~~212814~~

117922

REPORT BY THE U.S.

General Accounting Office

A Market Approach To Air Pollution Control Could Reduce Compliance Costs Without Jeopardizing Clean Air Goals

A market approach to air pollution control would allow the purchase, sale, and use of air pollution entitlements consistent with present standards governing outdoor air quality. A market incentive approach can lower the cost of clean outdoor air by allowing firms to find the most efficient way to control pollution without jeopardizing the air quality standards of the Clean Air Act. Problems in implementing such an approach can be overcome.

The committees with jurisdiction over the Clean Air Act should consider rewriting some of the provisions which currently limit the use of market incentives. Also, the committees should encourage the Environmental Protection Agency to emphasize a market approach to air pollution control wherever this system can achieve air quality at less cost and is permissible under the Act.

PAD-82-15A
MARCH 23, 1982

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

PROGRAM ANALYSIS
DIVISION

B-205035

The Honorable John D. Dingell
Chairman, Committee on Energy
and Commerce
House of Representatives

The Honorable Robert T. Stafford
Chairman, Committee on Environment
and Public Works
United States Senate

The use of market incentives in air pollution control could reduce compliance costs of the Clean Air Act without jeopardizing outdoor air quality standards. Such an approach to air pollution control would provide industry with the opportunity to find cheaper ways to meet our Nation's desire for clean outdoor air. This report provides an evaluation of the feasibility of employing market incentives to bring about greater economy and efficiency in regulating air quality.

Copies of this report are being sent to interested congressional committees; members of Congress; the Administrator, Environmental Protection Agency; the Director, Office of Management and Budget; the Chairman, Council of Economic Advisers; and other interested parties.

Morton A. Myers
Director

REPORT BY THE U.S.
GENERAL ACCOUNTING OFFICE

A MARKET APPROACH TO AIR POLLUTION CONTROL COULD REDUCE COMPLIANCE COSTS WITHOUT JEOPARDIZING CLEAN AIR GOALS

D I G E S T

Establishing a market in air pollution entitlements could be a less costly, more flexible way to meet minimum standards of outdoor air quality. These entitlements allow emissions consistent with present standards governing outdoor air quality. Such a market could save the public millions of dollars relative to the price tag currently imposed by command and control regulations to meet the requirements of the Clean Air Act, estimated at $22 billion in 1979.

GAO undertook this study to explore whether developing such a market is feasible, recognizing that numerous obstacles stand in the way. GAO's purpose is to offer the House Committee on Energy and Commerce and the Senate Committee on Environment and Public Works an assessment of this novel approach to air pollution control at a time when the Clean Air Act is being reauthorized. To the degree that such a market incentive approach could reduce compliance costs by using scarce economic resources more efficiently, a number of important results follow. First, more economic growth could be achieved without sacrificing the benefits of good air quality. Secondly, the individual taxpayer could benefit from more efficient operations of regulatory agencies.

To obtain a general perspective on the feasibility of developing a market in air pollution entitlements, GAO first reviewed relevant literature, Federal legislation and regulations, and Federal policy statements pertaining to the Clean Air Act, command and control regulation, controlled trading, and a market in air pollution entitlements. The review revealed the critical importance of regulatory reforms under way at EPA, known as controlled trading, which could lead to a limited form of a market. In contrast to command and control regulation, controlled trading gives firms considerable flexibility to choose pollution abatement measures to meet an overall emissions limit. Next, GAO studied efforts under way to implement controlled trading, because a full-scale market in air pollution entitlements

Tear Sheet

within a single industrial plant. If controlling one smokestack is cheaper than controlling another, this kind of flexibility can yield cost savings. Under some circumstances, the "bubble" policy also permits firms to trade in air pollution entitlements to achieve a less costly solution.

The offset policy allows major new industrial plants to be constructed in areas of the country which do not presently comply with the air quality mandates of the Clean Air Act. The owner of such a new plant must obtain external offsets--emission reductions--from owner(s) of existing plants.

The third component of controlled trading, banking, facilitates the use of bubbles and offsets by creating a central clearing facility, thereby making emission reductions more readily available.

Controlled trading is a limited market approach because opportunities to reduce abatement costs without jeopardizing air quality are restricted by certain technology requirements of the Clean Air Act. These requirements include Lowest Achievable Emissions Rate Technology, Best Available Control Technology, and New Source Performance Standards. As a result, a major new industrial plant may have to be equipped with stringent pollution controls, even though it might be cheaper for this plant to adopt weaker controls and, through trading, pay other companies to curtail their pollution.

OBSTACLES TO IMPLEMENTING A MARKET IN AIR POLLUTION ENTITLEMENTS

Many of the implementation problems in controlled trading are particularly relevant in assessing the feasibility of a market. This is especially true in arranging external offsets. Transaction costs in the air pollution permit process and search costs are cases in point. In the air pollution permit process, the regulator and regulatee incur transaction costs in negotiating the proper level of pollution abatement to comply with the Clean Air Act. In arranging external offsets, delay and expense can arise in the permit process in determining whether emission reductions at the offsetting sites, usually at existing industrial plants, are large enough to offset the emission increases at the proposed new plant. The answer

The major problems encountered in the permit process, namely disputes about the efficiency of pollution control equipment, the accuracy of offsetting emission reduction estimates, and the bona fide nature of some offsets, do not appear to be insurmountable. The search for offsets can be facilitated in the future by emission reduction banking in the Bay Area.

CONTROLLED TRADING IN LOS ANGELES

Given the severity of air pollution and the stringency of control measures in Los Angeles, that area's offset and banking experience can be considered as controlled trading "under duress." In particular, a greater potential conflict concerning the bona fide nature of offset candidates can be expected in Los Angeles, as the regulator seeks additional regulations to correct Clean Air Act violations. This factor and uncertainty associated with the effectiveness and cost of unusually stringent, state-of-the-art pollution controls there are not likely to make search easy. Yet, external offsets have been negotiated in Los Angeles.

Like San Francisco, Los Angeles' offset experience suggests that ownership of air pollution entitlements is being vested in existing firms, at least in a de facto sense. However, the permanency and intactness of these property rights are unclear. So long as that area's air quality management plan is judged deficient in meeting the Clean Air Act, new regulations can be expected to erode the value of these de facto rights.

OBSTACLES TO IMPLEMENTATION DO NOT APPEAR INSURMOUNTABLE

Based on GAO's case studies the problems impeding the widespread use of controlled trading and the eventual emergence of a full-scale market in air pollution entitlements do not seem unresolvable. GAO believes that many of these problems are primarily due to the novelty of trading in air pollution entitlements.

MATTERS FOR CONSIDERATION BY THE COMMITTEES

The committees should consider rewriting some provisions of the Clean Air Act which currently prevent controlled trading from evolving into

Contents

Page

TABLE

FIGURES

ABBREVIATIONS

AQCR	Air quality control region
BAAQMD	Bay Area Air Quality Management District
BAC	Bay Area Council
BACT	Best available control technology
CBE	Citizens for a Better Environment
CEQ	Council on Environmental Quality
CO	Carbon monoxide
EPA	U.S. Environmental Protection Agency
ERC	Emission reduction credit
HC	Hydrocarbons
LAER	Lowest achievable emissions rate
NAAQS	National ambient air quality standards
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NSPS	New source performance standards
NSR	New source review
PG&E	Pacific Gas & Electric
PM	Particulate matter
PSD	Prevention of significant deterioration
RACT	Reasonably available control technology
SCAQMD	South Coast Air Quality Management District
SIP	State implementation plan
SO_2	Sulfur dioxide
VOC	Volatile organic compounds

Criteria pollutant -- Any one of five contaminants subject to the National Ambient Air Quality Standards.

Discount rate -- The percentage reduction in the value of emission reduction credits at the time of their use, to reflect new regulations to meet the National Ambient Air Quality Standards.

Emission limitation -- Any regulation specifying maximum allowable discharge of a given pollutant into the atmosphere and requiring the use of specific types of fuel and/or pollution control equipment.

Emission reduction banking -- The U.S. Environmental Protection Agency's policy allowing a company or source to reduce its emissions beyond what is required by law, regulations, permits, etc., and "bank" this reduction for future use.

Emission reduction baseline -- The level of emissions below which a source must reduce its emissions so as to constitute an "emission reduction." Generally, it is the more stringent requirement of actual or allowable emissions. But this will depend on how the State Implementation Plan was developed and the specific policy of that locale in satisfying the requirements of the Clean Air Act.*

Emission reduction credits (ERCs) -- The commodity which is "banked" and can later be used by a source to satisfy the required emission limits contained in its permit. The ERC is the end product of the conversion of emission reductions. ERCs are used by being converted back into physical pollution units, after being discounted (if necessary) to satisfy ambient air quality requirements.*

Emission offset -- Emission reductions from existing pollution sources within a nonattainment area required as a condition for approval of a major new polluting source.

Emission standard - See emission limitation.

Lowest Achievable Emission Rate (LAER) -- The most stringent emission limitation contained in any State Implementation Plan or achieved in practice. LAER technology is generally more stringent than New Source Performance Standards (NSPS).

---

*U.S. Environmental Protection Agency, "Emission Reduction Banking Manual," September 1980.

Source -- Any building, structure, facility, or installation which emits any air pollutant. A source may include several specific emitting points, but is limited to those owned by a single legal entity.*

State Implementation Plan (SIP) -- The legal mechanism, subject to approval by the U.S. Environmental Protection Agency, by which a State proposes to achieve and maintain the ambient air quality requirements of the Clean Air Act.*

---

*U.S. Environmental Protection Agency, "Emission Reduction Banking Manual," September 1980.

CHAPTER 1

INTRODUCTION

The Clean Air Act has limited the degree to which outdoor air can be polluted. According to the Council on Environmental Quality (CEQ), $22 billion was spent in 1979 alone to comply with the Act. The principal reason for undertaking this study has been to explore the possibilities of lowering this price tag for clean air through using economic incentive approaches to air pollution control.

One such approach is a market in air pollution entitlements. Such entitlements allow emissions consistent with present standards governing outdoor air quality. Recently, the U.S. Environmental Protection Agency (EPA) promoted a number of regulatory reforms, commonly called "controlled trading," which could culminate in a limited market in air pollution entitlements. Within certain bounds, controlled trading allows firms to find cheaper ways to meet existing air pollution control mandates. Generally, conventional regulation has left little or no room for flexibility necessary for firms to find cheaper or more efficient ways to meet the air quality objectives of the Clean Air Act. This traditional system, commonly known as command and control, is characterized by rules commanding specific methods of pollution control and limits on the amounts of pollution from each industrial plant and even from each source of pollution within a plant.

By contrast, an economic incentive approach such as controlled trading would allow firms considerable choice in complying with the air quality mandates of the Clean Air Act. A firm might be allowed to meet an overall limit on pollution from its entire facility by freely choosing where and by how much to control pollution from that plant. Or, firms might be allowed to meet an overall limit on pollution from their combined facilities. If it were cost effective, one firm might pay other companies to control their pollution, rather than control that same amount of pollution itself. In this arrangement, where one firm elects to pay for pollution controls by another firm, we have the makings of a market in air pollution entitlements.

This report focuses on the problems of implementing this novel approach to air pollution control. With this emphasis in mind, a main premise of this study is that a workable system of controlled trading is necessary for emergence of such a market in air pollution entitlements. Accordingly, we paid special attention to applications of controlled trading and, as a result, witnessed firsthand the types of problems that must be resolved to implement a full-scale market in air pollution entitlements.

Among these implementation problems, we explore the role of transaction costs and uncertainty in the operation of controlled trading and any subsequent market evolution. These transaction

OBJECTIVES, SCOPE, AND METHODOLOGY

In theory, a market in air pollution entitlements can possibly save society billions of dollars relative to the price tag currently imposed through command and control regulation to meet the requirements of the Clean Air Act. Our objective in this study is to explore whether development of such a market is feasible, recognizing that numerous obstacles stand in its way.

To meet these objectives, we first reviewed the literature, Federal legislation and regulations, and Federal policy statements pertaining to the Clean Air Act, command and control regulation, controlled trading, and a market in air pollution entitlements. This research effort gave us an adequate perspective on the general feasibility of a market, which, in turn, serves as a useful benchmark for judging our findings from a select number of local jurisdictions.

Second, we performed extensive field work in California, in the Los Angeles and San Francisco areas, from July 1980 to February 1981. Much of the controlled trading directly pertinent to a market has occurred in California. So we believed that outstanding transaction costs and other implementation problems were more likely to be apparent there than in other places where little, if any, trading had occurred.

Relatedly, the nature of the problem suggested that many of the costs and problems of implementation were due to the novelty of controlled trading and a full-scale market, and to the complexity of air pollution control. Although the size and relative importance of these implementation problems are sure to vary from one metropolitan area to another, markets anywhere would be subject to a common set of implementation problems. For these reasons, a case study of California was judged sufficient to meet our objectives. Although Los Angeles has probably the worst air pollution problems of any large metropolitan area in the country and California has some of the most stringent regulations, we believe that these distinctions, on balance, make problems of implementation clearer. And, more importantly, the California experience, because of these distinctions, may be a worst-case scenario for controlled trading in metropolitan areas.

not have to justify "different standards for different industries." Whether an NSPS can be met by an industry was to be "decided on the basis of information concerning that industry alone." 1/

In contrast to its approach to new sources, the Act's provisions for controlling emissions of existing stationary sources were generally less specific. Rather than mandating specific emission standards, the Act stipulated that for each of 247 air quality control regions (AQCRs), States submit SIPs specifying emission limitations directed to existing stationary sources. 2/ 3/ In setting these limits, EPA assisted the States by issuing control technique guidelines containing information on the technology and costs of emission control. 4/

In controlling emissions from new and existing sources, however, there is one common element, "some level of control of emissions which is practical to ask all members of a well-defined class of emitters to achieve and that level of control should be achieved by all members of the class...." 5/ 6/

THE CLEAN AIR ACT AMENDMENTS OF 1977

Far-reaching amendments to the 1970 Act were made in 1977. Important amendments concern prevention of significant deterioration (PSD) in areas with better air quality than the NAAQS require, and address the problem of meeting the NAAQS in nonattainment areas. 7/ The PSD provisions set ceilings on allowable increases of particulate matter (PM) and sulfur dioxide (SO_2) concentrations in the air. The PSD amendments also contain, among others, the following conditions for permitting major new projects in attainment areas:

1/Background Information for New Source Performance Standards, vol. 3, U.S. EPA, Office of Air & Water Programs, Research Triangle Park, N.C., Feb. 1974, p. 128.

2/42 U.S.C. §7411(d) (Suppl. III 1979); R. Liroff, "Air Pollution Offsets," pp. 3,4.

3/S. Blacker et al., "Measurement and the Law," p. 171.

4/Ibid., p. 171.

5/Ibid., pp. 198-99.

6/The Council on Environmental Quality, "Environmental Quality-1979, The 10th Annual Report," Washington, D.C., December 1979, p. 670.

7/E. Murov,"Environmental Law," p. 911.

including such reduction in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology (RACT)." 1/ RACT is generally defined as a set of pollution control techniques which are less stringent than the NSPS. Additionally, in nonattainment areas violating the ozone (O_3) and/or carbon monoxide NAAQS, SIPs must also contain RACT for mobile sources.

Economic incentives

The promise of economic incentive approaches, including a market in air pollution entitlements, in the context of the present Clean Air Act has been aptly summarized by the Council on Environmental Quality (CEQ). On the one hand, uniform percentage reduction requirements from all dischargers within an industry ignore variations in pollution control costs among firms in that industry. 2/ The CEQ explains that "inefficiencies of this kind (have been) tolerated for several reasons, the most important being the appearance of equity." 3/ On the other hand, "another potential source of inefficiency" has consisted of "the de facto requirement that new sources of air...pollution install specific technology to abate their pollution." 4/

CONTROLLED TRADING

Since the Congress adopted the 1977 Clean Air Act Amendments, EPA has introduced an economic incentive approach known as controlled trading to take advantage of potential cost savings in air pollution control. Controlled trading consists of the bubble policy, the offset policy, and emission reduction banking. These policies are subject to the same air quality constraints of the Clean Air Act as their command and control counterparts.

The bubble policy

The bubble policy, initiated in December 1979, considers that an imaginary enclosure is placed over an industrial plant. From this enclosure, or bubble, a maximum allowable level of emissions is permitted. A firm in this bubble would be free

---

1/42 U.S.C. §7502(b) (Supp. III 1979). Reasonable further progress means "annual incremental reductions in emissions of the applicable air pollutant...which are sufficient...to provide for attainment of the applicable NAAQS" in nonattainment areas by Dec. 31, 1982, or, where such attainment is not possible for ozone and/or carbon monoxide, by Dec. 31, 1987.

2/"Environmental Quality-1979," p. 671.

3/Ibid.

4/Ibid.

Emission reduction banking

This policy, in a sense, ties together the previous two policies. EPA recognized that emission reduction banking could facilitate the use of both offsets and "bubbling" by having in storage and ready for use emission reduction credits. For example, a firm, anticipating future expansion or growth of itself or of other companies in its area, might find it advantageous to curtail its pollution by more than what the law required. This additional surplus reduction in its emissions could then be banked and kept for its own future use or transfer to others.

Some important banking provisions of the January 1979 interpretative ruling stipulated that States would assume the role of banker and would be "free to govern ownership, use, sale, and commercial transactions in banked emission offsets as it sees fit." 1/

1/40 C.F.R., Part 51, App. S (1981); 44 Fed. Reg. 3282 (1979).

USING ECONOMIC INCENTIVES

Several studies of different pollutants have explored the cost differences associated with various approaches to regulating emissions. These studies typically examine a specific pollutant in a particular Air Quality Control Region (AQCR). Making use of an actual inventory of the emissions of existing sources, information on the abatement costs of each source, and an air quality model that indicates how emissions from the source affect ambient air quality in the region, a typical study determines the least-cost solution for attaining one or more air quality objectives.

Particulate emissions in the St. Louis AQCR

Atkinson and Lewis have made one such study of particulate emissions in the St. Louis AQCR. 1/ Based on the 27 largest industrial sources in the area, the study accounts for approximately 80 percent of total particulate emissions. Atkinson and Lewis compared a command and control system consisting of a "representative set of emission regulations" to the least-cost solution for attaining the Federal primary standard for particulate concentrations. They estimate that abatement costs under the command and control system are about 10 times as large as the least-cost outcome.

Nitrogen dioxide emissions in the Chicago AQCR

A similar type of study of nitrogen dioxide (NO_2) emissions, this time for the Chicago AQCR, yields roughly comparable results to the Atkinson-Lewis findings. 2/ In their study, Anderson et al. explored the levels of abatement costs associated with different policy measures to restrict emissions from 797 point sources in the AQCR. Taking a standard for NO_2 concentrations of 250 $\mu g/m^3$, Anderson et al. found that the least-cost solution involves annual abatement costs of $21 million. Using the crudest sort of command and control policy, a simple across-the-board rollback of emissions of the same percentage for all polluters results in an annual cost of $254 million--approximately 12 times the costs associated with the least-cost solution.

1/Scott E. Atkinson and Donald H. Lewis, "A Cost Effectiveness Analysis of Alternative Air Quality Control Strategies," Journal of Environmental Economics and Management, November 1974, pp. 237-50.

2/Robert J. Anderson, Jr., et al., "An Analysis of Alternative Policies for Attaining and Maintaining a Short-Term NO_2 Standard" (MATHTECH, Inc., Princeton, N.J), 1979.

CHAPTER 4

IMPLEMENTING A MARKET IN AIR POLLUTION ENTITLEMENTS

In chapter 3, we looked at the potential for cost savings in using economic incentive approaches to air pollution control. Realizing these savings depends crucially on the ability to overcome a number of obstacles that could inhibit implementing such an economic incentive approach. Accordingly, in this chapter, we present a general framework useful for identifying and resolving implementation problems.

We begin by assuming that any feasible economic incentive approach must be at least as effective as the present regulatory system in meeting the air quality objectives of the Clean Air Act. Secondly, we assume that ongoing policies by EPA--i.e., controlled trading--could represent a steppingstone from command and control to a marketable entitlement scheme.

In this chapter, we investigate technical, legal, and regulatory issues to see how they may obstruct or encourage developing controlled trading and an eventual full-scale market in air pollution entitlements. Particularly, we focus on factors that may impede using external offsets--one of three controlled trading policies being implemented by EPA. In chapter 2, we observed that external offsets are particularly significant in evaluating the feasibility of a market.

PROBLEMS ARE POSED DUE TO THE INTRINSIC PROPERTIES OF OUTDOOR AIR

Unlike conventional resources such as capital and real estate, air cannot be easily transformed into excludable private property to be parcelled out among competing users. Outdoor air is likely to be less manageable because its quality depends upon complex factors such as weather and chemical reactions. These factors affect the dispersion characteristics of air pollution. Thus, air quality is a better example of a public, nonexcludable good than of a private good. Consumption of a public good is typically characterized by benefits and costs accruing to paying and nonpaying beneficiaries alike.

Another ramification of this difficulty in parcelling out air quality is controlling overall use of the outdoor air. Difficulty in tracking the air quality effects of emissions from different users increases the probability that some pollution will go undetected and ambient air quality standards will be violated.

To a limited extent a common tool called an air quality model is employed in parcelling out air quality and ensuring compliance with the air quality standards governing overall use. This model traces the movement of a plume of smoke from the stack

TRANSACTION COSTS CAN SIGNIFICANTLY INFLUENCE FEASIBILITY OF MARKET DEVELOPMENT

The technical problems of converting air quality into excludable private property are fundamentally linked to costs incurred in the permit process to negotiate the proper level of pollution abatement. It is useful to interpret these transaction costs as incurred and imposed primarily to reduce the risk or uncertainty of violating the Clean Air Act. Assuming that these costs are incurred to ensure good air quality management, two basic pieces of information--accurate data on emissions and their effect on outdoor air quality--are necessary. Providing this information can be a principal cause of sizable transaction costs in the permit process.

The engineering analysis necessary to estimate emissions may be complicated by several factors. How the product which generates pollution as a byproduct is to be made, including what types of inputs are to be used, and how much of the product will be made, must be addressed. The effect of pollution control technology on emissions must also be gauged. The above analysis is further complicated by decisions on the appropriate control technology, especially when BACT or LAER are mandated, since they are to be determined on a case by case basis.

With emission estimates, control technology, and the results of air quality modeling in hand, the regulator must then decide whether to conditionally approve a construction permit. This preliminary decision may then have to be reviewed by other regulatory agencies such as EPA. The public may have an opportunity to scrutinize the basis for this decision, and appeals and litigation can follow. Final approval of the construction permit only allows the firm to build the project. Operating the project depends on approval of an operating permit. Before this operating permit may be granted, further engineering analysis may be necessary.

When an operating permit is granted, the project can be considered "in compliance." However, meeting these permit requirements does not ensure this project's continuing compliance with the Act. Enforcement may entail an annual review of the effectiveness of pollution controls, a periodic check on input use and capacity utilization, and possible air quality and emissions monitoring. For external offsets, these permit requirements will usually apply to more than one firm because an external offset normally requires air pollution controls at the proposed project and at an offsetting source.

The other type of transaction costs relevant to the feasibility of a market in air pollution entitlements is search costs. Search costs pertain to the expense and time of gathering information on the availability and prices of air pollution entitlements between two or more firms. These costs are generic to trades in air pollution entitlements between two or more firms.

in the same basin, he might be very reluctant to sell entitlements if he knew about this link between controlled trading and command and control. Instead, he might prefer to hoard entitlements or sell them at only very high prices. Such behavior would lead to higher search costs incurred by prospective buyers. Finally, for every entitlement traded in a market, where a new control was revealed, the demand for many more entitlements in a market could be precluded, as BACT and LAER became increasingly strict. A firm envisioning a new major project might avoid all possible market opportunities for fear that such transactions might signal tougher controls on its future project.

Enforceability in a market for air pollution entitlements

To compare adequately enforceability between a command and control system and a market entails recognizing that the relevant choice is either command and control regulation that accommodates economic growth or a market, with some common constraint governing acceptable air quality, namely, the NAAQS. Suppose a new facility is envisioned for a nonattainment area but it emits nonattainment contaminants. In a nonmarket scheme, the regulator would free up a reserve of clean air for this facility by making emission regulations on established firms more stringent. Enforceable permit conditions on these offsetting firms would be necessary before approving the new project. Importantly, the same types of control measures and permit conditions would be required in a market scheme using voluntary external offsets. Thus, the enforcement issues under either scheme would be identical.

Finally, enforceability, rather than hindering the adoption of a market, can be an objective or important by-product of a market for air pollution entitlements. Buyers of valuable assets in such a market have an incentive to prevent encroachment of their property. For instance, if a company purchases air pollution entitlements, its interests are served by identifying and preventing "interlopers" from illegally using any part of these entitlements.

Property rights

As suggested earlier, the issue of who owns the air has arisen in applying EPA's offset and banking policies. But a precise resolution of this issue has not been forthcoming. Lack of confidence in pollution control measures adopted to achieve and maintain the NAAQS may be an underlying cause for the concern about vesting companies and individuals with entitlements to pollute. However, one commentator sees section 173(1)(A) of the Clean Air Act as suggesting that regardless of the ownership route

CHAPTER 5

OFFSETS AND BANKING IN SAN FRANCISCO

In this chapter we present the results of a case study of the offset and emissions reduction banking program in the San Francisco Bay Area. We chose the Bay Area for a more detailed analysis because at the time of our audit it was the only region in the country with considerable experience in both banking and offsets.

The Bay Area Air Quality Management District (referred to as BAAQMD), 1/ a local regulatory authority, has primary responsiblity for controlling air pollution in this area, except for pollution caused by motor vehicles (see figure 1). The California Air Resources Board (CARB), the State regulatory authority in air pollution control, has responsibility for motor vehicle emissions.

Since 1977, two types of offsets and a limited form of onsite banking have occurred in BAAQMD. External offsets were authorized by EPA in 1976 and internal offsets, involving emission trade-offs at a single facility, have been allowed by BAAQMD regulations for several years. Tied to the use of internal offsets is BAAQMD's onsite or informal bank. Since December 1977, firms have been able to accumulate emission reductions, not required by laws, rules, or regulations, in this informal bank for their own use as internal offsets.

NEW DEVELOPMENTS IN BANKING

Although an onsite bank has been operating for several years, support for a more versatile emissions reduction bank galvanized in 1979. The Bay Area Council (BAC), a trade association representing several hundred firms in the San Francisco region, advocated this reform because of dissatisfaction with two aspects of the informal bank. Emission reduction credits (ERCs) in this bank were subject to possible confiscation if new regulations imposing more stringent emission standards were levied, and credits in the informal bank could not be used as external offsets.

Striking a balance between regulatory flexibility and investment certainty

In pushing for banking reforms, the Bay Area Council and BAAQMD began designing a formal bank for the Bay Area. The bank, which opened January 1, 1980, was a compromise between the regulator's need for flexibility to change regulations if air quality objectives were jeopardized and industry's need for certainty to

---

1/BAAQMD will also be referred to as the District.

protect the value of its deposits from changing regulations. As a result of this compromise, the value of ERCs in the formal bank are fully protected from future regulation for 3 years from time of deposit. Secondly, a moratorium on deposits provision was enacted. This provision stemmed from industry's desire for unconditional use of what is banked and from the regulator's concern for meeting the NAAQS. In the unlikely event that withdrawing and using ERCs might threaten air quality standards, a moratorium on deposits could minimize this risk.

Reducing transaction costs of external offsets

The Bay Area Council claimed that delays in searching for offsets would be reduced with a pool of usable offsets in the formal bank. Firms could better synchronize their investment plans and their need for air pollution entitlements. Similarly, the California Air Resources Board concluded that "sources seeking offsets potentially could decrease high search costs by being able to go directly to the bank." 1/ And BAAQMD foresees "more readily accessible information concerning what emission reductions credits are potentially available and where." 2/

A community bank proposal

Alongside the formal and informal banks (or "private" banks), the Citizens for a Better Environment (CBE), an environmentalist group, has lobbied for a "community" bank in the Bay Area. According to CBE, the primary purpose of their proposed community bank is "to make offsets available to new sources." 3/ To date, no such community bank exists in the Bay Area.

EXTERNAL OFFSET REGULATIONS

BAAQMD has several simple trading rules to expedite external offsets. Previously, it required a case-by-case analysis to determine needed offsets. Currently, external offsets are triggered by cumulative emission increases of more than 550 lbs. per day for NO_2, and more than 250 lbs. per day for the other NAAQS pollutants, in nonattainment areas. A new project which triggers any of the offset requirements must also install BACT, equivalent to LAER.

1/State of California Air Resources Board, "Public Meeting to Consider Adopting Policy for the Implementation and Review of Systems for the Banking of Reductions in the Emission of Air Contaminants," San Franciso, April 24, 1980, pp. 34-5.

2/D. Goalwin, J. Phillips, BAAQMD, "Practical Aspects of an Emissions Bank," January 1981, p. 10.

3/CBE letter to BAAQMD, October 3, 1980.

project site, and that the HC offset credit had been overstated. This HC offset dispute was finally settled after Wickland agreed to scale down the size of its terminal, and after Wickland and CBE agreed on an estimate of about 73 tons per year as offset credit from Paris Dry Cleaners.

Outside the permit process, Wickland experienced difficulty finding HC offsets. In conducting this search, Wickland concentrated on dry cleaning offsets, showing owners of these establishments a copy of regulations being considered by BAAQMD to control cleaning equipment using Stoddard solvent. But, 130 out of 136 dry cleaners contacted in Contra Costa County were already using perchloroethylene, so they would be unaffected by this regulation. For dry cleaners outside of Contra Costa County, perhaps half of the approximately two dozen contacted were willing to sell, and in December 1978, Wickland negotiated an agreement with one of them, City of Paris Dry Cleaners. Besides dry cleaners, about a dozen other firms were contacted, including chemical manufacturers, paper manufacturers, and oil companies. Most allegedly refused to sell because they wanted to keep their HC offsets for future expansion. In all of these search contacts, it appears that the implicitly understood price for offsets was Wickland's willingness to underwrite any necessary pollution controls.

Outside the permit process, evidence suggests that prospective suppliers of offsets would rather hoard their entitlements, than sell them, at a bid price just covering pollution abatement costs. Given uncertainty about the adequacy of the Bay Area's implementation plan in meeting the NAAQS, and given the novelty of a market in air pollution entitlements, this hoarding behavior is not surprising.

Pacific Gas and Electric Company (PG&E)

To help meet increasing demand for electricity PG&E proposed to expand its power plant complex, called Potrero #7, on San Francisco Bay. PG&E submitted its permit application in March 1979. After reviewing this proposal, BAAQMD informed PG&E in May 1979 that it would have to acquire more offsets. PG&E then revised its application, agreeing to meet a more stringent BACT requirement and to limit the hours of operation of its proposed project. In November 1979, BAAQMD again judged that there were not enough offsets. PG&E then proposed to burn less polluting natural gas, instead of distillate oil, and offered more offsets. However, in July 1980, BAAQMD decided that a number of previously arranged offsets were no longer eligible because of new regulations. In addition, PG&E refused to meet a new, more stringent BACT requirement. In October 1980, PG&E appealed to BAAQMD's hearing board, but withdrew this appeal and the project 2 months later after receiving forecasts of lower demand for electricity.

Besides obstacles encountered in the permit process, PG&E also incurred substantial search costs. PG&E had a study conducted to determine the location of the cheapest offsets. PG&E claims that only one of the major sources contacted during the study wanted to sell pollution entitlements. Most of these sources wanted to use their potential offset supplies for their own future expansion. Expanding its search, PG&E was eventually able to purchase $70,000 worth of options to purchase offsets from dry cleaners using Stoddard solvent. Exercising these options, according to PG&E, would have cost it $1.3 million, but this was still an estimated $19 million cheaper than the alternative, retrofitting existing PG&E facilities with NO_x controls.

USING THE EMISSIONS REDUCTION BANK

Although the Bay Area's formal bank opened in January 1980, its first ERCs were not approved until nearly one year later. A number of factors are probably responsible for this hiatus. Even after the bank's opening, debate continued on a number of very important issues, including a moratorium on withdrawals, treatment of shutdowns, and the alternative posed by a community bank. Controversy over these issues contributed a great deal to uncertainty about the status and final design of the formal bank until these issues were settled in May 1980.

Another crucial factor in reducing demand for the formal bank has been the informal bank. First, the Bay Area did not allow transfer of credits from the informal to formal bank. Second, the informal bank, by disallowing use of its credits for external offsets, may have been perceived as a superior substitute to the formal bank. This can be understood in light of the threat posed to existing firms by the community bank initiative which would "tax" ERCs for deposit in the formal bank. Third, a more stringent certification process and public disclosure requirements of the formal bank may have made using the informal bank more attractive.

Despite these deterrents, four applications for ERCs in the formal bank had been submitted at the time of our review, and one of these--by Hewlett-Packard--had been approved by BAAQMD. That these firms opted for the formal bank is probably due to two factors. The first is the formal bank's pledge to protect the value of its ERCs from subsequent changes in regulations for 3 years from time of deposit. A Hewlett-Packard official cited this pledge as the primary reason for its decision to bank formally. A second factor may be the option available in the formal bank to sell ERCs to other firms.

As a depository of ERCs for possible sale, the Bay Area's formal bank could play an important role in reducing transaction costs of future external offsets. Before these ERCs can be approved, applications for these credits must be scrutinized in the NSR review process. Thus, this rigorous certification process could prevent the type of debacle which jeopardized the

CHAPTER 6

CONTROLLED TRADING IN LOS ANGELES

In this chapter, we focus on external offsets and emission reduction banking in the Los Angeles metropolitan area. The South Coast Air Quality Management District (referred to as SCAQMD) has primary responsibility for controlling air pollution in that area (see figure 2), except for pollution caused by motor vehicles.

THE OFFSET AND BANKING PROGRAM OF THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

External and internal offsets and onsite banking have occurred in SCAQMD for several years. Like San Francisco, onsite banking evolved as a result of New Source Review (NSR) regulations requiring firms to calculate cumulative increases in emissions in determining applicability of BACT. As part of this regulation, firms have been able to accumulate emission reductions not required by laws, rules, or other regulations for use as internal offsets.

To expedite external offsets, SCAQMD proposed establishing an emissions reduction bank in June 1980. One of the provisions of this proposal would allow ERCs presently in the "informal" bank to be transferred to this new institution. Other important features of this proposal include the following:

- banking is voluntary and ERC use is governed by "any discount factor or offset ratio in effect at the time of surrender of the certificate."
- emission reductions scheduled by a tactic in SCAQMD's Air Quality Management Plan are ineligible for banking unless the tactic is not adopted as a regulation by January 31, 1982, or unless the proposed emission reduction exceeds the tactic's reduction.
- a minimum deposit of 150 lbs./day is required "to open an account."
- there is a registration of title to ERCs and issuance of ERC certificates. 1/

1/SCAQMD, Proposed Rule 1309--Emission Banking, July 8, 1980, pp. 32-37.

OFFSET CASES

Port of Long Beach-- Pacific Coast Cement Company

On January 5, 1979, the Port of Long Beach (the Port) submitted an application to SCAQMD for permits to construct and operate a cement terminal. The lessee of this terminal was the Pacific Coast Cement Company.

Problems

According to a Port representative, finding an acceptable offset package was the most time-consuming phase of Pacific Coast Cement's permit process. Once offset candidates had been screened, the Port then approached prospects, offering to pay a price covering all pollution abatement costs, including maintenance and capital costs and the expense of getting through the permit process, necessary to bring about offsets. By June, the Port had identified promising offset sources of NO_2 and HC, owned by Long Beach Oil Development, Inc. (Long Beach Oil). These offsets were in the Port's "own backyard" and were readily available because Long Beach Oil anticipated future regulations requiring them to retrofit these engines. 1/ Additional HC offsets were located at a Long Beach dry cleaner. Like Long Beach Oil, this dry cleaner was willing to supply offsets because it might have to put on this additional control in any event, due to future regulations.

The Port had much greater difficulty finding PM and SO_2 offsets. To satisfy PM offset requirements, SCAQMD sanctioned the Port's use of an interpollutant tradeoff, substituting NO_2 reductions at Long Beach Oil for PM reductions. The Port found an SO_2 tradeoff at a U.S. Steel plant less than 10 miles away. In searching for these offsets, the Port encountered two prevalent responses: either a firm did not want to get involved with the regulator ("a low profile is a less risky way to deal with the regulator") or the company preferred to hoard its pollution entitlements for its own use. 2/ On January 31, 1980, SCAQMD issued a permit to construct the Pacific Coast Cement terminal. Two conditions were required: that pollution control equipment installed at Long Beach Oil and the Long Beach dry cleaner provide 90 percent abatement efficiency, and that U.S. Steel receives and uses a specified amount of low-sulfur fuel.

1/Port of Long Beach memo, May 25, 1979, p. 1.

2/GAO interview, September 23, 1980, with Port of Long Beach.

actual historical emissions rate for the plant as it was operating now and future controlled emissions resulting from its greater utilization later. The result was that very little, if any, offset credit would be available from this plant.

External offsets

Table 1 summarizes major implementation problems in the five California external offset cases which we examined. That all of these offset experiments were staged with little or no precedent is important. This suggests that transaction costs incurred in arranging these offsets could be high. For instance, with time, better information on the availability and prices of offsets may be developed in response to potential profits from trading, and can be expected to reduce search costs, all other things being equal.

The novelty of these experiments also has behavioral implications. Witness the fundamental change in the way that firms meet their air pollution control obligations under controlled trading. For instance, with external offsets, a company can rely on other firms to meet its own obligations. Perhaps due to this novelty, we found no evidence that prospective buyers offered to pay a price which covered more than the direct pollution abatement costs of offsets, even though there are good reasons to expect a higher minimum price asked by the seller.

From the seller's standpoint uncertainty regarding the adequacy of SIPS to meet the NAAQS suggests a more restricted supply of entitlements in the future. Thus, a seller can be expected to ask for a risk premium, above the direct costs of pollution control. On the buyer's side, this bidding behavior may reflect a reluctance to treat air pollution control as an investment in a market context. Buyers appear reluctant to pay more than what it costs the seller to abate, even though buyers may have to pay much more than that to curtail the pollution by their own means. The resulting hoarding problem and low bid prices will diminish if brokers and exchanges respond to the opportunity for profit in such a market and if firms begin to think in terms of profit or cost savings from a market in offsets.

Some transaction costs in the permit process aimed primarily at ensuring compliance with the Clean Air Act can be similarly categorized as transient. Specifically, the problem of conflicting opinion about BACT, which hindered both the Wickland and PG&E cases, could be ameliorated by replacing case-by-case determination with a periodic definition of these standards.

Other problems in the permit process, such as calculating offset credit (in the Port of Los Angeles and Wickland negotiations) and determining necessary offsets (in the PG&E case) also appear to be surmountable. In the case of offset credit, a simply understood rule is needed to identify real emission reductions from offsetting sources. Although a problem in the PG&E case, calculating necessary offsets has generally not been troublesome. The evidence from California suggests that there has been a reliance on an emissions basis with fixed offset ratios as opposed to an air quality modeling basis for determining needed offsets.

There are, however, other problems in arranging offsets which seem more deep-seated. The conflict between offsets and other air pollution control strategies is an example. In the Pacific Coast Cement Company case, evidence suggests that some firms were reluctant to sell offsets because they thought doing so might trigger additional, uncompensated regulation. In a related way, offsets initially approved for PG&E were subsequently declared ineligible because of new regulations. Unless offsets can be made to work as substitutes for other control strategies and not as mutually preemptive measures, this conflict is likely to deter offsets.

Another entrenched problem in the permit process appears to be the basic calculation of emissions. The seriousness of this problem seems to depend on how innovative the project is, as in the Watson case. Similarly, in the Port of Los Angeles case, uncertainty about the feasibility of both offset and project controls and resulting emissions was apparently linked to the innovativeness of the abatement measures being considered.

Significantly, none of the offset negotiations described in table 1 involved using emissions reduction banking and offsets in tandem. However, in all but the Watson case, the potential importance of banking--had a bank been there--is evident. In the Pacific Coast Cement case, a Port of Long Beach official acknowledged that a number of prospective suppliers were eliminated from consideration because what emission reductions they could have supplied were greater than what Pacific Coast Cement needed. Had there been a bank, this official stated that the company might have been willing to negotiate a trade with these suppliers and bank the rest. Thus, absence of a bank may have increased Pacific Coast Cement's search costs.

The sanctioning of interpollutant offsets is one policy adopted by California regulators which probably reduced search costs in the Pacific Coast Cement and PG&E cases. Enforceability and property rights have also been examined as possible impediments to controlled trading and a market in air pollution entitlements. In the offset negotiations which we investigated, there seems to be a pattern of "grandfathering" these rights, i.e., vesting ownership of offset credit with existing firms. These companies appear to have had the prerogative to sell or hoard these rights at the bid price.

Finally, enforcement can be enhanced through a market by requiring firms to report better emissions inventory data as the price for being given the opportunity to achieve sizable cost savings through controlled trading. This kind of linkage has been included in a permit approved in the San Francisco Bay Area.

equivalent air quality at a lower cost, the committees should consider allowing it. The committees should consider replacing case-by-case determination of LAER and BACT with periodic determination of those requirements. As we found in two offset cases in California, a major cause of delay in the permit process has centered on disputes of what constituted BACT, without any clear indication that the delay resulted in a better solution.

The committees should also consider approving the use of interpollutant offsets as they have been used in California. New sources in that State have been able to locate offsets more easily using this method.

The committees should encourage EPA to emphasize a market approach to air pollution control whenever this system can achieve air quality at less cost and is permissible under the Clean Air Act. Specifically, the committees should urge EPA to step up its promotion of emission reduction banking. As revealed in our case studies, this institution has the potential to reduce the sizable transaction costs and uncertainties which have beset external offset negotiations. The committees should also encourage EPA to promote a tie-in between cost savings from controlled trading and a requirement for improved information on emission inventories, to facilitate enforcement.

AGENCY COMMENTS

EPA reviewed a draft of this report and found it "lucid" and "well informed" but drew a conclusion not contained in the report that at present thousands of tons of offsets are "readily available at reasonable prices" in severe nonattainment areas. EPA believes that allowing controlled trading in place of New Source Performance Standards could result in an increase in emissions. On the contrary, we believe that this could lead to better air quality.

A number of industry, environmental, and regulatory officials from the State of California, where our case work was done, also commented on excerpts of the draft. Where appropriate, the report reflects their suggested changes. OMB commented that our report was timely; the Council of Economic Advisers said it was "well done."

Request for copies of GAO reports should be sent to:

U.S. General Accounting Office
Document Handling and Information
Services Facility
P.O. Box 6015
Gaithersburg, Md. 20760

Telephone (202) 275-6241

The first five copies of individual reports are free of charge. Additional copies of bound audit reports are $3.25 each. Additional copies of unbound report (i.e., letter reports) and most other publications are $1.00 each. There will be a 25% discount on all orders for 100 or more copies mailed to a single address. Sales orders must be prepaid on a cash, check, or money order basis. Check should be made out to the "Superintendent of Documents".

could develop from a workable system of controlled trading. Since much of the trading directly relevant to the feasibility of a full-scale market has occurred in California, GAO field work was conducted there.

Throughout the report, GAO relied heavily on economic analysis. In its field work, GAO made every effort to obtain documented evidence on problems of implementation and on potential cost savings of trading in air pollution entitlements.

ECONOMIC BENEFITS OF A MARKET APPROACH TO AIR POLLUTION CONTROL

The traditional air pollution control system, commonly known as command and control, is characterized by rules dictating specific methods of pollution abatement and limits on the amounts of pollution from each industrial plant and even from each source of pollution within a plant. By contrast, a market approach to air pollution control would allow firms considerable flexibility in choosing ways to meet the air quality mandates of the Clean Air Act. For example, a firm might be allowed to meet an overall limit on pollution from its entire facility by freely choosing where and by how much to control pollution within that plant, provided such choices were consistent with the air quality mandates of the Act. Or, several firms might be allowed to meet an overall limit on pollution from their combined facilities. For instance, a steel firm might find it cheaper to pay chemical companies to control their air pollution, rather than control that same amount of pollution itself.

GAO's review of a number of studies suggests that a full-scale market in air pollution entitlements could, in some instances, save industry as much as 90 percent in pollution abatement costs as compared to command and control. In addition, cost data gathered in GAO's field work suggest similar large potential cost savings.

EPA's CONTROLLED TRADING IS A LIMITED MARKET APPROACH

EPA's controlled trading approach consists of the "bubble," offset, and emission reduction banking policies. The "bubble" policy allows variation in pollution controls--instead of uniformity--among individual existing sources of pollution

depends upon estimates of pollution control efficiency and emissions, and the effect of these emissions upon air quality. Differing estimates may be reconciled only after considerable delay and expense.

Search costs pertain to the expense and time of gathering information on the availability and prices of air pollution entitlements. The search for air pollution entitlements can be complicated because air pollution control is so imprecise. For example, uncertainty about the adequacy of current air quality management plans designed to bring certain areas of the country into compliance with the Clean Air Act could lead to tougher regulations in the future to meet any shortfall in compliance. This possible scenario, together with the novelty of trading in air pollution entitlements, could make many reluctant to sell offsets. An individual supplier of offsets might conclude that higher prices are in store, yet have little idea how much higher. This firm might hoard its entitlements until better price information was available.

OFFSETS AND BANKING IN SAN FRANCISCO

The basic elements for developing a market in air pollution entitlements are present in the San Francisco Bay Area. An emissions reduction bank, where suppliers of air pollution entitlements receive credit for pollution curtailments not legally required, offers opportunities to reduce transaction costs in future trading. Cost data on retrofitting existing sources in that area suggest large potential savings from such trading and provide an incentive to trade.

The Bay Area also appears able to ensure an acceptable level of enforceability in controlled trading. One reason is the precedent set in an offset case in the Bay Area where greater flexibility to achieve cost savings was tied to a regulatory requirement for better information on the emissions inventory of the applicant.

As it becomes clear what changes in the air quality management plan are needed to comply with the Clean Air Act and as the novelty of trading wanes, uncertainty and hoarding should become less of a problem in the Bay Area.

a full-scale market capable of achieving our air quality standards at the least cost to society. Specifically, the committees should consider allowing controlled trading in lieu of New Source Performance Standards, Lowest Achievable Emissions Rate Technology (LAER), and Best Available Control Technology (BACT). Where this substitution can yield equivalent air quality at a lower cost, the committees should consider allowing it. In addition, the committees should consider replacing case-by-case determination of LAER and BACT with periodic determination of those requirements. The committees should also consider approving interpollutant offsets as they have been used in California.

The committees should encourage EPA to devote more effort to implementing controlled trading, particularly its promotion of emission reduction banking. The committees should also encourage EPA to promote a tie-in between cost savings from controlled trading and improvements in enforceability.

AGENCY COMMENTS

EPA reviewed a draft of this report and found it "lucid" and "well informed" but drew a conclusion not contained in the report that at present thousands of tons of offsets are "readily available at reasonable prices" in severe nonattainment areas. EPA believes that allowing controlled trading in place of New Source Performance Standards could result in an increase in emissions. GAO believes that this could lead to better air quality. GAO's responses to specific EPA comments are in appendix VII and elsewhere in the report.

A number of industry, environmental, and regulatory officials from the State of California, where GAO's case work was done, also commented on excerpts of the draft. Where appropriate, the report reflects their suggested changes. OMB commented that GAO's report was timely; the Council of Economic Advisers said it was "well done."

GLOSSARY

Air quality control region or area -- A geographical area defined by the U.S. Environmental Protection Agency for the purpose of implementing regulations necessary to attain National Ambient Air Quality Standards.

Air quality management plan -- See State Implementation Plan.

Ambient air -- Atmosphere (outside of buildings) accessible to the public.

Ambient air quality standard -- A standard establishing the maximum allowable concentration of pollutant in the ambient air.

Attainment area (with respect to a given pollutant) -- A geographical area which complies with the National Ambient Air Quality Standards for a given pollutant.

Best Available Control Technology (BACT) -- An emission limitation based on the maximum degree of reduction of each pollutant, after taking into account energy, environmental, and other economic costs.

Bubble -- The U.S. Environmental Protection Agency's alternative emission reduction option which, when incorporated into a State Implementation Plan, allows a source to reduce control requirements at one point by increasing controls correspondingly at another. The bubble can be applied both within a single plant and between different plants in the same area.*

Command and control -- A regulatory scheme based on rules which apply specific uniform emission limits--generally based on known feasible control technology--to every emission point within a regulated process.

Control technique guidelines -- Guidelines issued by the U.S. Environmental Protection Agency to assist State and local pollution control authorities in deriving means for achieving and maintaining air quality standards through existing source control.

Controlled trading -- A regulatory scheme which applies the profit motive to pollution control, allowing any source to meet its pollution control responsibilities by securing required emission reductions from any points within its own or other facilities, so long as air quality and the enforceability of the resulting trade in levels of control remain equivalent.

---

*U.S. Environmental Protection Agency, "Emission Reduction Banking Manual," September 1980.

Major new stationary source -- For purposes of implementing the Prevention of Significant Deterioration (PSD) provisions in the 1977 Clean Air Act Amendments, any source defined in any of 28 industry categories potentially emitting up to more than 100 tons/year of any pollutant, or any other source with emissions of more than 250 tons/year of any pollutant regulated under the Clean Air Act; for purposes of implementing the nonattainment provisions of the 1977 Amendments, any source potentially emitting up to 100 or more tons/year of any pollutant covered under the Act.

National Ambient Air Quality Standards (NAAQS) -- Standards governing maximum concentrations of contaminants in the outdoor air, typically stated as micrograms of pollution per cubic meter of air.

Permit -- The emission restrictions placed by the Air Pollution Control Authority on a specific source. The permit may specify a specific emission limit, require a percentage removal of a pollutant, or dictate a particular work practice. Where possible, the permit conditions should be used as the baseline for evaluating emission reductions.*

Pollution controls -- The means by which an emission reduction is achieved. Generally, this would be used in referring to the technological controls installed by a source--scrubbers, electrostatic precipitators, or other abatement equipment. However, it includes any measure taken to create emission reductions--shutdowns, cutbacks, altered work practices, alternation of inputs or production processes, etc.*

Prevention of Significant Deterioration (PSD) -- Provisions of the 1977 Amendments which establish three classes of attainment areas. The purpose of these provisions is to prevent existing ambient air quality with respect to sulfur oxides and total suspended particulate matter from deteriorating more than an established amount beyond baseline pollution concentration levels.

Reasonably Available Control Technology (RACT) -- Emission limitation that represents the lower limit that a particular source is capable of meeting by applying control technology that is reasonably available considering technological and economic feasibility.

Reasonable Further Progress (RFP) -- The requirement under the Clean Air Act that areas designated nonattainment achieve annual incremental steps toward satisfying ambient air quality standards by the designated deadlines.*

---

*U.S. Environmental Protection Agency, "Emission Reduction Banking Manual," September 1980.

costs are distinct from their more widely recognized "brethren," namely, capital and operating costs of pollution abatement. However, transaction and abatement costs are functionally related. Transaction costs represent the time spent and direct cash outlays in the actual negotiation of the proper level of abatement and, hence, pollution. Under the conventional system of air pollution control, the decision on abatement is made ultimately by the regulator or the court and is the culmination of the air pollution permit process. In this report, we assume that the traditional permit process and associated transaction costs would be an integral part of a market in air pollution entitlements. This assumption is consistent with the way in which controlled trading is evolving from the conventional system.

We also consider another type of transaction costs, one which would accompany any attempt to meet the air quality objectives of the Clean Air Act in the least costly way. In a market, a potential buyer of air pollution entitlements must find out how many entitlements are for sale and at what prices if he wishes to minimize his pollution control costs. This search effort is typical in any market, whether it be in air pollution or peanuts. But, in an unorganized and infrequently used market, these search costs can be very high.

We also investigate a number of other implementation problems which do not fit neatly under the rubric of transaction costs. One is the potential uncertainty in a market in air pollution entitlements. Simply put, there may be little assurance that air pollution control measures in place now are adequate to bring various regions of the country into compliance with the air quality objectives of the Clean Air Act. As a result, there may be a good deal of uncertainty about the future supply of air pollution entitlements and a reluctance on the part of companies to sell entitlements now, especially if they have to buy pollution control equipment or entitlements later at a greater expense. Similarly, some regulators may fear that controlled trading and a market may somehow limit their options for future controls--if they are needed for compliance--because of market connotations regarding property rights.

More generally, any uncertainty associated with controlled trading and a full-scale market in air pollution entitlements is also likely to be due to the novelty of the experiment. For instance, a market poses a fundamental challenge to the way in which firms have met their regulatory obligations in the past. Rather than being told exactly what to do by a regulator to comply with the law, controlled trading and a market would leave more of this decision up to the firm. A market would also make one company potentially reliant on another to meet air pollution control obligations. As with any market, when specialization and trading offer the opportunity for greater economic achievements at the cost of some added risk, so too does a market in air pollution entitlements.

CHAPTER 2

THE PRESENT APPROACH TO AIR POLLUTION CONTROL

In this chapter, we review major provisions of the Clean Air Act and strategies adopted by EPA to implement the Act. First, this review sheds light on the salient features of command and control regulation, and describes the air quality mandates likely to constrain the operation of any market approach. Secondly, it also reveals the evolution now under way, in which economic incentives are grafted onto the conventional system through controlled trading.

THE CLEAN AIR ACT OF 1970

The Clean Air Act of 1970 is the cornerstone for defining and controlling minimum outdoor air quality in the United States. This Act protects our outdoor air quality in three principal ways. First, national ambient air quality standards (NAAQS), setting minimum standards for outdoor air quality, were established, and a planning mechanism for meeting these standards was introduced. This mechanism, commonly known as the State Implementation Plan (SIP), underscores the States' responsibility for implementing this Act. Secondly, the Act authorized emission standards--typically controlling how much pollution is emitted from a smokestack--for stationary sources of pollution. Thirdly, various measures, such as exhaust standards, were set to control pollution from mobile sources. 1/

To control emissions from stationary sources, the Act provided several measures. The principal way was to incorporate emission standards for new sources of pollution in the SIPS. 2/ Known as new source performance standards (NSPS), they set maximum emission rates for specific categories of new stationary sources. These NSPS are based upon "the best available technology, taking into account the cost of achieving such reduction." 3/ In accounting for costs, the courts instructed EPA to choose those control techniques "which would not render the source's ultimate product noncompetitive." 4/ Secondly, EPA did

---

1/S. Blacker et al., "Measurement & the Law: Monitoring for Compliance with the Clean Air Amendments of 1970," Intern. J. Environmental Studies, 1977, vol. 11, p. 169.

2/E. Murov, "Environmental Law: Attaining and Maintaining Air Quality Standards Under the 1977 Clean Air Act Amendments," Tulane Law Review, vol. 53, no. 3, April 1979, p. 909.

3/S. Blacker et al., "Measurement and the Law," p. 174.

4/E. Murov, "Environmental Law," p. 912.

- adoption of best available control technology (BACT), an emission control at least as stringent as NSPS.

- ambient air quality impact analysis.

- public review.

Similarly, in nonattainment areas, with air quality worse than the NAAQS, entry of a major new firm or modification of an existing firm is subject, among other things, to the following requirements: 1/

- procuring emission offsets, or emissions reductions, from established firms, so as to result in an improvement in air quality.

- adopting lowest achievable emissions rate technology (LAER), the most stringent control measure used anywhere.

These PSD and nonattainment provisions will "generally increase the lead time for obtaining required permits to construct." 2/

The 1977 Amendments affect more than just these new projects. For nonattainment areas, these Amendments require of SIPs "implementation of all reasonably available control measures as expeditiously as practicable" and "reasonable further progress,

---

1/LAER is to be "superior to the advanced technology normally required by New Source Performance Standards" [Richard Liroff, "Air Pollution Offsets, Trading, Selling, and Banking" (Washington, D.C.: The Conservation Foundation, 1980), p. 7.] In other words, cost is "to be given less weight in a LAER determination than in the NSPS case" (ibid., p. 8). By LAER is meant, "for any source, that rate of emissions based on the following, whichever is more stringent:

- the most stringent emission limitation which is contained in the implementation plan of any state for such class or category of stationary source, unless the owner...demonstrates that such limitations are not achievable; or,

- the most stringent emission limitation which is achieved in practice by such class or category of stationary source." 40 C.F.R. Part 51, Appendix S (1981).

2/B. Goldsmith, J. Mahoney, "Implications of the 1977 Clean Air Act Amendments for Stationary Sources," Environmental Science and Technology, vol. 12, no. 2, February 1978, p. 144.

to use more cost-effective pollution controls than are usually allowed. Previously, a uniform level of pollution may have been allowed from each source of air contaminants within this plant. But, a regulation specifying that each smokestack of a factory curtail its emissions by 80 percent glosses over the fact that controlling one smokestack more and another less may be cheaper. Moreover, EPA has begun to address the inefficiencies related to uniform percentage reduction requirements from all dischargers within an industry and has expanded its bubble policy to include multi-plant applications encompassing more than one industry. Firms within this bubble are given the flexibility to swap air pollution rights to achieve a less costly solution to an overall emission limit. For example, one firm may be able to curtail a given amount of pollution at one-half the cost of another firm. A multi-plant bubble provides an economic incentive for the high-cost firm to finance additional pollution controls by the low-cost firm.

The bubble policy has not made as many inroads on the other source of inefficiency cited by the CEQ, namely, "the de facto requirement that new sources of air pollution install specific technology to abate their pollution." Multi-plant bubble applications cannot be used in lieu of LAER for nonattainment pollutants and multi-plant bubbles cannot be used as substitutes for BACT or NSPS.

The offset policy

This policy allows major new firms to enter nonattainment areas, provided they offset their emissions with emission reductions obtained from existing firms. Such reductions are commonly known as external offsets. Additionally, an existing firm contemplating a major modification in a nonattainment area may do so by arranging emission reductions from other firms. The offset policy is more cost-effective than the previous EPA stance which forbade the entry of major new companies in nonattainment areas. Also, prior to this policy, a major modification of a facility required that the owner reduce emissions in other parts of the plant. In some of these cases, external offsets may be cheaper.

External offsets are significant in evaluating a market in air pollution rights. Like multi-firm bubbles, these offsets may involve buying and selling air pollution entitlements. For example, one firm may pay other firms to curtail their own emissions. But, unlike multi-firm bubbles, external offsets had occurred at the time of our audit. Application by companies of external offsets has been severely limited by the requirement for LAER, which minimizes the amount of pollution that can be swapped. As in the case of multi-firm bubbles and BACT, external offsets cannot be used in lieu of LAER. In addition, external offsets cannot be used in place of NSPS.

CHAPTER 3

AN ALTERNATIVE APPROACH TO AIR POLLUTION CONTROL: USING ECONOMIC INCENTIVES

HOW ECONOMIC INCENTIVES REDUCE ABATEMENT COSTS

The reason is quite straightforward for expecting economic incentive approaches to be less costly in meeting the air quality objectives of the Clean Air Act than their command and control counterparts. Suppose, for example, that in a certain air shed 1/ the total emissions of a particular pollutant need to be cut in half to meet the prescribed standard. Under a command and control approach, the environmental authority might issue permits to individual polluters limiting their emissions, or alternatively might require specific abatement technologies for the different sources. For example, suppose that since total emissions must be reduced by 50 percent, the regulatory agency requires each polluter to reduce or "roll back" his emissions by 50 percent.

The inefficiency inherent in such an approach is apparent. The costs of abatement will typically vary among polluters so that an order to reduce emissions by 50 percent will result in considerably more expenditures on abatement by some polluters than others. But to minimize abatement costs, an environmental program should generate the greatest reduction in emissions where it is the cheapest to do so.

It would be extremely difficult for a regulator to amass all the necessary information on relative abatement costs before setting abatement quotas for each polluter. Moreover, since abatement technology and hence costs change over time, any initial set of quotas would soon be out of date. The attraction of the market approach is that it can generate automatically the least-cost pattern of abatement efforts without making heavy demands on the regulator. Suppose, for example, that a steel factory can reduce its sulfur emissions for $.20 per pound, while abatement costs for the chemical plant are $.10 per pound. If there were a price for sulfur emissions of, say $.15 per pound, then the cutbacks in emissions would take place where it is cheapest. The chemical plant would find it less expensive to reduce its emissions than to pay for the right to emit, while the steel factory would avoid the relatively costly abatement and pay for the right to continue its emissions.

1/For purposes of air quality management, an air shed is a space within which all or a sizable amount of the regulated pollutant disperses. An air shed can be thought of as a fallout basin.

An alternative command and control policy which involves uniform pollution controls across all firms within broad pollution-source categories was found to be less costly, but still more than four times more expensive than the least-cost outcome.

Innovation in abatement technology

We stress that the estimates of cost savings in the preceding studies are static in nature: they are based on existing abatement technology. The savings noted in those studies result simply from rearranging abatement quotas among polluters to get the largest cutbacks in emissions where control costs are the lowest. What may be of even greater quantitative significance are advances in abatement technology that produce less costly techniques for reducing emissions.

From this more dynamic perspective, economic incentives may stimulate research and development of new abatement technology by making such research and development directly profitable to private firms. A firm faced with paying for its emissions will find that developing more effective control techniques reduces costs and increases profits. In contrast, existing environmental programs, particularly those like NSPS that prescribe control procedures for each source, mute incentives for innovative efforts by polluters. It can even be in the interest of polluters, under some circumstances, to resist the introduction of new control technology.

of a factory, for example, through time and space, showing how the plume spreads with distance from the smokestack by means of a mathematical description of atmospheric diffusion. This model generally requires two types of input data: plant--or source--data, including emission rates and stack characteristics, and meteorological data. Unfortunately, the lack of good meteorological and source data has prevented air quality models from being precision instruments.

On implementing a market

What is the appropriate definition of outdoor air quality to be traded in a market in air pollution entitlements? Within a given air shed, the answer depends on the ease with which emissions from a smokestack translate into effects upon air quality. This can be a function of the accuracy of air quality models and the dispersion characteristics of the pollutants in question.

For widely and evenly dispersed contaminants, the entitlement to emit an air pollutant and the entitlement to pollute the outdoor air are barely distinguishable. The location of polluters is not critical to air quality within a fairly large fallout basin. Accordingly, an appropriate role for air quality modeling may be to set an overall emissions limit consistent with meeting the NAAQS in a fairly broad geographical area. Once this limit has been established, trading in air pollution entitlements would be equivalent to trading in emission entitlements. A prospective buyer who wished to have the right to emit 10 more tons per year would simply negotiate a reduction of 10 tons per year from other firms in the fallout basin. Air quality modeling would not be needed to determine the legal acceptability of this trade.

Conversely, for locally and unevenly dispersed contaminants, emission entitlements and air pollution entitlements are quite distinct. It would be both difficult and impractical to define fallout basins within which emissions from one firm were equivalent to emissions of other firms in terms of effect on air quality. It would be far more important to determine on a case-by-case basis what determined a legally acceptable trade.

Consequently, the transaction costs of transforming air quality into excludable private property could be minimal for "global" pollutants, and could be sizable for "local" contaminants within a given air shed. Unfortunately, the problem is slightly more complicated. Those "global" air pollutants which happen to be more widely and evenly dispersed are most likely to be transported across air quality control region, State, and even international boundaries. The result is that managing these air resources within their fallout basin--or air shed--can be complicated by jurisdictional disputes. Because these "global" pollutants may not stay within their originating jurisdictions, trading in emission entitlements is bound to be disrupted from time to time as some jurisdictions find that they have to further restrict the supply of these entitlements to meet the NAAQS.

Thus, procuring external offsets involves search. But both the availability and prices of these entitlements depend on our ability to control overall use of air quality and its utilization among different users in a legally acceptable manner. For instance, if air pollution control is fundamentally imprecise, there may be considerable uncertainty and doubt about the adequacy of current air quality management plans to meet the standards in nonattainment areas. This uncertainty may affect the willingness of some firms to sell offsets.

The cost of searching can also interface with the cost of getting through the permit process. Simply put, the searcher may be saddled with uncertainty about what constitutes a legally acceptable trade. It may be unclear where emission reductions need to be obtained.

EMISSION REDUCTION BANKING CAN REDUCE TRANSACTION COSTS

In emission reduction banking, a State can allow companies to "bank" any of their emission reductions that are over what is legally required. As a depository of actual emission reductions or offsets, a bank can improve information on the availability of air pollution entitlements. This can reduce search costs.

OTHER ISSUES AFFECTING IMPLEMENTATION AND SIZE OF TRANSACTION COSTS

Technology-based emissions standards pose problems for development of a market

It has been shown that major new sources of nonattainment pollutants must install Lowest Achievable Emissions Rate Technology (LAER). Similarly, major new sources of attainment pollutants must install Best Available Control Technology (BACT). These requirements sharply reduce or preclude altogether using external offsets or multi-firm bubbles by such sources. LAER and BACT can also prove troublesome in implementing a market for another reason. These emission standards are supposed to be determined by the regulator on a case-by-case basis, to capture any advances made in air pollution control technology. However, this determination of the latest advance in pollution control technology may discourage some companies from buying or selling air pollution entitlements. This could be the case if the market transaction itself serves as a signalling device for finding new or more advanced controls.

For example, a dry cleaning plant, in selling air pollution entitlements to another firm, might be retrofitted with a new pollution control measure. If this trade occurred in a nonattainment area and if the retrofit were judged "cost-effective" by the regulator, possibly all other dry cleaners in the air shed could be ordered to adopt this stricter control. If the owner of the previous dry cleaning plant happened to own other establishments

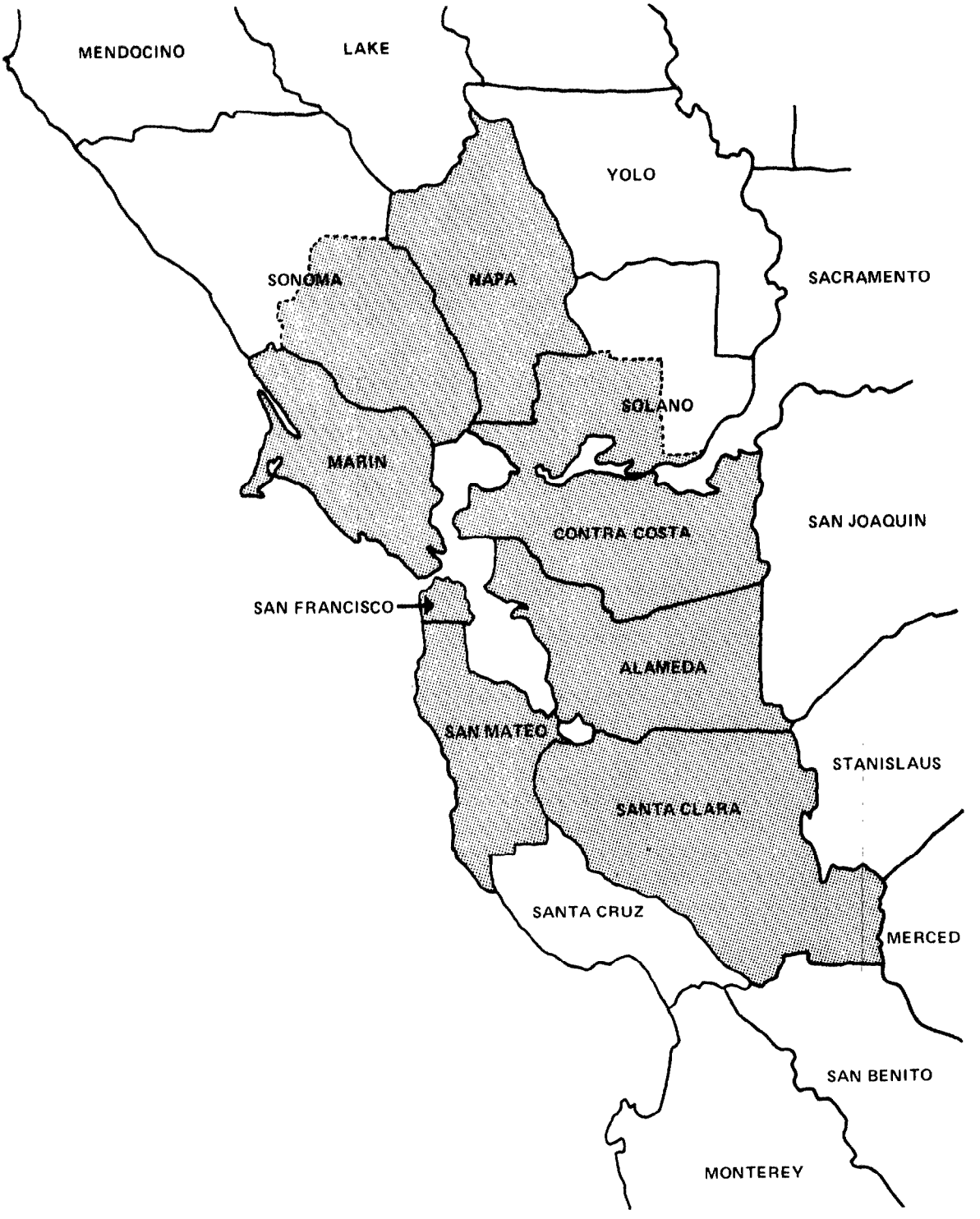
taken, the regulator has the authority to "confiscate" these entitlements either partially or entirely to meet the NAAQS. 1/

Opposition to vesting companies and individuals with air pollution entitlements may also be rooted in consideration of common property resources and market failure. The public or non-exclusive nature of air quality characterizes common property resources. In turn, this leads to the "free rider" problem which we addressed earlier. Without government intervention, air quality historically was a free-access resource which was over-exploited. However, the Clean Air Act was enacted to correct for this market failure. Firms and individuals legally exploit the air quality resource within the bounds of this Act. These entitlements of legal exploitation appear to be the issue, not entitlements to pollute in disregard of the NAAQS.

1/"Emission-Offset Banking: Accommodating Industrial Growth With Air Quality Standards," University of Pennsylvania Law Review, vol. 128, 1980, p. 950.

Figure 1

Bay Area Air Quality Management District



USING THE OFFSET PROGRAM

We identified two important external offset cases in the Bay Area. One of these--the Wickland Oil Company (Wickland) case-was successfully completed, but only after considerable delay and expense. The other--the Pacific Gas and Electric Company (PG&E) case--was abandoned by the appellant prior to action by the BAAQMD hearing board. In our investigation, we were able to link large transaction costs to efforts aimed at minimizing the risk of noncompliance and in determining the availability and price of external offsets.

Wickland Oil Company

In 1977, Wickland Oil Company proposed building a petroleum terminal in Contra Costa County. This project was expected to emit HC and SO_2 in amounts which would trigger both BACT and offset requirements. Wickland submitted its permit application in February 1978. BAAQMD denied this permit 3 months later, ruling that Wickland's proposal did not incorporate BACT and did not contain enforceable offsets. After this denial, Wickland found new offsets and submitted a revised application in October 1978. The District preliminarily approved this new proposal in May 1979, but a number of environmentalist groups, including CBE, appealed this decision. Nearly a year later, in May 1980, the District's hearing board reversed BAAQMD's earlier approval and denied Wickland a permit. Environmentalists and Wickland then negotiated a number of modifications to the project which the District approved in June 1980.

Problems

Transaction costs in the air permit process were principally due to problems involving HC emissions. Determining BACT and estimating emissions for the terminal proved difficult. In addition, a serious problem arose in estimating emission reductions from an offset site.

To satisfy BACT requirements, Wickland proposed a floating roof with double seals to control HC emissions from the terminal's petroleum storage tanks. But BAAQMD preferred a fixed roof with a vapor recovery or incineration system. According to BAAQMD's calculations, its control strategy would result in fewer emissions than Wickland's. Wickland disputed these calculations. After reviewing these arguments, a CARB official agreed with Wickland's assessment. As a result, BAAQMD reversed its decision and accepted Wickland's tank design as BACT.

In its revised application, Wickland proposed an HC offset at a dry cleaning plant in San Francisco, City of Paris Dry Cleaners, more than 20 miles away from the terminal site. Although BAAQMD tentatively approved this offset, during the public comment and hearing period, environmentalists argued that HC offsets should have been obtained in Contra Costa County, closer to the

Problems

As in the Wickland case, major problems in the permit process involved determining BACT and emissions for the project and arranging acceptable offsets. The difficulty with BACT centered on meeting numerical limitations for turbine NO_x emissions. Originally, PG&E had proposed to limit these emissions to 75 parts NO_x per million parts of air (75 ppm NO_x). This numerical limitation was guaranteed by the turbine manufacturer.

However, BAAQMD prevailed upon PG&E to agree to a 50 ppm NO_x limit prior to the District's second evaluation of PG&E's application. Subsequently, BAAQMD changed its mind about BACT, insisting on a still lower limitation because San Diego's air quality management plan stipulated such a limit. PG&E would not agree to meet this new requirement because the turbine manufacturer would not guarantee that low an emissions figure without the use of water or steam injection.

The principal difficulty in arranging offsets acceptable to BAAQMD occurred when PG&E, at the District's urging, decided in 1980 to use natural gas instead of distillate oil to power its generators. Earlier, in 1979, the District had prepared an evaluation of the project using natural gas. But despite this evaluation, BAAQMD chose in May 1980 to treat PG&E's fuel-switching strategy as a new permit application. The implications of this decision for offset availability were contained in the following language of the District's regulation 2-1-307:

> Emission reductions resulting from requirements of Federal, State, or District laws, rules, or regulations shall not be allowed or banked as emission offsets unless a complete application was filed with the District at least 90 days prior to the adoption date of such laws, rules, or regulations. 1/

Regulation 2-1-307 was critically important because in March 1980, 2 months before BAAQMD declared PG&E's application new, the District adopted regulations which would effectively require dry cleaners in the Bay Area to use perchloroethylene instead of Stoddard solvent. But PG&E had negotiated offsets involving such a switch in solvents with five dry cleaners in 1979. Applications for these offsets were apparently judged complete no later than September 1979, or more than 90 days before the newly adopted regulations. However, BAAQMD argued that the "complete application" mentioned in Regulation 2-1-307 referred to the Potrero #7 power plant, and not to the dry cleaners. Thus, BAAQMD ruled that the previous offsets were no longer available.

1/BAAQMD, Regulation 2, Rule 1, Section 307, p. 2-1-6. Recently, the District added "for such banking or actual emission reductions" after words "complete application"; cf., new Section 306.

Wickland case, where an emissions baseline chosen for computing offsets was successfully challenged.

In the PG&E case, it is also interesting to note what could have happened had there been a formal bank. PG&E's offset candidates, namely the dry cleaners, would have had an incentive to apply for ERCs. For a period of 3 years from time of their deposit in the formal bank, the value of these ERCs would have been insulated from changing regulation. The risk of offset forfeiture which beset this case would have been much smaller.

AN ENFORCEABLE MARKET

In chapter 4, we addressed the issue of enforceability in a market for air pollution entitlements. We saw that a fundamental issue in the enforceability of external offsets and a market is the basis for comparison. If the alternative to voluntary exchange of rights is a State-mandated offset or growth margin scheme, the same set of enforcement issues would be binding. Another important consideration is the effectiveness of enforcement under the current command and control system. The following account of an internal offset case in the Bay Area illustrates the possibility of combining the economic incentives embodied in a market approach with better enforceability.

Cost savings and better enforceability through the use of economic incentives

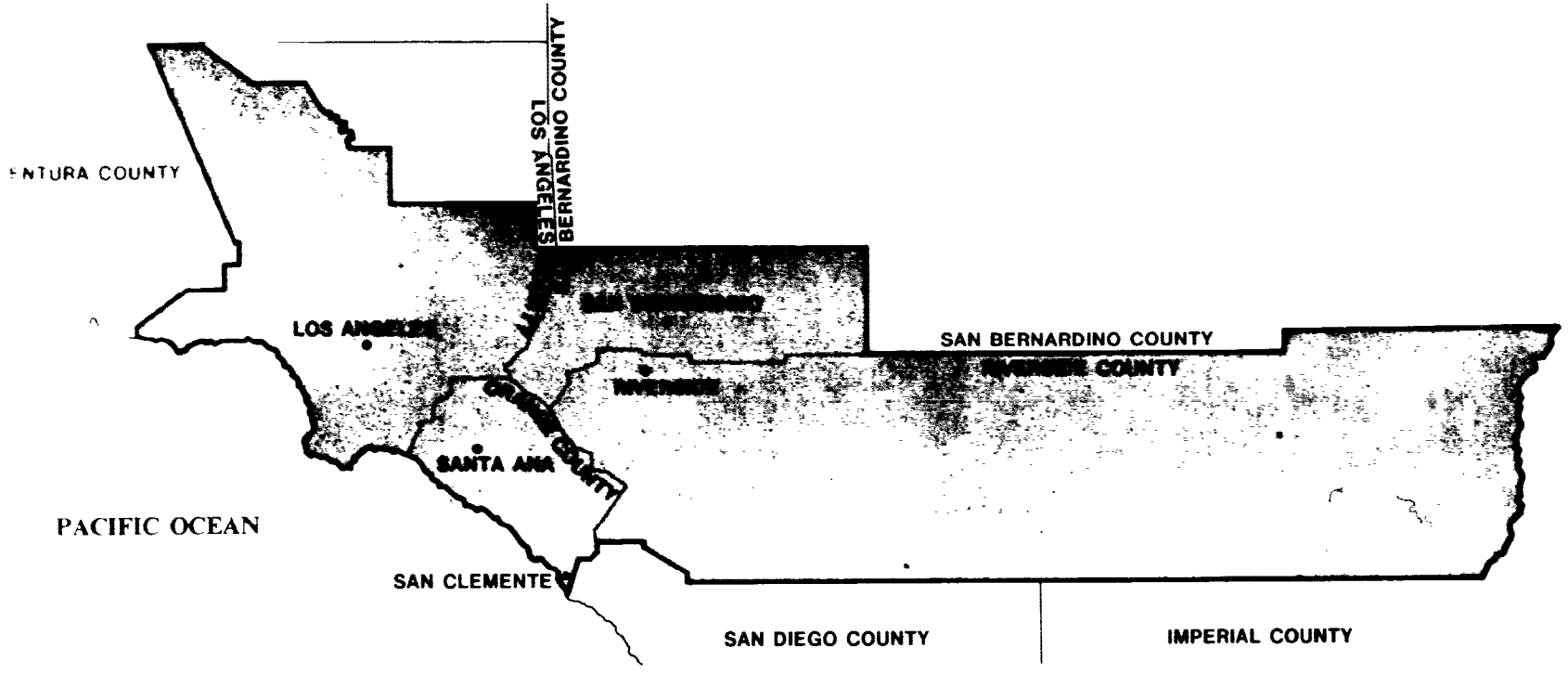
In June 1979, Shell Oil Company applied for approval of a major modification to its refinery in Martinez. Shell desired to have at its disposal a number of alternative production strategies. This flexibility would allow Shell to adjust to changing prices and availability of various energy inputs. Offsets would allow the modification to be built and the flexibility to tap different energy sources could provide significant cost savings in the operation of its refinery. But the District was concerned about enforcing this flexibility in Shell's proposal.

Negotiations between Shell and BAAQMD on these issues extended from October 1979 to February 1980. These negotiations culminated in an agreement in March 1980 under which Shell would establish an environmental auditing scheme to track the emissions of these various energy use alternatives. As part of this auditing scheme, Shell may computerize its audit, so that emissions can be automatically reported to BAAQMD on a daily basis.

According to BAAQMDs' Chief of New Source Review, who oversaw the processing of Shell's permit, the permit conditions set forth and the emissions data to be generated by Shell's environmental auditing scheme are much better than any information and checks which the District previously required of Shell.

Figure 2

South Coast Air Quality Management District



Port of Los Angeles harbor dredging project

In 1979, the Port of Los Angeles and the Army Corps of Engineers proposed to dredge the Port's navigation channel. The principal source of emissions would be diesel-powered dredges.

Problems

A principal cause of delay and sizable transaction costs was SCAQMD's unprecedented decision to treat this project as a stationary source of emissions. Given the project's expected emissions, this meant that it would be subject to New Source Review (NSR). The Port tried to get special legislation which would have exempted this project from NSR, but after several months of political wrangling, these efforts failed. During this dispute, SCAQMD initially favored using low-polluting electric-powered dredges, claiming that such an alternative would not require any air pollution permits. However, the Port feared that electric dredging might lead to noncompetitive bidding for its project, claiming that few dredging companies were equipped with this kind of dredge. As a second choice, SCAQMD initially urged the Port to investigate the feasibility of using selective catalytic reduction on diesel dredges.

There was, however, a great deal of uncertainty about the effectiveness and costs of these control strategies, but the Port finally agreed to participate in offset transactions, after more than 15 meetings with SCAQMD.

Playing the same role as the Port of Long Beach had in the Pacific Coast Cement case, SCAQMD spent considerable time and resources searching for offsets. As the search for offsets proceeded, a number of preferred candidates emerged. On May 20th, the press announced that the City of Los Angeles' Department of Water and Power was installing pollution controls on one of its power plants 3 years before it was required and that the entitlements so created might be used to offset the dredging operation's emissions. Offsets from two other plants, shut down by U.S. Steel and Goodyear Tire companies, were also mentioned as leading candidates.

Despite the effort and financial resources committed to an offset strategy, this control option collapsed shortly afterwards over a dispute between SCAQMD and the Port regarding how much offset credit the Port would receive from the Department of Water and Power's facility. This power plant had not been used very much in the past, but once new pollution controls were installed the City planned to use it more. It was this greater future use of the plant which lies at the heart of the controversy. The Port expected to receive offset credit equal to the reduction of a large amount of emissions which would result from extra controls on this plant as it operated at a high utilization rate. SCAQMD had initially concurred. But later, it reversed its position, ruling that offset credit must be the difference between the

CHAPTER 7

SUMMARY AND MATTERS FOR CONSIDERATION BY THE COMMITTEES

An important premise of this study is that a working system of controlled trading is necessary for a full-scale market in air pollution entitlements to evolve. Accordingly, we focused on implementation of controlled trading, and particularly emission reduction banking and external offsets. We devoted less effort to the bubble policy, the third component of controlled trading, because no "bubbles" had occurred as of the time of our research.

SUMMARY

Previous studies suggest that, in theory, a market in air pollution entitlements could lower pollution abatement costs, in some cases, from about 40 percent to 90 percent, to meet our society's outdoor air quality objectives. Cost data which we obtained from California point to potential cost savings of a similar magnitude. Indeed, we discovered one offset case in the San Francisco Bay Area with potential cost savings estimated at $19 million. Though cost savings are the driving force behind controlled trading and an eventual full-scale market, establishing a workable system to realize these savings is critical. Thus, implementation problems must be addressed.

With this emphasis in mind, we have taken the hypothesis that a workable market alternative must retain much of the existing air pollution permit process. As a result, our analysis was directed at identifying trouble spots in the permit process which result in sizable transaction costs. For several external offset cases in California, we examined how difficult it was to get through this process--it involves time and direct cash outlays on the part of both regulator and regulatee. If getting through the permit process is costly, the prospects for controlled trading and an eventual full-scale market are diminished.

Search costs are also germane to the feasibility of a market in air pollution entitlements. Typically, in an external offset case, one firm, possibly with the help of the regulator, must find other companies which can satisfy its need for emission reductions. Getting information on the price and availability of offsets and "striking the right deal" can be costly and occurs largely outside the permit process.

We also explored the effects other issues had on transaction costs occurring both within and without the permit process: emission reduction banking and possible conflicts between elements of command and control and controlled trading.

Table 1

Implementing External Offsets

Problem Type	Company				
	Pacific Coast Cement	Port of Los Angeles (aborted)	Watson	Wickland	PG&E (aborted)
Transaction costs in permit process		**	**	**	**
Estimating project emissions	*	*	**	**	*
Determining project controls		**	**	**	**
Determining necessary offsets				*	**
Estimating offset emission reductions		**		**	
Determining offset controls		*			
Offset eligibility					**
Search costs outside permit process	**	**		**	**
Hoarding	D			D	D
Likely price bid equal to direct pollution control costs	D			D	D
Fear that trade would signal further regulation	D				
Uncertainty about adequacy of SIP	D			D	D
Little or no precedent	D	D	D	D	D
Enforcement				*	
Questions raised about				*	
Special permit conditions	D		D	D	
Property rights					
Existing sources "grandfathered"	D	D	D	D	D

Note: D = the corresponding issue described the negotiation.
* = the corresponding problem impeded negotiations.
** = the corresponding problem was a major impediment.

Emission reduction banking

The second component of controlled trading scrutinized in this report is banking. As with offsets, we focused on California. In Los Angeles, language in a proposed regulation that "this [banking] rule does not recognize any pre-existing right to emit air contaminants" and in San Francisco the motion that an alternative community bank be established bear witness to this issue of property rights. 1/ On the other hand, the emissions reduction bank operating in San Francisco apparently intends to vest ownership with existing users of rights. In the Los Angeles proposal, the intent is unclear, given the disclaimer about pre-existing rights. More important, in both jurisdictions the intactness of any property rights is not sacrosanct. The Bay Area has a 3-year grace period, followed by possible discounting of any credits in the bank as new regulation is needed to meet the NAAQS. In Los Angeles, discounting from the day of deposit has been proposed. So, apparently what we have in these regions are banks which effectively recognize limited property rights.

MATTERS FOR CONSIDERATION BY THE COMMITTEES

Our review of existing theoretical studies of the potential cost savings from applying market incentive approaches to air pollution control, evidence from California suggesting a potentially wide variation in pollution abatement costs, and information from EPA on cost savings expected from using its bubble policy point to the possibility of meeting air quality objectives at a fraction of current abatement costs.

Whether this promise of theory becomes a reality hinges on implementation problems facing the greater use of controlled trading and the eventual emergence of a full-scale market in air pollution entitlements. Based on our findings from case studies of external offsets and emission reduction banking in California, we believe that significant, but not insurmountable, implementation problems currently impede the spread of controlled trading and the evolution of a full-scale market.

In light of the implementation problems identified in California and the potential cost savings of a market approach to air pollution control, the committees should consider allowing controlled trading in place of New Source Performance Standards, Lowest Achievable Emissions Rate Technology (LAER), and Best Available Control Technology (BACT). Specifically, allowing external offsets to be used in place of these rigid requirements can save industry money and can enhance air quality, especially in cases where regulators have required the use of highly stringent, but unreliable, pollution controls. Where this substitution can yield

---

1/SCAQMD, Proposed Rule 1309--Emission Banking, July 8, 1980, p. 32.

Contents

TABLES

FIGURES

ABBREVIATIONS

AQCR	Air quality control region
BAAQMD	Bay Area Air Quality Management District
BAC	Bay Area Council
BACT	Best available control technology
CBE	Citizens for a Better Environment
CEQ	Council on Environmental Quality
CO	Carbon monoxide
EPA	U.S. Environmental Protection Agency
ERC	Emission reduction credit
HC	Hydrocarbons
LAER	Lowest achievable emissions rate
NAAQS	National ambient air quality standards
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NSPS	New source performance standards
NSR	New source review
PG&E	Pacific Gas & Electric
PM	Particulate matter
PSD	Prevention of significant deterioration
RACT	Reasonably available control technology
SCAQMD	South Coast Air Quality Management District
SIP	State implementation plan
SO_2	Sulfur dioxide
VOC	Volatile organic compounds

GPO 888-069

AN EQUAL OPPORTUNITY EMPLOYER

UNITED STATES
GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE,$300

POSTAGE AND FEES PAID
U. S. GENERAL ACCOUNTING OFFICE

THIRD CLASS