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MARKETABLE PERMITS: WHAT'S ALL THE FUSS ABOUT?

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ABSTRACT

While the theoretical case for applying market mechanisms to control pollution is persuasive, there are several stumbling blocks which arise in their application. This paper examines some of the key implementation issues which must be addressed in designing a marketable permit scheme. The issues are brought into focus by considering a particular example--the control of sulfur oxides emissions in Los Angeles.

MARKETABLE PERMITS: WHAT'S ALL THE FUSS ABOUT?*

Recently, both state and federal pollution control agencies have begun to direct their attention towards more economical alternatives which would meet environmental objectives.[1] While it has been shown that schemes which offer firms greater choice in selecting abatement alternatives have the potential to significantly reduce the overall cost of meeting prescribed environmental goals, the response of industry, the public and even regulators has been, at best, lukewarm. What might be the cause of this less-than-overwhelming response to new approaches for controlling pollution such as bubbles, offsets or marketable permits? There would appear to be two key reasons for the cool reception. The first results from a lack of familiarity with the new regimes. The "command and control" technique currently employed is a well-seasoned approach which industry, regulators, and the public have dealt with on many occasions. It is possible that, in moving to an incentive-based approach, significant transitional costs would be incurred. A second reason for not adopting such schemes is that distributional issues may take precedence over efficiency considerations for many of the key industrial participants. This paper examines the problem of implementation for one particular alternative for dealing with pollution problems--marketable permits. The first part of the essay develops a simple framework for identifying implementation problems and points out several potential problem areas which need to be addressed. The second part of the essay addresses these issues using the specific example of setting up a market for controlling sulfur oxides emissions (SO_x) in a well defined air quality region.

I. Developing a Framework

As a starting point it is useful to construct a situation in which all firms would prefer a marketable permit scheme to a standards regime. The next step is to examine how real world considerations are at variance with the assumptions used to construct the example.

Figure 1 illustrates the relationship between levels of abatement and control cost for a composite variable called "air pollution".

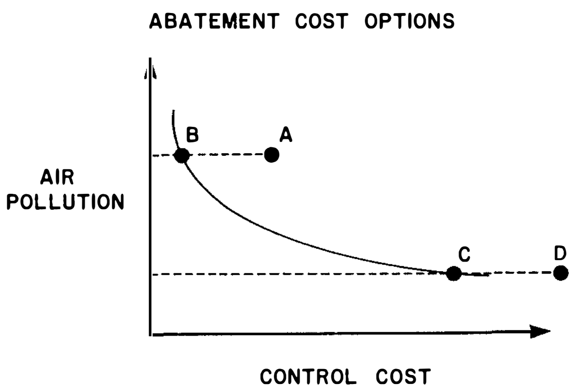

Figure 1

The curve passing through points B and C represents the minimum total cost of achieving a given level of abatement. Because of the difficulties in obtaining information on the nature of the least cost solution, it is typically thought that regulation leaves us at an inefficient point such as A. Since pollution associated with the existing situation usually exceeds the prescribed standard, let point C correspond to the target level of air pollution.

We wish to consider whether it is possible to devise a marketable permit scheme which allows us to move from point A to point C, and which would be preferred by all industrial participants. First consider the simpler problem of moving to a marketable permit scheme at the current level of pollution. This is represented by a move from A to B in the diagram. If transitional and administrative costs could be ignored, then it would be possible to move to a transferable rights scheme by issuing each firm an amount of permits which just equals their current level of emissions. This system of "grandfathering" the rights would be at least as good as the outcome under standards for some firms and unambiguously better for at least one firm (since the move from A to B implies that the overall level of abatement expenditures would be reduced).

The analysis of the situation in which the target air quality standard is more stringent (e.g., moving from A to C) is essentially similar to the argument given above, but requires one further assumption. We must assume that the distribution of rights under the standards approach is known for the level of pollution associated with C. With this assumption, it is sufficient to grandfather the rights in amounts which equal what they would have been under the standards regime. Under such a market scheme, all firms could be made at least as well off as they would be under a standards regime in which the rights to emit are nonnegotiable, since in the latter case, the air quality standard would be reached at a higher cost such as point D.

Two important factors ignored in the above analysis are the implications of uncertainty surrounding the rules to be promulgated by the agency, and the possibility that interested groups could influence the outcome. When these features are considered, the case for convincing industry that it is in their interest to adopt a permit scheme is considerably weakened.

For the case in which the level of air pollution remains unchanged and rights are grandfathered, industry might balk at the marketable permit idea for several reasons. One reason mentioned earlier is that use of a market to reach environmental goals is vastly different from the standards approach. Another possible objection is that grandfathering the rights is unfair because it tends to penalize those groups who have worked hardest to reduce their emissions. Finally, industry might argue that restrictions on trading combined with regulatory delay might lead to a system no better than the present situation, just different.[2]

If a marketable permit system is used to improve air quality over current levels, this introduces additional grounds for objecting to such a system. For example, industry might feel that the pollution associated with points C and D might never be met under a standards approach or that it would take a much longer time to reach the target. In either case, the discounted present value of staying at inefficient point A, with perhaps some chance of moving to inefficient point D in the future, could be less than the cost of immediately moving to C. Decreasing the level of pollution also makes the initial distribution

problem that much more difficult, since it is virtually impossible to know how firms would have fared if standards had remained in place.

Movement to a marketable permit scheme also raises significant issues for regulators and the public. The regulatory agency must be capable of making the transition. Resistance to change can be expected. The agency may have to augment its monitoring and enforcement staff to obtain more accurate measurements of emissions which could stand up in court. The economic tradeoff which must be considered is whether the increased administrative costs would be offset by the expected cost savings in abatement.[3] For the market to work, the agency would have to develop trading rules which are comprehensible and allow several firms to participate.

The preceding list of objections might lead to the conclusion that the prospects for adopting this alternative in the near future are bleak. On the contrary, the prospects for adopting this alternative are very good indeed. This is especially true for pollutants which are not heavily regulated. A case in point would be nonaerosol chlorofluorocarbons.[4]

The basic reason for the growing possibility of actually experimenting with marketable permits is the increasingly widespread dissatisfaction among environmentalists, industry and regulators with the existing standards regime--that is, if point A is bad enough, the objections can be overcome. Industry finds the red tape and uncertainty very costly while regulators and environmentalists are dissatisfied with the progress in abating pollution. Since marketable permits are known to possess desirable properties in theory and appear to be workable for several practical applications, experimentation with this approach may be just around the corner. In fact, the offset policy and bubble policy currently being used by the U.S. Environmental Protection Agency are almost identical conceptually to a marketable permit scheme. The bubble policy, as it currently operates, is merely a smaller version of the permit schemes which are envisioned. The offset policy differs from a transferable rights scheme in two respects: first, the firm purchasing an offset must reduce its emissions to the lowest achievable level,[5] and second, the transaction costs in finding offsets and negotiating a price are excessive. A well-organized market could substantially reduce such costs, thus inducing more trading.

The federal experience to date with bubbles, banking and offsets has not been a success for two reasons: uncertainty and regulatory delay. The principal areas of uncertainty concern who has the property rights and for how long. The regulatory delay is primarily caused by the cumbersome State Implementation Plan review process. If an incentive based mechanism is to work effectively, both of these issues must be squarely addressed. By providing firms with some minimum guarantees on the duration for which their rights are negotiable, it is likely that trades would increase significantly. Similarly, if the review process could be expedited and trading rules could be clarified, all involved would benefit. Not surprisingly, the problems which befuddle

the current incentive-based approaches could just as easily arise under a marketable permit scheme.

The preceding analysis provides some insights into the implementation problems which can be expected to arise in setting up an artificial market to control emissions. The next section takes a detailed look at one particular pollution problem--sulfur oxides emissions in Los Angeles.

II. A Potential Application

To demonstrate the viability of marketable permits without actually implementing the alternative requires selecting a specific pollutant, identifying the key implementation problems, and then designing a market which will address these issues. As an example, the problem of controlling particulate sulfates in the Los Angeles region was selected.[6] This problem was chosen because it appeared to be a likely candidate for marketable permits. The scientific aspects of the problem are well understood. Data on sulfur oxides abatement costs are available or can be constructed for most of the key sources, and monitoring and enforcement problems appear tractable.

The question at hand is whether such a market could actually work. First, the criteria for measuring the success of a market need to be specified. For this specific case we would like to design a market that will meet air quality goals in a more cost-effective manner than the current system of source-specific standards, that will encourage investment in finding new abatement technologies for the future, and that will be legally acceptable and politically feasible. Legal feasibility means that the market must meet the requirements of relevant constitutional and statutory constraints. Political feasibility means that the regulatory agency should be capable of administering the program and that the approach has a reasonable chance of being acceptable enough to industry, the public and regulators that it stands a chance of being enacted by political officials.

To meet air quality goals requires a good technical understanding of the problem. The particulate sulfate problem in Los Angeles is caused primarily by the combustion of sulfur-bearing energy products. Particulate sulfates are an important concern because they tend to reduce visibility, acidify rainwater, and may also have harmful health effects. The conversion of sulfur oxides emissions to sulfates in Los Angeles can be thought of as proceeding in three stages. First, sulfur enters the air basin. Virtually, all of the sulfur which man uses in the Los Angeles area enters in a barrel of crude oil. Second, when oil products are refined or burned, some of the sulfur contained in them is converted to SO_2 and SO_3 which is released to the atmosphere. Finally, the SO_x compounds react to form sulfates through a series of atmospheric chemical processes. Cass (1978) has shown that the relation between sulfur oxides emissions and sulfate air quality in Los Angeles is approximately linear and, in addition, can be modeled as if it were largely independent of the level of other key pollutants. Given a sulfate air quality objective, it will be possible to use an environmental model to compute the corresponding level of permissible emissions.[7]

The current approach towards controlling sulfur oxides emissions relies on standards and an offset policy. New sources of pollution must trade off the uncontrolled portion of their emissions by effecting further reductions at existing sources in the Los Angeles Basin. The owner of an existing source is thus vested with a valuable property right which can be sold in whole or in part to new source owners. The owner also has the option of holding onto his current abatement possibilities to facilitate subsequent expansion.

The offset policy is one limited form of a market in transferable licenses to emit air pollutants. Its principal drawbacks are that the costs of negotiation are excessive and the number of trades which can be made by new sources are limited. Negotiation costs are high because new entrants must first identify existing sources of pollution where emissions reductions are feasible, then try to estimate a reasonable charge for the offset, and finally perhaps have to purchase the entire business operations of some polluter. Purchases of offsets by new firms are limited by the requirement that new firms must reduce emissions to the lowest achievable level before being allowed to enter the offset market. Presumably, in a full-blown marketable permit scheme, all specific source by source restrictions on burning sulfur would be lifted. This would tend to increase the number of mutually beneficial trades. In addition, the market obviates the need for bilateral bargaining, which is cumbersome and unnecessary. By conveying a uniform price for a permit, the market also ensures that rights will go to the highest bidder, and the marginal value of a right owned by a firm will approximate the market price.

While the market in licenses can attain a least cost solution, this cannot be assumed. In constructing a market in sulfur oxides emissions licenses for Los Angeles, care has to be taken to ensure that a few firms will not be able to dominate. Table 1 gives some indication of the relative market shares of sulfur oxides emissions in 1973 and projected shares for 1980 under a low natural gas scenario.

TABLE 1

Past and Projected "Market Shares" for Sulfur Oxides Emissions by Source Type for the South Coast Air Basin

1973 Emissions		1980s Projection - low natural gas scenario and 1977 emissions control regulations	
Source Type	% of Total Emissions[b]	Source Type	% of Total Emissions[b]
Utility	28	Utility	31
Mobile Sources	16	Mobile Sources	27
Utility	11	Utility	10
Oil Company	8	Oil Company	4
Steel Company	7	Coke Calcining Company	4
Oil Company	3	Oil Company	3
Coke Calcining Company	3	Steel Company	3
Oil Company	3	Oil Company	3
Oil Company	2	Oil Company	2
Oil Company	2	Oil Company	2

[a]These figures are based on sources located within the 1974 definition of geographic boundaries of the South Coast Air Basin (which was subsequently revised).

[b]Emissions are rounded to the nearest percent.

Source: Based on author's calculations from data used to compile Cass (1978) and Cass (1979).

The low natural gas scenario is essentially a worst case because the absence of natural gas means that fuel with higher sulfur content will be burned. If this pattern of emissions is accurate, the electric utilities can be expected to account for the largest share of emissions. Note that mobile sources account for more than one-fourth of the total in the 1980s scenario. To force all mobile sources to participate in the market would, needless to say, be quite expensive.

Fortunately, it may be possible to transfer this responsibility to local oil companies since they make the gasoline, diesel oil, jet fuel, and bunker fuel burned by mobile sources.

While a transition to a market in tradable licenses will almost certainly imply different market shares from those presented above, the electric utilities can still be expected to have the largest share of the market. This presents some difficulties because even if the utilities act as cost minimizers their interaction with the public utilities commission rate-setting process might provide incentives towards investing in licenses which differ from more conventional privately-held firms. The problem of predicting utility behavior in a license market is currently being investigated by examining how other durable assets, such as real estate, are treated, and by observing utility behavior under the current system of offsets and banking.

Given that competition in such a market is not a foregone conclusion, it is important to ask what happens if some of the safeguards don't work and some of the firms successfully manipulate the price of a license. While this would certainly affect the distribution of income and should be avoided if possible, it by no means renders the system a complete failure. In fact, so long as the market provides greater flexibility for firms wishing to locate in Los Angeles while maintaining the current level of air quality, this will be a big step forward over current policy.

Some critics fear the market may not have a sufficient number of trades to be competitive. In the jargon of the economist, this is the problem of "thin" markets. The extreme case of a thin market is when no trading occurs. From a practical point of view, this lack of trading would be a concern even if firms in the area were at an equilibrium which minimized aggregate abatement costs. The concern stems from the observation that new firms wishing to enter the area would receive little information on the cost of entry. The solution to this problem is to devise a system which will give potential entrants a price signal when the market becomes too thin. One alternative whose properties are currently being investigated, is to have existing firms put a small percentage of their permits up for sale. Anyone wishing to bid on these licenses, including existing participants, would be encouraged to do so. Under such a scheme, new entrants would have a better idea of the cost of emitting sulfur oxides in Los Angeles.

While questions of efficiency are important, distributional issues must also be addressed if the market is to become a politically viable entity. One important concern in moving to a market to control sulfur oxides air pollutants is the transitional costs which firms will face. Some firms or industries may be forced to shut down. For example, if a firm competes in a national market and faces an elastic demand for its product, it may be the case that the costs of entering a license market could force it to move to another area where environmental regulations are less costly. Estimates of the likelihood of firm closings obtained so far indicate that plant closure will not be a problem in this specific case.[8] If the policy maker wishes to avoid plant closings, this issue can be addressed through a suitable initial distribution of licenses.

To gain some perspective on the distribution problem, it is useful to have a qualitative estimate of the size of the "pie." Preliminary estimates of the total annual value of emissions (i.e., the price of a license multiplied by the quantity issued) are in the neighborhood of 150 million dollars per year.[9] Assuming there are roughly 10 million people in the South Coast Air Basin implies that each person could receive 15 dollars per year if the licenses were auctioned and the proceeds were distributed to the public. Some critics have argued that the magnitude of the potential wealth transfers involved does not bode well for marketable permits in the political arena. While problems with distribution can be viewed as a barrier to implementation, there is an alternative view that control over the distribution of permits makes it that much more likely that a politically acceptable solution can be found.

What is really at issue here is who will be given the property rights to the air, and for how long. It is quite likely that a large part of the resistance to emissions tax proposals is related to the realization that under most taxation schemes, emissions rights will revert back to the public domain.[10] This is, in essence, the nature of the excess burden or double taxation argument which states that it is unfair for industry to have to pay the tax and pay to clean up as well. The alleged inequity of the excess burden can be directly addressed in

a marketable permit scheme. In the extreme case, all licenses could be distributed to industry if that were deemed fair or necessary to enlist industrys′ cooperation. Alternatively, some of the proceeds could go directly to the public or could be used to finance administrative costs. The basic point is that adopting a marketable permits approach provides a great deal of flexibility in addressing distributional issues.

The final question which needs to be addressed is whether the infrastructure exists to handle a marketable permits scheme. There is currently a nominal emissions fee system in place for the South Coast Air Basin. Each firm is required to complete a form analogous to an income tax form which gives annual emissions for air contaminants which are subject to the fee. The principal purpose of the fee system is to cover a part of the operating cost of the South Coast Air Quality Management District (AQMD). For example, during the 1980-81 fiscal year, fees can be expected to cover about 30 percent of the projected 20 million dollar budget.[11] Sulfur oxides emissions are one of five air pollutants which come under the fee system. The charge for emitting a ton of sulfur oxides is $21.[12] This can be compared with a license price which is estimated to be in the neighborhood of $1,000 per ton for the case in which sulfur oxides emissions remain at their present levels. Though the AQMD currently handles all disputes over emissions fees within the agency, when the price of emissions increases by one or two orders of magnitude, it is quite likely that the courts will play some role in settling disputes.

The problem is to figure out how to minimize the role of the courts. One way is by carefully defining a license in terms which can be monitored. Two obvious choices are to define a license in terms of a short-term maximum emissions rate such as a pound per hour, or in terms of a cumulative measure of emissions over a longer time interval. For the case of sulfur oxides emissions it would probably be preferable to define a license in terms of cumulative emissions over a time interval such as a week or a month, but the problem is that integrated stack monitors do not exist which would provide the necessary information to demonstrate that a violation had actually occurred. On the other hand, the technology for determining whether a source has violated a short-term maximum emission rate does exist. This can be accomplished by a team of 4 or 5 technicians performing a source test.

The monitoring and enforcement of a marketable permit scheme to control sulfur oxides emissions is well within the grasp of the AQMD. It is a relatively straightforward manner to monitor cumulative emissions for utilities and the majority of industrial sources who do not use any abatement equipment for reducing sulfur oxides emissions. The only information that is required to estimate emissions is the quantity of fuel burned and the sulfur content of the fuel. For those sources who do not route all of the sulfur input into the air, the task is less straightforward. The major sources in this category include the oil refiners, coke calciners, glass manufacturers and steel manufacturers. There are two basic approaches which can be used to monitor stack emissions. One is the source test performed by technicians. The second is

to install monitoring equipment which indicates the concentration of sulfur within a small area in the stack. Unfortunately, without some estimate of the flow rate, it is impossible to know the cumulative emissions. While the use of stack monitors for measuring SO_x is still in its infancy and the estimates are not always reliable, they may be used as a continuous check to determine when a firm's emissions appear to be exceeding its permits.

There are currently about 20 stack monitors in place and 100 are expected to be in place by the end of 1980 in the South Coast Air Basin.[13] One possibility for enforcing the SO_x permit scheme is to sample firms at random to see if they are in violation. This random sampling approach could be augmented by a program which uses the information provided by the continuous monitoring system installed in many of the larger sources.

It is likely that the current monitoring and enforcement staff, which has a little less than 200 members, would have to be increased if a SO_x marketable permit scheme were implemented. The size of the required increase is not certain, and depends on an assessment of how well the current system works. By all accounts of people interviewed, both in and outside the AQMD, the system for monitoring SO_x emissions works well now, so I feel that, at most, it would cost the agency an additional million dollars annually to monitor.[14] This amount is easily offset by the expected cost saving to be derived from using marketable permits.

There are some legal problems which need to be addressed in the implementation phase. For example, it is not clear whether under current law the AQMD can penalize violators by fining them in accord with the severity of the violation. It would be desirable to have a system of fines which could be administratively imposed in order to minimize the role of the courts. In addition, the question of who should be given the burden of proof needs to be addressed. The current reporting system for emissions is analogous to federal income tax reporting with the polluter responsible for substantiating his claims when the AQMD estimates differ with those submitted by the polluter.

The exact form of the fine raises some interesting issues. First, consider the objectives in designing a penalty system. The basic objective is to provide firms with a strong incentive to play by the rules so the air quality target will be met. But, how strong an incentive? Clearly, if the penalties were made high enough and there were some probability of getting caught, all firms would play by the rules. There is a question, however, both from a legal and an administrative perspective, as to how high you can make the penalties and still have them be workable. If the penalties far exceed the estimated damages, the courts are not likely to uphold them and the regulators might be reluctant to impose them. Such might be the case if all violations were to be punished by closing down the plant. Thus, in addition to providing an incentive for firms not to exceed their allowed emissions, a penalty scheme should be enforceable.

There are no magic formulas for determining a penalty scheme. The basic theoretical approach is to try to maximize the difference between social benefits and social costs. Operationally, this is not very helpful. If the firm's violation is viewed as marginal, then a less grandiose objective might be to equate the firm's marginal benefit from the violation with the marginal cost to society of allowing such a violation. The firm's marginal benefit can be estimated by members of the firm, but, in all likelihood, is not public information. The marginal physical damage to society of such a violation is anybody's guess, but can usefully be separated into two components: the probability of getting caught, p, given that a firm is in violation, and the damage due to a violation, D, which is detected. We shall then define the expected marginal physical damage to society of a violation D, which is detected as (D/p). The problem is to operationalize this notion by defining physical damages more precisely and converting them to monetary damages.

Quantification of damages is always difficult. For illustrative purposes suppose that damages are a function, f, of the size of the difference between monitored emissions and permits currently held by the firm. Call this difference x so that damages are represented by $D=f(x)$. Let F be the size of the fine in dollars and let ℓ be the price of a marketable permit. Equation (1) represents a preliminary attempt to link the fine to damages, the probability of getting caught when in violation and the existing price for polluting, ℓ.

$$F = \frac{f(x)\ell}{p} \qquad (1)$$

The numerator of equation (1) represents an estimate of the monetary value of damages. Dividing through by p gives a measure of expected damages. Thus, the firm is supposed to compare its expected marginal benefits with expected damages.

Though there is nothing wrong with equation (1) conceptually, it suffers from one serious flaw. Such a penalty system can be circumvented by driving the price of a permit to zero. This situation could easily arise if a sufficiently large number of firms chose not to participate in the market. Equation (1) is easily modified to deal with this issue. Let 'a' be a parameter set by the regulator which could reflect the expected market price of a permit if all firms were to participate in the market. This gives rise to equation (2) which captures the spirit of (1), but does not fall prey to manipulation as easily.

$$F = \frac{f(x)\ \mathrm{Max}(a,\ell)}{p} \qquad (2)$$

In Equation (2), "Max" denotes the maximum of a and ℓ. Thus, at a minimum, a firm caught in violation would have to pay $f(x)a/p$.

The nature of the damage function, $f(x)$, needs to be spelled out. If the objective is to keep firms close to their permit levels, then it makes sense to increase the marginal cost when the size of the

violation increases. This is easily accomplished by letting $f(x) = Kx^n$ where K is an arbitrary constant and n exceeds unity. Substitution into (2) yields:

$$F = \frac{Kx^n\ \mathrm{Max}(a,\ell)}{p} \qquad (3)$$

Equation (3) is offered merely as one possibility for designing a penalty scheme. It has the virtue that it is simple, and all the parameters can be estimated, at least roughly. Furthermore, it crudely relates benefits to costs, and also would appear to be consistent with the postulated objectives for a penalty system.

The point of going through this exercise of designing a fee was to demonstrate a general approach to the problem as well as noting some of the difficulties in moving from theory to practice. The above formulation is simplistic. It assumes away many of the measurement problems. For example, there is obviously some uncertainty in measuring x. Nevertheless, it is our belief that source tests are sufficiently accurate to warrant a penalty design which assesses fines which are commensurate with the size of the violation. Another problem is that p is really an endogenous variable, which depends on the penalty scheme actually adopted, making it difficult to estimate before implementation begins. In addition, the probability of detection may vary with the size of the violation.

The detailed design of a penalty system will require further distinctions not made here. For example, firms who report violations should be subject to less severe penalties than firms who do not. In the above model, p could be set equal to unity for firms reporting violations. In actuality, firms caught cheating on their reported emissions could be subject to other civil or criminal sanctions, similar to those imposed by the Internal Revenue Service.

The first objective in designing a penalty scheme was to induce firms not to exceed the allowable level of emissions most of the time. However, it was recognized that there may be unforeseen circumstances, such as an equipment failure, when a firm might violate its emission limit for a short time. Just as it is important to identify extenuating circumstances for the individual firm, it is also important to identify situations where a marketable permit scheme may be inappropriate. For the case of SO_x emissions in Los Angeles, these are two types of uncertainty which can be expected to strain the system. The first is the unpredictability of the natural gas supply. The permit scheme can handle this uncertainty in two ways: either by forcing industry to deal with this uncertainty or providing some relief in the form of issuing temporary permits should a crisis situation arise. The second major area of uncertainty is the problem of air pollution episodes which require dramatic action on the part of all participants. Because such events are very difficult to predict in advance, the best way of handling these situations is probably to suspend the permit system and invoke tighter regulations during these brief periods.

The preceding discussion indicates that it will be possible to design a market in tradable SO_x emission licenses for Los Angeles. Monitoring and enforcement capabilities currently exist, but will probably have to be expanded. A fee system needs to be worked out in detail which will induce firms not to exceed their allowed level of emissions. In addition, the problem of obtaining revenues to administer the market must be addressed. One simple solution is to set a nominal fee on SO_x emissions analogous to the 21 dollar/ton fee which is applied now. Such a fee could be expected to lower the permit price by the discounted value of the fee.

III. Conclusions

In a world not beset by uncertainty, but befuddled by pollution problems, it was possible to construct an example in which marketable permits were preferable to standards. In the real world in which we live, the comparison is less straightforward. There are transitional costs in moving to a new system. Not all firms will necessarily be winners in moving to a permit scheme. It is possible that firms may face higher abatement costs than under standards for the simple reason that the air quality goals may be reached more quickly.

Despite these objections, there appears to be an increasing willingness on the part of all groups to experiment with new kinds of environmental regulation. This enthusiasm is derived, in part, from the observation that the command and control approach is not working for many problems. It is burdensome administratively, and even though industry can sometimes foster delays in enacting regulations, the attendant uncertainties can be very expensive for firms who have long-term planning horizons. It might be the case that coalitions can be formed which are willing to consider alternatives such as marketable permits which can provide greater certainty.

If regulatory agencies decide to experiment with marketable permits, it is of paramount importance that some assurances be placed on the minimum duration of a permit. In addition, trading rules need to be spelled out clearly. If environmental agencies adopt a marketable permits approach and change the rules capriciously, they run the risk of losing support for a tool which can be a most-effective means of controlling pollution problems.

The importance of selecting the right problem cannot be overemphasized. It is helpful to have an understanding of the relationship between emissions and pollution so the target can be attained without having to iterate frequently. A monitoring and enforcement capability is imperative. Many environmental regulatory agencies currently do not have the resources or the expertise to successfully monitor and implement a marketable permit scheme. The final element necessary to assess the viability of the marketable permit alternative is an estimate of what it will cost industry to clean up the problem. This information can be used to identify implementation problems and design a market which will address these issues.

Footnotes

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1. Krier and Bell (1980) provide an insightful discussion on the relationship between some of the new approaches being proposed such as bubbles, offsets and marketable permits, and the traditional approaches to environmental regulation.

2. A summary of industrys′ skeptical perspective on the bubble policy which supports this view is contained in Environment Reporter (1980).

3. Both the study by MATHTECH and the study by Rand indicate that expected cost savings are much greater than any expected increase in administrative costs.

4. This is the subject of the Rand study prepared for the U.S. Environmental Protection Agency.

5. U.S. Environmental Protection Agency (1980), p. 8.

6. The Los Angeles region refers to the South Coast Air Basin and a part of Ventura County. The current definition of the South Coast Air Basin includes all of Orange County, the majority of Los Angeles County and parts of San Bernardino and Riverside County. See Air Report (1980) for a more precise definition.

7. See Cass (1978) for a description of the model and the validarion procedure.

8. There are two possible exceptions to this conclusion--a large steel manufacturer which may close down before the system could get underway, and the glass manufacturers who account for less than 1% of current emissions, but have very high abatement costs. It appears that both of these problems could easily be handled through a distribution scheme that is politically acceptable.

9. The calculations and methodology for obtaining these estimates are explained in Hahn (1981).

10. This point may need further clarification for readers with a legal perspective on the issue. In a legal sense, it may be true that the public has a claim on such rights. The point made here is that regardless of who has the claim, industry is, de facto, exercising the right whenever it spews forth emissions which are sanctioned by law.

11. Based on interview with Eric Lemke (1980).

12. Small emitters as defined in Rule 301 of the Rules and Regulations are exempted. SO_x is measured in equivalent tons of SO_2.

13. Based on interview with Eric Lemke (1980).

14. This upper bound estimate is based on the assumption that up to 25 or 30 more technicians might need to be hired.

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