Regulations and Economic Incentives in a Competitive Context

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While the regulatory system that has evolved in the United States over the last two decades to control industrial pollution is complex, there is widespread agreement about some of its more prominent features. (Some are shown in table 1-3 in chapter 1 in the column labeled prevailing system.) Emphasis remains on treating pollution once it has been released (end-of-pipe approach) rather than on preventing it. A single media approach to pollution predominates, with separate laws, regulatory offices and enforcement procedures for air, water, hazardous waste, and other media. Rather than setting an overall emission limit for a facility, regulations and permits often separately specify emission rates for individual sources within the plant. The system is characterized as command and control. In addition, there are overlapping local, State, and Federal laws and reporting requirements. The system is adversarial, with frequent challenges taken by all sides long after laws are first passed. Finally, there is little emphasis on technology development and innovation or on technical assistance to help industry meet pollution control requirements (discussed in chs. 7 and 8).

Much progress has been made to control industrial pollution under this system. Still, it is hard to argue that the level of environmental protection enjoyed today could not have been achieved in a more cost-effective fashion, As a result, there is considerable interest in finding ways to adjust the U.S. regulatory system so that comparable or even higher levels of environmental protection could be achieved at lower costs and with less adverse competitive impacts on U.S. industry. Other countries and

regions, including the European Commission, also are looking for new approaches.[1]

This chapter examines the potential to use new regulatory approaches and economic incentives in the regulatory system in ways that would achieve comparable or higher levels of environmental protection at lower costs and with less potential for adverse competitive impacts on U.S. industry.[2] It is assumed in this discussion that these alternatives are carried out in the context of a regulatory system with strong standards and vigorous enforcement. Otherwise, the environmental objectives might not be achieved.

PRINCIPAL FINDINGS

Regulatory Reform

- For the most part, the current regulatory system is characterized by a one-pipe-at-a-time approach to environmental protection, with separate legislative, regulatory, and implementation systems dealing with the different media. Moreover, the current permitting system requires individual sources to be controlled and permitted, and sometimes establishes permit limits that are defined by particular technologies. Finally, regulators often rely on strict interpretation of statutes and regulations regardless of the environmental record of the facility.
- Federal and State regulators and industry in many parts of the country are experimenting with innovations that, if widely replicated elsewhere in an appropriate manner, could ease adverse competitiveness impacts while reducing pollution and waste.[3] As shown in the third column of table 1-3, these experiments include multimedia regulation, permitting, and inspections; use of facility-wide emission caps and performance standards; giving more regulatory options to good environmental performers; a focus on pollution prevention; and more emphasis on technological innovation and technical assistance. Taken as a whole, these experiments, in addition to efforts to institute economic incentives, have promise as a way to expand the regulatory tool kit, but they have yet to be widely adopted.
- As long as strong regulation and enforcement are fully maintained, a number of steps could be taken to reduce the competitive burden on industry while still achieving environmental goals. The top leadership of EPA in the current and last administrations has recognized the need for change (including greater emphasis on pollution prevention), some people in various EPA offices have been proponents of new methods, and a limited number of pilot projects and small programs in alternative regulatory approaches have been started. However, widespread and systematic rethinking and reshaping of the traditional regulatory system has yet to take place.

Economic Incentives

- The marginal costs of pollution control usually differ between firms, and between processes and facilities within the same firm. Therefore, requiring equivalent pollution reductions by both high-cost and low-cost sources and polluters can be an expensive way to control pollution. When used as part of a strong regulatory

[1] For example, the European Commission reports that, ". . . achieving integration of the requirements for competitiveness and the environment requires the implementation of a strategy based on the coordinated recourse to a wide variety of instruments, within the fields of both environmental and industrial policy." European Commission *Industrial Competitiveness and Protection of the Environment,* Communication of the Commission to the Council and to the European Parliament (Brussels: European Commission, 1992). A similar consideration of alternatives is underway in Germany. Udo ESimonis, "Environmental Policy in the Federal Republic of Germany," paper of the Science Center Berlin, 1991.

[2] Another OTA assessment, due to be completed in early 1995, is examining new approaches to environmental regulation in more detail.

[3] For example, see Bradley I. Raffle and Debra F. Mitchell, *Effective Environmental Strategies: Opportunities for Innovation and Flexibility Under Federal Environmental Laws*, draft (Chicago, 111: Amoco Corp., June 1993).

system, economic incentives can lower environmental compliance costs by obtaining more reductions from polluters who can reduce most cheaply, and fewer reductions from those who face higher marginal control costs.

- Two principal incentive approaches are marketable permits and taxes and fees. Marketable permits allow firms to meet regulations by either releasing no more than permitted levels of pollution, or buying the rights to pollute from a firm that has reduced pollution below permitted levels. Alternatively, emissions can be taxed so that firms with high marginal costs of control would choose to pay the tax while firms with low costs would reduce emissions. In theory, with both approaches, total emission levels would be no higher than with a command and control system, while compliance costs would be lower and firms would possess a greater incentive to develop innovative technical approaches to reducing pollution.
- Incentive systems have limits. The necessary accuracy and timeliness in monitoring may be difficult to achieve in some situations. Depending on the type of pollutant, the covered geographic area might have to be defined quite narrowly to avoid excessive local concentrations of emissions. Unlike tradable permits, reliance on taxes or fees makes it difficult to predict the amount and pace of emission reductions. There is no assurance that, on net, firms will choose reducing emissions over paying the tax, However, fee and tax systems are likely to have lower administrative cost associated with them than with tradable permit systems. While incentive approaches promise much in theory, their use may be more limited in practice.

Linkages Among the Alternatives

- There are important linkages between and among these alternatives for regulatory reform and economic incentives. A shift in emphasis to pollution prevention (detailed in ch. 8) will produce more projects that do not fit the standard regulatory framework. More use of tradable permits might require greater delegation of authorities to the States and, at the same time, a closer working partnership between the States and EPA. Firms able to sell or trade pollution rights will likely have more incentives to undertake pollution prevention to lower emissions below what is required. Full facility permitting facilitates pollution prevention, since it enables firms to examine all issues at once and understand cross-media impacts. Heightened cooperation between industry, other affected interests, and regulators in regulation development fosters pollution prevention since industry can see in totality all upcoming requirements and plan for them. An emphasis on pollution prevention requires more effort devoted to technology development and diffusion. Organizing regulatory activities more by industrial sector, rather than media, enables greater levels of consultation, reduces paperwork requirements, and facilitates pollution prevention.

REGULATORY REFORM

A number of experiments are underway in the United States that are testing new ways to achieve high levels of environmental protection while minimizing competitive impacts for firms. In some cases, these efforts lower costs; others provide more opportunity for technological innovation and production flexibility, and still others reduce administrative burdens associated with compliance.

Interest in these new approaches, including use of incentives, can be expected to increase as further incremental reductions in emissions become more expensive. So far, for a number of reasons, their adoption has been relatively slow. First, many of these ideas have only recently emerged. Moreover, momentum for change will be based on the results of policy experiments underway in testing these approaches. Second,

some in the regulatory and environmental communities view regulatory reform the same as regulatory relief, which reduces environmental protection. Third, regulators have few resources (time or money) to devote to policy and program innovation; instead many have their hands full implementing existing laws. Fourth, ways to overcome monitoring and administrative difficulties will need to be addressed before widespread replication occurs.

Most regulatory agencies, including EPA, have focused principally on developing command and control regulations, and have made less effort to develop and implement innovative alternatives. Still, a small, but growing number of experiments are underway. EPA has initiated a number of projects to test new approaches, though these have yet to fully permeate the mainstream of EPA's culture. In contrast, a few States and localities are farther ahead in initiating and testing these approaches. So far, EPA has made only a few efforts to develop State-Federal regulatory partnerships to support these innovative State efforts, and to evaluate, actively use and diffuse the regulatory innovations.[4]

Formulation of Environmental Regulations

In the United States, affected interests, including industry and environmental organizations, compete to influence environmental decisions by legislative bodies and regulatory agencies. After laws are passed, the rulemaking process allows these interests to participate through comments on proposed rules.

Many view the current system of notice and comment rulemaking as slow, cumbersome, and adversarial. Even some informal rulemaking procedures allow opposing parties to present formal arguments and proof, similar to legal hearings. Currently, four out of five EPA decisions are said to be challenged in court, suggesting the difficulties of achieving consensuse[5] The adversarial process encourages polarization, which makes achieving effective solutions more difficult. Industry often initially overestimates the costs of compliance and the technical difficulties in achieving it, while environmental organizations often promote solutions with little evaluation of costs. Consultation is sometimes less extensive than optimal because EPA is often under time pressures for rule development, and finds it difficult to engage in more consultative efforts, even though more consultation might reduce the total time because implementation could then be made swifter and less contentious.

Some other countries involve regulated parties more fully in developing regulations.[6] For example, regulation formation in the Netherlands involves close tripartite cooperation between government, the scientific community, and industry. Because issues of technological feasibility, compliance deadlines, and cost are taken into account at an early stage, it is less likely that decisions will be challenged legally or politically by industry.[7] However, these systems also have drawbacks. As practiced elsewhere, they are usually less open and less accessible to environmental groups or other nongovernmental organizations (NGO) outside of industry. As a result,

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[4] A task force of state and federal regulatory managers was formed by former Administrator William Reilly in *1992* to formulate better organization of state-federal relations. Under current Administrator Browner, EPA is developing a management plan to implement their recommendations. See State/EPA Committee, "State Capacity: Building the Future for Environmental Management" (Washington DC: U.S. Environmental Protection Agency, Oct. 13, 1992; also *Report of the Task Force to Enhance State Capacity: Strengthening Environmental Management in the United States,* (Washington, DC: U.S. Environmental Protection Agency, June 21, 1993).

[5] Don Clay, ' 'New Environmentalist: A Cooperative Strategy, " *Forum for Applied Research and Public Policy,* Spring, 1993, pp. 125-126.

[6] Sheila Jasanoff, "Negotiation or Cost-Benefit Analysis: A Middle Road for U.S. Policy, " *The Environmental Forum,* July 1983, pp. 37-43.

[7] There arc significant institutional and cultural differences between these European nations and the United States that preclude simple adoption of these policy processes. However, they do point to the advantages of more cooperative approaches.

there may be less incentive for vigorous enforcement and possibly weaker regulations,

Some experimentation is underway in the United States to involve all affected interests (including environmental organizations) in more cooperative approaches.[8] For example, negotiated rulemaking (reg-neg) processes use informal bargaining among affected groups and regulators that may culminate in an agreement that becomes the basis for the rule.[9] In theory, these processes may have several advantages over more adversarial processes.[10] First, better outcomes are possible because all views are heard and can be woven together as parties become more aware of the needs and constraints of the other stakeholders. Second, negotiated rulemaking may increase rule acceptability and make implementation easier, since parties involved in making the rule are less likely to oppose its implementation. Third, negotiation may speed acceptance of new technologies and approaches once a law or regulation requiring an outcome is in place. For example, several major petroleum companies engaged in negotiations with the California Air Resources Board on reformulation of fuels and, as a result, reduced the time needed for approval of new reformulated gasoline products.[11]

Cooperative approaches can also be used in implementation. For example, a cooperative effort between EPA and Amoco Corp. provided an opportunity for industry officials and regulators to jointly examine emissions, regulatory requirements and control technologies for Amoco's Yorktown, Virginia refinery, The 2-year project resulted in a detailed emissions inventory of the facility. Moreover, it allowed industry and regulators to identify the lowest cost sources to control and the most cost effective control technologies—most involving pollution prevention. Besides developing a large amount of useful knowledge about the plant, the cooperative project also allowed industry officials and regulators to better understand each other's concerns and orientation to the problem. While the project itself was successful, the approach has yet to be widely replicated. However, both the President's Council on Sustainable Development and EPA Administrator Browner have indicated interest in further Amoco-like cooperative projects.

Not all issues are subject to negotiations. For example, it would be difficult to negotiate a statutory ban on a particular substance, although the timing, uses covered, and extent of technical assistance might be negotiated. Moreover, negotiated rulemaking and other cooperative approaches can be time-consuming and costly for stakeholders and regulatory agencies, especially on the front-end of regulatory development, Finally, care needs to be taken to ensure that all affected parties are included, particularly the unorganized or marginally affected. When many parties are involved, reg-neg may not be viable.

Integrated Regulation

As has been mentioned, the current regulatory system emphasizes a one-pipe-at-a-time approach to environmental protection, with separate legislative, regulatory, and implementation systems dealing with the different media. As a recent report suggests:

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[8] For example, EPA began negotiations in 1992 with industry, unions, environmental organizations, and state regulators to craft coke oven emission rules that all parties would agree to and not challenge in court.

[9] "Rethinking Regulation: Negotiation as An Alternative to Traditional Rulemaking" (research note), *Harvard Law Review*, vol. 94, 1981, pp. 1871-1891.

[10] peter Bohm and Clifford S. Russell, " 'Comparative Analysis of Alternative Policy Instruments," *Handbook of Natural Resources and Energy Economics, vol. 1*, edited by A.V. Knees and J.L. Sweeney (New York: North Holland, 1985).

[11] When ARCO developed reformulated gas, it involved technical staff from the California Air Resources Board (CARB) in the development process from the beginning. Staff knew how the work was progressing and what the issues were and, as a result, ARCO was able to reduce the time taken to get the new formulation approved by about a year. Similarly, Chevron worked with CARB to generate rules governing reformulated diesel fuel, allowing the company to develop a less-expensive fuel.

> EPA is caught in a structure that is oriented to environmental media or a particular problem, while its research, enforcement, and planning and evaluation staff struggle for broader approaches. The separate laws that guide each program use different standards for action and provide no overall mission for the agency .[12]

This single media approach has been criticized both for failing to adequately protect the environment[13] and for unnecessarily adding to U.S. industry's regulatory burden.

The one-pipe-at-a-time focus makes it difficult to take an integrated approach with multimedia benefits.[14] Sometimes efforts to clean up one kind of pollution create problems in another media. Scrubbing of stack gases, for example, creates sludge that needs treatment and disposal.

A facility may produce several different kinds of pollution, each subject to requirements that can run at cross purposes. Firms often report the same information to different media offices and agencies.[15] Monitoring, permitting, and reporting requirements for the various media offices use different timetables and measurement standards.

The media-specific organization of EPA and most State regulatory agencies has been a barrier to moving more towards lower cost pollution prevention approaches.[16] While some progress has been made in supporting pollution prevention, media office staff have more incentives to promulgate single-media pollution control regulations.[17] EPA funding reflects the emphasis on end-of-pipe programs.

The result has been the development of a corp of experts primarily focused on the problems in a single medium.[18] Sharing of expertise and information among media programs is often limited, a circumstance that can cause delays in rulemaking. Moreover, this structure hinders industry in finding a single point of contact in the agency to address data duplication, conflicting rules, or strategic planning for all media.

An alternative would be to seek to develop multimedia regulations and rules, perhaps organized around particular sectors (e.g., pulp and paper, petroleum refining). For example, the Swedish environmental program is focused in part on sectoral industry councils (e.g., pulp and paper, iron and steel). A few States have begun to organize more along industry lines. The Wisconsin Department of Natural Resources has set up eight technology teams for particular industries.

EPA also has made some efforts to organize its activities along industrial lines. In the late 1970s, it established the Integrated Environmental Management Program.[19] The agency undertook a series of industry studies to assess the joint effects of air, water, and solid waste regulations, both those in effect and forthcoming, on particular industries.[20] The studies found that sometimes the risks were much higher in a particular media and it made little sense to concentrate equally on all

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12 National Commission *On* the Environment, *Choosing a Sustainable Future* (Washington DC: Island Press, 1993), P. 100.

13 Barry Rabe, **Fragmentation** *and Integration in State Environmental Management* (Washington, DC: The Conservation Foundation, 1986).

14 The National Advisory Council for Environmental Policy and Technology, *Transforming Environmental permitting and Compliance Policies to Promote Pollution Prevention* (Washington, DC: U.S. Environmental Protection Agency, Office of the Administrator, February 1993).

15 Wendy Cleland-Hamnett and Joe Retzer, "Crossing Agency Boundaries, ' *The Environmental Forum,* March/April, 1993, pp. 17-21.

16 National Commission on the Environment, *Choosing a Sustainable Future,* Op. cit., footnote 12.

17 The National Advisory Council for Environmental Policy and Technology, *Transform-ng Environmental permitting and Compliance Policies to Promote Pollution Prevention,* op. cit., footnote 14, p. 25.

18 Mahesh Podar and Howard Klee, "~te~ated Environmental Management: A Cost-Effective Approach to Protecting the Environment," *The Journal of Resource Management and Technology, vol.* 21, No. 1, March 1993, pp. 33-43.

19 Personal conversation with Michael Gruber, former EPA official, June, 1993.

20 These industries included chemicals, copper refining, iron and steel making, metal finishing, petroleum refining, and pulp and paper.

media. Some studies questioned the cost-effectiveness of such approaches. While these exploratory studies unearthed useful information, they were not linked in a direct way to decision-making. The effort was phased out in the mid-1980s.

EPA has recently reinstituted similar efforts. Under the Agency's regulatory cluster team concept, a team from relevant EPA offices approaches particular problems from a broader viewpoint.[21] Four industry clusters have been formed (petroleum refining, oil and gas production, pulp and paper, and the printing industry) .[22] EPA is using clusters to jointly develop effluent guidelines for discharges to water and Maximum Achievable Control Technology (MACT) standards for toxic air pollutants for the pulp and paper industry.

EPA is also piloting a revised regulatory development process through its Source Reduction Review Project (SRRP), which commits the agency's single media programs to jointly investigate and promote pollution prevention during the rule development process. The SRRP is EPA's response to the 1990 Pollution Prevention Acts requirement that EPA ascertain the effect of its regulations on source reduction.[23] Its short-term goal is to ensure that source reduction measures and multimedia issues are considered during the development of air, water, and hazardous waste standards affecting 17 industrial categories. The long-term goal is to provide a model for a new regulatory development process for EPA.[24]

However, these cluster and source reduction review projects are still small and have not yet been broadly assimilated within the agency. There are several reasons for this. EPA often focuses on single media due to statutory requirements or court-ordered deadlines. The pressure to respond to tight deadlines makes it difficult to coordinate efforts involving several offices. Moreover, the current organization of media programs creates institutional barriers to more coordinated efforts.

Greater emphasis on industrial sectors might offer several advantages. Permit writers and inspectors could focus on a narrower range of industries and processes in order to develop more indepth knowledge of the nature of the pollution problems in those industries, the regulations covering them, and the most effective ways to solve them, including through pollution prevention, Regulators would be more knowledgeable about industry leaders and laggards in controlling and reducing pollution. Officials would better understand pollution prevention and industrial process technology, since, unlike treatment technology, pollution prevention technology is often specific to particular sectors. At present, some efforts to develop integrated regulations suffer from lack of indepth understanding of the sector being examined. Moreover, a sectoral orientation could stimulate new opportunities to experiment with cooperative interaction among industry, environmentalists, and government. Finally, because all parties would be examining the workings of regulation on an industry, it might be clearer when incongruities arise among proposed requirements.[25]

There are several potential drawbacks to such an approach. Regulators might be more easily captured by industry interests if they dealt exclusively with that industry. Moreover, some indus-

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21 Cleland-Hamnett and Retzer, op. cit., footnote 15.

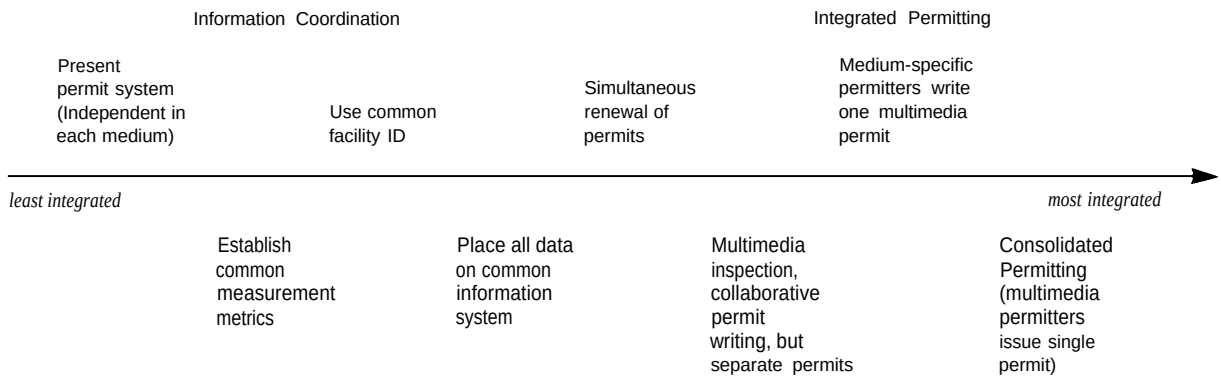
22 EPA has formed 17 clusters, most of which do not focus on specific industries but rather on chemicals (e.g., lead) or on activities (e.g., non-point source water pollution).

23 Lynn L. Bergeson, "The SRRP: Making Pollution Prevention Work," *Pollution Engineering,* July 1993, p. 73-76.

24 Discussion with Lym Vendenello, EPA Pollution Prevention Office, May 1993.

25 Among the alternatives being considered by EPA for reorganizing its Enforcement Office, is to organize it according to major industrial sectors.

Figure 9-l-Spectrum of Integrated Permit Options



SOURCE: James Cummings-Saxton and Robert G. Black, "Integrated Permits: What Are the Data Requirements," contract report for U.S. EPA, prepared by Industrial Economics, Inc., September 1990.

tries might argue that others are not regulated as heavily.

Integrated Permitting and Inspection

Presently, each medium's program operates separately, maintaining separate databases, using different reporting requirements, issuing separate permits with different timing, and even using unique definitions and nomenclature.[26] Less than 15 percent of EPA inspectors perform inspections in more than one program area.[27] One study concludes:

> Relatively few regulated facilities and regulators have begun to think in terms other than single-medium pollution control.[28]

More integrated approaches to permitting are possible--even including a fully consolidated permit system where each facility receives one permit, with allowed releases to the environment to be determined in a coordinated manner[29] (see figure 9-1). Other less comprehensive approaches include coordinated and concurrent permitting. With any of these approaches, permitting to achieve administrative streamlining can be coordinated to prevent pollution and avoid cross media transfers. For example, the principal purpose of New Jersey's integrated permitting program is to promote pollution prevention and reduce total releases from a facility.

Several European countries are aggressively pursuing integrated permitting and inspections. For example, in Sweden many larger regulated facilities have only one permit for all emissions.[30] The United Kingdom has passed legislation that proposes that covered installations be regulated

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26 Manik Roy, "Pollution Prevention, Organizational Culture, and Social Learning," *Environmental Law*, vol. 22, 1991, pp. 189-251.

27 U.S. Environmental Protection Agency, Office of Cooperative Environmental Management, *EPA Inspector Profile* (draft) September 1989. There has been some growth in multi-media inspections since then.

28 The National Advisory Council for Environmental Policy and Technology, Technology Innovation s-rid Economics Committee, *Transforming Environmental Permitting and Compliance Policies: To Promote Pollution Prevention* op. cit., footnote 14, p. 24.

29 James Cummings-Saxton and Robert G. Black, "'Integrated Permits: What are the Data Requirements,' Contract for U.S. Environmental Protection Agency, prepared by Industrial Economics, Incorporated, September 1990.

30 Frances H. Irwin, "An Integrated Framework for Preventing Pollution and Protecting the Environment," *Environmental Law*, vol. 22., No. 1, 1992, pp. 1-77. See also, Graham Bennett and Konrad Von Moltke, "Integrated Permitting in the Netherlands and the Federal Republic of Germany," in *Integrated Pollution Control in Europe and North America*, edited by Nigel Haigh and Frances Irwin (Washington, DC: Conservation Foundation, 1990).

Box 9-A—integrated Inspections in Massachusetts

Traditionally, the Massachusetts Department of Environmental Protection (DEP) conducted multiple, separate media inspections of each polluting facility. However, since 1987 DEP has been developing an approach to environmental protection that treats each regulated facility as a whole entity.' Under a pilot program named the Blackstone Project, individual inspectors conducted multimedia inspect ions of facilities regulated as major in one media program and m i nor in others, while teams conducted inspections for facilities regulated as major in more than one media program. The inspectors were trained to identify and promote pollution prevention opportunities. When more technical information was required, firms were referred to the State's pollution prevention technical assistance program.

The project was quite successful in the eyes of both the State and the business community. Business liked the team inspection approach because it saved them time and money through the promotion of pollution prevention. The State liked it because the inspection system took up to 50 percent less time than conventional inspections, which account for nearly one-fourth of the agency's $51 million operating budget. In addition, inspections were able to find more violations. Multimedia inspections also better facilitated pollution prevention. Based on the Blackstone model, the State launched its Waste Prevention Facility-wide Inspections to Reduce Sources of Toxics (FIRST) Initiative for inspections and resulting enforcements of industrial sources. DEP is developing teams in regional offices, training inspectors to work together, and training them in proficiency in all regulatory areas. Inspectors also receive training to identify and communicate pollution prevention opportunities. Through an agreement with EPA regarding use of Federal grants, DEP is expanding this approach. Two work groups will seek ways to improve reporting requirements and documentation of inspections. A few other States are making similar efforts. A pilot program in New Jersey will designate 18 industrial facilit ies for facilitywide permits, which, in some cases, could replace the hundreds of individual air emission and water discharge permits with varying requirements and expiration dates.

1 Manik Roy and Lee A. Dillard, "Toxics Use Reduction in Massachusetts: The Blackstone Project," *Journal of Air and Waste ManagementAs sociation,* October, 1990, 40:10, pp. 1368-1371.

under a single permit.[31] The European Commission is considering policies related to pollution prevention and integrated regulations. The OECD has also promoted integrated regulations and pollution prevention.

Several U.S. States, including Massachusetts, Minnesota, New Jersey, and Kansas, have taken steps in this direction.[32] For example, Minnesota is attempting to develop a computerized database containing all regulatory information on sources and allowing firms to apply for permits and permit modifications directly by computer modem. Massachusetts is establishing an integrated inspection program across all media (see box 9-A). New Jersey has initiated a pilot program to promote pollution prevention through integrated permitting.[33]

31 **John** Falks, **"Legal Profile: EC Integrated Pollution Prevention and Control," European** *Environment*, **vol. 2, Part 6, December 1992, pp.** 10-12.

32 **For more information on the New Jersey efforts, see Barry G.** Rabe, **"Environmental Regulation in New Jersey: Innovations and Limitations,"** *Publious*, **Winter 1991, pp. 83-103.**

33 Steven **Anderson and** Jeanne **Herb, ' 'Building Pollution Prevention** Into Facilitywide Permitting, " *Pollution Prevention Review*, vol. *2, No.* **4, Autumn, 1992, pp. 415429.**

Such projects are few and address only a handful of firms in the States implementing them. While EPA is providing a small amount of seed money and technical assistance to these projects and working to disseminate lessons, the Agency does not appear to have used the lessons arising out of these experiments to make significant changes in its own approach to pollution control regulation, or to actively encourage other States to adopt these approaches. Nor has EPA given States much encouragement to implement these innovative approaches.[34] Moreover, single-medium statutes can contain their own permitting requirements and compliance deadlines, making coordination more difficult.

Multimedia approaches have some limitations. First, it is unclear whether these projects r-night require more agency resources than the conventional single media approach. If they prove to be more costly, firms wanting multimedia inspections and permitting might be willing to accept higher fees in order to cover the marginal cost differences. Second, while multimedia approaches might work for both very large facilities where teams of inspectors are needed and small ones that don't have complex operations, they may be less suitable for mid-sized facilities.

Third, a single media focus can manage the complex interactions among laws, environmental emissions, and industrial processes. Regulators may not know enough about the tradeoffs between emissions in one media to another to make intelligent choices in granting a multimedia permit. Increased training of regulators and inspectors, particularly to recognize other media issues and pollution prevention opportunities, could address this issue. Finally, EPA's ability to fund multimedia approaches is made more difficult because of statutory limitations.

Performance Standards and Facility Bubbles

Normally firms must have a large number of separate permits, for different media (e.g., permits for air emissions, water discharges) and often for individual sources within the plant. Many regulations require sources to be controlled with release limits defined by particular technologies. These technology-based standards specify the method, and sometimes the equipment, that firms must use to comply with a regulation. Performance standards set a uniform standard of control for firms and often for their individual processes, but allow them flexibility in how to meet it. However, even most performance standards are usually based on some form of best available technology (BAT) prescribed in reference technology documents, which, in practice, the regulatory community and industry usually rely on to ensure compliance (see table 9-3).

These technology-based standards can discourage firms from developing or adopting more innovative and cheaper methods.[35] If standards describe one type of technology, and if firms choose a different type of technology they can have difficulty getting approval, since permit writers often do not have the time or inclination to approve approaches different from those normally prescribed.[36] Moreover, EPA will sometimes disallow technologies even if they are approved by State regulators.

Some performance standards limit flexibility. For example, concentration-based standards for effluent limitations may discourage pollution prevention approaches if they result in higher concentrations of the pollutant due to reduced water volume, even though the total amounts of pollutants are lower. In contrast, mass-based

34 For example, most EPA grant funds are tied to single media permitting and inspection.

35 The National Advisory Council for Environmental Policy and Technology, *Improving Technology Diffusion for Environmental Protection,* U.S. Environmental Protection Agency, October 1992.

36 Discussion with Howard Klee, Amoco Corporation, April 1993.

standards that measure total pollutants may better promote pollution prevention.[37]

The current permitting system also affects industry's cost-effectiveness in meeting regulations, Permitting is time-consuming, procedurally intricate, and technologically complex, both for industry and government. This is evidenced by the fact that nearly 50 percent of States' permitting resources are used for the routine reissuance of permits.[38] Moreover, the trend toward more specific operating permits risks loss of firm proprietary information.

Most significantly, the regulatory system sometimes has the effect of requiring control of those sources of emission that are the most expensive to control. It is often difficult for government to know what sources at a plant pollute the most, and it is virtually impossible for government to identify which emission sources in a plant cost more to control than others. Facilities in the same industry can differ in terms of pollutants because of use of different materials, equipment, products, and practices.

For example, the joint Amoco-EPA study of the cost of environmental control at Amoco's Yorktown, Virginia refinery found that marginal control costs differed significantly by source, and that regulations mandated control of the highest cost sources while allowing the lowest cost sources (which in this case could have been dealt with through pollution prevention options) to be significantly uncontrolled.[39] The Benzene Waste Operations National Emission Standards for Hazardous Air Pollutants (NESHAP) focuses on one emission source to one medium-benzene emissions to air from wastewater treatment operations. Yet, by measuring emissions to air from all sources, the joint EPA/Amoco team concluded that seven times more benzene reductions could have been achieved for one-eighth the costs of mandated controls by such actions as controlling marine loading losses and installing secondary seals on tanks. Significantly, the required controls reduce air emissions, but also create other wastes in the form of spent activated carbon and regenerator waste gases.[40] In part this stems from the fact that rules are developed for particular sources and applied to all facilities, rather than based on facility-specific plans that try to reduce pollution most cost-effectively.

Some other countries approach permitting differently. For example, Japanese and Swedish plants are often subject to discharge limits for the plant as a whole, not specific discharge points. Many Dutch plants are subject to only three permits, one each for air, water, and hazardous wastes, and within a few years may be subject to one permit for discharges from all media. Some argue that inspectors and permit writers in some European countries have more technical experience and as a result are able to provide flexibility and not require adherence to strict standards with a tight timetable. This flexibility allows European firms to cut costs they might otherwise bear with enforcement of more inflexible standards.

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37 For example, if a permit limits the pH of discharge water, firms may simply add water in order to dilute the chemicals until the pH reaches permitted levels. (The National Advisory Council for Environmental Policy and Technology, *Transforming Environmental Permitting and Compliance Policies to Promote Pollution Prevention,* op. cit., footnote 14, p. 34.)

38 Eighty-five percent of New York's NPDES permitting resources were used to review permit renewals with no significant change (Ibid, pp. 54 and 67.

39 *Amoco—U.S. EPA Pollution Prevention Project: Yorktown, Virginia, Project Summary* (Chicago, Illinois: Amoco Corporation, and Washington, DC: U.S. Environmental Protection Agency, June 1992). A similar study was done in Sweden of several petrochemical plants, which came up with similar results. Don Hinrichsen, "Integrated Permitting and Inspection in Sweden, " *Integrated Pollution Control in Europe and North America*, ed. Nigel Haigh and Frances Irwin (Washington DC: The Conservation Foundation, 1990).

40 The source reduction options had an average cost of $650/ton of pollutant recovered while the other options (largely treatment and disposal) had an average cost of $3,200/ton, nearly five times higher. It is important to note that these are Amoco, and not EPA, cost estimates, although EPA and Amoco did generally agree on the results.

Some U.S. States are experimenting with alternative permitting. Also there are some limited efforts at the State and Federal levels to move toward true performance standards and facility discharge limits. Under the 1990 Clean Air Amendments, firms that reduce emissions of air toxics 90 percent get a 6-year extension on having to implement Maximum Achievable Control Standards (MACT). But many in industry are dubious as to whether this is an advantage, since they will have already reduced emissions substantially and prior to the regulatory deadlines (although reducing the first 90 percent should be marginally cheaper than further reductions). Moreover, there is concern that approval for this extension will be onerous and complex.

The 1990 Amendments also include some provisions that move in the direction of bubbles. For example, in the air toxics programs, the MACT regulation of Hazardous Organic NESHAP (HON) allows firms to either control all points with reference MACT technologies, or use alternative controls at selected points, so long as total emissions equal the sum of all emissions that would occur if each point source were controlled using the MACT technology. However, this does not allow averaging across source categories and emissions credits obtained through averaging are discounted.

In a Minnesota pilot program, a 3M plant has been given one air permit for 5 years, and can change the process with little or no approval, as long as total emission levels are not exceeded (see box 9-B). As discussed above, the advantage to industry of such a system is being able to choose what sources to control and how. The advantage to the regulatory agency is not having to spend scarce resources approving small permit modifications and instead being able to focus on significant violators.

It is not practical to control all sources with performance standards, particularly sources that are difficult to measure. In these cases, installation of reference control technology may be the only way to ensure compliance. However, with better monitoring and compliance strategies it may be possible to move more in the direction of facility emission caps and performance standards. In addition, prescribing a number of alternative means of compliance (including pollution prevention or substitute materials), in addition to a reference end-of-pipe technology, would give industry more options in how they meet regulatory requirements. Finally, potentially large costs of collecting information and measuring releases could occur with these approaches. However, emphasizing performance standards and facility bubbles, as opposed to source-specific technology standards, might provide more than offsetting savings, and could better enable both industry and regulatory agencies to reduce pollution at the lowest possible cost.

Regulatory Flexibility

Manufacturing firms differ greatly in their level of environmental awareness, ability to meet environmental objectives, and commitment to pollution prevention. However, the same regulatory procedures govern both firms seeking exemplary solutions to environmental problems and laggards resisting regulations.[41] Moreover, permit writers and inspectors have little incentive or information to make the system more flexible. Instead, they often rely on strict interpretation of statutes and preference for prescribed methods and technology, generally in the name of creating a level playing field. As a result, companies have little leeway to try solutions that are potentially more risky, yet more environmentally and economically sound, including pollution prevention.

Pollution prevention often entails significant learning, engineering modifications, and changes in the production process before the best solutions

41 The National Advisory Council for Environmental Policy and Technology, *Transforming Environmental Permitting and Compliance Policies to Promote Pollution Prevention,* **op. cit., footnote 14, p. 27.**

Box 9-B—Flexible Permitting Systems: 3M and the Minnesota Pollution Control Agency

Under the current regulatory system, environmental regulatory agencies often tell industry how to control their pollution rather than letting industry determine how to best operate its plants within the confines of emission limits in a permit. The result is both large work overloads for the regulatory agencies with the incumbent delays, and increased costs and delays for industry. With shorter product lifecycle times and increased manufacturing flexibility, the ability to adjust the manufacturing process is increasingly critical for manufacturing competitiveness. The current regulatory system does little to recognize this new need for speed.

A new flexible permit recently issued to a 3M plant by the Minnesota Pollution Control Agency offers an alternative approach. 3M operates a Tape Manufacturing Division plant in St. Paul, Minnesota, that produces over 2,000 different pressure-sensitive tape and label products on 17 different production lines. These products are primarily manufactured by coating various solutions containing proprietary solids and solvents onto a substrate of paper or film. The major source of pollution is from evaporating volatile organic compounds (VOCs) from the coatings. In order to remain competitive in specialty tape markets, the Division will need to continuously upgrade and modernize its coating and mixing equipment and provide better and more timely service to its customers.

The area in which the plant is located meets EPA ozone standards; source modifications fall under the Prevention of Significant Deterioration (PSD) requirements. Many changes potentially could require lengthy analysis by the Minnesota Pollution Control Agency (MPCA), EPA, and 3M to determine applicability of PSD rules. While the PSD regulations allow 3M to "net-out" of PSD requirements, determination of whether 3M qualifies is time-consuming and complicated. It can take from 4 to 12 months or longer to obtain a PSD permit or determination, and this time may increase as new permit applications require more information. Moreover, changes to individual lines would normally require separate permit modifications.

3M proposed that MCPA issue a 5-year, full facility permit (a cap) for VOC emissions for the entire facility (rather than the current individual process permits currently used). Under the permit, 3M is allowed less total emissions from the plant than before, but 3M can modify processes as long as t he cap is not exceeded. The permit requires 3M to notify MCPA 10 days before beginning construction of the modifications authorized by the permit. 3M has anticipated a host of modification categories it may wish to implement. If the State does not respond within 10 days, 3M can proceed.

Compliance with the VOC emissions cap will be determined daily. A sophisticated emissions tracking system and Continuous Emission Monitoring (CEM) system will be used to factor daily emissions into a rolling annual total.

3M benefits from the flexible permit as it will be able to make needed changes in production lines without delays. In addition, near real time compliance determination reduces environmental liability resulting from regulatory or legal action, The State regulatory agency benefits because the system frees up permitting resources that can be devoted to other environmental and administrative priorities. Finally, the environment benefits because of the lower cap on emissions, and because the heightened monitoring allows quicker responses to problems.

3M is looking to expand this system to other plants in Minnesota. MCPA is viewing it as a possible model for regulation for other emission sources in the State. However, this model may work best for larger facilities with the resources to cost-effectively monitor releases.

are found.[42] In the process, firms may technically be in violation and may have no assurance that the solution will meet the standards. This is particularly true in cases where regulations are promulgated with limited time allowed for implementation. It is common for regulations to require implementation within 6 months to 3 years of promulgation. Not surprisingly, firms often rely on tried-and-true, but more expensive, end-of-pipe treatment methods that ensure compliance, even though these may be neither environmentally nor economically preferable.[43]

Moreover, the permit system itself is cumbersome and impedes flexibility. If firms change their production process, even sometimes to reduce pollution, they are often required to obtain anew permit, which often takes over 6 months for approval.[44] Efforts to streamline the permitting process have been limited. Permit writers often do not have clear instructions or manuals on what regulations and rules require from particular sources. In addition, as State permitting decisions are sometimes challenged or overriden by EPA, States are hesitant to make decisions that might lengthen the permit process.

When U.S. manufacturing was characterized by long runs of mass-produced products that changed slowly, such a permitting system would have only incidental impacts on competitiveness. However, in the new manufacturing environment, with more rapid changes in production processes, shorter product life cycles, and more rapidly changing market demands, the permitting system can inhibit needed flexibility.

Some specific regulatory measures impede flexibility and, in turn, pollution prevention. In particular, the regulatory process of defining and managing waste limits pollution prevention.[45] One of the principal barriers to reusing some wastes stems from a RCRA-derived rule that designates as hazardous waste "any solid waste generated from the treatment, storage, or disposal ... of a hazardous waste. The rule makes it difficult and costly for firms to employ reuse/recycling approaches to these wastes.[%] Regulations governing storage, transportation, and reuse can all impede pollution prevention and recycling.[47] While firms can apply to have wastes delisted under RCRA, this process is expensive

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42 OTA has feud that regulatory flexibility is also important in promoting green design of products and new processes. U.S. Congress, Office of Technology Assessment, Green *Products By Design,* op. cit., footnote *3.*

43 For example, according to one study, one reason why metal finishersin a number of cities did not develop centralizedtreatment and recycling facilities was because they were under the gun to comply with metal finishing rules under the Clean Water Act and would technically be out of compliance for a year or two until centralized facilities could be put in place. Valjean McLenighan, *Sustainable Manufacturing (Chicago:* Center for Neighborhood Technology, 1990).

44 For example, one pharmaceutical manufacturing facility has more than 200 permits just for air emissions. To get a new permit to modify their process takes significant time. The state employs one person to process regulatory agency air permits for companies in the region. Because competitiveness in the drug industry is increasingly related to development of new generations of drugs, using new processes that lower-wage competitors can't duplicate, such delays impede the ability to compete.

45 For example, see R. Lee Beyers, "RegulatoryBarriers to Pollution Prevention" *Pollution Prevention Review,* Winter, 1991-92, p. 19-29; also SRI International, *The Role of Recycling in Hazardous Waste Management,* report prepared for The Business Roundtable (New York March, 1992); also Jack H. Goldman andJeffrey S, Holik, "Regulatory Impediments to the Reclamation and Reuse ofSpent Potliner from Primary Aluminum Production,'' in *Proceedings: International Conference on Pollution Prevention: Clean Technologies and Clean Products* (Washington, DC: U.S. Environmental protection AgencyOffice of Research and Development, September 1990).

46 Matthew Weinberg, Gregory Eyring, Joe Raguso, and David Jensen, "Industrial Ecology: the Role of Government,'' in *Greening Industrial Ecosystems* (Washington DC: National Academy of Engineering Press, forthcoming, 1993).

47 Robert A. Frosch, ''Industrial Ecology: A Philosophical Introduction" *Proceedings of the National Academy of Science,* Feb. 1992, p. *802;* R. Lee Byers, op. cit., footnote 46.

and time-consuming, and has had limited success.[48] EPA resources to consider delisting petitions are limited and such petitions apply to a single site, rather than to the waste wherever it is generated. No consensus exists about how to regulate or encourage the recycling of industrial wastes.[49]

There are several approaches regulators could take to increase regulator-y flexibility without reducing environmental protection. Regulators could employ fail-soft strategies to go easy on innovators who come close to standards but fail.[50] Similarly, firms could be granted innovation waivers that allow limited noncompliance while developing new approaches .51 Fail-soft and waivers would still need to protect health and environment, but would allow near-misses for a limited period of time.

These waivers and greater flexibility might be granted to those firms with good records, similar to how firms are treated under the Occupational Safety and Health Administration's Star program, where good performers are given incentives or allowed to use flexible approaches. These incentives might expedite permitting, exempt some changes resulting in pollution reductions, and provide for more efficient inspections, streamlined paperwork requirements, and flexibility on timing and technology. In some cases, the possibility of moving to single permit, whole-facility, performance-based permits could be pursued. Safeguards, including strong monitoring systems, would have to be in place to avoid abuse of the system. Moreover, if it was demonstrated that firms were abusing the flexibility, regulators could impose the conventional system on them.

A number of States have begun to provide increased flexibility to good performers, although they cannot grant exemptions from Federal requirements. Some States are more lenient with firms that commit to work with the state pollution prevention technical assistance organizations to solve problems. California and Texas expedite permit reviews for businesses that implement pollution prevention. At the Federal level, EPA has recently proposed an environmental excellence program, but one with very few tangible incentives for industry participation.[52]

Finally, EPA rules often do not concisely or clearly State compliance needs. This makes it difficult not only for firms, especially small and medium-sized businesses, but also for inspectors and permit writers, to understand regulatory requirements .53

INCENTIVE-BASED REGULATIONS

Many economists make the case for giving firms incentives to look for more cost-effective

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48 Energetics, Incorporated, *Federal Legislative and Regulatory Incentives and Disincentives for Industrial Waste Reduction*, prepared for the U.S. Department of Energy, Office of Industrial Technologies, Industrial Waste Reduction program (Washington, DC: 1991).

49 See U.S. Congress, Office of Technology Assessment, *Managing Industrial Solid Wastes From Manufacturing, Mining, Oil and Gas Production, and Utility Coal Combustion-Background Paper*, OTA-BP-O-82 (Washington DC: U.S. Government Printing Office, February 1992).

50 The National Advisory Council for Environmental Policy and Technology, *Permitting and Compliance Policy: Barriers to U.S. Environmental Technology innovation* (Washington, DC: U.S. Environmental Protection Agency Office of the Administrator, 1992).

51 Nicholas Ashford, Christine Ayers, and Robert F. Stone, "Using Regulation to Change the Market for Innovation," *Harvard Environmental Law Review, vol. 9, 1985*, pp. 419-466.

52 Environmental Protection Agency, "Environrnentat Leadership Program," *Federal Register*, vol. 58, No. 10, January 15, 1993. This proposal, at least in its current form, may be dead.

53 For example, the rule for the Hazardous Organics NESHAP is 700 Pages.

54 OTA is conducting a separate assessment on the impact of alternative forms of regulation, including incentive approaches, on environmental protection.

ways of controlling pollution.[55] The marginal costs of pollution control usually differ between firms and between processes within the same firm. These variations in compliance cost stem from differences in size, age, and kind of technology, cost of substituting inputs, location, management practices, and other factors.[56] Therefore, requiring equivalent pollution reductions by both high-cost and low-cost sources can be an expensive way to control pollution.

The argument is that market incentives, while theoretically producing the same aggregate amounts of pollution control, would do so more cheaply by achieving more reductions from the sources that can do it for less, and fewer reductions from the sources that face higher marginal control costs. While incentive systems offer the opportunity to lower compliance costs, and in so doing reduce the competitive impact of regulations on U.S. manufacturers, they cannot be applied in all cases, and hence are best seen as a supplement, rather than a replacement, of the present regulatory system. This section discusses incentive approaches principally in relation to their role in more cost-effectively reducing pollution from industrial sources.

Types of Incentive Systems

There are two major incentive approaches that apply principally to pollution from industrial sources: marketable permits, and taxes and fees. With marketable permits, firms are allocated permits to release a certain amount of pollution, specified by statute or regulation. Firms that wish to release more pollutants than their permits allow are able to buy allowances from firms that have reduced their releases below the level of their permits. In theory, firms facing high control costs could buy allowances from firms facing low control costs and comply more cheaply than they could by reducing the pollutants themselves.[57] This is the approach taken in the 1990 Clean Air Act with respect to utilities' sulfur dioxide emissions. Another example is the bubble concept, where a facility could trade emission credits among various sources within a facility. This approach is discussed above in the section on regulatory reform. With fees, firms are charged for each unit of pollution they release.[58] Ideally, the fee would be set at a level equal to the marginal costs caused by the pollution. Theoretically, this would lead firms with low cost control options to cut emissions and firms with high cost control options to pay the fee, while achieving sufficient overall reductions to meet environmental objectives.

There are several other incentive systems.[59] Deposit-refund approaches have been used to ensure recycling or proper disposal of certain products, such as batteries or packaging materi-

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55 For an overview of incentive approaches, see Robert N. Stavins (cd.) *Project 88- Harnessing MarketForces to Protect Our Environment: Initiatives for the New President,* A Public Policy Study sponsored by Senator Timothy E. Wirth, Colorado, and Senator John Heinz, Pennsylvania (Washington, DC: December 1988). Also *Project 88—Round II, Incentives for Action: Designing Market-Based Environmental Strategies* (Washington DC: May 1991).

56 The EPA New Source Performance Standards (NSPS) were originally developed from a concept that the environmental controls on a new unit can be installed more cheaply than on an existing unit.

57 For example, under the NO_x trading scheme in the Clean Air Act, Wisconsin Power and Light sold credits to Tennessee and Pennsylvania utilities, It was able to do so, because Wisconsin law is more strict than national law, and it had already installed abatement technology that allowed it to exceed the national guidelines (*International Environmental Reporter, May 20, 1992.)*

58 For example, *see* U.S. *Congress,* General *Accounting Office, Environmental Protection: Implications of Using Pollution Taxes to Supplement Regulation* (Gaithersburg, MD: U.S. General Accounting Office, February 1993).

59 For a discussion of a wide variety of incentive approaches to protect the environment see: Alan Carlin, *The United Stares Experience With Economic Incentives To Control Environmental Pollution* (Washington, DC: U.S. Environmental Protection Agency, Office of Policy, Planning and Evaluation, July 1992); Economic Incentives Task Force, Economic Incentives: *Options for Environmental Protection* (Washington, DC: U.S. Environmental Protection Agency, OPPE, March 1991); John L. Moore, et al., *Using Incentives for Environmental Protection: An Overview (U.S.* Congress, Congressional Research Service, June 2, 1989).

als. They have also been proposed to reduce the generation of hazardous waste.[60] Buyers of a toxic chemical would pay a deposit at the time of purchase and receive it back when they took the chemical to a certified recycler or, in cases where recycling is not possible, to a certified disposal site. Making information on discharges public, such as through EPA's Toxic Release Inventory reporting requirements, can lead to public pressure on polluters, which induces them to reduce pollution. Liability rules, such as the strict and several liability conditions under Superfund, encourage polluters to reduce wastes, since they may be held liable for future cleanup. Finally, removal of government subsidies for practices such as below-cost timber sales and agricultural price supports are often advocated as a way to increase economic efficiency.[61]

Past Experience With Incentive Systems

Limited versions of marketable permit systems have been in place since the 1970s, when EPA introduced its emission trading program for certain air pollutants (see table 9-l). The first trading scheme, developed by EPA in 1974, concerned trades within plants that were expanding. Rather than stringently control new sources of emissions, plants could reduce sources of pollution in other parts of the plant so that no *net* increase in emissions occurred. A firm using netting must obtain the necessary emission reduction credits from its own sources within the plant.

In 1976, EPA developed its offset policy to allow major new sources or source modifications to be sited in nonattainment areas (under the Clean Air Act), so long as best control technology is applied and total emissions reductions are achieved. The new emissions have to be *offset* by emissions reductions from other sources in the area. Since 1976 there have been approximately 2,500 offset trades.[62]

Offsets and netting apply only to new sources. In 1979 EPA developed its bubble policy to provide benefits to existing sources. The name

Table 9-l—EPA Market-Based Environmental Incentives

Incentive Program	Date
Offset Program	1976
Offset Banking Program	1977
Bubble Program	1979
Netting Program	1980
Point Source Trading in Water	*1981*
Wetland Mitigation Banking	*1981*
Steel Industry Effluent Bubble in Water	1982
Lead in Gasoline Phasedown: Trading Program	1983
Point-NonPoint Source Trading in Water	1984
Lead in Gasoline Phasedown: Banking Program	1985
Heavy Duty Truck Engine Emissions Averaging	1985
Emissions Trading Policy	1986
New-Source-Performance-Standards Compliance Bubble Policy	1987
Stack Height Emissions Averaging	1987
CFC Trading Program	1988
Extended Heavy Duty Truck Engine Emissions Averaging (Banking and Trading)	1990
Acid Rain Industrial Source Opt-in Program	1991
Acid Rain NO_x Averaging Program	1991
Air Toxics Early Reductions Program	1991
Air Toxics Offsets Program	1991
Oxygenated Fuels: Averaging and Trading	1991
Reformulated Gasoline: Averaging and Trading	1991
Economic Incentives Rules Expansion	1992
Mobile-Stationary Source Trading Guidance	1992
Air Toxics MACT Averaging	1992
Scrappage of Old Cars	1992
Point-Nonpoint Source Trading	1992
Privatization of Wastewater Systems	1992
Safer Pesticides Incentives	1992
Streamlining Regulations of Premature Notification	1992
Municipal Solid Waste Pricing	1992
State Grants for Air Incentives	1992

SOURCE: Council on Environmental Quality, *Environmental Quality,* 1992, p. 56.

60 Molly K. Macauley, Michael D. Bowes, and Karen L. Palmer, *Using Incentives to Regulate Toxic Substances* (Washington, DC: Resources for the Future, 1992).

61 Robert W. Hahn and Robert N. Stavins, "Incentive-Based Environmental Regulation: A New Era from an Old Idea?" *Ecology Law Quarterly*, vol. 18, No. 1, 1991, pp. 1-42.

62 Barry s. Elman, Tom Tyler, and Michael Doonan, "Economic Incentives Under the New Clean Air Act' (Washington DC: Regulatory Innovations Branch, Office of Policy, Planning and Evaluation, U.S. EPA, May 1992).

derives from the placing of an imaginary bubble over a group of sources within a plant and treating all emission sources as one. Bubbles give plant managers the option of proposing an alternative configuration of emissions controls for a particular pollutant, as long as the configuration is adequately enforceable and equivalent reductions are achieved.

Finally, emissions banking allows firms to store emission reduction credits for future use in the offset, netting, or bubble programs, or for sale to others. The development of banking rules and administration of banking programs has been left up to the States. These programs were codified in EPA's Final Policy Statement on Emissions Trading in 1986, but, as discussed below, their use, particularly of the bubble policy, has been less than expected by some analysts.

More recently, EPA used trading and banking to achieve a nine-fold reduction of lead in gasolines between 1982 and 1987. The purpose of the provisions was to allow gasoline refiners greater flexibility while the amount of lead in gasoline was being reduced. Refineries were allocated credits based on the amount of gasoline they refined. EPA estimated that the savings to refineries from banking alone would be $228 million, but savings may have been greater because of high participation rates.[63] This program was much closer to the notion of a true marketable-permit system than the more limited efforts discussed above, which in part accounts for its effectiveness. The acid rain control systems in the 1990 Clean Air Act Amendments incorporate tradable permits that may save an estimated $1 billion annually, compared with a baseline cost of $6 billion.[64] EPA is promulgating new rules allowing States and firms to get credits for generating extra reductions from motor vehicles (e.g., by scrapping old, high-polluting cars), and to use these credits to meet reduction requirements in the stationary source sector. EPA also instituted some effluent trading schemes. The frost was used for in-plant trading (between two outfalls of the same plant) in the iron and steel effluent guidelines EPA issued in 1982.[65]

Some regions, States and localities are developing trading programs. The South Coast Air Quality Management District in California has proposed a NO_x trading program (see box 9-C). Massachusetts plans to issue rules for a NO_x trading system. Other States are considering such approaches, as well.

The savings achieved under EPA's trading programs, particularly netting, have been moderate, although trading has been applied to only a small share of pollution control efforts. Use of and savings generated by bubbles and banking, however, have been more limited relative to their potential. Because trading is not allowed under the bubble policy, actual savings are below potential savings.[66] (Table 9-2 lists the number of trades and estimated savings from these policies.)

Other incentives to control industrial pollution include taxes on hazardous waste, established by a number of States, increased tipping fees for disposal of waste, and sewarage discharge fees,

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63 us. Environmental **Protection Agency, "Costs and Benefits of Reducing Lead in Gasoline, Final Regulatory Impact Analysis, " (Washington DC: EPA, Office of Policy Analysis, February, 1985).**

64 Robert W. Hahn **and Robert N.** Stavins, **"Economic Incentives for Environmental Protection: Integrating Theory and Practice,"** *The American Economic Review, vol. 82, No. 2, May, 1992,* **pp. 464-468.**

65 See Mahesh Podar **and Mark** Luttner, **U.S. Environmental** Protection **Agency,** Office of Water, **"Economic Incentives in the Clean Water Act: Some** Preliminary **Results, " paper presented at the 86th Annual Meeting of the Air and Waste Management Association Denver, Colorado, April 12, 1993.**

66 **Robin W.** Hahn **and Gordon L. Hester 'Where Did All the Markets Go? An Analysis of EPA's Emission Trading** Program,'' *Yale Journal of Regulation,* **vol. 6, No. 1,** pp. **109-153, 1989; Daniel J. Dudek and John** Palmisano, **"Emissions Trading: Why is This Thoroughbred Hobbled?"** *Columbia Journal of Environmental Law,*13:2, **1988, pp. 218-56; Scott Atkinson and Tom** Tietenberg, **"Market Failure in Incentive Based Regulation: The Case of Emissions** *Trading' 'Journal of Environmental Economics and Management,* **vol.** 21, 1991, **pp. 17-31.**

Box 9-C-RECLAIM: Marketable Permits in Southern California

In 1992, the South Coast Air Quality Management District (AQMD), the regulatory agency responsible for air pollution in the Los Angeles region, proposed a major new approach to regulating air emissions. The Regional Clean Air incentives Market (R ECLAIM) is a proposal to allow firms to generate and trade emission reductions credits.'

Air quality in Los Angeles violates the national standard and improvement will require dramatic emission reductions through 2010.2 On the other hand, the region's economy has been suffering from recession, defense cuts, and outmigration of industry to other States and Mexico. This means that air pollution needs to be reduced, but at the lowest possible cost. Moreover, because drastic reductions are necessary, innovative approaches to reach these goals are needed. Because of this, AQMD proposed to progressively ratchet down permissible air emissions by 85 percent over the next 20 years, while allowing firms to meet these tougher standards by installing add-on controls, reformulating their production process, purchasing excess emissions reductions from other sources, and/or reducing mobile source emissions, including retiring old cars.

All major stationary sources with NO_x (488 facilities) and SO_2 (47 facilities) emissions, generally greater than 4 tons per year, will receive an emissions cap and an annual rate of reduction.[3] In turn, the emission reduction requirements of more than 30 adopted rules and over 12 future rules are replaced by a single permit that encompasses all NO_x or SO_2 emission sources at the facility.

The District developed rule language in May 1993 and proposes to fully implement the program by January 1994. There will be two separate markets in the program, for NO_x and SO_2. Mobile sources and companies emitting less than 4 tons of the pollutants are exempt from the program.

In some ways RECLAIM represents a significant departure from the command and control approach. While facilities will still be required to obtain permits to pollute, the new permits encompass all NO_x or SO2 emission sources at the facility, rather than individual pieces of equipment. Each facility will have an overall declining emissions cap that it must meet. However, if a firm believes that it can meet

1 South Coast Air Quality Management District, *RECLAIM Rules* (Diamond Bar, CA: SCAQMD, May 1993).

2 Approximately 50 percent of air pollution in the Los Angeles area comes from mobile sources (e.g., cars and trucks), 30 percent from area sources (e.g., dry cleaners) and consumer products (e.g., perfume), and 20 percent from stationary sources (e.g., industry).

3 SCAQMD is considering separately the development of markets for reactive organic compounds (ROCs).

(continued on next page)

Tipping fees have increased significantly since the early 1980s, although in some places tipping fees do not makeup for the total government cost. The city of Phoenix recently instituted a toxic-based fee on the dischargers to the local POTW. However, these fees may not always be high enough to encourage significant changes in behavior. Incentive approaches have also been proposed for a wide range of environmental problems, including global warming,[67] municipal solid waste, and nonpoint source water pollution.

While the U.S. incentive approaches have concentrated on marketable permits, some European countries have more experience using fees

67 Robert W. Hahn and Robert N. Stavins, ' 'Trading in Greenhouse Permits: A Critical Examination of Design and Implementation Issues, " prepared for *Global Climate Policy*, edited by William Clark and Henry Lee (Cambridge, MA: John F. Kennedy School of Government, Harvard University, March 18, 1993).

Box 9-C-RECLAIM: Marketable Permits in Southern California-Continued

its cap more cheaply by purchasing emission reduction credits from other firms, it can do this. It is hoped that RECLAIM will spur innovative control technologies and other new ways of reducing pollution, and will allow AQMD to avoid the battles over what is and is not technologically possible. Moreover, by reducing emission limits significantly, RECLAIM hopes to force the development of technology to meet the new limits.

An important component to the success or failure of the program will be the accuracy of monitoring. AQMD proposes to monitor SO_2 and NO_x through continuous emission monitors attached to air emission sources. One advantage of the monitoring program is t hat it will result in a better understanding of emissions and air quality.

Compliance costs under RECLAIM, as opposed to a conventional approach, are expected to be lower. While it would cost $346 million to reduce emissions over the period of 1994 to 1999 under a command and control approach, AQMD estimates that under RECLAIM costs wouldbe$182 million, or 47 percent less. Part of these savings are expected to come from advancements in pollution control technology stimulated by the RECLAIM incentives. RECLAIM also provides more flexibility for industry and gives facilities the ability to better engage in long-term planning and have more control over managing their emissions.

There are, however, a number of limitations in the program that might limit savings. To be consistent with Federal and State regulations, new, relocated, and modified (resulting in emission increases) sources must still meet Best Available Control Technology requirements, as do existing equipment currently permitted under BACT. Facilities that purchase credits to install a new source or increases above their annual allocation must obtain an amendment to their facility permit, and some facilities can only buy credits from facilities in the same geographic zone. Finally, because the future emission targets are so low, in some cases below currently available technology, firms may bank emission credits to meet future reductions.

Moreover, it is possible that the program could exacerbate the migration of industry out of the region, since firms in the program that relocate or shut down can obtain credits to sell. An additional possible problem is that the program could penalize firms that have already significantly cut pollutants. If emission baselines and credits are allocated to firms based on current emission levels, firms that have cleaned up get fewer credits than firms that haven't. AQMD is proposing to deal with this by basing credits on emission levels for the years 1989 to 1991. Facilities that today operate below their emission potential will receive a starting allocation commensurate with their emissions in 19870r 1988. However, these credits cannot be traded and can only be used by the firm to offset emissions increases from increased output in the first 3 years of the program.

or taxes on releases, particularly for water pollution.[68] However, the purpose of these fees is often to raise revenues, rather than to induce industry to control pollution. For example, the French environment agency (ADEME) charges large emitters of SO_2, NO_x, and hydrochloric acid a tax of approximately $30 per ton, while France's six river basin agencies charge fees on effluents of

68 Organization for Economic Cooperation and Development, *Environmental Policy: How to Apply Economic Instruments* (Paris: OECD, 1991); Huppes, et. al. New Market-Oriented Instruments for Environmental Policies, (London: Graham and Trotman, for The Commission of the European Communities, 1991); Mikael Skou Anderson, "GreenTaxes and Regulatory Reform: Dutch and Danish Experiences in Curbing Surface Water Pollution, ' working paper, (Berlin: Wissenschaftszentrum Berlin (WZB), 1991); Gardner M. Brown, Jr. and Ralph W. Johnson, "Pollution Control by Effluent Charges: It Works in the Federal Republic of Germay, Why Not in the United States?' *Natural Resources Journal*, vol. *24, No. 4,* October 1984, pp. 929-966;

Table 9-2—Estimates of Cost Savings From EPA Emissions Trading

Type	Number of trades	Amount of savings ($millions)
Offsets	2,500	$25*
Bubbles	132	$435**
Banking	100	very small**
Netting	5,000-12,000	$525-12,000'"

SOURCES: " Daniel J. Dudek and John Palmisano, "Emissions Trading: Why is This Thoroughbred Hobbled?" *Columbia Journal of Environmental Law,* 13:2, *1988,* pp. 218-256. .* Robert W. Hahn and Gordon **L. Hester "Marketable Permits: Lessons** for Theory and Practice," *Ecology Law Quarterly, VOI* 16, 1989, pp. 361-406.

BOD and suspended solids. However, in both cases the taxes are too low to have significant effects on firm behavior.[69] In a few countries, the fees are higher and may affect behavior, Holland charges higher fees on water pollution, which appear to have had an impact on reducing discharges.[70] Since 1974, Japan has charged a fee on SO_2 that may have encouraged some sources to install SO_2 scrubbers.

Advantages of Incentive Systems

There are several potential advantages of incentives in the regulatory system (see table 9-3).

COST SAVINGS

Many studies suggest that the total savings from using incentives rather than traditional regulations alone could be considerable, primarily because differences in compliance costs between sources can be substantial. For example, OTA estimated that the average costs for reducing volatile organic compounds (VOCs) may range from about $500 per ton for limits on fuel volatility to about $39,000 per ton for using methonal as a vehicle fuel,[71] and that the costs of reducing SO_2 emissions from eastern power plants by requiring wet scrubbers would cost between 40 and 110 percent more than allowing each utility to choose the lowest cost control option (coal washing, low sulfur fuels, and wet and dry scrubbers) .72

A number of studies have estimated that incentive systems could be two to five times less expensive than command-and-control.[73] However, many of these estimates, particularly those based on more theoretical models, may significantly overstate the savings from incentive approaches, in part because theoretically pure incentive schemes are unlikely to be workable in practice.[74] First, many firms with high control costs have already invested in abatement and therefore cannot reap savings available if they buy credits. Second, perfect markets for tradable permits may not develop. If firms are prohibited

69 @. French environmental Official argued that the taxes would&veto be 20 to 30 times higher in order to serve as an effective incentive for firms **to reduce pollution.**

70 Robert W. Hahn, ' 'Economic Prescriptions **for** Environmental **Problems: How the Patient Followed the Doctor's Orders,** *Journal of Economic Perspectives, 3, 1989,* **pp. 95-1 14; also Hans** Bressers, **"The Role of Effluent Charges in Dutch Water Quality Policy," in** *International Comparisons In Implementing PollutionLaws,* ed. **by Paul B. Downing and Kenneth Hanf (Boston: K1uwer-Nijhoff, 1983),**

71 Only the upper estimates are relevant, **however,** because **most of** the lower-cost **options are already** required. **U.S. Congress, Office of Technology Assessment,** *Urban Ozone and the Clean Air Act: Problems and Proposals for Change,* **(Washington, DC: U.S. Government Printing Office,** April **1989), pp. 106-108.**

72 U.S. Congress, Office of Technology **Assessment, AcidRain** *and Transported Air Pollutants: Implications for Public policy,* OTA-O-204 **(Washington, DC, U.S. Government Printing Office, June 1984).**

73 **For a discussion** of the theoretical **estimates of savings from emissions, see** T.H. Tietenberg, **"Emission** Trading: An Exercise in **Reforming Pollution Policy" (Washington: DC: Resources for** the **Future, 1985;** T.H. Tietenberg, **Economic Instruments for Environmental Regulation'** *Oxford Review of Economic Policy,* 1990, vol. 6, No. 1, 17-33; and Robert W. Hahn and **Robert N.** Stavins, **"Economic Incentives for Environmental Protection: Integrating Theory and Practice, "** *The American Economic Review,* **vol.** *82, No. 2,* **May,** 1992, **pp. 464-468.**

74 Robert N. Stavins, "Transaction Costs and the Performance of Markets for Pollution Control," unpublished paper **(Cambridge, MA: Harvard University, Kennedy School of Government, May 23, 1993).**

Table 9-3—Advantages and Disadvantages of Different Regulatory Approaches

Type of Regulation	Advantages	Disadvantages
Uniform technology-based standards	Easier to ensure compliance Able to set overall release targets for facility and region Ensures large market for producers of best available technology	More difficult to focus efforts on low-cost sources within or between plants Reduces incentives for pollution prevention and technology development
Source-based performance standards (sources within a plant)	Some incentives for pollution prevention and technology development Able to set overall release targets for a facility and region Greater flexibility to use low-cost approaches on regulated sources	More difficult to focus efforts on low-cost sources within or between plants Monitoring may be difficult
Plant-based performance standards (facility bubbles, no trading)	Can focus efforts on low-cost sources within a plant Moderate incentives for pollution prevention and technology development Able to set overall release targets for a facility and region	Monitoring may be difficult
Tradable pollution permits	Can focus efforts on low cost sources within a facility or between facilities Stronger incentive for pollution prevention and technology development Able to set overall release targets for a region Greater flexibility regarding when and to what degree reductions are made	Monitoring may be difficult Can lead to regional/local pollution concentrations May not be appropriate for emissions with threshold damage functions Early reducers can be penalized Potentially large transaction costs, which may diminish cost savings If permits are auctioned, can raise total compliance costs
Pollution taxes	Can focus efforts on low-cost sources within a facility or between facilities Stronger incentive for pollution prevention and technology development Greater flexibility regarding when and to what degree reductions are made Require few regulatory approvals Set marginal costs of control Source of government revenues Potentially less new source bias	Monitoring may be difficult, if the tax is placed on outputs rather than input purchases Can lead to regional/local pollution concentrations May not be appropriate for emissions with threshold damage functions Difficult to set overall release levels Firms may choose to pay tax rather than cut pollution Because of increased taxes, can raise total compliance costs

SOURCE: Office of Technology Assessment, 1993.

from banking emissions credits for future use or sale they may engage in early, suboptimal sale of credits. The number of firms in the market maybe small, especially when the bulk of pollution comes from a small number of widely dispersed sources or where a few large sources dominate. Third, transaction costs, particularly with tradable permits, may be high. Firms may have to pay consultants to identify sellers or buyers, pay brokers to facilitate transactions, and spend time negotiating. In addition, for fees or tradable permits, firms may have to pay to document and

monitor emission reductions, develop applications for a permit revision, and keep detailed records. Finally, environmental safeguards and other regulatory constraints can diminish the workability of incentives. In some cases firms have to wait up to 2 years to get certification that their reductions are legitimate and can in fact be sold, Requiring new sources to satisfy new source performance standards, rather than allowing them to install less stringent control technology and buy credits to make up the shortfall, reduces trading potential.

States and localities can further undercut trading as an option. For example, Illinois passed a law requiring some utilities to buy scrubbers so utilities would not buy low-sulfur coal from Western States and instead buy high-sulfur Illinois coal.[75] Atkinson and Tietenberg suggest that in reality, savings achieved would probably be 20 to 50 percent of the estimated ideal.[76] Notwithstanding these limitations, incentive systems can lower compliance costs, although not nearly as much as theory might suggest.

GREATER OPERATING FLEXIBILITY

The development and implementation of a new pollution control or prevention method entails certain regulatory risks for the business. One advantage of incentive approaches is that if firms choose to invest in a new control technology or a clean process solution that is low cost, but falls slightly short of meeting the regulation, or requires additional time to work out problems, they can buy credits (or pay a fee) to make up for the shortfall.

INCENTIVES FOR INNOVATION IN POLLUTION CONTROL

Under command-and-control, firms have little incentive to reduce releases below the required level since they receive no economic benefit. Moreover, regulated firms have limited interest in developing more efficient technologies for pollution control since, once developed, these technologies are likely to be mandated by regulators as standard for other sources in the future. Finally, designation of technology standards make it more difficult for firms to get alternative approaches accepted. As a result, command-and-control systems, particularly technology-based standards, can freeze the development of technology that could provide control at greater levels or lower costs.[77]

A potential benefit of incentive approaches is that they could provide firms with financial rewards for developing and adopting new pollution abatement and prevention technologies and other innovative control strategies that reduce releases below required levels.[78] Firms adopting innovative technologies that reduce pollution more than required would benefit financially, either through lower pollution taxes or saleable pollution rights.

While incentives may stimulate new ways of controlling pollution, these may not always lead to development of new technology. For example, firms may decide to use more straightforward approaches, such as fuel-switching or substitution of materials. Thus in some cases, in contrast to a technology-based standard that may force the development of a new technology, incentives could produce less technological innovation,

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75 *Energy Daily*, Sept. 3, 1992, p. 2.

76 Scott Atkinson and Tom Tietenberg, "Market Failure in Incentive Based Regulation: The Case of Emissions Trading" *Journal of Environmental Economics and Management, 21, 1991,* pp. 17-31.

77 For example see, Matt Ridley, "How to Smother Innovation," *The Wall Street Journal*, June 9, 1993.

78 Paul B, Downing and Lawrence J. White, "Innovation in Pollution Control," *Journal of Environmental Economics and Management,* vol. 13, *1986,* pp. *18-29.*

79 A final advantage of incentives is that they provide an additional set of regulatory tools to address problems or pollution sources that may not be effectively addressed using traditional regulatory tools. See Michael H. Levin and Barry S. Elman, "The Case for Environmental Incentives," *The Environmental Forum,* January/February 1990, pp. 7-11.

even though they produce lower cost means of control.[79]

Limitations and Disadvantages of Incentive Systems

There are limits to incentive systems. Incentives seldom eliminate the need for regulations. Indeed, incentive systems must generally be implemented within a clear regulatory framework. An incentive-based approach, however, may offer more compliance options than a traditional regulatory system.

One key to incentive approaches is accurate and timely monitoring and enforcement. Unlike many conventional command and control standards where adoption (and proper operation) of a certified control technology ensures compliance, incentive systems normally require accurate monitoring of emissions over a period of time. While current monitoring procedures and technology appear adequate for some types of processes and pollutants, they are less so for others. As a result, the application of incentives may be limited to cases where adequate monitoring and enforcement are feasible.[80] It is one thing to monitor utilities trading sulfur dioxide emissions under the Clean Air Act's acid rain provisions, since there is a manageable number of facilities in the program and technology for continuous stack emission monitoring is available.[81] It is quite another thing to adequately monitor a vast number of smaller sources and releases associated with a wide array of industrial processes. However, advances being made in new continuous emissions monitoring processes are likely to increase the potential of incentive approaches.[82] Regardless, incentive approaches will generally increase the need for and complexity of detailed modeling, monitoring, and enforcement, which could increase the administrative cost to government and industry. Monitoring is more complex when emissions output is regulated and less complex when materials input is taxed (e.g., carbon taxes in fuels).

Geographical constraints can limit applicability of incentives. For some pollutants (e.g., air toxics) the market may have to be defined quite narrowly, so that trades do not significantly reduce environmental quality in an area. Safeguards would be necessary under a tax or trading system to protect the interests of persons living in a place where polluters chose to pay the fee or buy the rights, rather than control pollution. However, even with small trading areas, potential savings might be significant.[83]

In cases where environmental damage is severe, there may be a need to use all feasible means of control and to limit the ability of firms to buy pollution rights. For example, in Los Angeles, which has major environmental problems, achieving ambient standards may require strict controls on almost all sources of ozone-causing emissions. In this case, the cost advantage of market-based approaches over command-and-control will be less, but still may be significant (see box 9-C).

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79 A final advantage of incentives is that they provide an additional set of regulatory tools to address problems Or pollution sources that may not be effectively addressed using traditional regulatory tools. See Michael H. Levin and Barry S. Elman, "The Case for Environmental Incentives," *The Environmental Forum,* January/February 1990, pp. 7-11.

80 In some cases, though, tradable permits and taxes may be easier to monitor and enforce, particularly in the regulation of the use of particular chemicals, such as CFCs. Robert Rabin, "EPA Regulation of Chlorofluorocarbons, " in *Making Regulatory Policy,* edited by Keith Hakins and John M. Thomas (Pittsburgh: University of Pittsburgh Press, 1989).

81 Most large source emissions of NO_x and SO_x in Japan are monitored by Continuous Emission Monitors (CEMs) and this information is automatically fed to local, governmentally controlled monitoring stations by telemetry,

82 However, in some cases, current CEMs can impede industrial performance. See Gunsell S. Shareef, et. al., ''Selective Catalytic Reduction NO_x Control for Small Natural Gas-Fired Prime Movers, 'presented at the 85th Annual Meeting and Exhibition, Air and Waste Management Association Kansas City, June 21-26, 1992,

83 T.H. Tietenberg, "Economic Instruments for Environmental Regulation" op. cit., footnote 73.

Taxes or fees make it difficult to predict the amount and pace of pollution reductions. More importantly, as discussed below, because managers may not optimize and choose low-cost options, firms may choose to pay the fee and continue to pollute, even if reducing pollution would save them money.[84] Unlike fees and taxes, tradable permits allow regulators to ensure an overall level of pollution reduction. It is difficult for government to set fees at the correct level to produce the desired change at the lowest cost.

Moreover, taxes and fees or the auctioning of permits could raise total compliance costs for industry, even if abatement expenditures were reduced.[85] However, fees and auction income can be rebated back to industry to be revenue neutral. For example, Sweden is planning to initiate a NO_x fee on 150 to 200 of the largest sources. In order to not discriminate against these, the revenues will be returned to the affected facilities through a rebate based on the amount of energy they produce.[86] Fees could also be returned to firms to help pay for the cost of pollution control equipment. For example, the revenues from the French air pollution charge are returned to those adopting pollution control equipment.[87] The revenue raised from fees can be used to offset other taxes (on industry or the general public), as well.

Assignment of credits or allowances can be inequitable. Depending on how these rights are allocated, firms that cleaned up early may be penalized. Similar to the current command-and-control system, a marketable permits program may penalize new firms and reward existing firms by making the former buy permits to enter the market. In addition, marketable permit systems may exacerbate industrial relocation, since firms moving out of areas with marketable permits may be able to sell their pollution permits, making it more profitable for them to leave. One way to deal with this would be to have closing and moving firms hand over credits to the local government, which can sell them or give them to firms relocating to the area.

Finally, under some systems, firms may get credit for reductions that they have already made, or for things they would have done anyway, such as shutting down an obsolete production line. In addition, existing permits under some State implementation plans may allow some sources many more releases than they are using. These excess releases have in some cases been available for trade; the results have been called paper trades.[88] The existence of historic emissions inventories can reduce this problem of measurement as can the assignment of more realistic emission caps. In addition, if the regulatory system explicitly accounts for the use of these paper credits by requiring lower emission limits from all sources, mandated reductions could likely be achieved.

Some oppose incentive systems because they feel that industry should not be given the right to pollute, and that every single reduction in releases possible is necessary, particularly in nonattainment areas.[89] But incentive systems can be designed to permit no more pollution than an equivalent command-and-control system.

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84 Some have argued that similar results occur with regard to adoption of industrial energy conservation practices. There is considerable evidence that there are proven, cost-effective, energy conservation technologies not widely used by industry. As in the case of pollution taxes, industry has market incentives (in the form of energy expenditures) to invest.

85 T H Tietenberg, "Emissions Trading: An Exercise in Reforming Pollution Policy," op. cit., footnote 74.

86 U.S. Environmental protection Agency, *Economic Incentives. Options for Environmental Protection,* (Washington DC: EPA, Policy, Planning and Evaluation, March 1991).

87 T.H. Tietenberg, "'Economic Instruments for Environmental Regulation,' op. cit., footnote 74.

88 peter Bohm and Clifford S. Russell, "Comparative Analysis of Alternative Policy Instruments," op. cit., footnote 10.

89 David Doniger, "'The Dark Side of the Bubble,' *The Environmental Forum,* July 1985, pp. 33-35.

Why Have Incentives Not Become More Widespread?

Despite their potential to reduce compliance costs, incentive programs have not been widely used as a pollution control strategy. Moreover, when the programs have been adopted, they have been used less frequently than expected. Most trades have been inside firms and, with the exception of the lead-trading program for gasoline and the mandatory offset trading, there have been few trades between fins. There are several reasons for the limited adoption of incentive programs.

First, with the notable exceptions of the 1990 Clean Air Act Amendments, Federal legislation has not encouraged incentives.[90] For example, while the Clean Water Act contains provisions that suggest that trading is allowed, it does not explicitly authorize its use. This has limited trading, because of the perceived risk that trades will be overturned by the courts or disallowed by regulators.[91] While the Clean Air Act authorizes a variety of incentives, the effects of these provisions are only beginning to be felt.[92]

Second, because incentive systems are the exception rather than the rule, it is much easier from an administrative standpoint for firms and regulatory agencies to work within the traditional regulatory system than to get new incentive programs up and running. Procedures for approving trades can further impede the process. For example, in the water pollution trading scheme on the Wisconsin Fox River, firms that entered into trades were required to either modify or receive new permits.[93] Because firms that applied for bubbles were subject to in-depth reviews of plant facilities, many were reluctant to use this tool.[94] Provisions in the 1990 Clean Air Act Amendments will, in some cases, reduce the need for indepth case-by-case reviews.

Third, clear and consistent leadership in support of incentives has been lacking. While the air office within EPA has been somewhat supportive of incentive approaches, other media program offices have not done as much .95 As a result, State and local agencies have not received the guidance and support needed to put in place incentive approaches, nor has EPA aggressively sought to identify situations where incentives might be fruitfully applied. Finally, support from industry and environmental groups for incentive approaches has been sporadic.

There are also reasons why industry has not used existing programs more extensively. First, transactions costs have been high, particularly for nonuniformly mixed pollutants (e.g., air toxics and some particulate), where extensive air dispersion modeling has been required. Moreover, the practice that EPA, instead of the States, approve trades involving dispersion modeling, hindered trading in the early 1980s as few trades requiring modeling were approved.

Second, firms may not know about the programs or may prefer the security of command and control where regulatory agencies essentially tell them what device to buy and how to monitor it.

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90 A number of bills recently have considered the use of incentives, See Regulatory Innovations Branch, Office Of Policy, Planning and Evaluation *Economic Incentives in Environmental Bills Introduced in the 102nd Congress* (Washington, DC: U.S. Environmental Protection Agency, February 1993).

91 U.S. Congress, General Accounting Office, *Water Pollution: Pollutant Trading Could Reduce Compliance Costs if Uncertain ties Are* Resolved, RCED-92-153 (Gaithersburg, MD: U.S. General Accounting Office, June 1992), p. 5.

92 EPA recently issue a proposed rule providing guidance to the states on economic incentive programs. EPA, ' 'Economic Incentive Program Rules," *Federal Register,* vol. *58, No. 34,* February 23, 1993. pp. 11110.

93 Robert W. Hahn, ' 'Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders, " Op. cit., footnote 70. The major reason, however, for the failure of this program was that the marginal costs of reducing emissions did not differ significantly between the plants, reducing the benefits of trading to the firms.

94 For example, see Box *8-G* discussing 3M's experience with bubbles.

95 Robert Rabin, ''EPA Regulation of Chlorofluorocarbons, " op. cit., footnote 80.

Industry may also worry that they will be required to install control technologies even after they have purchased credits. Finally, some firms may not want to be seen as polluters for fear of damaging their image with the public.[96]

Incentive approaches promise much in theory, but their application in the real world suggests that their use may be more limited. Notwithstanding these limitations, the potential for incentive-based approaches to cut costs (and stimulate innovation) has not been reached.

96 Some firms fear that they may be seen as buying their way out of controlling pollution. Some other firms are concerned about profit@ from controlling pollution. For example, 3M has a corporate policy that they will not profit from any money made by selling permits.

PART IV.
Government Support for Environmental Technology Development, Here and Abroad