. True, firms contribute to change through the abundance and diversity of their product output, but the intent of business is not really to change values and behavior except as a possible by-product of selling products or services. Firms are thus in a position of having to adapt and respond to societal changes—they are not the pacesetters which modify values and the contemporary societal ethic (1974, pp. 104–105).

A study of the phenomenon of responsiveness over time must be firmly grounded in an understanding of the issue as it evolves, forces at work in the industry, and characteristics of the organization which influence the rate at which it adapts to external pressures. A wide array of factors can influence and demonstrate responsiveness.

The specific research questions addressed in this study are the following:

1. What were the external pressures on oil refining companies to control air pollution? How and when did the issue evolve relative to the refining industry?

2. What specific kinds of actions are consistent with the two contrasting response patterns described in the literature?
3. What responses are observed in a sample of firms? Do responses vary?
4. Can specific responses be clustered into types which correspond to the two patterns?

To answer these questions systematically within the exploratory context of the study, the comparative case study approach is appropriate (Post and Andrews, 1982). Individual case studies are constructed from a wide variety of archival sources, followed by interviews with company executives and regulatory personnel. The goal of the case studies is not only to gather the specific data on which to base explicit comparison among firms but also to develop an understanding of the industry and organizational trends which affect the decisions made (or not made) about a social issue.

After preliminary study of the refining industry and data sources, ten companies were selected from among the top twenty refining companies in 1980.<sup>2</sup> To reduce the scope of inquiry to a manageable number of state and local regulatory environments, companies were selected with refineries in Texas or California, and preferably in both states.<sup>3</sup> Refineries in California's urban areas were subject to early local regulation of emissions. In contrast, refiners in Texas did not experience regulation until the late 1960s. All ten companies in the sample operated refineries in Texas. Five of the ten were operating refineries in Los Angeles in the 1940s when refiners there first faced local detailed regulations of emissions. These are Chevron, Mobil, Shell, Texaco, and Union. The other five companies (ARCO, Exxon, Gulf, Phillips, and Sun) did not operate in California in the 1940s.<sup>4</sup> The nature and timing of responses at the corporate level and at the refinery level in Texas would be a good test of each company's response pattern.

## EVOLUTION OF THE AIR POLLUTION ISSUE

Social issues evolve in distinctive stages from emerging concern to legislative debate to detailed regulation, and firms must respond at each stage (Downs, 1972; Ackerman, 1975; Eyestone, 1978; Post, 1978). Some issues never develop beyond the formative stage because they do not generate enough public support or they are handled by nonpolitical means. Other issues develop through stages of legislative ferment and regulation when public support is widespread and sustained. This uncertainty about the degree of public concern creates uncertainties for the firm. While the issue is in the formative stage, firms have a great deal of discretion in responding to it. As the issue moves through subsequent stages, firms have less and less discretion (Ackerman, 1975).

The issue of air pollution from U.S. industrial sources had evolved through all three stages by 1980. While concern about air pollution has a long history, prior to the 1940s it was directed primarily toward the reduction of urban smoke

caused by the widespread use of coal. Many large cities developed smoke abatement programs, but most were unsuccessful because of lack of scientific and technical knowledge by city officials, lack of public support for costly measures, and the "delay and defeat" tactics of some business executives (McCabe, 1949). In the 1940s, public concern began to include other sources, types, and locations of air pollution, in part due to a growing perception of its deleterious effects on health. The issue evolved at the national level from a period of emerging concern in the 1940s–1962 (Stage 1), to an intensive period of federal legislative ferment from 1963–1970 (Stage 2), to a period of tough and detailed federal regulation from 1971–1980 (Stage 3).

#### *Stage 1: 1940s–1962*

Two situations in particular focused public attention on air pollutants in the 1940s. One specific event was a brief, quite severe air inversion over Donora, Pennsylvania, in 1948 during which 20 persons died and almost 6,000 of the 14,000 residents became ill. An official investigation blamed the occurrence on an accumulation of industrial contaminants during extreme meteorological conditions (U.S. Public Health Service, 1949). The second was the growing and highly publicized concern about the Los Angeles smog problem. The appearance of smog seemed to many citizens to be related to the rapid expansion of petroleum refining in the area and the use of new catalytic cracking technology to process the hydrocarbons into higher proportions of gasoline and aviation fuel. Following several years of public agitation, the first U.S. air pollution control district was formed in Los Angeles County with broad powers to regulate business activity which might produce smog (Brienes, 1975). Petroleum refineries were targeted by the agency as major sources of smog and subject to the first rudimentary but very detailed emission regulations.

The effort to control smog in Los Angeles attracted even more nation-wide attention in the mid-1950s when it began to worsen despite the relatively tough regulations on business. During this period, many other large cities began to face air pollution problems. Legislation at the state and local levels gradually increased as the number of affected localities grew and the possible health impacts grew.<sup>5</sup> A modest federal effort to promote research was authorized in 1955 and extended in 1959, but gradually a consensus that the federal government had to do more developed. The public perception that air pollution was an unaesthetic nuisance and local in scope changed to a much greater concern about the extent and severity of air pollution.

#### *Stage 2: 1963–1970*

Urban groups and many legislators clearly supported a permanent and more comprehensive federal program to assist in air pollution abatement in the early 1960s. The precise extent and nature of the federal role in controlling emissions

from stationary sources was a subject of Congressional debate in 1963, 1967 and 1970. The major issues in contention in 1963 were whether a federal agency should establish criteria for judging air quality and whether a federal agency should have enforcement power in interstate and intrastate pollution abatement. All U.S. industry opposed both extensions of federal involvement, but business groups were focusing much more attention on water pollution legislation during 1963 and did not present a strong and united position of air pollution. Largely as a result of this inattention, both extensions of federal involvement remained in the legislation in a cumbersome and weakened form (Ripley, 1969).

After 1963, the federal Department of Health, Education, and Welfare (HEW) began to take an active role to stimulate local and state programs by providing budgetary assistance. Pollution issues of various types appeared on Congressional agendas throughout the 1960s. Air pollution from stationary sources returned to the forefront in 1967 because many believed that the approach devised in 1963 was completely inadequate to handle a deteriorating atmosphere. In 1967 the dominant issue in contention was whether the federal government should go further by establishing specific emission standards for industry. HEW had not issued the first set of air quality criteria guidelines, as required by the 1963 legislation, until March 1967. These guidelines, which set the levels of sulfur oxide acceptable for health, alarmed both the coal and petroleum industries. Spokesmen from both industries attacked the guidelines as "economically unrealistic, scientifically indefensible, and technologically impossible" (Air Quality . . . , 1967). Industry was largely successful in weakening the stronger proposals in 1967. The compromise put in place was an extremely complex arrangement between state agencies, which retained primary responsibility for setting air quality standards and enforcing compliance, and HEW, which was to continue formulation of air quality guidelines (although HEW was also ordered to reconsider the sulfur oxide guidelines which had so alarmed the coal and petroleum interests.)

Implementation of the 1967 Act was slow, and public concern about environmental quality continued to climb to a fever pitch, culminating in Earth Day in April 1970. The sheer numbers of participants in Earth Day activities in every part of the nation demonstrated the strength of public concern which would not be denied. Congressional and administrative action in 1970 was in large measure a game of one-upmanship and Presidential politics in response to this high level of public concern. Industry's recommendations to be patient and let the system already in place work were ignored by Congress and President Nixon (Esposito and Silverman, 1970; Marcus, 1980). In July 1970, the Environmental Protection Agency (EPA) was created by Executive Order to consolidate all federal pollution programs under a single independent regulatory agency. In December 1970, a new air pollution law which was extremely unfavorable to industry interests was passed by very high majorities in Congress and signed by the president. This set the stage for the federal government's dominant role in air pollution control.

*Stage 3: 1971–1980*

The newly formed EPA began to implement the 1970 Clean Air Act by promulgating national standards for six air pollutants within 30 days and by defining the standards to protect human health and public welfare to be achieved within the time frame specified in the law. The law specified 1975 as the deadline for achieving primary standards to protect human health and dictated a strict timetable and procedure to achieve these standards. For existing sources of air pollution, state and local agencies still had important roles to play in monitoring and enforcement but with much less discretion than in the past. States had to prepare detailed Implementation Plans for approval by EPA, which used the approval process to inject greater consistency into air pollution control throughout the nation. For new sources, EPA retained responsibility to set uniform standards of performance for various types of plants and equipment. The major debates about air pollution policy in the 1970s included the following issues of special interest to refiners: whether to relax pollution regulations in the face of the energy crisis; what to do about deterioration of air quality in areas which met the 1975 standards; and what to do about areas which did not meet the 1975 standards (the nonattainment problem).

What is important to keep in mind for the purposes of this study is that in Stage 3, power had definitely shifted to the federal regulators who were operating under a popular mandate and strict statutory requirements. EPA established much more stringent standards of performance and enforcement mechanisms at the state and local levels. The technical specifics of pollution control were beyond the understanding of all but a few experts. The public seemed to be unconcerned about the economic costs imposed by pollution regulations, but industry groups were often not satisfied that the very great expenditures yielded much benefit. Regulators tended to be caught in the middle between environmentalist interests and business interests, and were taken to court by both sides regularly to clarify the goals and appropriate methods to achieve those goals. Both goals and means were subject to extremely legalistic interpretations about which the general public was largely ignorant.

## THE REFINING INDUSTRY AND AIR POLLUTION

A number of industry trends have affected the levels of air pollution from refineries since the 1940s. Many of these trends have increased the amount of emissions, but some have acted to decrease air pollution levels. Predominant among the factors leading to higher levels of air pollution was the rapid growth of production of all types of petroleum-based products. The amount of crude oil processed annually more than doubled between 1945 and 1980. The types of crude oil available for processing also tended to increase air pollution levels. Sulfur is the most troublesome pollutant in crude oil and an expensive contami-

nant to remove. Since the 1940s the amount of low-sulfur crude oil has declined relative to high-sulfur crudes available for processing. Thus, more sulfur-type emissions were created and needed to be controlled. Changing refinery technology acted primarily to increase pollution levels. More sophisticated processing technology was devised to extract a higher proportion of the more valuable light-end products, gasoline and jet fuel. This technology also created higher levels of air emissions. Public policy in a perverse way also contributed to higher air pollution levels. In the 1970s the drive to reduce and remove lead from gasoline led ironically to the processing of greater quantities of crude oil and associated emissions.

Public policy developments were very important, but not the only, stimuli on refiners to reduce air pollution. Also acting to decrease the amount of refinery emissions were some technical developments, such as the increasing use of expensive catalysts whose recovery was economically justified. Economic rationales were also applied to recovering sulfur for periods in the early 1950s and the mid-1960s when world sulfur supplies could not meet growing demand. Carbon monoxide was routinely emitted from refineries until a technique to convert it to a refinery energy source became economical in the early 1960s. Refiners rushed to install carbon monoxide boilers to cut operating costs. Controlling carbon monoxide was a secondary benefit. After the energy crisis in 1973, hydrocarbons which once evaporated into the atmosphere became valuable enough to encourage installation of recovery units.

During each stage of evolution of the air pollution issue, the industry as a whole responded as well as each company. In Stage 1 of emerging public concern, the refining industry began serious study of its air pollution problems. When refiners were blamed for causing smog in Los Angeles, the Western Oil and Gas Association and the American Petroleum Institute established permanent Smoke and Fumes Committees to identify the scientific issues related to smog and the role of refineries in its formation. These committees sponsored research on techniques to isolate, measure, and analyze air composition and currents. The definition of good industry waste disposal practices began to change as the result of these studies.<sup>6</sup> Los Angeles refiners cooperated with the U.S. Public Health Service and California state and local agencies in a major study of all sources of refinery air pollution in 1955–58. These research efforts were extremely important in improving the state of scientific and technical knowledge about air pollution. The petroleum industry's position was that air pollution was a local problem in a few urban areas, and refiners in those areas should take reasonable voluntary measures to control pollutants if they reached hazardous or troublesome levels.

During the second stage of legislative ferment, the refining industry was generally opposed to any expansion of the federal government's role except for funding research. In 1963, it was not very active in Congressional hearings and was surprised along with the rest of industry at the degree of political support and success of the issue. This lack of participation was not repeated. Pollution issues

were identified as the number one problem for refiners in the mid-1960s at national industry conferences. Later in the 1960s, the API monitored public policy developments very carefully and participated in every Congressional committee hearing held on a wide array of pollution issues.

During the third stage of detailed federal regulation, refiners were concerned primarily about limits to energy development and economic growth, imposed by pollution regulations. Proposals to deal with the failure to achieve the 1975 deadlines varied in their impacts on industry operations. The API continued in its role as developer of industry consensus and active participant in Congressional hearings. The culmination of these debates over the direction of federal air pollution policy was the 1977 Clean Air Act amendments which once again disappointed industry in their tough approach to reducing pollution levels. Relations with EPA had never been very good, but during the mid-1970s, they deteriorated to adversarial legalism.

## INDICATORS OF RESPONSE

In order to categorize the behavior of firms, their actions must be matched with predetermined sets of empirical manifestations of each response pattern. Due to the exploratory nature of this study and limitations of data sources over the thirty-five year time period, no single indicator could be considered sufficiently complete and unambiguous. An aggregate measure would provide a stronger (a more strongly defensible) basis on which to assess responsiveness. Four components of response were selected as indicators of the response category:<sup>7</sup>

1. statements about air pollution by top management;
2. changes in organizational structure to assign responsibility for the issue;
3. technical actions to reduce refinery air pollution;
4. political and legal actions related to air pollution.

A series of propositions was developed for each component at each stage in the evolution of the issue. For example, a company exhibiting an accepting response was expected to mention air pollution earlier and more frequently in annual reports than a firm in the resisting response category. The complete lists of criteria are specified in Table 2 for resisting responses and in Table 3 for accepting responses.

Descriptions of each component and related criteria for categorization are presented in the following four sections. To simplify the presentation, the evidence about each company's actions and the appropriate assignment to a response category are presented with descriptions of each component. The specific assignments to a response category are listed in Table 4. When a company's behavior clearly did not fall into either category but fit between the two, it was placed in a middle position in Table 4.

Table 2. Resisting Response Pattern

Component	Stage 1	Stage 2	Stage 3
Management Statements	No acknowledgment of air pollution in annual reports, speeches, or promotional material.	Reference to air pollution in annual reports by questioning the need for federal involvement and the motives of supporters of legislation.	Development of a corporate policy on the environment. Criticism of regulations and focus on high costs in annual reports.
Structural Actions	No assignment of responsibility for air pollution at any level in the organization.	Assignment of an executive to follow the issue but with no internal responsibilities to improve environmental performance.	Creation of environmental affairs units at the corporate and operating levels and assignment of environmental specialists at each major facility.
Technical Actions	No voluntary air pollution control activities and no participation in industry research projects.	No voluntary air pollution control activities and no participation in industry research projects.	Allocation of resources for new pollution control equipment only when faced with heavy fines and shutdowns.
Political/Legal Actions	Opposition to formation of local and state regulatory agencies.	Opposition within API to federal involvement.	Litigation to limit federal powers and regulations. Variances regularly sought to delay compliance. Challenge every violation regardless of merit.

### Management Statements

Two sets of management statements about air pollution are readily available and provide a basis on which to compare companies. These are official corporate policies about air pollution and corporate annual reports. The formulation of an official corporate policy about a social issue is, at minimum, an indicator that top management is aware of an issue and its importance to the company. The timing and content of policy statements provide some evidence of corporate response category. Corporate policies issued during Stage 1 of emerging public concern are indicators of an accepting response, and the timing of this criterion is not unrealistic in this historical context. API's Smoke and Fumes Committee recommended in 1955 that each refiner establish an air pollution control policy to guide lower level personnel in this important matter. If the air pollution policy was not issued until the 1970s (Stage 3), after more than twenty years of awareness of the issue, this suggests a resisting response.

Formal corporate-level policies about air pollution were issued as early as 1956 and as late as 1982, with a midpoint date for the ten companies of 1969.

Table 3. Accepting Response Pattern

Component	Stage 1	Stage 2	Stage 3
Management Statements	Acknowledgment of air pollution and voluntary activities to reduce emissions in annual reports. First corporate policy.	Expand references to air pollution in annual reports and support some form of federal involvement.	Publicize firm's good record in annual reports in pollution control without criticizing legislation and regulations.
Structural Actions	Assign responsibility for air pollution control at all major facilities and at headquarters to monitor corporate environmental activities.	Create full-time environmental affairs units at the corporate level with both external and internal responsibilities.	Increase environmental staffs at all levels. Develop reporting systems to evaluate environmental performance.
Technical Actions	Modest amount of voluntary air pollution control activities. Support industry research efforts and begin R&D projects.	More substantial voluntary air pollution control activities and environmental research programs.	Allocate funds for speedy compliance with new regulations. Cooperate with agencies on technical studies to improve standards and equipment.
Political/Legal Actions	Support formation of state and local regulatory agencies.	Support some form of federal involvement in air pollution within API. Make its support public in Congressional hearings and advertising.	Publicize support for federal regulations and refuse to join litigation and coalitions to limit regulators. Cooperate with agencies and challenge violations only with good cause.

Mobil was the only company in the sample to formulate a corporate-level policy in stage 1. Five companies (ARCO, Chevron, Shell, Sun, and Union) developed such policies in Stage 2. Two companies (Exxon and Phillips) issued their policies early in Stage 3. Gulf added a policy in 1977. Texaco delayed its development of a formal policy until 1982, although an internal memorandum in 1971 stressed that the company would obey all pollution laws and regulations.

These statements vary in content, but each indicated that the company would comply with legal requirements. Four companies (Mobil, Shell, Chevron, and Sun) consistently and explicitly mentioned support for voluntary actions to reduce air pollutants. The possibility of voluntary actions was implied in policies by all other companies. All statements except Gulf's 1977 policy and Union's 1967 policy indicated the need for cooperation with regulatory agencies and the desire to participate in the public policy process.

Annual reports are a second source of management statements about social issues. The annual report serves a number of functions. Its chief purpose is to

Table 4. Evidence of Response Category

COMPONENTS OF RESPONSE	Resisting Response	Accepting Response
<i>Management Statements</i>		
Corporate Policy	Exxon Gulf Phillips Texaco	ARCO Chevron Shell Sun Union
Annual Reports:		
a. Mention in Stage 1	Gulf Phillips Texaco	ARCO Chevron Exxon Mobil Shell Sun Union
b. Support of federal involvement in Stage 2 <sup>1</sup>		Chevron Exxon Mobil Phillips Sun Texaco
c. Support/criticism of regulation in Stage 3	Chevron Sun Texaco Union	ARCO Exxon Gulf Phillips
<i>Organizational Responsibility</i>		
Full-time refining department staff for all facilities	Chevron Phillips Union	Exxon Gulf Mobil Shell Sun Texaco
Full-time corporate staff	Chevron Gulf Phillips Texaco Union	ARCO Exxon Mobil Shell Sun
<i>Voluntary Technical Actions</i>		
Sulfur oxide control	Phillips Texaco	ARCO Chevron Exxon Gulf Mobil Shell Sun Union

(continued)

Table 4. (Continued)

COMPONENTS OF RESPONSE	Resisting Response	Accepting Response
Hydrocarbon control	ARCO Gulf Phillips Texaco	Chevron Exxon Mobil Shell Sun Union
Smoke control	ARCO Gulf Phillips Sun Texaco Union	Chevron Exxon Mobil Shell

*Note:*

<sup>1</sup>Atlantic Richfield, Gulf, and Union made no statement about government in annual reports in Stage 2 and will not be placed in any category.

meet the legal requirements to disclose financial information to shareholders, but it is also used to communicate corporate views and performance in a number of other areas (Ryan, 1981). In general, the amount of social reporting in annual reports increased in the 1960s and had become the norm in the 1970s (Dierkes et al., 1973). As a solitary indicator of response type, the annual report has a number of limitations. These include the accuracy of self-reporting and whether reporting differences measure real performance differences among firms (Abbott and Monsen, 1979). Despite these limitations, annual reports do reflect to some extent what top management is concerned about and what it perceives the shareholders and members of other interested groups to be concerned about.

The analysis of statements about refinery-related air pollution in annual reports over the 35-year period revealed considerable variation in the early years, but much less after the early 1960s. During Stage 1 (1945–62), mentions of air pollution were relatively infrequent, but seven of the ten companies mentioned the issue in at least one year. Union had the earliest mention (1946) and the highest number of sentences devoted to air pollution. These were concentrated in the late 1940s and 1953. ARCO and Sun annual reports also had relatively more attention to refinery air pollution in the 1950s than one might expect since they did not operate California refineries at this time. Chevron, Exxon, Mobil, and Shell had fewer references in Stage 1. Gulf, Phillips, and Texaco had no references to air pollution in Stage 1. Beginning in the mid-1960s, all companies began to report regularly about air pollution. Not surprisingly, the most extensive coverage occurred in 1970, the year in which the tough federal Clean Air Act was passed and the Environmental Protection Agency was formed. Later in the 1970s the amount of space devoted to refinery air pollution declined, although

other types of pollution and other social and political issues received a great deal of attention.

Content of annual reports was evaluated to determine whether firms indicated support for or criticism of increasing federal involvement during Stage 2 (1963–70) and whether they tended to support or criticize government programs to reduce air pollution in Stage 3 (1971–80).

Companies exhibiting an accepting response would support some form of federal action in air pollution control in Stage 2; resisting companies would criticize the potentially increasing federal involvement. An analysis of the statements related to federal involvement provided little evidence by which to categorize firms on this criterion. Seven of the ten firms (all except ARCO, Gulf, and Union) mentioned government involvement, but only Shell mentioned the federal government explicitly. Shell indicated support for federal pollution control programs. Exxon, Chevron, Sun, and Texaco made neutral statements of fact about increasing government involvement without revealing either support or opposition. Mobil and Phillips had statements which might be considered critical of increasing federal involvement. Mobil cautioned against the danger of “crash” programs in 1966 and the possibility that the public would be “misled by superficially attractive but unsound ‘solutions’” in 1969. Phillips feared that “misleading public statements based on emotion and opinion rather than scientific fact” would hamper progress in the 1966 report. These statements do reflect a concern about the potential impact of increased public concern but are not directed to federal involvement per se. Thus, no company fits precisely in the “resisting” category by this criterion.

A similar content analysis was conducted with annual reports in Stage 3. Public policy statements related to implementation of air pollution laws and regulations during Stage 3 were separated into support, neutral, and critical categories.<sup>8</sup> If 50 percent or more of the statements indicated support, the company was classified as exhibiting an accepting response. Mobil and Shell fit this criterion. If 50 percent or more were critical, the company was classified as resisting. Chevron, Sun, Texaco, and Union fit this criterion. The other four companies (ARCO, Exxon, Gulf, and Phillips) have a mix of both types and a number of neutral statements so that they fit neither category precisely.

### Structural Changes

Traditionally, organizations have created boundary-spanning roles to buffer their technical cores from disruption. The boundary-spanner functions to protect the organization by managing relationships with entities outside the organization and by identifying opportunities and threats facing the firm. The goal is to improve the organization's ability to deal with uncertainties generated in the external environment (Thompson, 1967). When the potential disruption is caused by new social demands, the organization faces the greatest uncertainty

because it has little control over the forces initiating the call for change. The more serious the threat, the more likely the organization will assign a person to monitor the issue and to represent the organization in dealing with the external environment. The more pervasive the issue, the more likely the designated person will be at a high level in the corporate hierarchy.

Organizations have a variety of structural alternatives to deal with social issues, ranging from temporary task forces through permanent departments. The specific choice depends upon a number of factors related to the issue itself (especially the degree and type of impact on company activities) and characteristics of the organization (such as level of centralization, visibility, and influence of staff in general). Research indicates a trend toward permanent departments when the social issue is ongoing, especially so for pollution control which requires technical expertise and regular monitoring of internal and external environments (Holmes, 1978). The role of the social issue specialist is particularly difficult because of the ambiguity about what he is supposed to do and how exactly he should go about doing it. Conflicts abound with operating managers and other staff over how much change is necessary and who should have authority to make policy and implement programs.

Relating these concepts to this study, the second component of response is the assignment of responsibility within the organization for air pollution. At the individual refinery level, all companies claimed that some employee or group had been designated to handle air pollution problems on at least a part-time basis since refining operations had begun. This claim could not be verified independently, nor could firms confirm when the function became full-time at each refinery in most cases. Comparative data were available for the assignment of responsibility at two higher levels in the hierarchy: at the corporate staff level and at the refining department staff level.

The formation of full-time corporate environmental affairs units indicates, at minimum, that top management is sufficiently concerned about the future consequences of public policy initiatives to monitor the political environment and participate in legislative and regulatory activities. These units were frequently given internal responsibilities to coordinate pollution control programs in all segments of company operations. Companies were classified in the accepting response category if corporate units were formed in Stage 2 or prior and in the resisting response category if such units were not formed until Stage 3. The earliest corporate-level unit was appointed in 1959, the latest in 1975. Two of the smaller and highly centralized companies had full-time corporate environmental affairs staff in 1959 (ARCO) and 1960 (Sun). Three of the large decentralized companies assigned full-time environmental affairs personnel in the mid-1960s (Exxon in 1964; Mobil in 1965; and Shell in 1967). The remaining companies assigned corporate environmental staffs between 1971 and 1975.

Assignment of air pollution responsibility at the refining management staff level indicates the need for expertise and coordination beyond a one-facility

perspective. The earlier a firm with many plants made such an assignment, the more likely it was exhibiting an accepting response. The later into the 1970s the firm waited to make such an assignment, the more consistent this is with a resisting response. The earliest documented full-time assignment was in 1959 by ARCO. The latest assignments were in 1977 and 1978 by three companies (Chevron, Phillips, and Union). The remaining six companies created the full-time refining department positions in Stage 2.<sup>9</sup>

#### *Technical Actions to Reduce Air Pollutants*

The levels of emissions from a refinery are determined by a number of factors: crude oil capacity (size), general levels of maintenance and good housekeeping, types of crude oil processed and processing system used, pollution controls in use and their operational efficiency, and government regulations over a particular source (U.S. Congressional Research Service, 1980). The major air pollutants from refinery operations are sulfur oxides and hydrocarbons. Less significant problems come from smoke and particulates, carbon monoxide, and nitrogen oxides (National Petroleum Council studies). Up to the 1940s, air pollution control at refineries was technically simple. Refiners had developed rudimentary control devices by the 1920s to prevent gross loss of product and to protect workers and neighbors from noxious, sometimes deadly, vapors. The first regulations of refinery emissions in Los Angeles stimulated technological developments in air pollution controls. Many ideas and processes developed in Los Angeles refineries were utilized in other parts of the country. However, there was variation in the speed with which particular companies incorporated better air pollution control outside Los Angeles.

Until the 1970s, the degree of air pollution control in many geographic areas was determined by the firm itself. Local regulations developed gradually in some urban areas, but, with the exception of Los Angeles, these regulations left considerable room for voluntary reductions in emissions. In the 1970s, however, the degree of control needed to achieve the goals set in the 1970 Clean Air Act removed most of the discretion firms had about emission levels and the particular methods by which reductions would be achieved.

Technical activities to reduce air pollution were considered the most important indicator of response category, but also one of the most difficult areas to obtain complete and reliable data about and the most complex to evaluate. An ideal indicator of technical performance would be the voluntary reduction in emissions since the 1940s, but this information is not available. A substitute measure, the voluntary installation of air pollution control equipment, was used in this study. Refinery managers in some companies had discretion to make expenditures to be a good neighbor and a good employer. In others, refinery managers were not encouraged to make these expenditures and had little discretion to do so. As the issue and technology evolved, firms had to invest more to be a good neighbor.



Industry publications such as *The Oil and Gas Journal* have routinely reported detailed descriptions of refinery expansions and installation of new processing equipment, including air and water pollution controls. Individual refinery histories of air pollution controls were compiled, and the equipment installation dates were matched with prevailing regulatory requirements to separate voluntary from mandated installation. Company environmental affairs personnel reviewed these histories for accuracy.

Evidence of voluntary installation of equipment was found in each geographic area investigated. In Los Angeles where local regulation of refineries began in 1947 and in the San Francisco Bay Area where a local voluntary program began shortly thereafter, Chevron and Union were early leaders in voluntary activities. Mobil and Shell were also fairly active. In Pennsylvania, ARCO and Sun were innovative in developing new control techniques for their large refineries operating in heavily populated areas. Texas, the largest refining state, did not issue air pollution regulations until 1968, and these had to be strengthened quite a bit in 1972 in preparation for compliance with deadlines imposed by the 1970 Clean Air Act. All companies operating in Texas had ample opportunity to reduce emissions voluntarily, and numerous actions to reduce air pollution in Texas were undertaken by several firms. Exxon and Shell are particularly noteworthy in the early installation of a wide variety of air pollution controls.

In categorizing firms, if any evidence was found of voluntary installation, the firm was put in the accepting response category. Table 4 contains the results of this analysis for control of sulfur oxides, hydrocarbons, and smoke.<sup>10</sup> Only two companies, Phillips and Texaco, have no voluntary technical actions for any of the three pollutants in any geographical area. All other companies provided some voluntary reductions. Companies with such actions for all three pollutants are Chevron, Exxon, Mobil, and Shell.

#### *Political and Legal Actions*

Research into the fourth component of response, political and legal actions related to air pollution, was disappointing. Reliable comparable data for categorizing firm behavior were simply not available. The criteria to differentiate accepting responses from resisting responses involved company activities in support of or opposition to the formation of state and local regulatory agencies, to the strengthening of federal pollution policies, and to state and local compliance actions. A number of data sources were investigated, but none yielded satisfactory data by which to compare companies. Little published information was available about each firm's positions on legislation and actions taken to influence political outcomes. A critical, confounding factor in this area is the desire for industry consensus and unity in the political arena. The API has been the major vehicle within which industry positions on environmental legislation have been formulated and communicated to legislators. Several executives com-

mented that companies often differed widely in their initial policy positions within trade association meetings, but would give no specific information by which to classify firms. API staff would not even acknowledge that companies differed. This is understandable, given the delicate position of API, but it thwarts efforts to analyze company differences.

Only one example of an accepting response emerged quite clearly. This involved Union Oil's leadership in supporting the formation of Los Angeles County's regulatory agency in 1947. The California oil industry opposed state legislation necessary to permit the establishment of local air pollution districts, and was successful in keeping it in committee even though the measure had very high popular support. A number of highly critical articles in Los Angeles newspapers stimulated a meeting of top-level industry executives. At this meeting, the executive vice president of Union Oil, W. L. Stewart, Jr., stated that his company's future was tied to the wellbeing of Los Angeles. Therefore, Union was going to break with the industry position and support the state bill. Upon hearing this, the other companies fell into line in support and the bill passed unanimously (Kennedy, 1954). This story is unique in my research in that it reveals the "inside story" of intra-industry differences and gives credit to one individual for pushing powerful petroleum interests beyond what they would have done.

## RESPONSIVENESS MEASURES

Two aggregate measures of responsiveness were developed from the information collected in the case studies. One measure is based on the data concerning management statements, structural changes, and voluntary technical actions in Table 4. A second method of comparison is based on a rank ordering of a more limited number of actions based upon the time elapsed before these actions took place.

Table 5 contains a simple counting of the number of times a firm is listed in each column of Table 4. A total score for each firm is based on a weighting of 0 for each resisting response, 1 for each accepting response, and .5 for cases in which the company was at neither extreme. Companies operating in Los Angeles in the 1940s are indicated with an asterisk(\*). The range in scores is surprisingly wide. The potential range of scores is a low of 0, which indicates all resisting responses, to a high of 8, which indicates all accepting responses. The actual scores range from .5 to 7.5. Mobil, Shell, and Exxon have the highest scores and fit the accepting response pattern most closely. Texaco, Phillips, and Gulf have the lowest scores and fit the resisting response pattern most closely. The other four companies have a mix of both response types.

This simple counting technique does not take into account differences in timing within a stage. For example, whether a company undertakes an action in 1947 or 1962 (both in Stage 1) suggests a significant difference in respon-

Table 5. Summation of Responses<sup>1</sup>

	Resisting Response		Accepting Response	Weighted Score <sup>2</sup>
	0	.5	1	
Weight				
ARCO	2	2	4	5.0
*Chevron	3	1	4	4.5
Exxon	1	2	5	6.0
Gulf	5	2	1	2.0
*Mobil	0	1	7	7.5
Phillips	7	1	0	.5
*Shell	0	2	6	6.5
Sun	2	2	4	5.0
*Texaco	7	1	0	.5
*Union	4	1	3	3.5
Total	31	15	34	

Note: The asterisk (\*) denotes companies which operated refineries in Los Angeles in the 1940s when local regulations were issued.

- One element, support of or opposition to increasing federal involvement in air pollution in annual reports in Stage 2, is not included in order to avoid bias against three companies which have no ranking on this element.
- The score is calculated by multiplying the number of accepting responses by 1 and the number in the middle category by .5.

siveness. A second method of comparison, based upon a rate-of-events calculation, attempts to capture these differences in timing by counting the time elapsed before certain important actions (called "events") occurred. Five events were selected for this analysis. Two relate to top management's statements about air pollution: the date of the first official corporate-wide policy, and the date of first mention of refinery air pollution in the annual report. Two events relate to organizational assignment of responsibility: the date of formation of a full-time corporate environmental affairs unit, and the date when full-time refining department staff were assigned to handle air pollution problems. The fifth event relates to technical actions, ignoring whether the action was voluntary or mandated: the initiation of sulfur recovery in a Texas refinery. This technical event was selected because all companies operated refineries in Texas, and the data are the most accurate and complete. Specific dates of these events for each company are listed in Table 6.

These data can be aggregated into an average per company by using a rate-of-events calculation. The formula is the accumulated waiting time in years (using 1945 as year 1), divided by the number of events for each company. This formula has the advantage of allowing for cases of missing data and non-applicable events (Tuma and Hannan, 1978). The rank ordering from this calculation of events in Table 6 is provided in Table 7 with an asterisk(\*) to denote companies

Table 6. Data Used in the Rate-of-Events Calculations

Company	Event 1	Event 2	Event 3	Event 4	Event 5
ARCO	1964	1951	1959	1959	1953
*Chevron	1970	1960	1971	1977	1966
Exxon	1971	1950	1964	1970	1953
Gulf	1977	1965	1974	1970	1955
*Mobil	1956	1955	1965	1970	1958
Phillips	1972	1966	1975	1977	1967
*Shell	1969	1956	1967	1968	1952
Sun	1967	1948	1960	1968	(1)
*Texaco	1982	1965	1971	1965	1971
*Union	1967	1946	1972	1978	(2)

Note: The asterisk (\*) denotes companies operating refineries in Los Angeles in the 1940s when local regulations were first issued.

Event 1: First formal corporate policy applicable to all U.S. refineries.

Event 2: First mention of refinery air pollution in annual report.

Event 3: Formation of full-time corporate environmental affairs unit.

Event 4: Full-time assignment at refinery department level.

Event 5: Initiation of sulfur recovery in Texas refinery.

(1) Company states that no sulfur treatment was required.

(2) Company states that no treatment was required prior to 1976 when a new processing unit began operating. Use of the 1976 date would bias Union's ranking unfairly.

operating refineries in Los Angeles in the 1940s. The range in the average number of years is sufficiently wide to suggest significant variation in the rate of response. One would also conclude that the five companies operating refineries in Los Angeles in the 1940s were *not* more likely to respond earlier at the corporate level, than companies without California refineries at that time, a result that may be surprising.

Table 7. Results of the Rate-of-Events Analysis

Rank	Company	Average No. of Years	1945 + Average
1	ARCO	13.2	1958
2	Sun	16.75	1961
3	*Mobil	16.8	1961
4	Exxon	17.6	1962
5	*Shell	18.4	1963
6	*Union	21.75	1966
7	Gulf	24.2	1969
8	*Chevron	24.8	1969
9	*Texaco	26.8	1971
10	Phillips	27.4	1972

Note: The asterisk (\*) denotes companies which operated refineries in Los Angeles in the 1940s when regulations were issued.

The correlation between the two rankings, using Spearman's rank correlation coefficient, is 76.4 percent. The greatest discrepancies in rank involve Atlantic Richfield and Shell. ARCO's early actions give it the first place ranking in the rate-of-events calculation, but Shell had more accepting and no resisting responses in the first measure.

## INTERPRETATION AND CONCLUSION

The primary empirical focus of this study has been on the period prior to regulation, in the "zone of discretion" when firms select an approach to deal with an emerging issue under a great deal of uncertainty. The scientific uncertainty was very high in the 1940s and 1950s. The causes and dangers of air pollution were largely unknown. The refining industry as a whole took action to reduce this scientific uncertainty by sponsoring research because it perceived its vulnerability as a highly visible contributor to rising air pollution levels. This industry-level response served to increase awareness of the issue in all firms, even those not subject to regulation at that time.

While the industry was funding air pollution research, individual firms had to decide how to handle the issue in a period of gradually increasing public concern. The results of this study provide evidence that firms responded to the issue in different ways and at different rates. Some firms took the lead in establishing policy, assigning responsibility, and investing in voluntary controls, and were fairly consistent in doing all three. Mobil, Shell, and Exxon, representing the largest firms, and Atlantic Richfield and Sun, representing relatively smaller firms, fit into this pattern. Texaco, Gulf, and Chevron (to some extent) display more characteristics of the resisting response among the largest companies. Phillips and Union, representing relatively smaller companies, also fit the resisting response pattern more closely.<sup>11</sup>

Additional information which would be useful in understanding how each firm responded includes the specific nature of the duties assigned to environmental staffs and the amount of conflict within the organization about how to handle the emerging issue. Expanding the empirical focus to other states, especially those with relatively late regulation such as Louisiana and Illinois, would provide opportunities to find whether the level of voluntary activities to reduce emissions increased in Stage 2. Also, as noted previously, information gathered about political and legal actions was not sufficient to base any judgments about response category. This component of response is a fertile, but quite difficult, area for further study.

Responses in Stage 3 need more empirical study. It is not clear how much variation firms exhibited during Stage 3. An adversary relationship with a regulatory agency has significant costs and few benefits. Inspectors in many jurisdictions retain a good deal of discretion in handling potential violation situations. A store of credibility and history of good faith efforts to solve problems are

useful to the firm. It seems quite plausible that firms can exhibit a resisting response in the early stages of an issue and switch to an accepting response once a federal regulatory program is in place. Uncertainty is reduced, and compliance can be less costly than resisting the social demands which now have a strong legal mandate. It seems less plausible that firms displaying an accepting response in the early stages would switch to a resisting response during Stage 3, because they have already committed financial and other organizational resources in support of the social goals. Thus, it should be emphasized that this study's results about past response patterns do not necessarily reflect the current philosophical approaches of the subject firms. A cross-sectional study to correlate current resisting/accepting responses with this study's findings about the past would be valuable.

Once the existence of distinct response patterns is confirmed, a further important research question emerges. Why did a firm exhibit a particular pattern? The literature on corporate social response indicates that the attitude of top management is a key variable in determining the nature and timing of social responsiveness (for example, see Sturdivant and Ginter, 1977). Executives interviewed in this study unanimously agreed that top management's attitudes and commitment, rather than financial impacts, are the most important factors in determining environmental performance. Top managers set the direction of internal policy, establish organizational structure, and select political positions and strategies. While environmental problems and possible solutions occur at all levels in the hierarchy, top executives must acknowledge the existence of pollution problems and provide financial resources and encouragement before much will be done. The views of top managers are undoubtedly influenced by external factors such as emerging public concern and public policy developments. Indeed, this is one of the desired outcomes of public policy. Research to explain the causes of response patterns is the logical next step and should be based upon sound empirical measurement of the response pattern as the dependent variable.

The primary purpose of this study has been to analyze evidence of response patterns to one social issue, based on the concept of an evolving continuum of responsiveness with carefully differentiated endpoint categories. The study of responses by firms to social demands is an important area of research in the business and society field. Ultimately, we will want to compare the responses of the same set of firms to a variety of issues to learn more about the consistency of response across issues and to compare the responses of firms in a variety of industries to the same issue to learn more about industry characteristics of response. This will require a number of issue-industry-specific studies in which companies are named, so that subsequently researchers can tie the threads of these many studies together. A creative blending of historical methodology and social scientific analysis is necessary to understand how and why firms responded as they did.

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## NOTES

1. The terms "business policy model" and "pressure response model" have been applied to distinguish the two types of response (Post, 1978). These terms are not used in this study because they are not unambiguous and mutually exclusive. The "business policy" label is confusing to many scholars, even those in the field of business policy, when applied only to firms which adapt quickly to meet new social demands. A firm's policy may be to resist until legal pressure requires adaptation and then only to do the absolute minimum to avoid fines or forced closure of a plant. The "pressure response" label can be misleading because all firms are responding to some degree of pressure, even those in the forefront of accepting the legitimacy of the issue. The generic labels of "accepting" and "resisting" reflect more clearly the essential differences in response types. It should be clearly noted that ignoring the issue or doing nothing to demonstrate acceptance is classified as a resisting response in this study.

2. The top 20 refiners controlled about 80 percent of U.S. refining capacity in 1980. Smaller refiners were excluded from the study after several industry experts indicated that small companies had few air pollution issues to contend with until the mid-1970s. Most small refiners produce specialty products from petroleum which has already been partially processed by the major companies. These plants do not engage in processing which produces the most air pollution. In addition, as a practical matter, research about these small refiners is much more difficult. Industry publications devote relatively little attention to them, and they are usually privately held.

3. In 1980, Texas had the largest concentration of refining capacity (27 percent). California followed with 14 percent. After the companies were selected, I found that three operated refineries within or near Philadelphia, Pennsylvania and gathered information about these refineries and regulatory developments affecting them.

4. Several companies have changed names over the 35-year period of the study. To avoid confusion, ARCO will be used to refer to both Atlantic Refining and the Atlantic Richfield Company. Atlantic and Richfield merged in 1966. Exxon will be used to designate Standard Oil Company of New Jersey and Humble Oil and Refining. Chevron will be used to designate Standard Oil Company of California. Details of subsidiary names and company histories are found in the larger study on which this paper is based.

5. Prior to 1956, four states (California, Massachusetts, New Jersey, and Oregon) had statewide air pollution control programs. The extent of local regulatory programs is difficult to ascertain. Not even the U.S. Public Health Service collected such information until 1962. By 1959, twenty-two states had some type of air pollution legislation. By 1963, thirty-three states and territories had an air pollution statute. Except for California, these programs were poorly funded. (See Rogers, 1960; Ripley, 1969; Davies III and Davies, 1975.)

6. Since the early 1930s the API had published a *Manual on the Disposal of Refinery Wastes*, which had focused mostly on water pollution. Beginning in 1953, the air pollution section began to incorporate techniques developed in Los Angeles refineries.

7. Gricar's (1979) cross-sectional study of responses to OSHA regulation utilized four similar components of response: technical, informational, administrative, and political.

8. Supportive statements indicate some type of approval for government action to reduce air

pollution, such as "Industry and government are working together toward sound future environmental policies." Neutral statements are simple statements of fact about the law or air pollution and statements about the need to balance environment, energy, and economic growth. Critical statements indicate disapproval of government actions on the basis of "environmental extremism," excessive costs, or unnecessarily stringent regulations.

9. Documentation of the assignment of personnel to this function on a part-time basis in the 1950s was found for several companies. However, the nature and extent of associated duties are unknown. It is extremely likely that all companies had some part-time assignment during this period, if only to answer inquiries from API's Smoke and Fumes Committee. The data about part-time assignment were too unreliable and incomplete to use in categorizing firm responses.

10. Control of two other air pollutants, particulates and carbon monoxide, was also investigated, but evidence was inconclusive. Information about particulate control is very difficult to interpret because the level of control necessary to maintain efficient and continuous processing and to retain valuable catalysts cannot be differentiated from controls to reduce air pollution. The utilization of carbon monoxide boilers to provide energy at reduced operating costs was so widespread that air pollution reduction appeared to be a very minor factor, if any, in the adoption of this equipment.

11. Each company was given the opportunity to review the entire study before publication to correct any factual errors or misinterpretations. Phillips was the only company to object to its relative position in both measures. It pointed out that certain actions which could be interpreted as accepting responses were not incorporated in the measures although these actions were reported in the detailed case study. One action was the formation of a top management committee to deal with conservation issues in the early 1960s. Another was the formation of a pollution control group in the engineering department, rather than in the refining department, in the mid-1960s. I reviewed this information and did not change the score. The top management committee did act in such areas as wildlife and grassland preservation and water pollution, but I found no statements or actions related to air pollution. The criterion relating to refinery department pollution control personnel was applied strictly, and perhaps Phillips did organize its activities so that the separate Engineering Department staff filled the same role as a refinery department air pollution unit. If so, Phillips' position on this component would move from the resisting column to the middle column in Table 4. Its total score would be 1.0 rather than .5.

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