The Pollution Prevention Act of 1990: A Policy Whose Time Has Come or Symbolic Legislation?

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ABSTRACT / In 1990, the United States officially entered the era of pollution prevention with passage of the Pollution Prevention Act. This paper analyzes EPA's implementation of the Pollution Prevention Act from its passage in 1990 to the present. It examines the barriers EPA must overcome if it is to effectively integrate pollution prevention into its existing regulatory structure, including impediments created by statutory and organizational structure, the existing relationship between EPA and the groups it regulates, the fragmented implementation scheme of national environmental regulation, the balancing of conflicting demands advanced by powerful interests, industry's economic and technical concerns, and institutional inertia. It also examines issues such as industry commitment, the limits of prevention, and measurement concerns. The findings suggest that EPA's efforts at shifting to a pollution prevention regulatory ethic that holds primacy over pollution control are mixed. Its organizational structure, statutory authority, and incentives system still reflect a single-medium pollution control focus, appropriations for pollution prevention programs and activities are paltry compared to traditional pollution control programs, and participation in the program is voluntary. Yet, the findings also point to some promising programs that are working to institutionalize a pollution prevention regulatory ethic, and many states appear very committed to the concept.

Since the rise of the ''public lobby regime'' (Harris and Milkis 1989) in the early 1970s, environmental regulation has become one of the largest and fastest growing areas of federal and state regulatory activity. The number of statutes targeted towards the regulation of pollution and hazardous wastes is impressive, both in scope and magnitude, including such well known statutory acronyms as FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act), SMCRA (Surface Mining Control and Reclamation Act), RCRA (Resource Conservation and Recovery Act), CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act), SARA (Superfund Amendments and Reauthorization Act), CWA (Clean Water Act), and CAA (Clean Air Act). With few exceptions these statutes focus on ''end-of-pipe'' cleanups, meaning that they are directed towards the control, treatment, and disposal of pollution after it has been created. In 1990 the United States officially entered the era of pollution prevention with passage of the Pollution Prevention Act (PPA). In contrast to the above legislation, PPA targets the reduction of pollution before it has been created.

PPA defined pollution prevention as source reduction, which is defined as ''any practice which—(i) reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and (ii) reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants'' (Pollution Prevention Act 1990). By focusing on the creation of pollution instead of on the recycling, treatment, and disposal of pollution, PPA shifts the regulatory emphasis from a world of finite to a world of infinite possibilities. By doing so, it encourages society to reevaluate what an acceptable level of pollution really means by delegitimizing what Bobertz (1995) calls ''scapegoating theory'' or the legitimization of pollution through pollution control laws.

Although PPA is the first federal statute dedicated to pollution prevention, the idea of preventing pollution at the source is not new. For example, the Hazardous and Solid Waste Amendments of 1984 emphasized source reduction as the preferred method of waste disposal and the nonpoint pollution goals of the Clean Water Act are similar in emphasis to prevention. EPA has been trying to integrate pollution prevention in its Effluent Guidelines Program since the early 1970s. Support within the agency for making prevention a top priority had been rising since the appointment of William Reilly as EPA Administrator. At least 10 states had passed pollution prevention or waste minimization statutes prior to PPA, and after the congressional Office of Technology Assessment (US Congress 1986, 1987)

KEY WORDS: Pollution prevention; Source reduction; Pollution control; Alternative regulatory design; Barriers to implementation

reported favorably on its environmental benefits, the idea began gaining national legislative steam as well. In 1989 the Senate Committee on Environment and Public Works held oversight hearings on right-to-know pollution data that included testimony on ways to improve pollution prevention efforts. In 1990 this same committee held a hearing to discuss topics such as the definition of pollution prevention, ways to integrate it into the existing regulatory structure, and industry examples of where it was working. In the same year, other committees held hearings on bills with provisions similar to what would become PPA. Furthermore, there has never been anything keeping industry from pursuing source reduction as a strategy to meet ambient standards and emission rules established in various pollution control statutes.

What makes PPA noteworthy is that it places source reduction at the top of a waste management hierarchy by declaring prevention to be the first option and preferred alternative for dealing with pollution. PPA thus represents the first step, if only symbolically, towards reordering industry priorities by asking it to shift its attention and resources to prevention over abatement. This fundamental difference makes PPA unique, for it shifts regulatory activity upstream to the source, thereby making it the first pollution statute completely dedicated to inputs and processes rather than outputs and disposal. As such, it encourages us to ask not ''How do we clean it and where does it go?'' but rather ''How do we not create it in the first place?''

Unlike most pollution control legislation, however, PPA did not come with large budget outlays, complicated regulatory structures, ambitious implementation deadlines, command-and-control compliance authority, or stringent emissions standards. In fact, PPA came with no substantive standards at all and has been described by at least one critic as a ''short and mainly hortatory measure shoehorned into that year's omnibus budget reconciliation act'' (Bobertz 1995, p. 750). Without these more or less standard compliance and action forcing mechanisms included in previous environmental legislation, PPA appears to be more symbolism than substance. For example, PPA states that ''Congress hereby declares it to be the national policy of the United States that pollution should be prevented or reduced at the source whenever feasible'' (Pollution Prevention Act 1990). To implement this goal, PPA authorizes EPA to: (1) develop and implement a strategy that promotes activities at EPA that prevent the generation, emission, or discharge of pollutants at their source; (2) establish an office independent of its single medium organizational structure to more effectively coordinate the promotion of a multimedia approach to source reduction; (3) coordinate with other federal agencies to facilitate source reduction; (4) develop a standard means of measuring source reduction; and (5) establish a state matching grants program and a national clearinghouse on source reduction practices and techniques. These are not exactly the kinds of bold steps from which regulatory revolutions are made, but as the Senate Environment and Public Works Committee stated in its report on the bill, PPA was only intended as a first step in developing a larger pollution prevention regulatory framework (US Senate 1990).

The problem that PPA presents from an implementation standpoint, however, is whether EPA can effectively implement a voluntary pollution prevention program while simultaneously enforcing its many command-and-control pollution abatement programs. As one analyst pointed out to the agency in a 1992 report: ''at the present time the EPA is projecting very conflicting images to the public and to industry. . . . Through the lenient and voluntary approach of pollution prevention, the EPA is projecting an image of an agency that desires a 'kinder, gentler' relationship with industry, a partner in achieving a mutually beneficial goal. In contrast, elsewhere in the agency stringent single medium programs continue to be promulgated'' (US EPA 1992, p. 22). Can EPA be both a prescriptive authority and a collaborative friend to industry? The purpose of this paper is to examine EPA's implementation of PPA from its passage in 1990 to identify whether a multimedia policy with ''no enforcement stick'' can be integrated into a regulatory structure built around ''single medium programs that carry a club'' (US EPA 1992, p. 23). Areas examined include barriers to implementation, EPA's progress towards overcoming these barriers, and other issues (interests, limits, and measurement) that must be addressed if EPA is to truly shift its regulatory focus towards prevention.

Framework

The literature on policy implementation is rich in conceptual theorizing over the factors affecting the implementation process. For example, some authors (Van Meter and Van Horn 1975) argue that contextual factors affect implementation, such as policy standards, budgetary resources, social and economic conditions, and political support. Other authors (Bardach 1977, Rein and Rabinovitz 1977, Berman 1978) focus more on how the behavior of individual actors pursuing their own strategic interests affects implementation. Taken as a whole these authors provide a fairly comprehensive account of the complexity of the implementation process and the types of factors affecting it. None of them, however, examine within the same framework both individual behavior and the context in which it occurs. Moreover, they tend to overlook other factors affecting

implementation such as the level of problem solvability and statutory structure.

One model developed to address these concerns is Sabatier and Mazmanian's (1980) implementation framework. These authors examine both individual behavior and contextual factors, as well as examining the role of problem solvability and statutory structure. They argue that implementation success is dependent upon identifying all relevant factors impacting statutory goal attainment, which they separate into three categories: ''(1) the tractability of the problem(s) being addressed by the statute; (2) the ability of the statute to favorably structure the implementation process; and (3) the net effect of a variety of 'politcal' variables on the balance of support for statutory objectives.'' Problem tractability refers to the ease with which a policy problem is solvable. Sabatier and Mazmanian (1980, p. 544) argue that a policy problem is most tractable if ''(1) there is a valid theory connecting behavioral change to problem amelioration, the requisite technology exists, and measurement of change in the seriousness of the problem is inexpensive; (2) there is minimal variation in the behavioral practices which cause the problem; (3) the target group constitutes an easily identifiable minority of the population within a political jurisdiction; and (4) the amount of behavioral change is modest.''

The ability of a statute to positively structure the implementation process means that legislation is most likely to achieve its objectives if: ''(1) it incorporates a valid causal theory linking behavioral change to desired impacts; (2) its objectives are precise and clearly ranked; (3) it provides adequate funds to the implementing agencies; (4) the number of veto points in the implementation process is minimized and sanctions/inducements are provided to overcome resistance; (5) the decision rules of the implementing agencies are biased toward the achievement of statutory objectives; (6) implementation is assigned to agencies which support the legislation's objectives and will give the program high priority; and (7) the provisions for outsider participation are similarly biased through liberalized rules of standing and by centralizing oversight in the hands of statutory supporters'' (Sabatier and Mazmanian 1980, p. 548). Lastly, Sabatier and Mazmanian's implementation framework incorporates a number of political and external variables that affect implementation outcomes. These include social, economic, and technological conditions; intensity and duration of media attention; public, constituency, and institutional support; and the quality of leadership skills in the implementing agencies. While not all of the factors from each category presented in this framework are applicable to this study, it nevertheless provides a useful referent for evaluating EPA's implementation of PPA.

EPA Implementation

From many corners, the 1990s have been hailed as the era of pollution prevention. For example, a number of scholars have noted that the dominant governmental policy is shifting from pollution abatement to pollution prevention (Rosenbaum 1994, 1995a, Costain and Lester 1995, Ringquist 1995). From industry, a number of trade journal articles have supported the need to focus on source reduction over pollution abatement, often arguing that pollution prevention is more cost effective in the long run than pollution control (Wolf 1988, Mackerron 1989; Grogan and Schwartz 1991, Stahl 1993, Buzzeli 1995, Stack 1995). From EPA has come an outpouring of studies, articles, speeches, and policy statements touting the environmental and economic benefits of pollution prevention, advocating the need to shift the agency's focus from downstream to upstream solutions and showing the growing commitment of the states to pollution prevention (US EPA 1989, 1991, 1994b, 1995b,c,e; Popkin 1989, Reilly 1990, Vendinello 1992, Browner 1993, Kling and Schaeffer 1993).

Conceptually, the notion of pollution prevention is attractive because it embraces two goals that have often been portrayed as incompatible: the promotion of environmental quality and economic productivity. Whereas pollution control regulations are often seen as coming at the expense of economic growth or vice versa, pollution prevention promotes a cleaner environment through changes in production processes and product packaging that both conserve resources and decrease the volume of pollution that must be mitigated and disposed of (Kling and Schaeffer 1993, US EPA 1994a). By reducing it at its source, pollution prevention also reduces the potential seen in pollution control strategies for the cross-media transfer of pollutants (i.e., air pollution resulting from solid-waste incineration, solid wastes created by water-treatment facilities, etc.). Simply put, there is nothing to transfer. Pollution prevention thus promotes a win–win strategy: the public wins through reduced levels of pollution across all media types (air, land, and water), and industry wins through long-term cost savings resulting from a more efficient use of resources, reduced pollution control costs associated with abatement and disposal, and reduced exposure to future liability from pollution control laws such as CERCLA (US EPA 1995e).

As long as pollution prevention remains nothing more than a conceptual goal, it meets little resistance from affected parties; after all, it is hard to argue with the goal of reducing pollution for the betterment of all. The rub comes when this goal is converted into concrete policy proposals. As with most policies, when the

goal takes shape, it creates real or perceived winners and losers among the stakeholders. Since a complete embrace of pollution prevention would require a fundamental reordering of EPA's priorities, organizational structure, and modes of operation, it is subject to the intense resistance that often accompanies innovative and thus threatening change. As both a distributive and regulative agency organized around separate and semi-autonomous program offices, each equipped with its own statutory mandates, budgets, supporters, and detractors, implementing change at EPA can be challenging to say the least.

Barriers to Implementation

There are at least six barriers EPA must overcome if it is to effectively integrate source reduction strategies into its existing regulatory structure. These include impediments created by statutory and organizational structure, the existing relationship between EPA and the groups it regulates, the fragmented implementation scheme of national environmental regulation, the balancing of conflicting demands advanced by powerful interests, industry's economic and technical concerns, and institutional inertia. What these barriers show is the difficulty of implementing PPA due to its moderate level of problem tractability, weak statutory structure, and a number of political and external variables affecting outcomes.

The first barrier is statutory structure, which has been identified by numerous authors as an important determining factor in programmatic outcomes (Sabatier and Mazmanian 1979, 1980, N. Rosenbaum 1981, W. Rosenbaum 1994, 1995b). The absence of substantive standards, mandatory timeframes for source reduction, and command-and-control enforcement authority makes implementation of PPA extra challenging since these are some of the primary tools EPA uses to ensure industry compliance. They are also action forcing mechanisms that limit agency autonomy, flexibility, and discretion, narrowing the opportunities for noncongressional influence over the implementation process. Since Congress chose not to include any control or enforcement mechanisms in PPA, it increases the opportunities for EPA to respond to its own and other actors' policy preferences, which might be supportive or hostile to pollution prevention. It also becomes more difficult for Congress to use the types of legislative strategies identified by Rosenbaum (1981) to subsequently control agency decision making if it has already relinquished much of its control on the front end by not articulating its expectancies in the statute. The result is a law with a weak statutory structure, making it less likely that the legislation will achieve its objectives. Furthermore, the single-medium end-of-pipe focus of EPA's many other statutory mandates has led to the creation of an agency organizational structure built around single-medium ''after-the-fact controls'' (Vig and Kraft 1994). As a result, EPA's regulatory rule-making apparatus is geared towards end-of-pipe compliance as well, meaning that its decision rules are biased towards abatement over prevention. Shifting this emphasis within the agency will require a fundamental statutory change in mission and resource distribution.

Second, the existing relationship between EPA and the groups it regulates can influence the effectiveness of the regulatory approach chosen (Davis 1988). For example, EPA's command-and-control regulatory compliance style in one area may make its target groups hostile to other styles of regulatory compliance in other areas. Since participation under PPA is voluntary, EPA can only pursue a nondirective or incentives-based approach towards compliance. EPA thus finds itself in a situation where the industries it is now encouraging to voluntarily implement source reduction strategies are the same industries that are subject to its command-and-control regulatory prescriptions, creating a potentially hostile environment where some industries might be reluctant to cooperate voluntarily. Although EPA is the most appropriate agency to implement PPA, the mixed message it creates makes it more difficult to achieve the statute's objectives.

The third barrier is the fragmented implementation scheme of national environmental regulation. EPA must somehow coordinate pollution prevention policy horizontally across a multitude of agencies located in a number of different departments, as well as vertically through the states. This fragmented system creates a regulatory structure susceptible to disputes over agency professional values and jurisdictional boundaries, state economic concerns, clientele interests, and the degree of discretion afforded each agency in the implementation chain (Rabe 1986, Lowry 1992, Rosenbaum 1994, 1995a,b). There are at least 27 federal agencies outside of EPA that have some type of environmental regulatory responsibility (Rosenbaum 1995b), and a comprehensive pollution prevention policy could conceivably involve them all. Furthermore, like most federal pollution legislation, EPA must ultimately rely on the states to encourage industry to embrace pollution prevention. EPA simply lacks the resources to directly approach industry on a large scale, depending instead on the states who are closer and more familiar with their resident industries, as well as economically motivated to maintain friendly and productive relations to discourage interstate relocations (Lowry 1992). This fragmented system of implementation maximizes potential

veto points and shifts authority to the states, which might or might not support PPA's statutory objectives.

Fourth, the balancing of conflicting demands advanced by powerful interests can impede EPA's integration of pollution prevention strategies into its existing regulatory structure. EPA must try to accommodate several institutional and noninstitutional actors, including Congress, the White House, the courts, and a litany of friendly and hostile interest groups. Each of these interests typically has its own agenda and pressures the agency to advance its policy preferences accordingly. Thus the American system of interest group pluralism, where policy outputs are shaped by competing group demands filtered through a political process characterized by multiple access points, fragmented and dispersed power, and partisan and institutional rivalries, greatly complicates policy implementation. Especially intense are the institutional and partisan battles between Congress and the White House and the impacts that hostile actors—institutional or otherwise—can have on an agency's organizational structure, access to resources, rules for outsider participation, and relationship with congressional oversight committees (Moe 1980).

Fifth, the real or perceived economic impacts and technical hurdles that business experiences by shifting from pollution control to pollution prevention can impede implementation of pollution prevention strategies. Much of the existing pollution control legislation has forced industry to invest heavily in expensive pollution abatement technologies. Now that many have done so and are reaping the rewards from these ofttimes more efficient processes, they are justifiably reluctant to shift to source reduction technologies (Lis and Chilton 1993). Many industries are so deeply entrenched in pollution control technologies that they perceive a shift to pollution prevention as an expensive retooling in an area where they have little expertise. This is primarily attributable to a lack of readily available technical information on pollution prevention techniques, an incomplete understanding of the ''full range of costs'' associated with end-of-pipe pollution, and technical staffs that have been trained in colleges and universities that have yet to incorporate pollution prevention problem solving into their curricula (US EPA 1994b). The effect is industry resistance, especially when change is voluntary.

Sixth, institutional inertia can impede implementation of pollution prevention strategies. Like all complex organizations, EPA has developed patterns of behavior consistent with its rules, procedures, and modes of operation. These patterns of behavior often discourage agency personnel from experimenting with and adopting new operating procedures, especially when these changes threaten the status quo (US EPA 1994b). To overcome this barrier, change must be strongly supported by upper management, who must not only support the concept of pollution prevention but also the application of pollution prevention approaches to solving problems. This is best demonstrated by rewarding pollution prevention problem solving through the organization's traditional incentives system.

Slow Progress

When EPA first developed its pollution prevention strategy in 1991, it recognized that it ''must confront institutional barriers within the Agency's own organization that limit its ability to develop effective prevention strategies'' (US EPA 1991, p. 7851). While it did not fully articulate what these barriers were, it nevertheless developed an implementation strategy, which included: (1) appointing a pollution prevention advocate for each assistant administrator's office; (2) creating incentives that encourage agency efforts at pollution prevention; (3) adding pollution prevention into each program office's four-year strategic plan; (4) providing training to agency staff in pollution prevention techniques; and (5) incorporating pollution prevention into various agency procedures and processes.

Three years later in 1994 EPA submitted a draft report (US EPA 1994b) to Congress in fulfillment of PPA's Section 6608(a) reporting requirement regarding the agency's implementation progress. In this report, EPA listed a number of barriers within the agency that inhibited implementation; however, instead of developing a new strategy for overcoming these now identified barriers, it concluded that since the existence of these barriers was only based on ''anecdotal evidence,'' the agency could not develop a strategy to address them until their actual effects were systematically studied and verified. Thus four years after PPA's passage, instead of evaluating whether its 1991 strategy was effective, EPA was just beginning to evaluate the scope and impact of the barriers it had recently identified, so that if they actually exist it can begin to develop remedial strategies for them. This is another way of saying that EPA has made little progress towards removing implementation barriers. Moreover, EPA appears ill prepared to mount an effective response if these and other as yet unidentified barriers prove to be not only real but difficult to systematically study, let alone overcome.

A programmatic example of EPA's difficulty at removing implementation barriers can be seen in its effluent guidelines development process. In 1995, after over 20 years of effort, EPA announced that it had made little progress in this area. According to agency officials,

''Although EPA's Effluent Guidelines Program has been addressing pollution prevention ever since its inception in 1972, the focus of the program has traditionally been on end-of-pipe controls. EPA's Toxics Release Inventory (TRI) shows that, although the discharge of chemicals is decreasing, there is not a similar downward trend in waste generation prior to recycling, treatment, and disposal. This suggests that industry has not yet fully embraced pollution prevention and that EPA needs to do more to promote pollution prevention in the Effluent Guidelines Program'' (US EPA 1995c). As this admission indicates, while there has been some progress towards incorporating pollution prevention into this program, there is still a significant bias toward downstream solutions. Among the barriers identified by the agency, two of the most persistent are the lack of a true multimedia orientation and a pollution prevention mindset among those involved in the program (US EPA 1995c).

As these examples demonstrate, despite its rhetoric embracing pollution prevention, EPA still has a ways to go to fully integrate pollution prevention into its existing regulatory programs. It is simply not ready for the fundamental shift some its rhetoric implies. Exacerbating this situation, some observers have argued that the main reason why industry has voluntarily explored and implemented pollution prevention measures to the extent it has is because the growing volume of state and federal pollution control regulations have made preventing pollution often less costly than abatement (Wolf 1988, Johnson 1992). In other words, industry only turns to pollution prevention when the costs of pollution control make it a viable alternative. This suggests that implementation of pollution prevention strategies is somewhat dependent on the continued enforcement of state and federal pollution control laws that encourage industry to search for less expensive alternatives. Thus the ironic position in which EPA finds itself is that while pollution control is needed to make pollution prevention cost effective, the two approaches often work at cross purposes since the former encourages industry to invest its time and resources on expensive pollution control technologies instead of searching for new prevention solutions (Johnson 1992).

Even though EPA has had its troubles identifying and removing barriers that impede the integration of pollution prevention strategies into its existing regulatory programs, it has begun the process of institutionalizing pollution prevention within the agency. For example, EPA has instituted a series of organizational changes to help ensure that pollution prevention is incorporated into the agency's decision-making hierarchy by giving it visibility and stature within the agency. It has done this by creating the Office of Pollution Prevention and Toxics, a Pollution Prevention Policy Staff in the Office of the Deputy Administrator, and a senior Policy Council and Executive Committee devoted to pollution prevention. The Office of Pollution Prevention and Toxics is the program office established to be the focal point for pollution prevention activity. It was combined with the Office of Toxic Substances to give it higher visibility and greater availability to resources and expertise. The Pollution Prevention Policy Staff's function is to ''guide, mediate, and coordinate the development of EPA's pollution prevention program . . . [and] to coordinate the activities of the Policy Council and Executive Committee'' (US EPA 1994b, pp. 2–6). The Policy Staff also works closely with the Office of Pollution Prevention and Toxics to implement the Policy Council's directives.

Composed of assistant and regional administrators, the Policy Council reviews analyses, options, and recommendations developed by its Executive Committee. The existence of the Policy Council, with its composition of top EPA management, helps ensure that pollution prevention will come to the attention of the agency's top administrative levels where policy and budget decisions occur (US EPA 1994b). Moreover, each of EPA's ten regions has a pollution prevention staff that coordinates its policies with state and local governments, industry, local and regional environmental organizations, and other organizations interested in pollution prevention. While these steps are by no means radical alterations of EPA's organizational structure, they are an attempt by the agency to incorporate pollution prevention into its regulatory structure. Organizational changes that enhance PPA's stature and visibility within the agency represent concrete steps towards positively structuring the implementation environment to better meet the statute's objectives.

Other steps EPA has taken include integrating source reduction strategies into the regulatory development process of each program office; establishing a pollution prevention research agenda within its Office of Research and Development; providing pollution prevention training to agency staff in each program office, especially for line employees performing functions such as inspecting, permit writing, and rulemaking; integrating pollution prevention into state media grants administered under separate legislative mandates (i.e., RCRA, CWA, and CAA); creating a clearinghouse for pollution prevention information so that interested parties (states, federal facilities, businesses, and individuals) can contact one central location for information; and instituting outreach programs that disseminate research and other new technology-related information through dem-

onstration projects, speeches, publications, and presentations, and recognize outstanding achievement in the development of pollution prevention techniques with EPA achievement awards (US EPA 1994b).

In addition, two programs in particular show considerable promise of institutionalizing pollution prevention within EPA's existing regulatory structure. These are pollution prevention enforcement settlements and the state matching grants program. When EPA's Office of Enforcement developed an action plan in 1989 for integrating pollution prevention into its existing programs, one of the strategies it identified as key was the promotion of pollution prevention through the regulatory settlement process (US EPA 1989). Although PPA does not provide a statutory basis for pursuing pollution prevention through enforcement settlements, this strategy has become instrumental in achieving PPA's goal that ''pollution should be prevented or reduced at the source whenever feasible.'' There are two types of pollution prevention remedies available in enforcement settlements: injunctive relief and supplemental environmental projects (SEPs). Both are voluntary in that whether they are used as remedies has to be mutually agreed upon by the agency and the violator.

Injunctive relief is a remedy for redressing a specific violation. When used in enforcement settlements, pollution prevention remedies are substituted for end-of-pipe remedies to bring violators back into compliance (Stahl 1993). SEPs, on the other hand, instead of trying to bring industry back into compliance for a specific violation, allow it to substitute a pollution prevention environmental project of its own design (subject to agency approval) as a remedy for its violation. The project does not necessarily have to redress the original violation. This not only provides violators with greater flexibility, it also leads to potentially better environmental outcomes since SEPs encourage industry to surpass federal, state, and local laws in reducing human health and environmental risks (Stahl 1993). Along with encouraging remedial action that exceeds regulatory standards, SEPs and injunctive relief also avoid problems associated with the cross-media transfer of pollutants and can be fairly easily incorporated into EPA's existing single-medium organizational structure.

In a recent study, Becker and Ashford (US EPA 1995b) analyzed ten EPA enforcement settlement cases where pollution prevention was included as a remedy in the settlement. They found that although there are agency and industry barriers to its wide application, pollution prevention remedies (especially SEPs) have been generally successful at expediting positive technological changes in industrial processes that have led directly and indirectly to economic, environmental, and health benefits for industry and the public. SEPs and injunctive relief encourage industry to improve its production processes through innovative change and technological diffusion, creating the potential for firms to realize a number of spillover benefits as they adopt or transfer technologically superior processes to other areas of operation. Although enforcement settlements take place in a legalistic and thus adversarial atmosphere that can exacerbate tensions between EPA and violators, the flexibility of the agency to negotiate penalty reductions in exchange for industry-sponsored environmentally benign activities and the improved public and agency relations accruing to firms that agree to pollution prevention remedies make them a mutually beneficial strategy for resolving conflict.

A second program that shows promise of institutionalizing pollution prevention is the state matching grants program. Also known as Pollution Prevention Incentives for States, this program by 1995 had awarded over $40 million in matching grants to states, tribes, and other regional organizations developing and implementing pollution prevention programs (US EPA 1995a). The bulk of the grants have gone to states to help build organizational capacity that in turn facilitates the adoption of pollution prevention techniques by industry. Since states typically have more contact with and are closer to the industries within their borders, they are in the best position to facilitate pollution prevention goals (US EPA 1994a). Grant money awarded to the states has gone towards activities such as technical assistance and training, education and outreach, identification of regulatory barriers and promotion of regulatory integration, demonstration projects, statutory development and infrastructure, and recognizing businesses that implement innovative pollution prevention solutions (US EPA 1992).

The state matching grants program illustrates the role that socioeconomic factors play in the design of a program that is voluntary rather than command-and-control. By providing a monetary incentive to build organizational capacity, this program helps overcome some of the institutional inertia attendant with change. By 1994, according to the Waste Reduction Institute for Training and Applications Research (WRITAR 1994), 29 states had developed pollution prevention programs that specified source reduction as the preferred method of prevention and established a pollution prevention agency or designated an existing agency to implement the program (Table 1). The state matching grants program has helped build state capacity by making federal resources available. This has encouraged some states that might have ignored the legislation to participate. Even states whose pollution prevention legislation

Table 1. State pollution prevention statutes, 1994[a]

State	Statute	Implementing agency
Alaska	1990 Solid and Hazardous Waste Management Act	Department of Environmental Conservation
Arizona	1991 Amendments to Hazardous Waste Management Statutes	Department of Environmental Quality
California	1989 Hazardous Waste Reduction and Management Review Act and amendments (1992)	Office of Pollution Prevention and Technology Development, California EPA
Colorado	1992 Pollution Prevention Act	Pollution Prevention and Waste Reduction Program, Department of Health
Connecticut	1991 Environmental Assistance to Business Act	Hazardous Waste Management Service, Department of Environmental Protection
Delaware	1990 Waste Minimization and Pollution Prevention Act	Department of Natural Resources and Environmental Control
Florida	1991 Pollution Prevention Act	Division of Waste Management, Department of Environmental Regulation
Georgia	1990 Amendment to Hazardous Waste Management Act	Environmental Protection Division, Department of Natural Resources
Illinois	1989 Toxic Pollution Prevention Act	Illinois EPA
Indiana	1990 Amendment to the Environment Code	Department of Environmental Management
Iowa	1991 Toxics Pollution Prevention Act	Waste Management Authority, Department of Natural Resources
Kentucky	1988 Hazardous Waste Reduction Act	Department of Environmental Protection
Louisiana	1987 Waste Reduction Law	Department of Environmental Quality
Maine	1990 Reduction of Toxics Use, Waste and Release Act and amendments (1992)	Department of Environmental Protection
Massachusetts	1990 Toxics Use Reduction Act	Office of Technical Assistance, Executive Office of Environmental Affairs
Michigan	1987 Waste Minimization Act; 1987 Waste Reduction Assistance Act	Office of Waste Reduction Services
Minnesota	1990 Toxic Pollution Prevention Act	Office of Waste Management
Mississippi	1990 Comprehensive Multimedia Waste Minimization Act	Bureau of Pollution Control, Department of Environmental Quality
New Jersey	1991 Pollution Prevention Act	Department of Environmental Protection
New York	1989 Hazardous Waste Management Act	Bureau of Pollution Prevention, Department of Environmental Conservation
North Carolina	1989 Hazardous Waste Management Commission Act	Office of Waste Reduction Services, Department of Natural Resources
Oregon	1989 Toxic Use Reduction and Hazardous Waste Reduction Act	Hazardous and Solid Waste Division, Department of Environmental Quality
Rhode Island	1989 An Act Relating to Litter Control, Recycling, and Hard-to-Dispose Materials	Office of Environmental Coordination, Department of Environmental Management
Tennessee	1990 Hazardous Waste Reduction Act	Hazardous and Solid Waste Management Division, Department of Health and Environment
Texas	1991 Waste Reduction Policy Act	Office of Pollution Prevention, Texas Water Commission
Vermont	1990 Hazardous Waste Management Act	Hazardous Material Management Division, Agency of Natural Resources
Virginia	1993 Amendment to the Waste Management Act	Waste Reduction Assistance Program, Department of Environmental Quality
Washington	1990 Hazardous Waste Reduction Act	Waste Reduction, Recycling and Litter Control Program, Department of Ecology
Wisconsin	1989 Hazardous Substances, Toxic Pollutants, Hazardous Waste Use and Release Reduction	Department of Natural Resources

[a]Source: Waste Reduction Institute for Training and Applications Research (WRITAR 1994).

predates passage of PPA benefit since they can expand their programs by offsetting some of their costs with federal funds. Kling and Schaeffer (1993, p. 26) argue that the state matching grants program has enhanced state efforts by enabling them to ''enhance innovative and results-oriented programs, implementing multimedia prevention approaches and targeting high-risk, high-priority areas.'' Moreover, many of the state programs that predated PPA were primarily geared towards reducing the volume of wastes to be disposed of rather

than reducing wastes at the source (US Senate 1990). PPA's focus on source reduction should help encourage these states to reorient their programs towards this end.

Issues

Pollution prevention through source reduction is a continuous process. Ultimately, most source reduction will come from industry as it reevaluates and redesigns its production processes and product packaging, a continuous process of technological innovation and diffusion. EPA is facilitating this process by pushing for pollution prevention remedies in enforcement settlements and the state matching grants program, both of which encourage—through the use of incentives—industry to adopt pollution prevention strategies. Industrial redesign, however, is an expensive and time-intensive undertaking, often with uncertain benefits. As such, any switch from pollution control to pollution prevention must address three issues.

The first issue is whether the factors mentioned by some authors (Wolf 1988, Sullivan and Floyd 1991, Johnson 1992, Millan 1993) as encouraging industry to examine and adopt pollution prevention strategies—potential liability, public opinion, and industry efficiency—are strong enough to irreversibly and continuously propel industry down the path of pollution prevention without the financially onerous threat of pollution control legislation. If not, then EPA might very well be stuck enforcing pollution control programs that are extremely expensive, often inefficient, and of questionable environmental value simply to encourage industry to voluntarily adopt less expensive (in the long run at least) and more efficient pollution prevention strategies—a rather circuitous and wasteful way of achieving a cleaner environment. Yet because pollution prevention is a process, constant refinement, reinvention, and technological advancement are paramount. For it to live up to its potential, industry must adopt and inculcate a value system that places pollution prevention near the top of its research and development agenda. The issue is how to ensure that investing in this process remains in industry's interest.

A second issue involves the limits of pollution prevention and what it can ultimately accomplish, both technologically and economically. Some argue (Lis and Chilton 1993, p. 55) that the elimination of pollution is technologically unfeasible and that the ''excessive promotion of 'win–win' pollution prevention rhetoric reinforces the public's illusion that a zero pollution society is achievable.'' Others argue (Helfand 1992, 1994) that whether or not the total elimination of pollution is achievable, pursuing pollution prevention strategies when their economic costs exceed their benefits diverts resources that could be better used elsewhere in society. It obfuscates what society should settle for as an optimal level of pollution given the cost–benefit trade-offs. The issue, then, is whether pollution prevention should be measured by its economic efficiency rather than by its possibilities.

The third issue deals with developing mechanisms to measure the effectiveness of switching from abatement to prevention (Geiser 1995). Currently, EPA's only source reduction measurement is through the Toxics Release Inventory (TRI) of the Superfund Amendment and Reauthorization Act of 1986 (SARA): PPA requires facilities that must report under section 313 of SARA to ''include with each such annual filing a toxic chemical source reduction and recycling report for the preceeding [sic] calendar year'' (Pollution Prevention Act 1990). However, since TRI did not require any accounting of total wastes generated prior to PPA, no baseline data exist for determining the overall effectiveness of pollution prevention strategies at reducing pollution levels. This means that much of the evidence claimed as benefits gained from switching to pollution prevention comes not from systematic study but from firms' anecdotal accounts. EPA will have to address this measurement and reporting deficiency if it expects to organizationally sustain a long-term switch to pollution prevention.

Conclusion

The findings in this paper suggest that implementation of PPA presents EPA with both problems and opportunities. Looked at under the lens of Sabatier and Mazmanian's implementation framework, PPA only shows a moderate degree of problem tractability, is mixed in its ability to positively structure the implementation process, and encounters a number of political and external hurdles. Turning to problem tractability, PPA provides a causal theory that connects behavioral change (prevention of pollution) to problem amelioration (less pollution), but the requisite technology to accomplish behavioral change is not always available and measurement of change in the seriousness of the problem can be extremely difficult due to the paucity of baseline data. The target group is easily identifiable within each state, but often includes large, powerful, and highly organized industry interests that can resist state pressure. Last, the amount of behavioral change needed in the target group and in EPA is significant.

Second, the ability of PPA to positively structure the implementation process is mixed. The statute provides a causal theory connecting behavioral change to outcomes, but how it achieves those outcomes is not clearly

articulated. In addition, funding for pollution prevention is inadequate to the task, the number of veto points in the implementation chain can be extensive, and it is not yet clear whether it provides enough incentives to overcome resistance. Even though EPA is rhetorically supportive of the concept of pollution prevention, the single-medium emphasis of existing environmental legislation biases the agency towards pollution control strategies. It is PPA's inherently weak statutory structure that makes implementation the most problematic. As EPA's slow progress demonstrates, PPA does not provide the agency with much of a tool bag to facilitate implementation. EPA has, however, instituted a number of organizational changes that should help elevate pollution prevention in the agency's decision-making hierarchy to the status afforded other important programs.

Finally, PPA encounters a number of political and external hurdles. These mostly come in the form of resistance from an existing regulatory structure built up over the last 25 years for the specific purpose of controlling downstream pollution. Included in this structure are legislators writing the statutes, the thriving pollution control industry that designs and builds mitigation equipment, the corporations heavily invested in control technology and expertise, and the universities training engineers in pollution abatement techniques. Similar to other policy issue areas, pollution control has become institutionalized and thus has taken on a life of its own, making it extremely resistant to change. Pollution prevention, like any fundamental reordering of priorities, creates a potentially new set of winners and losers and hence threatens the political status quo. Here again, however, there is some movement towards change. Jonathan Bulkley (1997), director of the National Pollution Prevention Center at the University of Michigan, recently wrote that pollution prevention and sustainable development approaches to solving problems are increasingly being integrated into college and university programs.

Thus the findings are mixed. EPA is a long way from fully embracing a fundamental shift to a pollution prevention regulatory ethic that holds primacy over pollution control. Despite EPA's laudable efforts to incorporate pollution prevention strategies throughout the organization, the agency is still primarily wedded to pollution control. Its organizational structure, statutory authority, and incentives system still reflect a single-medium pollution control focus, appropriations for pollution prevention programs and activities are paltry compared to traditional pollution control programs, and participation in the program is voluntary. Yet, the findings also point to some promising programs that are working to institutionalize a pollution prevention regulatory ethic, and many states appear very committed to the concept. EPA is making an effort to incorporate pollution prevention, but is doing so and has only been provided with the statutory authority to do so through incremental rather than radical change. Whether it is possible to truly give preference to pollution prevention over pollution control without radically altering the agency, however, is open to debate. Ultimately, the long-term success or failure of institutionalizing a pollution prevention ethic will be determined by the devotion of industry to the concept and the pressure or incentives states can offer industry to innovate. Thus one fruitful area of future research will be in evaluating the determinants of successful state pollution prevention programs.

The question posed in the title of this paper was whether the Pollution Prevention Act is a policy whose time has come or simply another example of symbolic legislation with little substance. The answer is that it is both: although PPA makes pollution prevention a national policy and embraces a waste management hierarchy that gives source reduction primacy, it nevertheless provides EPA little statutory authority to engage in systemic change. In a broader sense, however, PPA is only one facet in a growing pollution prevention regulatory strategy. In this sense, it provides a foundation for EPA to proceed down the pollution prevention path. Other components of this strategy include executive orders mandating pollution prevention within federal facilities, other federal statutes and regulations that have or will incorporate various pollution prevention requirements, state and local statutes and regulations promoting pollution prevention, and a growing industry awareness that pollution prevention is not only environmentally benign but can be cost effective as well. Thus, while this paper focuses specifically on EPA's implementation of PPA, the ultimate success or failure of pollution prevention as an alternative or supplement to pollution control must be viewed in this larger legal, institutional, and social framework. In this sense, perhaps the real value of PPA comes not from the ultimate success of its implementation, but rather from the shift in regulatory emphasis that it helps create along the way.

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