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Innovative Approaches for Revising the Clean Air Act

ABSTRACT

The deadline for meeting the ambient ozone standard was December 31, 1987. With over fifty regions of the country out of attainment, there is no possibility that the standard will be met. Indeed, it may never be met in some highly polluted areas such as Los Angeles. The purpose of this paper is to suggest new approaches for dealing with the problem of meeting the ozone standard in nonattainment areas. The paper also examines how these policies could be implemented within the current political context.

INTRODUCTION

By the end of 1987, the entire U.S. was required to be in compliance with the 0.12 parts per million standard for ground level ozone.¹ If states or selected regions of the country were not in compliance, the U.S. Environmental Protection Agency (EPA) could apply a series of rather draconian sanctions. These sanctions included severely restricting federal funds for highways, sewage treatment plants, and air quality programs, and imposed a ban on construction of major new sources.² Recently, EPA Administrator Lee Thomas identified 76 regions of the country as non-attainment areas.³ While most of these areas are quite close to being in compliance with the law, a few, such as Los Angeles and Houston, have a long way to go.

Congress and the EPA face a difficult dilemma. The deadline is approaching, the costs of meeting the deadline are unacceptable, and there is no obvious path to follow. The EPA Administrator characterized the situation this way:

... the public difference of opinion about EPA's future course of

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1. National Clean Air Coalition, *The Clean Air Act: A Briefing Book for the Members of Congress* 26 (Apr. 1985).

2. *Id.* at 48.

3. *Clean Air Standards: Hearings Before the Subcomm. on Health and the Environment of the House Comm. on Energy and Commerce*, 100th Cong. 1st Sess. 9 (1987) (testimony of Lee M. Thomas, EPA Administrator).

action mirrors the complexity of the ozone issue itself. There is no obvious course of action. There is no simple course of action. Any decision on an ozone strategy will have to balance a number of factors that are more or less important depending on your point of view.⁴

The purpose of this paper is to define new approaches for dealing with the problem of meeting the ozone standard in nonattainment areas. The reason for searching for new approaches is simple. The existing approach is not working very well. Section 2 of the paper provides an overview of the current approach to regulating ozone. The potential role of market-based approaches in helping to meet the current standard is examined in Section 3. Section 4 highlights the key findings and discusses areas for future research.

THE CURRENT REGULATORY APPROACH

The problem of ozone nonattainment is not new. There is already a detailed infrastructure which has been created to help meet the ozone standard. Congress has grappled with this problem in the 1970 Clean Air Act and the 1977 Clean Air Act Amendments. It is useful to examine the basic design of this Act as a first step in developing reform proposals.⁵ In order to comply with the national ozone standard of 0.12 parts per million, the Act requires that states submit a plan which has to be approved by the EPA. State Implementation Plans for ozone were required to be submitted in 1979 for ozone nonattainment areas. Areas which could not demonstrate attainment by 1982 had to submit revisions in 1982 which would demonstrate attainment no later than 1987.

The plans generally consist of a series of control measures aimed primarily at limiting emissions of volatile organic compounds (VOCs) from existing stationary sources. In addition, many areas have implemented inspection and maintenance programs which attempt to reduce emissions of hydrocarbons from motor vehicles. Most of the implementation plans require specific reductions from individual sources or classes of sources. In many cases, even the nature of the technology is specified. This is the cornerstone of the so-called "command-and-control" approach. In some instances, other alternatives have been explored. For example, the EPA has attempted to promote the trading of "emission reduction credits" as a way of providing firms with greater flexibility in meeting emissions objectives. These credits are limited forms of property rights that can be created when firms reduce their emissions beyond specified

4. *Id.* at 17-18.

5. See R. STEWART & J. KRIER, ENVIRONMENTAL LAW AND POLICY (2d ed. 1978) for a more complete account.

regulatory requirements. To date, programs involving "emissions trading" have not been a critical part of state plans aimed at achieving attainment.⁶

Placing the primary responsibility for the development of plans on the states and local regions represents a sensible approach to environmental regulation. Within this context, it is important to develop a set of workable plans that will help meet the objectives mandated by Congress. Unfortunately, these plans are difficult to design and implement in some non-attainment areas. Most low cost technology-based standards have been applied. What remains are a series of high cost options. States, locales, and even the EPA, are finding it increasingly difficult to induce industry to use options that are quite expensive and offer relatively modest gains in moving towards the standard.

The command-and-control approach is unlikely to make significant progress towards meeting the ozone standard in severe nonattainment areas. Thus, it is worthwhile considering new approaches which may. One possibility is the use of market-based approaches similar to those promulgated under EPA's emissions trading programs.⁷ The idea behind these approaches is to specify an overall ceiling for allowable emissions, but to allow firms a great deal of flexibility in choosing technologies to reduce emissions. In some instances it may be possible to design systems which have the potential to both achieve cost savings and improve environmental quality in a timely manner. Whether these benefits can be achieved in practice depends on the nature of the systems which are put into place.

DESIGNING AND EVALUATING ALTERNATIVES

The basic problem is to develop a framework which would enable nonattainment areas to meet the ambient standards, or substantially reduce their ozone concentrations in a timely manner. The subsequent analysis will take the goal of meeting the existing ambient ozone standard as a "given"; not because I believe this standard is justified, but because this is the way that Congress and EPA have chosen to frame the problem.

A major factor affecting the speed with which attainment can be reached

6. See R. Hahn & G. Hester, *Where Did All The Markets Go?: An Analysis of EPA's Emissions Trading Program* (1986) (Working Paper 87-3, Sch. of Urban and Public Affairs, Carnegie Mellon Univ., Pittsburgh, Pa., forthcoming in the *YALE J. ON REG.*). See also R. LIROFF, *REFORMING AIR POLLUTION REGULATION: THE TOIL AND TROUBLE OF EPA'S BUBBLE* (1986). While these authors note that the overall use of trading programs has been limited, they also argue that the programs have resulted in significant cost savings to participants in the programs. The effect that these programs have had on overall environmental quality appears to have been small.

7. R. Hahn & G. Hester, *supra* note 6.

is the cost of pollution control.⁸ The question is whether it is possible to substantially reduce the control costs while maintaining or enhancing environmental quality. Here, I will argue that it is, indeed, possible to substantially reduce costs by placing appropriate incentives on firms to search for less expensive ways of reducing VOCs and nitrogen oxide emissions (NO_x), the two primary chemical species which contribute to the formation of ozone. The key idea is to design a regulatory system that promotes greater *flexibility* for individual firms, while still making significant strides towards attainment of the ozone standard.

One alternative frequently suggested by economists for increasing flexibility is marketable permits. The implementation of a marketable permit system involves several steps. First, a target level of environmental quality is established. Next, this level of environmental quality is defined in terms of total allowable emissions. Permits, which are essentially limited property rights, are then allocated to firms. Each permit enables the owner to emit a specified amount of pollution. Firms are allowed to trade these permits amongst themselves. This feature gives firms greater flexibility in their abatement decisions. However, environmental quality is preserved by limiting the total number of available permits.

The theory behind the use of marketable permits is well established. Such approaches can, in theory, result in considerable reductions in cost without sacrificing environmental objectives.⁹ The practical aspects of these systems, however, are only now beginning to be appreciated. Over the past decade, EPA has implemented a program which is similar in spirit to the use of marketable permits. The "emissions trading program" is designed to provide firms with greater flexibility without sacrificing environmental quality. Measured in terms of cost savings, the program has been a success. Cost savings have resulted in the billions of dollars.¹⁰

Since the emissions trading program is already in place, it is important to consider whether this program will, in itself, be sufficient to promote attainment. The answer to this question is, unfortunately, no. At present, states have the option of whether they want to use some form of emissions trading as part of their attainment strategies. While elements of emissions trading are used in a large number of areas, the current program appears to have had little effect on environmental quality. This is, in part, because emissions trading represents a relatively small element of the existing regulatory approach. It is also because emissions trading is not explicitly designed to meet ambient standards, though parts of the program are aimed at reducing emissions. With suitable modifications, however, it

8. There are, of course, other factors and these will be considered shortly.

9. Montgomery, *Markets in Licenses and Efficient Pollution Control Programs*, 5. J. OF ECON. THEORY 395 (1972).

10. R. Hahn & G. Hester, *supra* note 6.

would be possible to fashion an emissions trading program that would help address the ozone nonattainment problem.

Within the context of existing requirements for State Implementation Plans, there are two key criteria that need to be met for a program to be approved by EPA. The first is that the plan pinpoint identifiable emissions reductions from specific sources. The second is that it demonstrate that the projected emissions reductions will allow the area to meet the ambient standard for ozone. Since many states have plans that were approved by EPA, yet are still not in attainment, it is worth examining how this situation arose. As several authors have noted, there are many problems with the process.¹¹ There is a great deal of uncertainty in emissions inventories, and in the relationship between emissions and ambient air quality. It is also difficult to project economic growth and the effectiveness of different control options. Moreover, there are incentives for states to be overly optimistic in their projections. Thus, control options which are promised in the plan are not always implemented. Any alternatives that will be implemented should take these design requirements and uncertainties into account.

In devising any practical alternative, it is important to specify how decisions and responsibilities should be divided among state and federal regulators, and the Congress. For purposes of analysis, it will be assumed that Congress will specify a time frame in which the 0.12 ppm standard must be met. This time frame could vary across regions depending on the difficulties that are likely to be encountered in meeting attainment. One important consideration in setting a deadline or series of deadlines is the likelihood that regions will comply with the deadline. If deadlines are going to serve as more than symbolic gestures, it would be helpful if considerations of political and technical feasibility entered into the development of new legislation. Moreover, realistic mechanisms for enforcement will need to be added.

While Congress is in a good position to decide on general policy objectives, micromanagement is better left to federal and state agencies. One general problem which the states and EPA will need to grapple with is the definition of required emissions reductions of NO_x and VOCs. This exercise will need to be based on environmental modeling which predicts how ozone concentrations vary with different emission profiles. The general approach to this problem would be similar to the current approach taken with State Implementation Plans involving ozone control.

The problem of defining broad guidelines and general emissions targets applies to any program aimed at widespread environmental control. For specific applications involving market-based mechanisms, there are sev-

11. See R. Hahn & G. Hester, *supra* note 6; R. Liroff, *supra* note 6, at 25-34.

eral other steps which need to be taken. At a general level, the rules for trading need to be specified. A good rule of thumb to follow is to encourage trading when it reduces costs, but does not compromise environmental quality. A key issue involving ozone attainment is whether trading should be allowed across different types of emissions. While EPA probably has the authority to allow interpollutant trading for ozone attainment, an endorsement from Congress would be helpful in expediting the development of this policy. Moreover, Congress may want to consider developing a framework which explicitly acknowledges interdependencies among pollutant problems. For example, NO_x emissions represent an important part of the acid rain problem as well as the ozone problem. By taking advantage of certain chemical interconnections, it will be possible to reduce the costs of achieving environmental goals.

Some of the most difficult political and administrative problems arise in designing the detailed applications of market-based alternatives. The options considered below will examine three different questions. First, how are emission rights defined and allocated? This is a critical question for determining who bears the costs of emission control, and how reductions are going to be achieved over time. Second, how are specific trading rules defined? This definition is critical in defining the scope for trading and the potential for cost savings and environmental quality improvements. Third, what type of administrative changes will be needed under the new system? This issue is important for assessing the practical feasibility of a proposal.

Three options are considered here. These options all represent significant departures from the current policy. However, they differ in the degree to which they supplant the existing command-and-control approach. Each plan involves the reductions of VOC emissions and/or NO_x emissions. Trading across pollutant categories would be allowed under all plans. As noted above, previous control strategies have been defined primarily in terms of VOC reductions; thus, allowing trading between NO_x and VOC emissions would represent an important change in existing policy.

The first option consists of organizing a full-scale market in property rights for emission credits. Organization of the market requires establishing a baseline for defining emission rights. States and local areas would be charged with defining the relevant baseline subject to broad guidelines set forth by EPA. Existing emissions inventories could be used to establish and revise this baseline. One alternative for establishing the baseline is to issue emissions rights for a specified period on the basis of actual emissions. This is similar to the approach that EPA has advocated in its final emission trading policy statement.¹² This allocation scheme is

12. 51 Fed. Reg. 43,814-60 (1986).

based on the grandfathering of emission rights. It takes the existing distribution of emissions as a legitimate basis for defining tradable rights. Firms which have already spent large sums of money on cleaning up pollution abatement may object to this system on the grounds that it rewards firms that have not shouldered their fair share of the burden. If these objections are strenuous, states may choose to establish other baselines that reflect local concerns. For example, some states might retain some rights for the public, and sell or auction these rights off to raise money for promoting environmental quality. Environmentalists could be expected to favor options which force industry to pay for polluting activities.

Once a realistic baseline is established for emission rights in both VOCs and NO_x emissions, a plan needs to be developed which yields the necessary emissions reductions. This can be accomplished relatively easily by reallocating emissions rights at specified intervals. For example, suppose that in the first year of the program, 100 rights were issued which allowed 100 tons of VOCs to be emitted. In year two, the objective is to cut these emissions in half. This could be done by redefining the value of existing rights, so that each right corresponds to .5 tons as opposed to 1 ton. In order to provide industry with some certainty, states would want to define the system for reducing rights with great care. The objective should be to provide firms with certainty while building enough flexibility in the system to adapt to changing environmental conditions.¹³

It is important to recognize that the rules set up for reducing emissions can have an important effect on how individual firms respond to the market-based system. If firms which reduce emissions by more than the average are unduly penalized, this will make them think twice about exploring new technologies which would lead to any further emissions reductions. A simple way to avoid this problem is to dilute the value of existing emissions rights by some fixed fraction for all firms, independent of their previous performance.

A problem will also arise in situations where firms are emitting at levels that exceed those allowed by their emission rights. This problem is precisely analogous to the problem where an operating permit is violated. The regulatory agency will need to develop ways of dealing with such problems. A logical place to start is to refer these problems to the enforcement staff. It remains an open question as to whether the enforcement staff will need to be increased to accommodate a market-based regulatory initiative.¹⁴

13. Hahn & Noll, *Implementing Tradable Emission Permits*, in *REFORMING SOCIAL REGULATION: ALTERNATIVE PUBLIC POLICY STRATEGIES*, 125-50 (L. Graymer & F. Thompson eds. 1982).

14. A market-based system could provide firms with additional incentives to police other firms. The value of a firm's marketable permits will depend, among other things, on the effectiveness of

The states and local areas would develop plans subject to EPA approval. EPA should produce broad guidelines which suggest what types of trades are acceptable, and how to set appropriate parameters.¹⁵ For example, EPA could produce guidelines on trades involving mobile and stationary sources, and trades which involve more than one pollutant. In the case of interpollutant trading which involves VOCs and NO_x, EPA should suggest appropriate modeling requirements for states. Decisions on specific trading rules should be left to the states. Like Congress, EPA should try to avoid micromanagement.

Note that this proposal would not distinguish between new and existing sources. New firms would not be required to meet any specific standard, but they would be required to own emission credits corresponding to their existing emissions. This is a dramatic departure from existing law, which imposes more stringent restrictions on new sources in the hopes that this will eventually result in better environmental quality.¹⁶ Environmentalists have been strong supporters of legislation which imposes stringent requirements on new sources. They are unlikely to support this system unless they can be persuaded that it offers the potential for substantial improvements in environmental quality relative to the *status quo*.

Moving to a full-blown market approach would require some important changes in the way regulatory agencies do business. Engineering staff at state and local levels in charge of writing standards would now be asked to evaluate the validity of trades in terms of their environmental benefits. A record keeping system would need to be installed to keep track of changing ownership of emission rights. This system would rely primarily on the self-reporting of firms along with occasional inspections.¹⁷

One important issue relates to the definition of valid trades. To promote

the enforcement system. Where the marginal gains from private enforcement actions exceed the marginal costs, firms could be expected to help enforcement authorities. On the other hand, it may be more difficult to bring enforcement actions under a marketable permits system. Since the explicit monetary stakes are higher, there may be a greater tendency to use the court system rather than using traditional administrative approaches. Moreover, it may be necessary to specify the nature of the violation with greater precision in order to assess the appropriate remedies. These issues have been addressed at great length in theory. The time is now ripe for a careful applied study of enforcement issues as they relate to market-based systems which have actually been implemented. For an overall evaluation of the performance of marketable permit systems, see R. Hahn & G. Hester, *Marketable Permits: Lessons for Theory and Practice* (1987) (Working Paper, School of Urban and Public Affairs, Carnegie Mellon Univ., Pittsburgh, Pa., presented at the 1987 APPAM meetings).

15. Without such guidance, it is unlikely that the states would expand the domain for emissions trading. Reasons for the states' unwillingness to change include limited resources, a general view that emissions trading imposes additional burdens on state regulators, and a reluctance to develop new programs which might not be acceptable to federal regulators and/or environmentalists.

16. In reality, the effect of the new source legislation has been to induce many firms to retain outdated plant and equipment for a longer time period than they otherwise would have.

17. This is the dominant approach used in environmental monitoring and enforcement in the U.S.

cost savings, trading should be defined as broadly as possible. For example, electric utilities that show demonstrable gains in environmental quality as a result of conservation efforts should receive the same treatment as utilities that choose to install hardware, such as scrubbers. The precise details of trading rules should depend on key parameters related to the transport and formation of ozone. States and local areas should be given a broad mandate so they can tailor trading programs to their individual needs and capabilities.

At the federal level, EPA would have to increase its oversight function. It would want to focus on the validity of baseline estimates as well as evidence that the state was heading towards its attainment goals. EPA could accomplish this oversight through occasional auditing of individual trades; asking for updates on aggregate emissions of NO_x and VOCs; and using data from existing monitoring networks.

This proposal would face many hurdles in implementation. However, none of these hurdles are insurmountable. The problem of establishing an appropriate baseline is already addressed under current State Implementation Plans. There is, admittedly a great deal of uncertainty in emission baselines and inventories.¹⁸ This does not imply, however, that trading cannot work effectively any more than it implies that command-and-control approaches cannot work effectively. What it does suggest is that the design of a trading system needs to take the quality of the existing data into account.¹⁹

There are several ways that safeguards can be built into the system. At an aggregate level, if specific interim targets related to air quality were not met, the plan could call for greater across-the-board reductions in emissions rights. At the level of individual trades, EPA could expand its role as an auditor, in much the same way that the Internal Revenue Service does. Instead of trying to monitor each individual trade in detail, for example, it could monitor selected trades. Over the long run, there is no substitute for getting a better picture of emissions profiles for individual firms and consumers. However, in the past, Congress and the EPA have demonstrated a marked unwillingness to address this problem.

Another potential objection to this plan is that it runs counter to the intent and legislative requirements of the Clean Air Act. Under current law, there is a distinction between new and existing sources. Sources which were in existence when emissions were first inventoried in the mid-1970s are called existing sources; sources which have been built

18. The recent EPA emissions trading policy statement attempts to address these issues. See 51 Fed. Reg. 43,814-60 (1986).

19. For a somewhat more pessimistic assessment of the potential for trading, see A.S. Meiburg, *Innovation and Infrastructure: Competing or Complementary Goals in Air Pollution Control* (1987) (presented at the 80th Annual APCA Meetings, New York, N.Y., June 21-26).

since that time are called new sources. The distinction between new and existing sources is important because new sources generally must comply with more stringent technology-based regulations. Existing sources have the option of meeting emissions standards through conventional approaches or by purchasing emissions credits. If Congress is unwilling to lift the restrictions on new sources, then this proposal may be infeasible.

As an alternative, consider a second option which requires all new sources to meet the more stringent control requirements, but is otherwise identical to the first proposal. Relative to the first option, this proposal could be expected to reduce the amount of new sources locating in non-attainment areas since it would be more expensive to locate there. Additionally, the overall level of cost savings would decline, since new sources would have less flexibility in how control requirements were met. The major advantage of this proposal in comparison to the first proposal is political. Part of the reason for the existing new source legislation is to protect eastern coal mining jobs. This proposal would retain the regulations that protect these jobs. At the same time it would add much greater flexibility into the existing system by changing the structure of the regulatory system to promote trading. The structural changes would be precisely the same as those discussed in the previous option.

Both the first and second options represent radical departures from the *status quo*. Moreover, they tend to accentuate the role of markets. If there is anything that recent lessons from the application of market-based approaches has taught us, it is that full-blown markets tend to be the exception rather than the rule.²⁰ This is especially true when there is a great deal of controversy over the appropriate distribution of property rights, and it is difficult to monitor and enforce standards. For precisely these reasons, it is unlikely that these two approaches will be implemented. Thus, it is worthwhile considering policies that are more in line with the existing regulatory approach.

The third option consists of building directly on EPA's current strategy for dealing with the ozone problem. EPA currently identifies control strategies that must be used for both new stationary sources and mobile sources. For example, recently there has been a debate over whether to install devices in gas tanks which reduce emissions from refueling. The control strategy is referred to as "onboard."²¹ The automobile companies are understandably concerned about the cost and effectiveness of this

20. R. Hahn, *Economic Prescriptions for Environmental Problems: Not Exactly What the Doctor Ordered* (1987) (Working Paper, School of Urban and Public Affairs, Carnegie Mellon Univ., Pittsburgh, Pa.).

21. U.S. ENVIRONMENTAL PROTECTION AGENCY, EVALUATION OF AIR POLLUTION REGULATORY STRATEGIES FOR GASOLINE MARKETING INDUSTRY (Office of Air and Radiation, EPA-450/3-84-012a, 1984).

option. Yet, under the current system, their options are quite limited if EPA decides to implement this approach. They must comply with the technology-based standard or be in violation of the law.

An alternative approach is to continue to allow EPA to impose technology-based standards, but to allow companies to meet the standards by making equivalent or greater emissions reductions through other means. This concept is very similar to the EPA's existing "bubble policy". The bubble policy allows a firm to add up the emission limits from individual sources of a pollutant in a plant, and to adjust the levels of control applied to different sources so long as this aggregate limit is not exceeded. The bubble policy, as currently implemented, applies to existing sources. The approach considered here is precisely analogous to the bubble concept, except that it would apply to new regulations on both mobile and stationary sources.

Consider the example of the onboard system. Suppose the automobile companies found a new, less expensive, technology which significantly reduced emissions, such as a new catalytic converter or a new fuel. Then, they should be allowed to implement this technology instead of the federally mandated solution provided it meets or exceeds the environmental targets that the regulators had in mind when setting the standards. Even if the companies do not make the reductions themselves, they should still be allowed to receive credit for them, provided they can persuade other companies to make changes which result in verifiable emissions reductions. Thus, for example, the automobile companies might find it less costly to pay oil refiners to reduce emissions than to install the onboard system themselves.

There is no reason why this third option could not be extended to specific policies mandated by states to meet the ozone standard as well. In any instance where regulators promulgate a technology-based standard, firms could be given the opportunity to identify and implement an approach which either is less costly or achieves equivalent or greater improvements in environmental quality.

The third option would still require major emission reductions in some nontainment areas. States and local areas would have the primary responsibility for regulations in these areas. However, EPA could augment these reductions with regulatory requirements and guidelines, such as onboard strategies. Note, however, that EPA need not pursue a strategy that requires across-the-board emission reductions in all areas. Rather, it could continue to focus its efforts on nonattainment areas. Difficulties will inevitably arise in targeting mobile source reductions. However, these difficulties do not imply that the best route is necessarily to require all mobile sources to install stringent control equipment.

One of the attractive features of this approach is that it does not require

major administrative changes. EPA would continue to regulate ozone within the existing framework. The only significant change would be the added flexibility given to firms in meeting new standards. Yet, this change is important because it could increase the political acceptability of the current approach by allowing firms the opportunity to save money by implementing less costly control technologies.

The proposals presented here are not without problems. Moreover, there are many details which would need to be worked out in implementing these ideas. Since design issues have been addressed in detail by several authors, the focus in this article will be on those issues which are likely to be of greatest concern for the particular problem at hand.²²

One important issue is how to compare emissions reductions from different kinds of sources. In this area, there are likely to be important tradeoffs between administrative simplicity and the degree to which the regulatory approach is fine-tuned to address specific features of individual sources. It is clear that certain kinds of emissions reductions are subject to greater uncertainties than others. For example, stationary source reductions may be more easily estimated and verified than reductions in emissions involving mobile sources. Even within the stationary source category, the ability to verify reductions will differ across sources. It would be cumbersome and unnecessary to define emission credits which differ in value for every abatement technology. Unless there are pressing reasons for considering reductions from one source as being less effective or less certain than similar reductions from another source, the two reductions should be weighted equally by the regulator. This is not to suggest that all reductions of a particular type of emissions be treated equally. Attention can and should be given to the costs of monitoring, and the distribution of uncertainty over claimed emission reductions. When agency monitoring costs are very high, or uncertainty is quite large, this might constitute grounds for either diluting the value of a particular credit, or alternatively, asking the source proposing the reduction to address these issues constructively.

A related issue is how to design an overall scheme for achieving reductions in ozone.²³ As noted earlier, both VOCs and NO_x emissions contribute to the formation of ozone, and they do so in a highly nonlinear manner. It is by no means obvious that the best approach for addressing

22. For a discussion of general design issues, see Hahn & Noll, *supra* note 13; & T. TIETENBERG, *EMISSIONS TRADING: AN EXERCISE IN REFORMING POLLUTION POLICY* (1985). For an evaluation and discussion of concrete policy proposals related to emissions trading, see R. Hahn & G. Hester, *supra* note 6; R. Liroff, *supra* note 6, at 135-45.

23. R. Hahn, G. McRae & J. Milford, *Coping with Complexity in the Design of Environmental Policy* (1985) (Working Paper 87-16, School of Urban and Public Affairs, Carnegie Mellon Univ., Pittsburgh, Pa.) (forthcoming J. ENVTL. MGMT.).

the ozone problem in specific areas is to continue to reduce VOC emissions. States need to re-evaluate this strategy. All of the proposals suggested above can be used to help meet changes in the required levels of NO_x or VOC emissions.²⁴

The options examined here are not foolproof. Thus, it is reasonable to ask what happens if a mistake is made. The answer to this question depends on the source of the error and the size of the problem it creates. Probably, the most serious problem relates to missing the overall target for emissions reductions. As noted earlier, this can be accommodated in the first two options by further tightening of the overall number of available emission credits. Under the third option, EPA would have to continue imposing more stringent measures, and then allow firms to search for alternative ways of meeting the prescribed emissions limits.

All three of these proposals are designed to set up a system of incentives that directly involves industry in a constant search for more productive ways of cleaning up environmental problems. The specific details of the proposals are meant to be suggestive. For example, the appropriate method for allocation of permits would be determined by the political process. Grandfathering is suggested here only because the existing distribution of property rights frequently has an important effect on the design of new regulatory systems.²⁵ The only part of the design that is critical is allowing firms greater flexibility in meeting prescribed environmental targets.

Given the promise of these proposals, it is reasonable to consider why they have not been implemented. One problem is legal. The first option may not be allowed because it would no longer require new sources in nonattainment areas to meet specific emission targets. However, the status of new source trading is changing. EPA recently approved a bubble which allows trades between two generators that are subject to the same new source regulation.²⁶

The other two options appear to be well within the realm of what EPA and states could do within the current bounds of the Clean Air Act. Thus, the reasons for not using these options must lie elsewhere. To understand the reasons for not exploring these options, it is useful to look at the past attitudes of key actors in the decision making process. At the federal level, neither Congress nor EPA has ever been terribly disposed towards

24. For a proposal that would allow regulators to trade off among NO_x and/or VOC emissions see R. Hahn, *A New Approach to the Design of Regulation in the Presence of Multiple Objectives* (1987) (Working Paper 87-8, School of Urban and Public Affairs, Carnegie Mellon Univ., Pittsburgh, Pa.).

25. See generally Rolph, *Government Allocation of Property Rights: Who Gets What?*, 3 J. POL'Y ANALYSIS & MGMT. 45 (1983); Welch, *The Political Feasibility of Full Ownership Property Rights: The Cases of Pollution and Fisheries*, 16 POL'Y SCI. 165 (1983); R. Hahn, *supra* note 20.

26. 50 Fed. Reg. 3688-95 (1985).

moving away from command-and-control approaches. While some states have employed market-based approaches, state and local agencies have not generally promoted this option, except in a few circumstances. The past attitudes of industry towards trading is characterized by a healthy skepticism. There has been concern that these approaches might not confer significant benefits, and might introduce considerable uncertainty. Environmentalists have vigorously opposed most attempts at initiating or expanding the scope for trading, arguing that trading is very difficult to implement without resulting in adverse environmental consequences.²⁷

The most vigorous support for previous trading initiatives has come from a surprisingly small set of individuals. In the case of emissions trading, the primary support for this program came from a small group of scholars and reform-minded bureaucrats.²⁸

Is there any reason to think the views of various groups will change? I believe there is. As it becomes increasingly apparent that the command-and-control options are not buying very much, both industry and environmentalists may become more receptive to different alternatives. Legislators will be left with three basic choices. The first is to "redefine" the standard in areas where it can't be met. The second is to continue along the current path, which is unlikely to buy very much, but gives an outward appearance that something constructive is happening out there. The third is to explore new approaches along the lines suggested here.

If new approaches are to be promoted, in all likelihood, Congress will have to provide greater incentives for both EPA and the states to explore these ideas. The key signal that Congress will need to send out is that flexibility is going to be encouraged in meeting the goals of the Clean Air Act. For example Congress could require, at a minimum, that EPA allow firms to use alternative approaches for meeting their proposed standards. Moreover, it could suggest that alternative approaches be viewed in the same context as the current approach to regulation. There is currently a striking asymmetry between emission credits which are traded and those which are not traded in terms of how they are treated.²⁹ Emissions trading effectively establishes two classes of emission rights: those which are traded and those which are not. State regulators have tended to treat traded rights in a way that affords them an inferior status. This can be seen in the treatment of banked credits in selected banking pro-

27. See R. Liroff, *supra* note 6, at 57; National Clean Air Coalition, *supra* note 1, at 38-47.

28. R. Hahn & G. Hester, *supra* note 6. See also Meidinger, *On Explaining the Development of "Emissions Trading" in U.S. Air Pollution Regulation*, 7 LAW & POL'Y 447 (1985).

29. R. Hahn & G. Hester, *The Markets for Bads: EPA's Experience with Emissions Trading* (1987) (Working paper, School of Urban and Public Affairs, Carnegie Mellon Univ., Pittsburgh, Pa., forthcoming in REG.).

grams.³⁰ These credits are sometimes subject to a "discount" which is a *de facto* partial confiscation. The inferior status of traded rights can also be seen in the close scrutiny regulators give to the creation of emission credits. Eliminating this asymmetry in the treatment of credits would help induce firms to search more vigorously for cost saving environmental improvements. All three options presented above could be tailored so that traded rights could stand on an equal footing with untraded rights.

Related to this idea, Congress could require that EPA spell out the type of tradeoffs it will allow among different types of technologies.³¹ For example, how much credit will be given for using cleaner fuels in automobiles, such as methanol, or different blends of gasoline? Currently, firms do not have much of an incentive to explore such options. This incentive could be increased by spelling out the rules which apply in counting the environmental benefits from different approaches.

Spelling out these trade offs will not be easy in some cases. Moreover, the task is complicated by the fact that many technologies do not offer unambiguous improvements for all pollutant categories. These technologies could be precluded from being adopted, as is typically done now. However, this strategy may not make sense either from the perspective of increasing overall environmental quality or reducing costs.

Congress should also consider encouraging EPA to specify conditions under which trading could take place between NO_x and VOC reductions. As noted earlier, this is a tricky problem in that the specific schemes adopted will need to be tailored to air quality conditions in specific regions. EPA would need to provide guidance to the states about what sort of trade offs are permissible.³²

An important strategic issue in addressing the ozone nonattainment problem is the extent to which controls are targeted for nonattainment areas. In the past, Congress and the EPA have been reluctant to promote standards for mobile sources that differ by regions. However, as noted above, targeted strategies may be better than across-the-board standards if the problem is viewed as regional. Thus, even if EPA's onboard strategy were a good idea, it need not be required for all cars if the sole objective

30. Banking allows a firm to store an emission credit for future use once it has been created. See R. Hahn & G. Hester, *supra* note 6, for a detailed evaluation of actual banking activity under the emissions trading program. See R. Hahn & G. Hester, *supra* note 14, for an examination of the lead banking program, which has been the most active program to date.

31. For a critical view on past EPA policies, see Gray, *Octane, Ozone, and Obstnacy*, 11 REG. 37 (1987).

32. California has already begun to use interpollutant trades on a limited basis for a variety of pollutants. Examples include trades of NO_x for VOCs, and trades of particulate matter for NO_x, VOCs, and sulfur oxides. Telephone interview with R. Menebroker, Chief, Project Review Branch, California Air Resources Board, Sacramento, Cal. (July 21, 1987).

is to reach attainment in areas which currently exceed the standard. As noted above, a critical part in designing the mobile source component of an ozone control strategy is to ensure that reductions in emissions are verifiable. This problem can be handled in several ways. Credits for emission reductions could be based on estimated emissions associated with different types of mobile source categories. For example, sales of vehicles to owners of dedicated fleets, such as taxicabs, could result in higher levels of emission credits per vehicle than sales to the public at large.

Even if Congress came out unambiguously in favor of market-based alternatives which promote meeting the standard, it is possible that very little would actually be done to enhance environmental quality. There are two reasons why this outcome might arise. One is that the market-based programs could be designed poorly. A second, and probably more likely one, is that the current system of rewards and sanctions will serve as a major impediment to getting states to move in a timely manner. The rewards for being in attainment are not terribly high; moreover, the credible sanctions are not available to EPA for inducing progress in nonattainment areas. The current set of draconian sanctions related to highway funds, sewage treatment funds, and construction bans, need to be replaced by measures which are less blunt. Administrators have been very reluctant to impose these sanctions because they have potentially dire economic and political consequences. In addition to exploring the modification of sanctions, Congress may want to reconsider the amount of discretion the administrator has in imposing particular sanctions. If sanctions and rewards are viewed as credible, then states are more likely to take them seriously.

If EPA were given a signal to promote flexibility, there are several steps it might take. Consistent with the suggestions above regarding legislative changes, it could provide greater guidance on tradeoffs so firms had a better sense of the payoffs that would result from adopting innovative technologies. Another way of increasing trading activity is to decrease the level of federal oversight on particular trades. EPA's "generic bubble" policy, which allows states to approve bubbles without direct federal oversight, represents a step in this direction. The agency could also establish a series of rules regarding trading between new and existing sources in nonattainment areas, if this were not spelled out in the enabling legislation.

This section has argued that the current Clean Air Act is not sufficient to promote widespread use of markets as a vehicle for expediting attainment. Changes will be required in the Clean Air Act and in the way EPA interacts with the states if market-based approaches are going to play a significant role in addressing the ozone nonattainment problem. While

the second and third options outlined above could probably be implemented without any legislative changes, it is unlikely that they will be adopted in the current political environment.

CONCLUSIONS AND AREAS FOR FUTURE RESEARCH

Economists are quick to point out that "there is no free lunch." In some ways, though, there is a free lunch out there. It is possible to decrease costs and increase environmental quality through the judicious design and implementation of new regulatory approaches. Of course, what is possible and what will actually happen are two very different things. This explains, in part, why attempts to initiate market-based approaches have met with such strong resistance. Many groups simply do not believe that greater reliance on the market approaches will work. Some groups also question whether these approaches represent an appropriate response to environmental problems.

Appropriate or not, I have tried to argue that more flexible approaches may be one of the few ways that can be used to help achieve the ozone standard. These approaches are not without their pitfalls, but then neither is the existing system.

If Congress is interested in using market approaches as a key strategy in reaching attainment, it must take at least two important steps to promote their use. The first is to send out a clear sign on the desirability of using market mechanisms. At present, innovative market-based approaches play a small role in environmental management. The best way to upgrade this role is for Congress to encourage EPA and states to implement these approaches where they are appropriate in nonattainment areas. For example, Congress could mandate that states which are unable to convincingly demonstrate attainment be required to use market-based approaches as part of their attainment strategy.

The second step which Congress needs to take is to provide credible sanctions in the event of nonattainment. This is a generic problem with the current approach to air pollution control. Without the appropriate rewards and sanctions, it is unlikely that states and local areas will make much progress toward reaching attainment. Existing rewards and sanctions have been shown to be insufficient to induce some states and local areas to take the necessary steps.

This paper has focused exclusively on market-based approaches. However, there is no reason, in principle, why other incentive-based options, such as emissions fees, could not be considered as well. For example, firms could be permitted to pay a fee to the state in lieu of obtaining emission reduction credits directly. Revenues from this fee could then be

used to enhance environmental quality. The firm paying the fee would be given emission credits based on the expected environmental improvements that would result from using revenues from the fee. In addition to enhancing environmental quality directly, these revenues could also be used to improve emissions inventories and monitoring capabilities. This is an area that deserves further exploration.

Given current political interests, it is unlikely that full-blown markets will be used to address the ozone nonattainment problem. It is possible, but unlikely that a more incremental approach, such as the limited trading described in the the third option, will be used. As it becomes more apparent that the political costs of reaching attainment are quite high, Congress will be left with some difficult choices, including effectively rescinding the current standard for selected areas. If Congress is serious about wanting to use market approaches, legislation will be needed to help promote their use.