

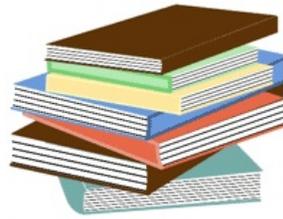


Compliance Information Project

Literature Summaries



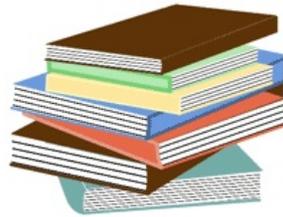
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Office of Planning and Policy Analysis

NOTICE

This report contains a directory of resources for people employed in, or interested in learning more about, the field of environmental compliance and enforcement. It identifies governmental and non-governmental literature on topics related to compliance monitoring, enforcement, compliance assurance, and compliance behavior. The non-governmental sources described in this document were included because they cover topics of potential interest to the U.S. Environmental Protection Agency (EPA), State agencies, the regulated community, and other persons. EPA makes no guarantee nor assumes any liability with respect to either the accuracy or use of any of the literature, information, or recommendations cited in this document. The inclusion of non-governmental resources should not be viewed as an endorsement of these resources by EPA or the States. Persons requiring additional information on, or clarification of, any literature described in this report should consult with the authors or sources directly.

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Message from the Deputy Assistant Administrator

The environmental and public health benefits of the nation's environmental laws cannot be realized unless there is a high degree of compliance by the regulated community. Enforcement activities such as monitoring compliance and taking enforcement actions to bring about compliance have been critical to the success of the modern environmental protection era that began in the 1970s. As the number and complexity of environmental requirements increased and the regulated universe expanded to include hundreds of thousands of small businesses, however, it became clear that these enforcement approaches, by themselves, would not be enough to bring about high levels of compliance. Further, limited government resources for compliance and enforcement needed to be used as efficiently and effectively as possible.

Over the past several years, the U.S. Environmental Protection Agency (EPA) and its State partners have been working both to maintain and improve our capacity to use enforcement actions effectively as well as to develop and implement new approaches to achieving compliance by providing information and assistance about regulatory requirements, and offering incentives for self-auditing to regulated facilities. Through the National Performance Measures Strategy and other projects, EPA is developing a better understanding of how its enforcement and compliance efforts can be more effective in increasing compliance of regulated parties and improving actual conditions in the environment.

The Compliance Information Project (CIP) is part of EPA's ongoing effort to find new ideas and insights for improving the quality and effectiveness of compliance and enforcement programs. Under the CIP, EPA is soliciting suggestions and experiences from people at all levels of government, the business community, professional organizations, academia, and citizen groups.

This Literature Summaries report, the first product of the CIP, presents the results of a broad-based literature search for papers analyzing various aspects of environmental compliance and highlights 17 papers on an array of compliance-related topics. Some of the studies reinforce the importance of monitoring compliance and taking enforcement actions; others suggest new approaches that can be effective in fostering compliance.

EPA hopes the ideas and findings in these papers will stimulate thinking about how to make compliance and enforcement efforts more effective. We welcome your comments and suggestions.

Michael M. Stahl
Deputy Assistant Administrator

About the Compliance Information Project

The Compliance Information Project (CIP) is a pilot program of the U.S. Environmental Protection Agency (EPA) designed to improve the effectiveness of environmental compliance efforts. The CIP grew out of concerns on the part of EPA and State officials that standard compliance information collection procedures and databases may overlook information that could prove useful in developing and implementing more effective compliance programs. In the CIP, EPA is seeking information from a wide range of sources on compliance-related topics, including successful tools, techniques, and strategies for achieving compliance.

The CIP is searching for compliance-related information using two methods:

- (1) a broad-based literature search on environmental compliance topics; - and -
- (2) a questionnaire distributed to experienced Federal and State enforcement officials soliciting innovative compliance monitoring and targeting techniques and approaches.

This report presents the results of the literature search, and covers a wide range of topics. Findings from the questionnaire component of the CIP, focusing on compliance monitoring, targeting, and inspections, will be presented in a subsequent report.

The CIP is managed by the Office of Planning and Policy Analysis (OPPA) in EPA's Office of Enforcement and Compliance Assurance (OECA). Additional copies of this report can be downloaded from OPPA's web site at <http://www.epa.gov/oeca/oppa>.

Reader Comments and Suggestions Requested

Whether EPA implements future compliance information projects of this kind will depend in part on reader reactions to the materials produced by the CIP. OPPA welcomes comments and suggestions regarding the value and utility of the summaries and literature cited in this report, whether EPA should expand this literature search or conduct periodic compliance literature searches in the future, and ways EPA might make the results of such searches more useful. EPA also strongly encourages readers who are aware of additional compliance literature of potential interest to EPA, State compliance and enforcement staff, or the public to bring it to OPPA's attention for inclusion in a possible future report.

Please send comments on the CIP, and suggestions for additional literature to be reviewed, to: CIP Project Manager, U.S. Environmental Protection Agency, Mail Code 2201-A, Washington, D.C. 20460; or send e-mail to cip.manager@epa.gov; or telephone (202) 564-2530.

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APPENDIX II: Compliance Information Project: Cohen Bibliography

INTRODUCTION

Government has limited resources for ensuring compliance with environmental requirements and promoting sound environmental management. The U.S. Environmental Protection Agency's (EPA) Compliance Information Project (CIP) is part of EPA's continuing effort to identify successful techniques and strategies for achieving environmental compliance. This report presents the results of a literature search for papers analyzing various aspects of environmental compliance, conducted under the auspices of the CIP. In another CIP effort, EPA is asking compliance and enforcement staff directly for their suggestions and experiences in devising and implementing new approaches to compliance monitoring, targeting, inspections, enforcement, and compliance assistance.

By highlighting some of the more interesting papers that were found in the literature search, EPA hopes to shine light on new ideas and provide insights that can help improve the quality and effectiveness of compliance and enforcement efforts at all levels of government. Some of the papers selected for inclusion in this report challenge assumptions; others lend new support to existing approaches. All are meant to stimulate creative thinking. Some papers focus on improved targeting of compliance and enforcement programs, and measuring the results they achieve. Others illustrate the effectiveness of various tools in achieving compliance. Several describe innovative approaches to inspections and enforcement. Some of the papers provide insights into why firms comply and the positive benefits they receive when they do.

The literature search identified well over a hundred compliance-related documents. A list appears in Appendix I. Seventeen of the documents are summarized in this report. Each summary suggests who is most likely to be interested in the paper and contains information about the study or project's scope and purpose, the methodology used, and key findings and recommendations. The brief summaries provide information useful in deciding whether a particular paper is of interest. However, since summaries cannot provide the background, context, and details that may be necessary for a full understanding and fair use of their findings, interested readers are urged to obtain copies of the original documents from the sources shown at the end of each summary.

Many of the papers summarized in this report address multiple topics. To help the reader find summaries that may be of particular interest, the table on page 6 shows the topics addressed in each paper. A brief description of each paper follows.

- “Monitoring and Enforcement of Environmental Policy” is a compilation of the diverse **literature examining why firms comply with environmental requirements, including the impact of government sanctions, economics, and social factors on compliance decisions.** The report also reviews literature on how to maximize the utility and deterrence of inspections, enforcement actions, and other compliance tools. The report includes a bibliography with citations to 148 additional studies. (*Summary 1*)

- “Empowering the Community: Information Strategies for Pollution Control” is a review of **research on environmental disclosure strategies throughout the world that involve public or private attempts to increase the availability of pollution information** to workers, consumers, shareholders, and the public. *(Summary 2)*
- The Massachusetts Department of Environmental Protection (DEP) uses **facility-wide inspections to assess compliance and identify potential pollution prevention opportunities**. “Evaluation of the Massachusetts Compliance Assurance Demonstration Grant” describes the results of DEP’s Facility-Wide Inspections to Reduce the Source of Toxics (FIRST) program. *(Summary 3)*
- In the Massachusetts DEP’s Environmental Results Program (ERP), **permits for some small and medium-sized companies are replaced with a whole-facility, performance-based approach in which companies self-certify their compliance annually**. Companies must file a Return-to-Compliance Plan for violations that are self-discovered. DEP gives a high priority to inspection to assure compliance with these plans and targets non-certifiers for enforcement action. The “Evaluation of the Environmental Results Program (ERP) Project” showed significantly increased compliance rates for the small and medium-sized companies that participated. The program is being expanded to additional sectors. *(Summary 4)*
- The State of Illinois’ “Annual Environmental Conditions Report” describes the State’s efforts to develop and test **measures designed to tie compliance information with environmental impacts**. In a water measure that is now being used, Illinois calculates the amount of pollutants discharged to surface water that are in excess of each NPDES facility’s permit limits. Illinois then calculates the percentage of non-compliant loadings by facility and watershed, and targets its compliance efforts to eliminate the most significant excess loads from its most highly stressed watersheds. *(Summary 5)*
- The Florida Department of Environmental Protection (DEP) is using a state-of-the-art **performance measurement system to assess strengths and weaknesses in its programs and to identify geographic areas where focused attention is needed**. The four tiers of measures in the innovative system allow for the development of statistically valid compliance rates and also include environmental indicators, program outcomes, and program outputs. The “Secretary’s Quarterly Performance Reports” for 1997 and 1998 describe the State’s performance management system. *(Summary 6)*
- A study by the National Conference of State Legislatures found that **neither an audit privilege and immunity law nor an audit policy appear to influence the level of audit activity by facilities**. In a survey of 988 facilities, more than 75 percent are conducting audits, but there was no statistically significant difference in the self-auditing rates in States with audit laws, audit policies, or neither laws nor policies. *(Summary 7)*

- The authors of “Compliance and Enforcement: Air Pollution Regulation in the U.S. Steel Industry” used a statistical model to evaluate **the relationship between compliance status and inspection rates** at integrated steel mills. The model incorporates many factors affecting the compliance decisions of individual plants and the firms which own them. Enforcement actions, whether measured as total enforcement actions or inspections alone, were determined to increase steel mill compliance. Firm size, diversification, and gross cash flows were determined to have little impact on compliance. The authors also found that larger firms specializing in steelmaking, large local employers, and plants with a high probability of closure received relatively fewer inspections and less enforcement. The authors believe these factors may suggest regulator sensitivity to political clout. *(Summary 8)*
- New survey evidence in “What Improves Environmental Performance? Evidence from Mexican Industry” highlights the **effects of regulation, environmental management policies, and plant/firm characteristics on the environmental performance** of Mexican factories. The variables that showed significant positive impacts included regulatory pressure (inspections and enforcement), implementation of ISO 14000 procedures, size, public trading of the firm’s stock, and general environmental training of workers. “Mainstreaming” environmental responsibilities seemed to produce better compliance outcomes than assigning responsibilities to specialists removed from day-to-day production. Many variables that were expected to influence performance, such as OECD linkages, technology vintage, and indirect community pressure, seemed to have no significant effect on performance. *(Summary 9)*
- The **impact of enforcement and monitoring activities in reducing the time spent in non-compliance** by pulp and paper facilities was analyzed in “EPA Effectiveness at Reducing the Duration of Plant-Level Noncompliance.” The statistical analysis showed that increased inspections and enforcement actions reduce the length of time in violation. Facilities with increasing production levels appeared to pay less attention to environmental requirements, and larger facilities tended to remain out of compliance longer. The study also concluded that the strength or weakness of state programs affects the speed at which companies return to compliance. *(Summary 10)*
- There is a **correlation between high levels of environmental performance and enhanced profitability**, according to “A Resource-Based Perspective on Corporate Environmental Performance and Profitability.” The relationship is strongest in high growth industries. The authors examined two different corporate decision-making models for environmental pollution: “end-of-pipe” control strategies focused on compliance with environmental requirements; and “beyond compliance” strategies concentrating on pollution prevention and process innovation. Companies implementing the first strategy only affect their physical assets, so they gain no competitive advantages. Companies going “beyond compliance,” however, increase both human resource and organizational capabilities. They gain competitive advantages by efficiently using all of their internal resources -- tangible, intangible, and human -- and are better positioned for future legislation and consumer mandates. *(Summary 11)*

- Some companies will take steps to improve in response to the potential for **public disclosure of poor environmental performance**. The World Bank’s 1997 Working Paper, “Regulation in the Information Age: Indonesian Public Information Program for Environmental Management,” reports the results of a pilot program designed to assess the potential role of public disclosure and pressure in improving compliance behavior. The Indonesian Environment Ministry assessed the compliance and beyond-compliance environmental behavior of 187 firms, and assigned each a color-coded rating easy for the public to understand. Companies with the poorest ratings were informed confidentially of their ratings six months before the ratings were to be released publicly. A substantial percentage of them made improvements that moved them into a better category before the rankings were released publicly. Several companies reported that the performance ranking brought environmental compliance issues to managements’ attention for the first time. (*Summary 12*)
- The “Colorado Compliance Study” is a **compendium of innovative approaches to Clean Air Act inspections, enforcement, and compliance assistance**. Prepared by an independent contractor for the Colorado Department of Health and Environment, the report includes information provided by Federal regulators and state and local air quality boards. Topics include template permit language, source-specific inspections forms, self-certifications of CEM equipment, inspector on-site assistance, “white hat” inspections, improved inspector-permit writer interaction, facility compliance plans, and other tools. (*Summary 13*)
- A case study on the “Southwest Environmental Action Team: Helping Ohio’s Generators (SWEATHOGS)” describes how the self-directed team used **random inspections, surveys, and past inspection data to determine the compliance rates and assistance needs of local waste generators**. As a result of the project, the SWEATHOGS improved compliance and developed new assistance tools. In addition, the productivity of inspectors and compliance assistance providers rose by a reported 270%. They also reported increased job interest and improved communication. (*Summary 14*)
- **Strong enforcement is a fundamental factor inducing implementation of environmental best management practices (BMPs)**, according to a Canadian study, “Enforcement vs. Voluntary Compliance: An Examination of the Strategic Enforcement Initiatives Implemented by the Pacific and Yukon Regional Office of Environment Canada 1983-1998.” Improvements correlated first with the transition from voluntary to mandatory standards, and second, with increasingly stringent levels of enforcement. The overall benefit of a comprehensive compliance promotion and enforcement program was deemed to be approximately a 30% improvement in BMP implementation. (*Summary 15*)
- The **quality of a company's environmental management is a strong indicator of the quality of its overall business operations** and a major factor in increasing or losing market share, according to study results presented in “Environmental Performance and Shareholder Value.” Therefore, shareholders should consider environmental management in assessing the security of their investments. Truly “eco-friendly” corporations integrate environmental

concerns into their overall business policy through improved customer focus, technical innovations, management and marketing, and human development. The analysis explains how companies can actively utilize environmental information and goals as drivers to increase operational and production efficiencies. *(Summary 16)*

- The U.S. General Accounting Office's "Investigators' Guide to Sources of Information" is designed to help investigators identify **sources of information about people, property, business, and finance**. It describes Federal, state, local, and non-governmental databases and references of potential use to Federal and state inspectors. The publication includes a guide to using the Internet for investigative purposes, as well as a list of potentially useful Internet sites. *(Summary 17)*

TOPICS IN COMPLIANCE INFORMATION DOCUMENTS

| TOPIC | DOCUMENT | | | | | | | | | | | | | | | | |
|--|----------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| Innovative targeting | | | X | X | X | X | | | | | | | X | | | | |
| Effect of inspection approach and frequency | X | | X | | | | | X | | X | | | | | X | | |
| Root causes of non-compliance | | | | | | | | X | X | | | | | | | | |
| Impact of compliance assistance | | | X | X | | | | | | | | | X | X | X | | |
| Economic factors and compliance | X | X | | | | | | X | X | | | X | | | | X | |
| Performance measures | | | X | | | X | | | | | | | | | | | |
| Issues in measuring compliance | | | X | | X | X | | | | | | | | | | | |
| Compliance impact of strong/weak enforcement program | X | | | | | | X | X | X | X | | | | | X | | |
| Sector compliance trends | X | | X | | | | | X | | X | | | | | | | |
| Impact of publicity on compliance | X | X | | | | | | | | | | X | X | | | | |
| Characteristics of compliant and noncompliant facilities | X | X | | | | | | X | X | X | X | X | | X | | X | |
| ISO 14000/self-certification, auditing, and compliance | | | | X | | | X | | X | | | | X | | | | |
| Databases and information sources | | | | | | | | | | | | | | | | | X |
| RCRA program | X | X | X | X | | X | | | | | | | | X | | | |
| Air program | X | X | X | | | X | | X | | X | | | X | | | | |
| Water program | X | X | X | | X | X | | | | | | | | | | | |
| Other programs | X | X | | | | X | | | | | | | | | | | |

Compliance Information Project

LITERATURE SUMMARIES

Notes

1. Monitoring and Enforcement of Environmental Policy

Author: Mark A. Cohen, Owen Graduate School of Management, Vanderbilt University
(August 1998)

Of Primary Interest To: (1) Persons interested in reviewing literature on a broad range of compliance and enforcement issues; (2) Environmental economists.

Scope: The compliance and enforcement literature summarized in this report encompasses public and private mechanisms for compelling firms and individuals to comply with formal environmental regulations, including informal rules of conduct and social norms. These firms and individuals are situated in business sectors throughout the economy and are subject to virtually all environmental laws.

Purpose of Report:

The primary purpose of the report is to compile the diverse economics literature on environmental enforcement in a format conducive for researchers and policy makers to consider the literature when setting and evaluating environmental policy. The report, which includes a bibliography with citations to 148 additional studies (reprinted in Appendix II, below), is a highly recommended starting point for people wishing to delve more deeply into these topics. In particular, legal and economics articles cited in the report which do not mention the word “environment” but apply to virtually all law enforcement may be new to environmental practitioners.

Methodology:

The report reviews compliance and enforcement literature addressing why firms comply with environmental requirements; the impact of government sanctions, economics, and social factors on compliance decisions; how to maximize the utility and deterrence of inspections, enforcement actions, and other compliance tools (including market forces and publicity/information); and other similar issues. It begins by addressing the fundamental question of why firms comply with environmental laws. Next, it considers various economic theories of government behavior and how the theories have been used to explain observed enforcement behavior. The report then reviews normative theories of optimal penalties as they relate to environmental regulation, including recent studies examining complexities associated with sanctioning both organizations and their employees. It continues by assessing the available empirical studies on environmental enforcement, including analyses of government enforcement, along with private enforcement mechanisms such as citizen suits and the role of market forces in compelling compliance. The report concludes by describing the most critical gaps in our knowledge of these areas and offers suggestions for future research.

Examples of Studies Reviewed in the Report:

- Polinsky and Shavell (1979) analyze the impact of variable enforcement costs on sanctions, explicitly examining the tradeoff between the probability of detection and the optimal amount of the fine.
- Shavell (1979) and Cohen (1987) analyze how risk aversion affects the manner in which potential violators respond to variations in the frequency of monitoring and/or size of the penalty.
- Oh (1995) and Huang (1996) find that raising emission fees may increase emissions where evasion is possible, but if the government raises the probability of detection, the value of a given level of avoidance activity is reduced and compliance increased.
- Segerson and Tietenberg (1992), and Polinsky and Shavell (1993), apply principal-agent models to determine whether the employee or the firm should be punished for environmental violations.
- Gabel and Sinclair-Desgagne (1993) adapt the principal-agent framework to the issues of how firms should structure their incentive systems to maximize individuals' compliance with company policy.
- Arlen and Kraakman (1997) consider how best to structure enforcement penalties so that companies are given the incentive to monitor their employees' conduct.
- Magat and Viscusi (1990) connect higher levels of enforcement activity to resulting lower levels of pollution with a one quarter lag specific deterrence effect.
- Laplante and Rilstone (1996) determine that, in addition to actual inspections, the threat of inspections ("expected inspection rate") at Canadian pulp and paper mills induce compliance and more frequent self-reporting.
- Harrison (1995) compares empirical evidence of Canadian and U.S. enforcement policy towards pulp and paper firms to find that the more stringent and even-handed U.S. approach produces greater compliance.
- Hamilton (1996) finds that administrative penalties for hazardous waste violations are higher in regions where key Congressional Committee members reside and environmental group membership is high.
- Konar and Cohen (1998), Arora and Cason (1996), and others explore the role of community pressure and other forms of informal sanctions in emissions and compliance.

- Brehm and Hamilton (1996) consider the extent to which willfulness and ignorance explain noncompliance, on the part of toxic chemical emitters, with TRI reporting requirements.
- Hamilton (1995) estimates that the first public disclosure of TRI information on emissions had a significant effect on the market value of publicly traded firms.
- Konar and Cohen (1997), following up on Hamilton's work, demonstrate that the firms which suffered the worst financial consequences upon the initial TRI announcement subsequently achieved the greatest emissions reductions.
- Burby and Patterson (1993) provide an introduction to non-economic environmental compliance literature, including the role of social norms in promoting cooperation and deterrence.
- Burby and Patterson (1993) review data for inspections in North Carolina to determine whether delegating enforcement authority from the state to the local level results in more or less enforcement.

Recommendations for Future Research:

According to the author, we probably know the least about the most important and fundamental topic in enforcement, why firms comply with the law. Two developing areas of research on this topic which appear particularly promising are incorporating social norms, community pressure, and firm reputation into the compliance analysis, and opening up the "black box" of the firm to order to incorporate environmental incentives within organizations.

Considerations, Caveats:

Although the report focuses on economic analyses of environmental monitoring and enforcement, it also reviews papers by sociologists and public policy analysts which include "deterrence" components. By design, however, it does not address the role of liability laws, e.g., torts and nuisance actions, in compelling polluters to reduce emissions.

Source: The full report is published at:
http://www.worldbank.org/nipr/work_paper/cohen/index.htm; -and-
<http://www.vanderbilt.edu/VCEMS/papers/pubs.html>;
 In addition, it is forthcoming at: "International Yearbook of Environmental Resource Economics 1999/2000," Vol. III; edited by Tom Tietenberg & Henk Folmer (Edward Elgar Publishing Limited).

2. Empowering the Community: Information Strategies for Pollution Control

Authors: Tom Tietenberg, Professor of Economics, Colby College, and David Wheeler, Lead Economist, World Bank; Frontiers of Environmental Economics Conference (October 1998)

Of Primary Interest To: (1) Persons interested in promoting pollution control through information disclosure; (2) Persons interested in comparing information disclosure strategies to traditional enforcement

Scope: The report addresses environmental disclosure strategies throughout the world that involve public or private attempts to increase the availability of pollution information to workers, consumers, shareholders, and the public as an environmental management strategy. The programs apply to a wide array of corporations and individuals.

Purpose of Report:

To review the conceptual foundations for using disclosure strategies to control pollution, consider how policy settings influence the types of information strategies which may be employed, and identify where further research would be helpful.

Methodology:

The authors believe that disclosure strategies involving public or private attempts to increase the availability of information on pollution represent the “third wave” of pollution control policy after legal regulation and market-based instruments. In their research, they study pollution caused by production and consumption of products in four settings: households, consumers, workplaces, and communities. The authors also identify four key functions to implementing a disclosure strategy: detecting environmental risk; assuring reliable information; disseminating the information; and acting on the information. To determine whether and when such strategies are effective, the authors analyze innovative environmental information disclosure strategies in the United States, Latin America, and Asia such as occupational risk communication, toxics release information/community-right-to-know, and voluntary and required labeling. They also review the available empirical research on these strategies’ effectiveness. The references section of the report is an excellent starting point for persons interested in reviewing research on environmental disclosure strategies.

Examples of Studies Reviewed in the Report:

- Arora and Carson (1996): Used an econometric model to assess the factors that influence a firm’s decision to participate in EPA’s 33/50 program.

- Naysnerski and Tietenberg (1992): Analyzed data on more than 1,200 citizen suits to determine the effects of various incentives on the types of claims filed.
- Magat and Viscusi (1992): Examined the potential role of hazard warnings on behavior, including how the warnings' structure influences their effectiveness.
- Muoghalu, Robison, and Glascock (1990): Examined the impact on the capital market of hazardous waste lawsuit filings and settlements during a nine year period.
- Badrinath and Bolster (1996): Studied stock market reaction to USEPA judicial actions affecting more than 700 publicly traded firms.
- Hamilton (1995): Examined the effect of the public announcement of Toxic Release Inventory (TRI) emissions information on the stock prices of more than 400 companies.
- Khanna, *et. al.* (1997): Examined how TRI disclosures in the chemical industry affected stock market prices and waste management responses.

Hypotheses and Conclusions:

- Disclosure strategies are effective, but the form of disclosure is critical. Disclosing overall performance seems to encourage pollution abatement, but focusing only on some pollutants may simply promote substitution of undisclosed forms of pollution.
- Voluntary information disclosure programs tend to attract the largest firms with the greatest emissions. There is no evidence, however, to suggest that these firms “free ride” on prior emissions reductions, or participate to divert attention from poor compliance with mandatory rules.
- For one class of polluters, public facilities, combining disclosure with empowering private enforcers has apparently been more effective in curtailing pollution than traditional public enforcement.
- Large declines in stock market value seem to motivate firms to improve their environmental performance. Public announcements seem to affect firms' stock market evaluations, but the effects are lower for known polluters. Differing results from Canadian and U.S. programs suggest that it is the predominant enforcement culture which may determine whether it is the initiation of the action, or the announcement of a final settlement, that has the greatest impact on the firms' market value.
- The available “green pricing” information suggests that some consumers are willing to pay higher prices for products with lower environment impact even when they are not directly affected by the resulting pollution.

Recommendations for Future Research:

Disclosure-related issues identified as warranting further study include:

- Are environmental disclosure strategies efficient (the fact that they are effective does not necessarily mean that providing information produces efficient outcomes relative to other pollution control policy investments)?
- Do investments in providing information yield rates of return that compare favorably with other pollution control policy investments?
- Under what circumstances is providing aggregated and structured information, e.g., the Indonesia's PROPER program, more effective than releasing raw data, e.g., the EPCRA Toxics Release Inventory?
- Are there diminishing returns to providing information as the number of substances and circumstances covered by disclosure increases? Does the public become saturated, and effectiveness diminish over time, as disclosure becomes a more common form of regulation?

Considerations, Caveats:

The report, by design, does not address literature on the relationship between regulator and polluter when the stakeholders have private information that is not disclosed to the public. Nor does it examine literature on the role of strategies, such as auditing, for increasing the amount of information available to firms. The authors suggest that while the information currently available regarding disclosure strategies suggests they are effective in improving environmental results, it is insufficient to allow for firm conclusions as to whether those results are economically efficient.

Source: The full report is published at:
http://www.worldbank.org/nipr/work_paper/ecoenv/index.htm

3. An Evaluation of the Massachusetts Compliance Assurance Demonstration Grant

Authors: Bureau of Waste Prevention, Massachusetts Department of Environmental Protection (April 1997)

Of Primary Interest To: (1) Persons targeting inspections or compliance assistance; (2) persons analyzing compliance rates and trends; (3) persons designing performance measures.

Scope: Statutory: Clean Air Act (CAA), Clean Water Act (CWA), Resource Conservation and Recovery Act (RCRA), Massachusetts Toxics Use Reduction Act (TURA) and solid waste requirements.

Types of facilities: Major facilities normally included in federal grant requirements plus state- identified facilities, including smaller, less commonly regulated facilities and specific categories of facilities identified by state as being environmentally significant (e.g., fuel dispensers).

Breadth: Annually, Massachusetts conducts multimedia inspections at approximately 1,000 industrial facilities; it also inspects 1,000+ asbestos abatement jobs and 200+ solid waste management facilities

Purpose of Report:

- (1) To evaluate enforcement and compliance trends in Massachusetts under the Compliance Assurance Demonstration Grants in 1995 and 1996, which provided increased flexibility to Massachusetts DEP to target facilities other than USEPA priority sources (primarily major sources) based on the criteria described in the report.
- (2) To assess the impact of the Facility-Wide Inspection to Reduce the Source of Toxics (FIRST) protocol. The FIRST protocol is a multimedia inspection approach developed by a joint MA DEP-EPA workgroup, under which multimedia inspections are conducted by specially trained single-media inspectors. The inspections begin with a review of facility production processes, allowing the inspectors to assess compliance with requirements from all media programs as well as identify potential pollution prevention opportunities.

Methodology:

To evaluate the benefits of targeting flexibility, the report compares compliance data for various sectors or subsets of facilities identified as priorities by EPA or MA DEP. The FIRST protocol was expected to improve MA's ability to identify violations in multiple program areas during a single inspection. To evaluate the benefits of the FIRST protocol, the report provides a detailed inspection

and enforcement trends analysis for the time period 1993-1996, including number of inspections and enforcement rates per inspection category, sector, or subsets of facilities. The effectiveness of the FIRST approach is also assessed through interviews of participating MA DEP staff. Innovative statistical sampling of behavior before and after the MA DEP activities was conducted for two specific sectors, fuel dispensers and printers.

Innovative Inspections:

Multimedia inspections under Massachusetts' FIRST protocol focus both on a facility's production process and on basic compliance requirements under federal and state environmental programs. There are 20 checklist-type modules for the inspection (1 general, 10 for air, 3 for wastewater, 1 for solid waste, 3 for hazardous waste, 1 for the Massachusetts TURA requirement, and 1 for pollution prevention). The report describes, in frank terms, the advantages and drawbacks of the FIRST approach, and associated inspector training requirements, to promote effective inspections. An analysis of a half year's worth of inspections found that, on average, a facility inspection and all ancillary inspector duties required about 34 hours, or 6.8 hours per regulatory program. This compared favorably to an average of 4 hours required per single media inspection, especially since, according to the State, under the flexible multimedia approach, a greater variety of facilities were inspected and each inspection was more comprehensive, resulting in a wider array of violations uncovered in more than one regulatory program area.

Innovative Targeting:

Using information on violations identified during both EPA-mandated inspections, and state-prioritized inspections allowed by the grant flexibility, the report concludes that the highest non-compliance rates are often found among the state-targeted facilities, though for a smaller facility the actual environmental impact of the violations may be small. The State inspection priorities encompassed standard factors such as high-risk activities, sensitive ecosystems, sectors with historically high noncompliance rates, and industries subject to new regulatory requirements, as well as new state priorities such as plants with pollution prevention opportunities, and new or smaller facilities never before inspected. Some of the new targets replaced facilities with good historical compliance records that, in the past, would have been automatically revisited because they fell into the set of traditional targets.

Compliance Rates and Trends:

Key new measures of environmental program outcomes deemed useful by MA include the "outlaw rate" (unpermitted, unregistered, or unlicensed activities at a facility), and the "multimedia hit rate" (violations discovered in more than one medium). In general, MA found the highest enforcement, outlaw, and multimedia hits rates among categories with the greatest degree of targeting flexibility. The overall "outlaws rate" in 1996 was 12% of all inspections, four times the rate in 1995. More than one in ten inspections under the flexible targeting approach discovered "outlaw" activity. The average "multimedia hit rate" in 1996 was 40%, meaning that of all enforcement actions issued, two in five

cited more than one regulatory program. This was double the rate in 1995. In addition, several specifically targeted sector initiatives such as fuel dispensers, and facilities in unsewered areas, proved to have high actual noncompliance rates. Interspersed throughout the report are charts and graphs presenting supporting numbers and percentages for the classes of facilities addressed in it.

The report shows that the overall enforcement rate in MA rose yearly from 39% in 1994, to 58% in 1996. It describes the reason for this increase as an open question, though the state believes the seeming increase in noncompliance reflects better targeting and improved inspections (e.g., more knowledgeable and experienced inspectors), rather than a bleaker environmental picture. The fact that enforcement rates among facilities that had been visited for several years actually decreased supports this view.

Considerations/Caveats:

Qualifications in the report include:

- While the FIRST protocol allows for a broader overall inspection scope than the traditional single-medium inspection, the FIRST protocol does not necessarily result in as complete an inspection for each medium as a corresponding single-medium inspection.
- While the FIRST protocol has led to significant success in identifying outlaws and multimedia violators, there are still inspection staff concerns to be addressed. For example, some inspectors cited a need for increased process-based technical training and supplemental training on violations in unfamiliar programs, and expressed difficulties wearing both “enforcer” and “assistance provider” “hats” during inspections.

Source: For a copy of the report, write to:

Compliance Center Audits Branch
Bureau of Waste Prevention
MA DEP
1 Winter Street
Boston, MA 02198

or call Helen Waldorf (617-292-5819)

4. Evaluation of the Environmental Results Program Project

Author: Massachusetts Department of Environmental Protection (November 13, 1997)

Of Primary Interest To: (1) Persons interested in self-certification programs; (2) environmental program managers involved in regulatory “reinvention;” (3) small business and compliance assistance providers.

Scope: Federal media statutes (Air, Water, RCRA), plus state Toxics Use Reduction Act (TURA)

Type of Facilities: Small to medium-sized companies with mixed environmental compliance histories and varying degrees of operational complexity. The businesses that participated in the pilot program included dry cleaners, photoprocessors, and manufacturers of printed circuit boards and plastic buckets.

Breadth: 18 firms participated in the Environmental Results Program (ERP) Demonstration Project (originally there were 23, but 5 either were suspended for cause by the State or left the pilot prior to ERP certification in January 1997).

Purpose of Report:

The evaluation was intended to provide an indication of how successful full ERP implementation might be. ERP is a new regulatory reinvention initiative pioneered by the Massachusetts Department of Environmental Protection (DEP). Its goals include improving compliance rates and encouraging pollution prevention by replacing state-required permits for small and medium-sized companies with a whole-facility, performance-based annual compliance certification approach based on uniform performance standards. The ERP certificates must be signed by the highest ranking company officials under penalty of perjury. Steps in the ERP process are: 1) develop performance standards that are sector-specific and easily understood; 2) develop workbooks and conduct workshops to educate the sector on their new performance standards and certification responsibilities; 3) require facilities to certify that they are covered by the program, and to submit annual certifications that performance standards are being met; 4) conduct DEP audits, inspections, and enforcement, and 5) implement a “before” and “after” program evaluation. This report is an evaluation of the original ERP pilot involving 18 facilities.

Methodology:

The evaluation methodology involved three components: 1) DEP field inspections at participating pilot businesses both before and after the demonstration project; 2) an assessment of the certifications submitted by the firms; and 3) interviews with officials at the firms to elicit information on the costs

and benefits of ERP.

Compliance Rates and Trends:

As a metric of ERP success, the evaluation found that the overall compliance rate of participating firms rose from 33% in the spring of 1996, to 78% one year later. For the purpose of this study, the compliance rate was calculated as the number of facilities found with no violations divided by the total number of facilities inspected. It does not consider nature, significance, or number of violations. For future ERP evaluations, DEP will use other evaluation criteria that will compare environmental business practices and consider the significance of environmental problems found. For comparison purpose, a statewide compliance rate of 42% was found by DEP inspectors at industrial facilities over the period from October 1, 1995 to September 30, 1996.

Characteristics of Facilities Found Out of Compliance:

In 12 out of 18 firms, before ERP, there was improper hazardous waste management/storage/labeling. After ERP, 4 out of 18 firms continued to have noncompliance in that category area. Before ERP, there were incidences of firms operating without the necessary permits and/or registrations. Most of these situations were resolved, but in two categories of violations -- generating hazardous waste out of status, and generating waste without hazardous waste determinations -- there was no improvement after ERP. In other categories, e.g., lack of industrial wastewater treatment plant O/M manual, and inadequate industrial wastewater treatment plant staffing, the number of violating firms increased after ERP. The evaluation does not specifically explain each result.

Creative Ways to Target/Inspect:

One purpose of ERP is to reinvest agency resources that would normally be required to develop, process, and track numerous permits for smaller facilities in inspections, audits, and enforcement. Certifiers are required to file Return-to-Compliance Plans for violations that are self-discovered. DEP places a high priority on tracking those facilities and verifying their return to compliance via inspections. In addition, non-certifiers are targeted for enforcement.

Other Observations:

DEP interviewed officials at pilot firms to gather feedback and analyze inspection and certification data to assess program effectiveness. Two-thirds of companies interviewed (12 out of 18) described the annual certification process as an excellent compliance education tool and reported that it helped them make positive changes in their firms' environmental management systems. These benefits came at a cost which 7 of the 18 companies described as "insignificant," but others reported required 15 to 200 hours of staff time and/or outside consulting services. Additionally, even with one-on-one compliance assistance from DEP, 39% of the certifications submitted had administrative or technical errors, and the same proportion were submitted late. About half the errors were deemed significant

in nature. This first-time error rate is comparable to the deficiency rate in DEP's traditional permitting

programs.

Since this report, the ERP has been rolled out to two business sectors: 900 Dry Cleaners and 650 Photoprocessors. Currently, the state is working on additional categories of firms to bring into ERP, including industrial wastewater dischargers, commercial printers, and firms installing or modifying small combustion units (e.g., boilers). In October 1998, USEPA and Massachusetts announced a Final Project Agreement (FPA) making ERP an XL Project. This FPA is the first State XL Project in the nation, and the first XL Project focused on small business sectors. The FPA itself is publicly available at http://yosemite.epa.gov/xl/xl_home.nsf/all/october98fpamass.html.

Considerations, Caveats:

According to the report's authors, "Data collection, sample size, evaluation methodology and inherent differences between demonstration project and full ERP implementation may limit the applicability of these findings to subsequent rollout. The sample size was small (18 firms), companies were not randomly chosen (participation was voluntary), they received one-on-one assistance from DEP and were notified of inspections in advance."

Source: The full report is published at:
<http://www.state.us/dep/erp/erppubs.htm> (file name: ERPevalmass.pdf)

5. Annual Environmental Conditions Report - 1997

Author: Illinois Environmental Protection Agency (IEPA), June 1998 (IEPA/ENV/98-007)

Of Primary Interest To: (1) People interested in compliance targeting; (2) people interested in compliance measurement.

Scope: Statutory: The Report encompasses all environmental statutes implemented by IEPA. This summary focuses on one section of the Report describing progress in setting Clean Water Act (CWA) goals and measuring performance towards achieving those goals.

Types of Facilities: Industrial and municipal sources subject to permit limits discharging into Illinois waterways.

Breadth: CWA priority targeted facilities for FYs 1995-1997.

Purpose of Report:

The 1997 IEPA Annual Environmental Conditions Report, which Illinois committed to prepare as part of its FY 98 Performance Partnership Agreement (PPA) with USEPA, is intended to help focus attention on environmental results. Under the Performance Partnership system, environmental goals and indicators are used as a management tool to help program managers achieve desired outcomes. As part of this process, IEPA seeks to better characterize state environmental conditions, relate overall IEPA program goals to specific environmental objectives, document performance, and show important environmental quality trends.

Methodology:

IEPA's program objectives for its Water Quality Management program include reducing the percentage of non-compliant pollutant load discharged in the year 2000 to less than 0.5% of the total permitted load discharged. Exceedences of permit limits are environmentally significant because they are an indication of stress being placed on the receiving waters. IEPA used Monthly Discharge Monitoring Report (DMR) data from 1997 to calculate aggregate values for the 12 major river basins in Illinois (300 parameters are reported for about 2600 dischargers).

IEPA's measurement of the total pollutant load associated with noncompliance as a percent of total permitted load discharged was developed in the following way. A non-compliant load value representing the excess pollution released beyond the NPDES compliance permit level was calculated for each facility on a monthly basis, and summarized and reported on annually. The non-compliant load is presented as a fraction of the total load from the permitted sources in order to indicate the degree to which non-compliance may be affecting water quality. According to the State, its database

containing the calculated loads will enable it to summarize load values for pollutants in various categories (toxic, conventional, metals, etc.), or for various groups of facilities (major/minor, targeted, watershed, basin, county, region, etc.).

Creative Approaches to Targeting:

Calculating the percentage of non-compliant load by facility and watershed has provided a basis for targeting based on environmental impacts. Targeting can be designed to eliminate the most significant excess loads from facilities, emphasizing priority watersheds where non-compliant loads create the most serious environmental problems.

Compliance Trends:

For the 325 facilities in the original 1995-1996 target group, the percent of excess pollutant load discharged was 0.79%. In 1996, this percentage was reduced to 0.49%. This achieved, for the initial group of 325 priority targeted facilities, the State goal of 0.5% for the year 2000.

Having identified critical watersheds and facilities with significant levels of noncompliant load, IEPA prioritized its efforts to eliminate the most significant environmental impacts from these loads and achieved its stated goal for the initial facilities ahead of schedule. IEPA characterized its initial effort as an effective tool for reducing excess pollutant loading. It therefore expanded the 1997 target group to 747 facilities. The 747 facilities included all major dischargers (269) and minor facilities of concern (478) within priority watersheds.

Using the expanded list of 747 facilities and 1997 data, the excess load during 1997 was less than 0.5% for 432 of the 747 facilities, greater than 0.5% for 138 of the facilities, and greater than 10% for the remaining 177 facilities. Further analysis of the exceedences showed that 99.79% of the excess loading related to conventional pollutants, and 0.21% to priority pollutants. Excess loads were also calculated by watershed.

Considerations/Caveats:

Detailed data by type of facility, pollutant and location are not provided in the Report, but the data underlying the Report's analyses should be available from IEPA.

Source: Segments from the 1996 report, and information on obtaining the full 1997 report, are published at: _____
<http://www.epa.state.il.us/environmental-conditions/index.html>

6. Secretary's Quarterly Performance Reports

Author: _____ Florida Department of Environmental Protection, Vol. 1, Nos. 1-4
(Oct. 1997 - Aug. 1998), Vol. 2, No. 1 (Dec. 1998)

Of Primary Interest To: (1) State and national environmental program managers; (2) inspectors and compliance assurance personnel in environmental regulatory programs; (3) natural resource managers.

Scope: Major environmental statutes: Air, Water, RCRA, SDWA, as well as selected resource protection program areas under the responsibility of the Department of Environmental Protection, such as Aquatic/Marine Resource Conservation and Protection, and Habitat Conservation and Protection. During the initial implementation phase, the performance measurement system has focused on major sources of pollution (e.g., Title V facilities; major wastewater dischargers; RCRA treatment, storage, and discharge facilities) and natural resource measures. Eventually, the performance measurement system will be applied to all Florida commercial and industrial facilities.

Purpose of Report:

To report (quarterly) on the results of Florida's performance measurement system, an innovative system consisting of four tiers of performance measures used to evaluate the Department's progress in fulfilling its mission. The Quarterly Reports are: 1) management tools to judge effectiveness; 2) targeting tools to identify problem areas that need attention; and 3) stakeholder/public accountability tools to demonstrate exactly how, and to what degree, the environment is being protected.

Methodology:

DEP's quarterly performance reporting system allows a broad range of measurements, including compliance rates, environmental indicators, program outcomes, and management measures of program outputs, to be compared with previous reporting periods. The four tiers of measures are summarized below:

- Tier 1: Environmental indicators that track long-term trends in the condition of Florida's natural resources, public health, and general environmental quality.
- Tier 2: Behavioral outcome measures that track compliance rates, resource usage, best management practices, and other behaviors that affect environmental quality.
- Tier 3: Program output measures that track the traditional measures of program performance, such as number of inspections, number of compliance assistance activities, numbers of violations found.

- Tier 4: Resource efficiency measures that provide taxpayer accountability by tracking budgetary dollar allocations to each program area.

Compliance Rates and Trends:

A major portion of the Tier 2 measures track compliance rates and trends. The goal of the compliance rate section is to report statistically valid compliance rates. Compliance is determined via physical inspections, tests, and reports, and review of annual operating reports. Compliance rates are based on the number of facilities inspected found to have no significant violations divided by the total number of facilities inspected. Significant violations are defined to include: (1) illegally exceeding emission limits, discharges, or disposals; (2) lack of required monitoring equipment; (3) operating without required permits; (4) failure to operate and maintain required pollution control devices; and (5) sustained repeat violations. Within each inspection cycle, only the first “random” or routine inspection result for a facility is used to determine compliance within that period. “Targeted” (e.g., complaint-based or follow-up) inspection results are not included, as they would create a bias toward higher non-compliance within the data. With the exception of the Air program whose rate is based on a rolling average of the previous 12 months of inspections, compliance rates are only calculated when 100% of the facility universe has been inspected. For programs that do not inspect 100% of the universe on a quarterly basis, the percent of facilities inspected and the resulting compliance outcomes are reported.

As the percentage of facilities inspected increases, the resulting compliance outcomes become more representative. The DEP is working with USEPA Region IV to establish a random-based inspection protocol that will allow compliance rates to be generated on a more frequent basis.

At this time, the Tier 2 compliance measures include the following:

- Title V major air source compliance rates
- Drinking water system monitoring compliance rates and trends
- Domestic wastewater facilities monitoring compliance rates
- Pretreatment program compliance rates
- Industrial wastewater facilities monitoring compliance rates
- Petroleum storage tank facility compliance rates
- Underground Injection Control (UIC) facility compliance rates

As the performance system evolves and the databases become facility-linked, DEP expects to add more measures that would assess the performance of minor air sources, small quantity generators, specific sectors, etc. In calculating statistically valid, facility-based significant compliance rates, DEP must first enhance their COMpliance and Enforcement Tracking (COMET) database. Historically, COMET only provided inspection information as to how many facilities were in or out of compliance. DEP is working on linking inspection data to specific facilities, and distinguishing between random and targeted inspections.

Creative Ways to Target or Inspect:

DEP uses the performance measurement system information to identify both programmatic and geographic areas of concern. They do this via the quarterly designation and status tracking of “Good,” “Watch,” and “Focus” areas. Measures that are designated “Focus” must be addressed via an Action Plan. Action Plan strategies might include enhanced compliance assistance, inspector training, industry outreach, increased enforcement, or some combination of these tools. The first Quarterly Report identified Title V compliance rates in the South District (Ft. Meyers area) as a “Focus” area. By the second Quarterly Report, the District’s Title V compliance rate went from 84% to 97%, and was moved into the “Good” category.

Root Causes of Compliance/Non-Compliance:

The Tanks Program, which regulates petroleum tank storage facilities, had a statewide compliance rate in the 80% range, and was assigned a “Watch” rating in the first three Quarterly Reports. DEP conducted a root cause analysis to understand the most common tank violations, and found that more than 70% were related to leak detection equipment issues. When this information was used to target compliance assistance, the statewide compliance rate increased to 89% in the final Quarterly Report, and the “Watch” designation was removed.

Considerations, Caveats:

According to the State, the performance measure system is still a “work in progress.” The goal is to derive all Tier 2 compliance rate measures using statistically significant, facility-based compliance rate methodologies, supported by a modified COMET database system. Only then will trend analyses be appropriate.

Source: The full reports are published at:
<http://www.dep.state.fl.us/ospp/report/sqprdown.htm>
or call Darryl Boudreau (850-921-9717)

7. State Environmental Audit Laws and Policies: An Evaluation

Author: Larry Morandi, National Conference of State Legislatures (NCSL) (October 1998)

Of Primary Interest To: (1) Persons interested in factors that influence environmental audit activity; (2) citizens seeking access to environmental compliance information.

Scope: All environmental statutory areas.

Type of Facilities: 988 manufacturing facilities.

Breadth: Surveys were administered to facility and state respondents (staff in environmental regulatory agencies and offices of attorneys general) in states with (1) audit privilege and immunity laws; (2) audit policies; (3) neither laws nor policies.

Purpose of the Study:

At the time the NCSL study was conducted, more than 20 states had enacted some type of environmental audit privilege and immunity law, and eleven states had adopted environmental audit policies. The NCSL study sought to determine whether audit privilege and immunity laws or policies encourage facilities to conduct more audits and disclose more compliance violations relative to states with no laws or policies. NCSL also sought to measure the extent to which state agencies were aware of audit activities by regulated entities.

Methodology:

NCSL, with a contractor's assistance, surveyed environmental compliance officials at 988 manufacturing facilities in more than 30 states, and state staff in 28 states. USEPA funded the study, but did not design the survey questions nor prepare any portion of the report. The states fell into three categories: those that had enacted audit privilege and immunity laws, adopted audit policies, or had neither audit laws nor policies. Only states that had audit laws or policies in place for at least two years were included in the survey because it was felt that the two-year period provided companies with enough time to learn about, and make changes in response to, the laws or policies. NCSL directed the surveys to facilities that were certain to have environmental regulatory obligations, i.e., manufacturing facilities that reported to USEPA's Toxics Release Inventory (TRI) and held one or more major air, water, or hazardous waste permits. The survey inquired concerning the amount and type of environmental auditing the companies were performing. NCSL also sought to determine whether there were additional factors, independent of audit privilege and immunity legislation or policies, that affected the rate and quality of the auditing. Experienced interviewers administered the survey over a two-month period using established protocols from a national survey group. The overall facility response rate was 41 percent, with little variation between the three state categories.

Study Results:

The study found that neither an audit privilege and immunity law, nor an audit policy, appeared to influence the level of audit activity by facilities. More than 75% of the 988 facilities surveyed were performing audits. NCSL found no statistically significant difference in auditing rates based on whether the state in which the facility operates has an environmental audit law, an audit policy, or no law or policy. In fact, more facilities responded that they are doing audits in states with no audit law or policy than in states with an audit privilege and immunity law (though the difference in auditing rates was not statistically significant).

The study also looked at whether there had been any increase in auditing among the surveyed facilities over the past four years, when environmental audit laws began to be enacted. The number of facilities beginning to conduct audits increased by a few percentage points over that time period, as did the number of audits conducted by all of the facilities surveyed. Again, however, NCSL found no statistically significant difference in the increase in auditing rates over the four year period for facilities based on whether they were located in a state with an audit law, an audit policy, or neither. The majority of company officials surveyed confirmed that the state audit law had no impact on their companies' audit programs.

Study results also show that the existence of an audit privilege and immunity law does not appear to influence the disclosure of violations by facilities. The majority of facilities surveyed had not disclosed violations that had been discovered during an audit. Whether the facility was located in a state with an audit privilege and immunity law does not appear to have made a difference. Finally, NCSL also found that states generally are unaware of auditing rates. Therefore, they are unable to determine whether their own state laws or policies have impacted their compliance rates.

Other Auditing Motivators:

The study identified other motivators for environmental auditing. NCSL found that the most important reason why facilities do not audit is that they feel they are having few problems complying with environmental requirements. The second most important reason cited was a concern that a state or federal regulatory agency could obtain the audit report and use the information in an enforcement action or civil or criminal suit, though USEPA notes that there are in fact few instances in which USEPA has used audits in enforcement actions. An overwhelming number of facilities (90%) identified measuring compliance with environmental laws and regulations, and finding and correcting violations before inspectors do, as very important reasons why they conduct audits.

Considerations, Caveats, and Implications of the Study:

For ten years, USEPA has opposed passage of state audit privilege and immunity laws because of their effect on public access to environmental information, and on states' ability to protect human health and the environment through law enforcement. Proponents of audit privilege and immunity laws argue that the laws will encourage companies that do not currently audit to begin to do so, companies that already audit to do more auditing, and - with respect to immunity laws - encourage the

disclosure and more prompt correction of environmental violations. The NCSL study does not support any of these rationales. The NCSL study suggests as well that adopting environmental audit policies, USEPA's preferred approach, also does not influence the level of facility audit activity. USEPA acknowledges that only when the incentives offered by a well-marketed penalty-mitigation policy are combined with a strong environmental enforcement program can better environmental compliance and protection be achieved.

Source: Information on the study and instructions for obtaining a full report are available at: <http://www.ncsl.org/program/esnr/enr2.htm>

8. Compliance and Enforcement: Air Pollution Regulation in the U.S. Steel Industry

Author: Wayne B. Gray and Mary E. Deily, *Journal of Environmental Economics and Management* (July 1996)

Of Primary Interest To: (1) Persons who target air or other inspections; (2) persons interested in factors associated with compliance and enforcement decisions by plants and regulators.

Scope: Statutory: Clean Air Act

Types of Facilities: Integrated steel plants.

Breadth: 41 integrated steel plants open in 1980, representing virtually the entire U.S. integrated steel-making capacity.

Purpose of Report:

Using 1980-1989 data, the authors evaluated the relationships between compliance, inspections, and enforcement at integrated steel mills, with an emphasis on the links between enforcement of air pollution regulations and firms' compliance decisions. The authors also investigated whether and why certain firm characteristics might affect compliance behavior. An area of emphasis in the study is the effect of potential plant closings on compliance and inspection decisions in a declining industry which is also a major employer. Analyzing these issues in a declining industry allowed the authors to explore regulators' sensitivity to plants under extreme financial pressure.

Methodology:

The study utilizes a two-stage statistical regression model allowing an estimation of the relationships between enforcement, compliance, and plant closing decisions. The model generates plant-specific enforcement and compliance predictions for each year of the study period using data from USEPA's compliance databases, TRI data, and industry sources (including information on plant capacity and employment, and compliance costs/ton of capacity based on engineering cost estimates and the types of production equipment in use at each plant). For purposes of the analysis, a plant is considered to be out of compliance if it is out of compliance for any of the four quarters of a year.

For plant compliance decisions, the model assumes that firms weigh the cost of compliance against the penalties they would expect to receive if determined to be in violation. The model incorporates factors which could affect the compliance decision both for the individual plant and (for multiplant firms) the firm owning the plant. For the individual plant, the model considers, among other things, the projected capital cost of compliance, expected plant lifetime, and the steelmaking capacity of the plant (as a variable to capture potential economies of scale in pollution control technology). Firm-

level factors considered include the steelmaking capacity of the entire firm (again, as a stand-in for potential economies of scale), the percentage of the firm's workforce involved in steelmaking (an indicator of the firm's diversity, which potentially would allow the firm to finance pollution control expenditures using internal cash flows in lieu of borrowing), and a variable for single-plant vs. multi-plant firms. This variable is used to assess whether multiplant firms are more likely than single plant firms to comply, since presumably compliance at any individual plant would serve to enhance the firm's overall good reputation.

For the government agency's enforcement decisions, the model assumes that regulators allocate enforcement resources to maximize political support. This is defined, in the study, in the limited sense of pleasing the general public, which presumably would prefer to have lower levels of pollution at the least cost. The model evaluates several factors which could be relevant to enforcement decisions given this assumption, including the plant's recent compliance history, the firm's size, the perceived costs of compliance or possibility of plant closure, the ratio of plant employment to total employment in the local labor market, the degree of specialization in steelmaking, and the local unemployment rate.

Impacts of Enforcement on Compliance:

The authors found that enforcement, whether measured as total enforcement actions or inspections alone, increased compliance by integrated steel mills. Lagged enforcement (defined as any enforcement actions in the previous two years), in particular, increased compliance at the steel plants. This result was consistent with the findings of a prior analysis of OSHA enforcement finding that inspections reduced injuries for up to 3 years. The authors conclude by stressing the importance of assessing compliance behavior and enforcement decisions, at both the plant and firm levels, together in order to better understand how they affect each other.

Characteristics Associated with Compliant/Non-Compliant Behavior:

- Firm characteristics such as size, diversification, and gross cash flows were determined to have surprisingly little impact on compliance. There was also no evidence that potential economies of scale (for firms or plants) increased the compliance rates.
- Single-plant firms were determined to be more likely to be in compliance than multi-plant firms. There was some evidence, however, of a residual corporate attitude towards compliance; plants owned by firms with higher past-year compliance rates in other plants are more likely to be in compliance.

Factors Impacting Enforcement Decisions by Regulators:

- Steel plants anticipated to be in compliance (based on compliance in the preceding period) faced less enforcement, whether measured as total enforcement actions or inspections.

Regulators also directed less pressure towards plants with a higher probability of closure or situated in attainment areas.

- Firms that owned only one steel plant and firms with a higher compliance rate over the entire period, however, faced more enforcement. According to the authors, this result, which runs counter to the results for plant specific compliance (where more compliant plants faced less enforcement) may reflect regulators' willingness to pressure more cooperative firms who are more likely to respond.
- Plants which were large local employers tended to face reduced inspection and enforcement activity, but the opposite was true for plants located in counties with high unemployment rates.
- Larger firms, and firms specializing in steelmaking, faced less enforcement. In the authors' view, this suggested regulator sensitivity to firm's political power. Firms with higher gross profit rates also faced less enforcement.

Considerations/Caveats:

According to the authors, the effects of firms characteristics were less predictable than the interactions between compliance and enforcement decisions and the effects of plant characteristics on these decisions, pointing to the need for further work in this area. While the study reports on the significance of the associations reported on in statistical terms, it does not translate the "means" or "standard deviations" into percentages or other measures easily understood by people without a background in statistics.

Source: The article is published in: Journal of Environmental Economics and Management, Vol. 31, pp. 96-111 (July 1996)

9. What Improves Environmental Performance? Evidence from Mexican Industry

Author: S. Dasgupta, H. Hemamela, and D. Wheeler, World Bank Policy Research Department Working Paper (December 1997)

Of Primary Interest To: (1) Persons interested in understanding industry compliance motivators and responses; (2) policy analysts and program managers designing enhanced environmental performance systems that utilize ISO 14000.

Scope: Mexican environmental protection statutes and regulations

Type of Facilities: Four sectors that generate between 75% and 95% of Mexico's total industrial pollution: Food, Chemicals, Non-metallic Minerals, and Metals.

Breadth: 236 facilities across these four sectors, chosen to represent Mexican factories within a set of categories defined by facility size (large, medium, small) and location (large city, medium city, industrial corridor).

Purpose of Report:

The authors use new survey evidence to analyze the effects of regulation, environmental management policies, and plant/firm characteristics on the environmental performance of Mexican factories to determine why plant-level compliance in developing countries varies so widely. Recent studies in Asia suggest the importance of three factors: (1) formal regulation; (2) informal regulation (community pressure); and (3) plant and firm characteristics affecting the cost of abatement and the incentive to abate. The Asian research did not, however, resolve these questions:

- 1) Are plants with newer equipment more likely to comply with regulations?
- 2) Are plants that export heavily to the OECD affected by environmentalist concerns in client countries?
- 3) Are plants cleaner if they have managers whose training or experience has been in OECD countries?
- 4) Are firms whose shares are publicly traded more sensitive to environmental issues?
- 5) Do economies of scale in pollution control come from the firm level as well as the plant level?
- 6) Do plants with more human capital (i.e., educated employees, employees trained in environmental management) control pollution more effectively?

Methodology:

To answer these questions, as well as to determine how manufacturing facilities can achieve better environmental performance, a statistical analysis (two-state least squares for econometric estimation)

of a series of factors (e.g., plant and firm scale, ownership, human resource quality, trade relationships, OECD training and experience of plant managers, degree of formal regulation, degree of informal regulation by local communities) was used to identify factors with the greatest impact on a firm's compliance behavior. The degree of compliance with Mexican environmental regulations was also related to ISO 14000 participation, and the environmental training and responsibilities given to management and workers. To accomplish this multi-level analysis, the authors used a two-stage model which allows for identification of possible cause/effect relationships. The basic data collection method involved a national survey consisting of in-depth confidential interviews at 236 facilities, carried out in the fall of 1995. The survey was designed by the World Bank team (including the authors), and had the explicit support of Mexico's National Environment Ministry and the Mexican National Association of Industries.

Compliance Rates and Trends:

52% of survey respondents reported that their plants were not in compliance with regulations. Only 10% rated their facility as Excellent (doing far more than necessary for compliance). 38% rated themselves as Good (almost always in compliance), 44% as Fair (occasionally compliant), 4% as Poor (never in compliance), and 4% as Very Poor (far below compliance; very damaging).

Attitudes, Programs, Characteristics Associated with Compliant/Non-Compliant Behavior:

The authors reached these conclusions on variables affecting environmental performance:

1. *Regulatory pressure works:* Plants that have experienced inspections and enforcement are significantly cleaner than those that have not, underscoring the importance of strengthened enforcement. Stricter enforcement raises the price of pollution and provides an important incentive for pollution reduction.
2. *Process is important:* Plants which institute ISO 14000-type management policies show superior environmental performance. Programs which promote more effective environmental management and training within plants can increase the degree to which industry responds to regulation, and may in some cases provide very cost-effective complements to stricter enforcement by increasing the elasticity of industry's response to regulation.
3. *Mainstreaming works:* Assigning more workers to environmental monitoring, in and of itself, had no significant effect on compliance. "Mainstreaming" seems to fair better, in terms of compliance outcomes. The better environmental performing firms assigned environmental responsibility to general managers with day-to-day production responsibilities, rather than special environmental managers removed from these responsibilities.
4. *Public scrutiny promotes stronger environmental policies:* Publicly-traded Mexican firms are significantly cleaner than privately held firms.

5. *Size matters*: Large plants in multiplant firms are much more likely to adopt policies that improve environmental performance.

6. *General worker education makes a difference*: Firms that provide environmental training to all employees perform better than firms reserving such training for specialists. In addition, plants with more highly educated workers generally outperform their counterparts environmentally.

It was surprising to the authors that other variables commonly thought to influence environmental performance had no significant effect. These included (1) OECD linkages (neither multinational ownership, trade, nor management training or experience showed any significant linkage to performance); (2) technology vintage (no evidence that plants with newer equipment performed better environmentally, once other factors were accounted for); and (3) indirect community pressure.

Considerations, Caveats:

Independent auditing was not available to verify whether the self-reported assessments were credible measures of environmental performance, but evidence from an auditing of a large sample of Indonesian plants suggests that the upward bias may not be large. In any case, the authors focused on relative, not absolute performance with respect to the variables.

Source: The full report is published at:

<http://www.worldbank.org/html/dec/Publications/Workpapers/WPS1800series/wps1877/wps1877-abstract.html>

10. EPA Effectiveness at Reducing the Duration of Plant-Level Noncompliance

Author: Louis W. Nadeau, Journal of Environmental Economics and Management (September 1997)

Of Primary Interest To: Persons interested in (1) enforcement targeting; (2) incentives for compliance.

Scope: Statutory: Clean Air Act

Types of Facilities: Pulp and paper mills using a range of different production processes.

Breadth: 175 pulp and paper plants, covering 41 reporting quarters during 1979-1989, using data from 7,175 plant quarters. 46% of the plants use the kraft process; 37% bleach pulp.

Purpose of Report:

The author evaluated the impact of USEPA enforcement and monitoring activities in reducing the time spent by pulp and paper facilities, already identified by USEPA as being out of compliance with air regulations, in observed, continued noncompliance.

Methodology:

To provide a framework for determining the effect of USEPA's enforcement and monitoring activities on out-of-compliance facilities, the author used a statistical model (survival analysis) which estimates the probability of remaining in a state for a specific amount of time -- in this case, the probability of a facility remaining in a state of compliance. Assumptions for the model include that USEPA maximizes net environmental benefits in its choice of enforcement and monitoring activity, and that firms make decisions that maximize their profits. It is also assumed that while EPA can only respond to observable non-compliance, plants know whether or not they are in compliance, even if non-compliance has not been identified by USEPA. A theoretical analysis of a series of factors (e.g., production levels, capacity and profits; environmental emissions and expenditures; regulatory actions and costs) is used to identify those factors with the greatest impact on a firm's decision to return to compliance. These factors are then quantified in a statistical model.

To allow calculation of the extent to which USEPA actions influence decisions to return to compliance, the author used a two-stage model. The first stage involved estimating a model of USEPA activity in which the Agency's actions were correlated with a number of potential explanatory factors. This model produced a predicted level of USEPA activity for each facility at each time

period. The second stage utilized this resulting measure of USEPA activity to calculate the impact on the behavior of the firm. The two-stage process was designed to eliminate certain statistical problems that could arise from the theoretical specifications of the model. The model was designed also to differentiate between the effects of monitoring activities (inspections, tests) and enforcement activities (e.g., administrative orders, legal actions, penalties) on the firms' responses.

The data to which the model was applied involved 277 periods of one or more quarters of non-compliance, accounting for 1,452 quarters of non-compliance out of the total 7,175 quarters for 175 pulp and paper plants. Eight plants had no non-compliant spells; 89 had 1; 55 had 2; and 23 had more than 2. The average spell of non-compliance was 5.04 quarters.

Methods for Targeting:

The data indicates several targeting priorities in USEPA monitoring and enforcement activities (the study itself does not focus on the rationale behind the Agency's choices):

- Enforcement actions were higher than average for plants out of compliance for the previous quarter. Over the course of the several quarters during which a plant was out of compliance, USEPA's enforcement activity (the average number of orders, fines, etc. per quarter) tended to remain constant, while the number of inspections and/or tests carried out by the Agency decreased.
- Plants with high particulate matter (PM) emissions received more monitoring attention from USEPA than did other plants. Non-compliant plants with high PM emissions were subject to more enforcement actions than the average non-compliant plant.

Characteristics Associated with Compliant/Non-Compliant Behavior:

When plants increase production levels and capacity utilization, they appear to pay less attention to meeting environmental requirements as a consequence of focusing on production demands. A 1% increase in a plant's capacity utilization rate leads to a 3.3%-4.15% increase in the expected length of time a plant is out of compliance.

There is a tendency for larger non-compliant plants to spend more time out of compliance; a 10% increase in size is correlated with a 1.76% increase in the length of the period in non-compliance.

The differences between plants using kraft processes, as opposed to other processes, are very small with respect to length of time spent out of compliance. Kraft plants have shorter average non-compliance, but only at the minuscule 0.49% to 0.69% level.

Factors Affecting State-Level Differences in Length of Non-Compliance:

The strength or weakness of state programs can impact the speed of return to compliance. Each 10% increase in overall state monitoring activity (that is, at plants other than those non-compliant plants subject to USEPA enforcement and monitoring) correlated with a 2.5% decrease in the length of the period of non-compliance.

Non-Compliance Length Trends:

Non-compliant plants that experience a larger number of tests and inspections during the period of non-compliance tend to spend less time in violation. A 10% increase in monitoring activity leads to a 4.2% reduction in the average length of time facilities remain in non-compliance..

Non-compliant plants that experience a larger number of enforcement actions during the period of non-compliance also tend to spend less time in violation. In this case, a 10% increase in enforcement responses leads to a reduction of 4% to 4.7% in the average length of time a facility will remain out of compliance.

Considerations/Caveats:

The model assumes benefit-maximizing behavior by USEPA and profit-maximizing behavior by the firms. While these simplified assumptions may not always mimic real world conditions, according to the author, they are not critical to his statistical model because the statistical equations were not derived directly from the theoretical assumptions. The assumptions were used rather to provide a coherent theoretical framework for the statistical model. Therefore, the author could have developed the same model without the assumptions.

Source: The article is published in: Journal of Environmental Economics and Management, Vol. 34, pp. 54-78 (September 1997)

11. A Resource-Based Perspective on Corporate Environmental Performance and Profitability

Author: Michael V. Russo and Paul A. Fouts, *Academy of Management Journal*
(June 1997)

Of Primary Interest To: (1) Persons interested in developing “beyond compliance” strategies;
(2) persons interested in rating firms’ environmental performance.

Scope: Statutory: All environmental statutory areas.

Type of Facilities: 243 U.S. facilities, indexed for environmental performance, for which financial performance data was available.

Breadth: The facilities span all industrial categories except utilities (because utility returns on investment are regulated).

Purpose of Report:

Previous empirical studies as to whether improved environmental performance results in positive financial performance for a firm have shown mixed results. Some published reports indicate no linkage, while a few have shown that better environmental performance improves profitability. This study tests the hypotheses that: (1) high levels of environmental performance are associated with enhanced profitability; and (2) the greater the industry growth, the greater the positive impact of environmental performance on firm profitability.

Methodology:

Using a group of firms assigned environmental ratings by the Franklin Research and Development Corporation (FRDC), financial statistics from the commercial database COMPUSTAT were drawn for each company. Data for a two-year period (1991-1992) were analyzed using standard statistical analysis techniques (regression) to test for correlation of variables. The covered firms span all industrial classifications, but only firms with consistently supplied data were included in the study. A total of 243 firms were included in the analysis.

The analyzed economic variables included: (1) industry concentration; (2) firm growth rate; (3) firm size; (4) capital intensity; (5) advertising intensity; and (6) industry growth rate. The FRDC environmental ratings are based on a scoring system that considers firms’ compliance records, but the authors do not provide details on how the scoring is done.

Model Results:

The analysis found a link between high levels of environmental performance and organizational profitability, as measured by return on assets. Firms with the highest levels of environmental performance were rewarded with bottom-line profitability gains. The study indicated that the relationship is influenced by industry growth, which enhances the positive impact of environmental performance on firm profitability. Based on their study, the authors advise corporate decision makers to regard pollution limits as minimum standards and strive to exceed compliance levels because anticipating future legislation and consumer mandates positions the pro-active firm for the future.

Observations and Implications:

The authors examine two differing environmental decision-making models employed by firms: (1) a compliance strategy focused on “end-of-pipe” approaches to pollution abatement, such as technology add-ons, where the promulgation and enforcement of environmental rules is resisted; and (2) a strategy going “beyond compliance” towards pollution prevention, source reduction, and process innovation.

Resource-based theories of competitive advantage are rooted in the belief that firms acquire competitive advantage by most efficiently utilizing *all* of their internal resources: tangible, intangible, and personnel-based. The authors suggest that “end-of-pipe” strategies are less effective and profitable because they affect only the physical assets of a company. Once “end-of-pipe” hardware is installed, it does not fundamentally vary production or service delivery processes, leaving the firm in essentially the same resource and capability situation, and unprepared for future regulatory changes and demands. Therefore, “end-of-pipe” strategies do not provide a competitive advantage. According to the authors, managers of such firms tend to support legislative and political lobbying aimed at slowing down the pace of environmental legislation.

“Beyond compliance” strategies, on the other hand, enable a firm to increase both human resources and organizational capabilities. The prevention mode of environmental management may require systemic changes to existing organizational processes, particularly when prevention is achieved through the redesign of production and delivery systems. The authors suggest that the process of developing a pollution prevention policy enhances organizational commitment and learning, cross-functional integration, and employee skills and participation, all of which can be characterized as emerging prime resources in the modern competitive environment. “Beyond compliance” strategies also enable firms to develop a reputation for environmental leadership. This quality, which consumers are increasingly seeking in the marketplace, builds consumer loyalty. It also assists in employee recruitment.

The authors cite one survey which showed that 68% of executive respondents agreed that a poor environmental record makes it difficult to recruit and retain high caliber staff.

Considerations, Caveats:

The specific criteria used by the FRDC in assigning environmental performance ratings is not presented in this article. In addition, although the study's hypotheses were supported, the relative strength of the correlations and levels of variation in firm performance suggest that other variables, as yet untested, may also have important impacts on firms' environmental performance.

Source: The article is published in: Academy of Management Journal, Vol. 40, No.3, pp. 534- 559 (June 1997)

12. Regulation in the Information Age: Indonesian Public Information Program for Environmental Management

Author: Shakeb Afsah, Benoit Laplante, and David Wheeler, Working Paper for the World Bank, (March 1997)

Of Primary Interest To: (1) Persons analyzing compliance trends; (2) persons designing publicity-based compliance assurance programs.

Scope: Programmatic: Water pollution in Indonesia

Types of Facilities: Manufacturing facilities with substantial water discharges

Breadth: 187 facilities

Purpose of Report:

To present an argument that, in the new information age, regulation should change from strictly setting rules and imposing standards of behavior, to collecting and disseminating appropriate information and harnessing the power of communities and markets to induce environmental improvement. The success of the Indonesian PROPER PROKASIH program is used to illustrate the broader potential of such a program. Regulation of water pollution was initiated in 1991 with a Ministerial Decree on discharge standards. Regulation of air pollution and hazardous wastes was instituted in the mid-1990's.

Methodology:

In 1995, the Indonesian Environment Ministry (BAPEDAL) sought to supplement its limited enforcement and monitoring capacity by implementing a large-scale public disclosure program. BAPEDAL sought to induce significant pollution abatement while allowing its formal regulatory system time to further develop and strengthen. It assigned 187 Indonesian factories to enter the program's pilot phase. A color coding system, designed to be understood easily by the public, was used to rate each factory on its environmental performance. The Ministry's evaluations were reported to the press. The authors compare changes in the companies' compliance rates and other environmental behavior prior to, and after, the disclosure of their environmental performance ratings to the press.

Creative Ways to Penalize or Reward Compliant and Non-compliant Companies:

BAPEDAL selected 187 firms for participation in PROPER, its program to assess how public disclosure of environmental performance could induce plants to improve compliance. The goal was

to use the power of public pressure to supplement the agency's limited enforcement capacities in order to increase rates of compliance. BAPEDAL chose the following rating system, one which could be readily understood by the public, as an indicator of a firm's environmental performance:

- Black -- non-compliance with regulatory water pollution limits, with no effort to achieve compliance.
- Red -- non-compliance with regulatory water pollution limits, with some effort to achieve compliance.
- Blue -- actions sufficient to achieve the standard, but no accomplishments beyond compliance.
- Green -- pollution level significantly lower than the discharge standards, and polluter also properly disposes of sludge, keeps good records, and maintains its waste water treatment system.
- Gold -- facility meets all requirements of a Green rating, plus achieves similar levels of pollution control for air and hazardous waste.

Compliance Rates and Trends in Response to Public Dissemination of Compliance Information:

The response of many companies in the first disclosure of ratings indicated some companies were sensitive to public perceptions, and could be encouraged, both by public pressure and recognition, to improve environmental performance. In June 1995, the Ministry evaluated the 187 facilities as follows: Gold - 0; Green - 5; Blue - 61; Red - 115; Black - 6. The Red and Black factories were privately notified of their rating, and were given until December 1995 to improve, at which time their ratings would be publicly disclosed. By December, 1995, there was a 6% decrease in the number of Red facilities (from 115 to 108), and a 50% decrease in the number of Black facilities (from 6 to 3). There was a consequent 18% increase in Blue facilities. Improvements in plant performances generally continued over the following nine months. When information was next released in September 1996, 34 factories progressed to a Blue or Green rating, an increase of 29%. The number of Black facilities remained approximately the same (according to the authors, as the program continued, a number of plants were added; also, some plants graduated from the Black category, while other new firms with Black ratings replaced original firms who had improved their Black ratings). There is anecdotal evidence that at least one of the poorly rated facilities took action to improve to a Blue rating because of its plans to begin publicly trading its stock, and its concern about the potentially negative impact that a poor rating could have on its offering.

Other Interesting Observations:

In some instances, this rating system was the mechanism by which factory owners first became aware of the environmental performance of their factory. The program also had the effect of educating factory employees about environmental regulations and the status of their company.

Considerations, Caveats:

The data reported is sometimes unclear. The table summarizing the numbers of facilities by category and the changes over time, for example, reports that there were 3 Black facilities in December 1995.

Under a subsequent heading, it states that there were 5 Black facilities in December 1995. As discussed above, an explanation for the slight variation in the number of firms rated during each point of disclosure is that new firms were added to the program over time. In addition, firms were not rated simultaneously.

A related paper by Sheoli Paragal and David Wheeler, “Informal Regulation of Industrial Pollution in Developing Countries- Evidence from Indonesia,” suggest some of the strengths and limits of a compliance policy based so heavily on public release of information:

- The pollution intensity of emissions is much higher for plants located in poorer, less-educated communities than in richer, better educated ones. This difference appears to be too large to reflect preferences alone. Differential ability to pressure polluting firms may also be important.
- Water pollution intensity declines significantly with increases in plant size, efficiency and visibility to the local community. Older plants and publicly owned facilities are more heavily polluting; multinational ownership has no independent effect on levels of pollution.

Source: The article is published at: www.worldbank.org/nipr

13. Colorado Compliance Study

Author: Woodward-Clyde International Americas, for the Colorado Department of Health and Environment (August 1, 1997)

Of Primary Interest To: (1) Air inspectors, (2) persons targeting inspections, (3) persons designing compliance assistance programs, (4) persons interested in improving inspector productivity

Scope: Statutory: Clean Air Act

Types of Facilities: sources included agricultural and energy-related industries, gas processing, electric utilities, mining, petroleum terminals and distribution facilities, and service stations.

Breadth: ~ 162 major sources with >100 tons of emissions/yr., and 5,500 minor sources, 1,500 of which are synthetic minors with allowable emissions below 100 tons/yr.

Purpose of Report:

To evaluate Colorado's (CO) air compliance program and provide recommendations to create a more efficient air compliance and enforcement effort. Evaluation focused on the Air Pollution Control Division (APCD), Stationary Sources Program, Field Services Unit. Objectives: (1) to develop a comparative data base in order to evaluate CO's program and compare it to other state and local air compliance programs; (2) to survey existing programs and literature to identify and evaluate innovative compliance strategies.

Methodology:

The contractor: (1) evaluated the CO program through interviews with CO air compliance program staff, and by reviewing program information; (2) bench-tested a Phase I questionnaire with a several State and local air programs, followed by a more detailed set of Phase II interviews with air program personnel in MN, KS, MA, LA, IN, the South Coast Air Quality Management District (SCAQMD), and the Bay Area Air Quality Management District (BAAQMD); and (3) evaluated current literature and USEPA data to consider possible new innovative approaches to Clean Air Act compliance in CO.

Creative Ways to Target/Inspect:

Example: MA reported targeting petroleum terminals for increased scrutiny because solutions to problems identified at one terminal are often transferable to other category sources.

Effective Tools to Increase Compliance Rates:

Examples:

(1) The study cites template permit language, source-specific inspection forms, and increased reliance on self-certifications, coupled with enhanced monitoring and recordkeeping, as useful tools for cutting inspection times and streamlining permit approvals.

(2) IN's survey responses cited "inspector onsite assistance at the time that a permit is issued" as the single factor most likely to increase compliance rates. Annual compliance certifications for Part 70, Federally Enforceable State Operating Permits (FESOP), and Source Specific Operating Permits (SSOAs) were cited as the second most likely compliance improvement factor.

(3) LA cited perceived compliance rate improvements over the past few years as due to, among other factors, better and more detailed permits, improved interaction between the inspectors and permits sections during permit review, utilizing the same inspectors over time, and maintaining experienced and stable inspector management.

(4) SCAQMD described three VOC control regulations that rely on self-auditing as the *primary* means of determining compliance. SCAQMD compared noncompliance before and after the rules became self-implementing by conducting field audits. It determined that compliance rose from approximately 70% to more than 90%. At the same time, the staff responsible for compliance with these rules was cut from 5 to 3. Credible government verification audits were cited as a critical factor in the program's success.

Methods for Identifying Illegal Operators:

The predominant view of the compliance officers interviewed for the study was that field inspections remain the most effective and reliable tool for determining compliance with most types of air requirements. According to APCD staff, the most effective compliance activity is the development of compliance plans that are separate and apart from the compliance plans otherwise required to be developed in response to Title V requirements. These compliance plans include an operating and maintenance plan for all control equipment and practices, and a proposed recordkeeping format for demonstrating compliance on an ongoing basis. Additional activities which enhance compliance include facility self-certifications, and audits and incentives for voluntary disclosure.

Compliance Rates and Trends:

(1) There was a disconnect between CO's air compliance rate calculated as "NOVs issued per source inspection," and the corresponding rate indicated by the Title V certification program. Based on the number of NOVs issued in CO and assuming all major sources are inspected once a year, the major source compliance rate would be nearly 96%. Using USEPA's Significant Noncompliance (SNC) definitions, the APCD reported only 7 major source and 4 minor source SNCs during the year studied, also indicating an extremely high level of compliance. These conclusions were contradicted by the operating permit applications from the Title V sources which

indicated that at least 40% of the Title V sources had reported noncompliance.

(2) The contractor could not correlate increased inspections, nor size or frequency of penalties, to higher compliance rates.

State and Local Compliance Strategies:

The table below provides additional examples of compliance strategies described in the study.

Examples of State and Local Compliance Strategies Described in the Study

| <i>State</i> | <i>Compliance Strategies</i> |
|---------------------|--|
| Kansas | Requires source-specific inspection forms, which provide guidance to inspectors as to applicable requirements and permit limits. Multiple facilities owned by the same company can receive reduced inspections if the first few facilities inspected are in full compliance. |
| Minnesota | Targets inspections using referrals from its Records Review Unit based on CEM and continuous opacity monitoring data. |
| Indiana | Uses “new permit” inspections to instruct facilities on how to self-certify. |
| Minnesota & SCAQMD | Require sources to self-certify their CEM equipment, reducing labor-intensive inspector time. |
| Several States | Precede C&E inspections with so-called “white hat” (i.e., practice) inspections which provide compliance assistance. |

Considerations/Caveats:

(1) Considerable uncertainty exists regarding the data reported by CO and the other States (the numbers could be off by as much as 20%).

(2) The lack of accurate, reliable, commonly accepted compliance indicators, including concerns over differences in facility size and complexity, levels and quality of inspections, severity of noncompliance, practices for resolving violations informally, etc., led the contractor to conclude that it would be misleading or useless to attempt to compare compliance rates across states.

(3) The contractor concluded that cost-benefit comparisons of innovative and conventional compliance strategies, and efforts to determine the most effective mix of compliance assistance and enforcement, were prohibitively difficult. If attempted, the Contractor would have needed to base its comparisons and determinations essentially on professional judgement, given the lack of objective data to permit quantitative comparisons.

Source: For a copy of the report, call:

Christopher Dann, Public Information Officer, CO Department of Health and the Environment (303-692-3281); or

CO Stationary Sources Program (303-692-3281)

14. Southwest Environmental Action Team: Helping Ohio's Generators (SWEATHOGS): A Case Study for a Self-Directed Work Team

Author: Southwest District, Division of Hazardous Waste, Ohio Environmental Protection Agency, September 1996

Of Primary Interest To: (1) RCRA inspectors; (2) persons who target RCRA inspections and compliance assistance; (3) persons interested in improving inspector productivity and morale.

Scope: Statutory: RCRA

Type of Facilities: Hazardous waste generators in Greene County, Ohio, including autobody shops, drycleaners, manufacturers, agricultural operations, and retail establishments; all generators: Conditionally Exempt Small Quantity Generators (CESQGs), Small Quantity Generators (SQGs), as well as Large Quantity Generators (LQGs).

Breadth: Study focuses on facilities on the State's Hazardous Waste Generator Identification List (the List does not include non-notifiers or illegal operators).

Purpose of Report:

(1) To measure RCRA compliance rates in Greene County, Ohio; (2) to discover common characteristics of non-compliant generators; (3) to determine what compliance assistance methods work best, and why.

Methodology:

Random inspections were conducted at a subset of generators, and a survey delivered to both inspected and non-inspected facilities. Specifically, a team of Ohio EPA inspectors randomly inspected 76 of the 178 generators of hazardous waste on the Ohio Hazardous Waste Generator Identification list in Greene County, Ohio during the six month period from June-Dec. 1995. Normal inspections were done with some additional questions asked. The purposes of the surveys were to determine areas of improvements in Ohio EPA RCRA inspections and to discover what methods of compliance assistance generators preferred. Survey questions covered the generator's status (e.g., CESQG, SQG or LQG), any previous contact with Ohio EPA, number of previous hazardous waste inspections, whether the facility had a full time environmental manager, and the types of compliance assistance the generators preferred. The SWEATHOGS developed a database of common characteristics of non-compliant waste generators based on a 10% survey response rate from 127 generators not targeted for inspections, and the responses of the 78 inspected firms.

Compliance Rates and Trends:

91% of the inspected facilities were in compliance with hazardous waste rules and regulations. 82% of facilities had changed their generator status, compared with how they were listed on the Ohio Hazardous Waste Generator Identification list for Greene County. The breakdown of the 82% follows: 35% of the generators who previously appeared on the Generator Identification list as either LQGs or SQGs had become CESQGs, due either to decreased generation of hazardous waste or to an incorrect original designation. 17% were found to be no longer generating any hazardous waste at all. Some were found to have gone out of business. 13% had either moved or increased their waste generation to the extent that they had moved into a higher-volume generator category, (e.g., from SQG to LQG).

Creative Ways to Target or Inspect:

The inspection data on the hazardous waste generators included in this study indicated that manufacturers, more than anyone else, needed enhanced compliance assistance. The inspection team began working with the Ohio Manufacturing Association to create a self-auditing checklist targeted at manufacturers, but which all generators could utilize. The team plans to conduct a reassessment to determine the impact of the self-auditing checklist on compliance. In addition, the project has been expanded to include Warren County, and there are plans to add an additional County in the future.

Characteristics of Facilities Not in Compliance:

9% of facilities were found to be out of compliance. These were largely manufacturers, drycleaners, and auto body repair shops. Within the inspected group of facilities, 9 of the 24 companies (37.5%) with a dedicated “environmental compliance person” had violations, but only 6 of the 88 companies (6.8%) that did not have compliance people had violations. These results, mentioned in a separate cover letter accompanying the SWEATHOGS report, suggest that one cannot assume a RCRA generator is more likely to be in compliance simply because it has a dedicated environmental compliance person on site.

Other Compliance Observations:

62% of non-inspected survey respondents reported that they did not know who to call for help regarding RCRA regulations. The most often cited useful compliance tools were reading materials, and training. 50% of inspected survey respondents indicated that they understood what was expected of them prior to their inspections. All indicated that they understood what was expected of them after the inspections. The inspected respondents confirmed that self-auditing checklists and phone contact lists would be helpful to them in their compliance efforts.

As a result of having conducted the SWEATHOGS project, the productivity of the inspectors and compliance assistance providers was described as having risen by 270%. They also reported increased job interest and better communication.

Considerations, Caveats:

The study attempts to measure the compliance rate of known generators only. Illegal operators and non-notifiers are not addressed.

This unpublished report was provided to USEPA by a State inspector attending a Compliance Information Project (CIP) roundtable meeting associated with the questionnaire component of the CIP.

Source: To obtain a copy of the report, contact: Elisabeth Rothschild, Division of Hazardous Waste Management, Ohio EPA (937-285-6080)

15. Enforcement vs. Voluntary Compliance: An Examination of the Strategic Enforcement Initiatives Implemented by the Pacific and Yukon Regional Office of Environment Canada 1983-1998

Author: Peter K. Krahn, Prof. Eng., Acting Head, Inspections Division,
Environment Canada, Pacific and Yukon Region (March 1998)

Of Primary Interest To: (1) Persons targeting sectors or facilities for inspections; (2) persons designing compliance assistance programs; (3) inspectors.

Scope: Programmatic: The Canadian program for water pollution control

Type of Facilities: The conclusions drawn in this report are based on three case studies of the anti-sapstain wood preservation, pulp and paper, and heavy-duty treated wood industries.

Breadth: These industries include 154 of British Columbia's largest industrial facilities.

Purpose of Report:

To analyze the effectiveness of Environment Canada's voluntary compliance and enforcement methodologies, and to evaluate how best to modify current practices to increase enforcement efficiency for other industry sectors.

Methodology:

The report analyzes variations in compliance rates at different phases in the development of an enforcement approach for each of the industries analyzed. Comparisons were drawn between compliance rates when compliance with Best Management Practices was voluntary, and compliance rates when Environment Canada exercised enforcement authority.

Attitudes, Programs, Characteristics Associated with Compliant/Non-Compliant Behavior:

Krahn summarizes the results of an earlier report, the 1996 Canadian Environmental Management Survey (conducted independently by KPMG Chartered Accountants), which assessed the reasons why companies implement Best Management Practices. The Survey concluded that the factors which most influenced action on environmental issues were: 1) legal duty to comply with regulations (>90%); 2) potential for Board of Directors liability (>70%); 3) employees (>30%). The least influential factors were: 1) voluntary programs (15% to 20%); 2) interest groups (10% to 12%); 3) trade considerations (<10%). Krahn found the KPMG survey findings to be consistent with the compliance behavior of the industry sectors described in the three case studies in this report.

Root Causes of Compliance/Non-Compliance:

On the basis of the three case studies and a review of the reduction levels achieved by facilities in an additional sixteen industrial sectors, Krahn concludes that the fundamental factor inducing compliance with best management practices or standards is strong enforcement. He describes a pattern of improvement in levels of environmental performance and compliance correlating, first, with the transition from voluntary to mandatory standards, and second, with increasingly stringent levels of enforcement:

- After promulgating best management practices for an industry, while inspectors are still being trained for the new program, the “most progressive” members in the target industry group exhibit a high degree of co-operation. Typically, 10%- 15% of the facilities will be in a reasonable state of compliance during this phase.
- Once regular inspections begin and warning letters are issued to managers of facilities in violation, 80% to 90% of the facilities normally reach a high level of compliance. Facilities comply because the letters place significant liability on corporate directors, and the result is substantial administrative pressure to resolve the issues.
- Once enforcement has been initiated, some facilities with significant negative environmental impacts will make efforts to comply.

Since enforcement is the critical factor in achieving best management practices at a facility, the failure of voluntary programs -- as in the case study of the heavy duty treated wood industry -- should be anticipated.

Compliance Rates and Trends:

During a period of voluntary implementation of a code of practice, only “negligible improvements” in toxic discharges occurred within the antisapstain wood preservation industry. Over a six year period, even after Environment Canada released information on significant discharges by the industry, the voluntary program did not result in meaningful operational changes. In a review of regulations affecting 19 industry sectors, those industries which relied on self-monitoring or voluntary compliance programs averaged only a 60% implementation rate for best management practices. By contrast, industries which had to comply with a regulation and which were subjected to federal (or combined federal/provincial) inspections and/or sustained enforcement initiatives averaged 94% compliance rates. Discharges of harmful substances by these industries frequently decreased by over 90% from the pre-enforcement periods.

Krahn also determined that approximately 1/2% to 5% of the facilities in any industry group will normally wait for enforcement or prosecution prior to attempting to comply. Of these facilities, 1/2% to 1% will normally be penalized through an enforcement action. Overall, the benefit of a comprehensive compliance promotion and enforcement program was determined to be an approximately 30% improvement in compliance with best management practices.

Considerations, Caveats:

The study focuses heavily on the effectiveness of voluntary compliance programs where traditional enforcement capacities are, at least initially, lacking. It does not control for other variables which might affect compliance behavior (e.g., size, profitability, political clout, sensitivity to public perception, etc.). At times, it assumes uniform responses across divergent industry types (e.g., that the experience with farming and ranching facilities will track that of the industries in the three case studies). The analysis does not provide a rationale for why 10-15% of an industry sector often exhibit differentially cooperative behavior during the initial phase following rule promulgation.

Canadian law allows a court to order a violator to publish the fact of its conviction in the newspaper at its own cost. No analysis was reported of the effect of this provision on compliance rates.

Source: The full report is published at:
<http://www.pwc.bc.doe.ca/ep/programs/eppy/enforce/index.html>

16. Environmental Performance and Shareholder Value

Author: World Business Council for Sustainable Development (WBCSD) (May 1998)

Of Primary Interest To: Persons interested in (1) motivation for compliance/beyond compliance behavior; (2) indicators of compliance/beyond compliance behavior.

Scope: Programmatic: All (assessments of overall corporate environmental performance)

Types of Facilities: A range of major corporations (case studies are provided).

Study Participants: Working group of 40 business and financial experts from WBCSD member companies (findings were reviewed by representatives of the London, New York, Oslo, and Basel financial markets).

Purpose of Report:

To examine the relationship between environmental and financial performance, and to provide practical guidance and information to equity investors by explaining the links between ecological and economic efficiency (“eco-efficiency”).

Methodology:

Representatives of WBCSD member companies analyzed corporate environmental performance with an emphasis on its relationship to profitability. They then developed a set of environmental management principles based upon the corporate case studies.

Environmental Drivers, Business Strategy, and Compliance:

The principal theme in this business-developed study is that if a company is concerned simply with achieving compliance with current regulations, it has adopted a fundamentally mistaken strategic approach to environmental management. The report’s findings include:

- 1) The quality of a company's environmental management provides the outside world with a strong indicator of the overall quality of its business management.
- 2) Strong environmental management and performance is potentially a major factor shareholders do, or should, take into account in assessing the security/strength of their investments.
- 3) The environmental quality of a company's operations and products can be a major marketing factor in increasing or losing sales or market share.
- 4) Companies can actively utilize environmental information and goals as drivers to increase operational and production efficiencies, directly impacting financial performance.

Assessing Eco-Efficiency:

The WBCSD defines “eco-efficiency” as creating value for society and business by doing more with less over the full life-cycle. Elements which should be considered in assessing a firm’s eco-efficiency are the extent to which the firm reduces energy input and toxic dispersion, enhances material recyclability, maximizes sustainable use of renewable resources, extends product durability, and enhances the functional value of goods and services. The study lists 27 questions to guide analysts in assessing companies’ abilities to identify, prioritize, integrate, and use environmental drivers for value creation. Examples include: (1) What is management’s level of awareness of environmental drivers and how well positioned is the company to take full advantage of them? (2) Are the environmental factors vulnerabilities for the business, or do they offer opportunities for its value-chain? (3) Is there a management system in place on matters such as policy, goals, programs, and actions to record and evaluate environmental data, and ensure follow-up? 4) Where and how is that system put into practice, e.g. in R&D, manufacturing, sales-marketing, legal, lobbying, or accruals?

The WBCSD recommends further work to establish international industry benchmarks for serious analysts to use to screen for superior investment opportunities. The benchmarks should reflect a consensus on environmental performance indicators, reporting standards, and measurement units, thereby assisting corporate insiders, as well as outside stakeholders. For example, a case study in the appendix to the report describes the Swiss Bank Corporation’s methodology for assessing environmental performance. The methodology focuses on, among other things, how well companies integrate environmental concerns into their overall business policy through customer focus, technical innovation, management and marketing, and the development of human knowledge as “capital.”

Environmental Drivers as Quality and Productivity Tools:

The WBCSD study finds that companies can improve their bottom line by, among other things:

- (1) integrating environmental drivers into their overall business strategy;
- 2) paying close attention to how consumers value environmental product qualities;
- 3) subjecting environmental investment proposals to the same appraisal process as any other investment proposal to promote sound environmental investments;
- 4) increasing energy efficiency per unit produced;
- 5) reducing negative impacts (emissions, discharges, wastes) on eco-systems;
- 6) recycling ‘waste’ material; and
- 7) reducing the cost of credit to entities with clean environmental records.

For example, case study information provided by Dow Chemical touted how, over the past 10 years, Dow achieved average returns of 55% from voluntary, as opposed to compliance-driven, environmental and safety investments. A major vehicle for this success was Dow's "Waste Reduction Always Pays" program, described in the study as having yielded countless cost-effective projects. One of the projects involved process changes in oxide derivatives plants, resulting in an 88% reduction in incinerated wastes, a 98% improvement in yield, and annual cost savings of over \$600,000 in raw material and incineration costs. The WBCSD study describes many additional examples of economically successful environmental investments.

Impact of Environmental Performance on Market Share:

The public's perception of a firm's eco-friendliness can provide a major incentive for firms to improve their environmental performance. This is illustrated by an example supplied by Sony demonstrating the relationship between environmental performance and market share. A Dutch consumer magazine gave a popular Sony television model a "reasonable," as opposed to a "best buy," rating because of environmental factors. Thereafter, the market share for the Sony model in the Netherlands dropped by 12%, while the two brands which received a "best buy" rating increased their respective market shares by 57% and 100%. Accompanying research shows that consumers ranked environmental concerns before innovation as a factor influencing corporate image.

Considerations/Caveats:

The authors stress that environmental drivers are likely to produce better bottom-line results only when associated with an otherwise solid business strategy. Investors are cautioned to beware of companies engaging in "environmental greenwash," i.e., hiding poor environmental performance behind "eco-friendly" smoke screens. By the same token, a company need not "look green" to outside observers in order to derive tremendous benefit from environmental drivers.

Source: The article is published at: www.wbcds.ch/publications

17. Investigators' Guide to Sources of Information

Author: Office of Special Investigations, U.S. General Accounting Office (April 1997)

Of Particular Interest To: (1) Persons targeting sectors and facilities for inspections or compliance assistance; (2) inspectors.

Scope: Internet sources for a wide range of information; databases from federal, state, local, and non-governmental sources.

Purpose of Report:

This GAO Guide provides information on Internet sources and databases for investigative research. The summary below, copied from the Guide, provides an overview of the information available in the report.

About the Guide

The 1997 Investigator's Guide to Sources of Information is an investigative tool for identifying sources of information about people, property, business, and finance. The Guide contains four chapters on information sources and a fifth on how to access information through the Internet. The first four chapters discuss selected information sources in definitive categories that investigators will find helpful. The guide's descriptions of information found in specific electronic databases were furnished by the organizations that administer the databases and have not been validated by GAO. Depending on their specific needs, users of the guide may want to independently validate the currency and accuracy of information in the databases. Tables in chapters 1 and 2 provide details on topics discussed in the chapters. Chapter 5 is a guide to using the Internet for investigative purposes.

Chapter Contents

- Chapter 1: Local and State Governments
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 - State Government

- Chapter 2: Federal Agencies
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 - Financial Institutions and Related Administrations and Corporations
 - Independent Agencies and Government Corporations
 - Legislative Branch Agencies
 - Judicial Branch
 - Inspectors General

Chapter 3: Directories, Reference Works, and Other Sources

- Directory About Directories
 - Directories Focusing on Businesses
 - Directories Focusing on Individuals
 - Directories of Associations
 - Directories of Banks and Financial Institutions
 - Law Firm and Law Enforcement Directories
 - Lloyd's Directories About the Shipping Industry
 - Other Directories, Indexes, and Reference Works
 - Other Sources
- Chapter 4: Electronic Databases
 - Government Investigative and Law Enforcement Databases
 - Other Databases
- Chapter 5: Investigators' Guide to the Internet
 - Internet: the Storehouse of Government Information
 - Accessing the Internet
 - Examples of Internet Functions and Tools
 - Searching the Net
 - Internet Sites Provide Valuable Information
 - Security on the Internet

Source: The complete report may be obtained at: www.gao.gov/special.pubs/soi.htm

The publication number is: **GAO/OSI-97-2**

APPENDIX I

Compliance Information Project

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media: a=air; e=community right-to-know; w=water; r=hazardous waste; x=multi-media

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media: a=air; e=community right-to-know; w=water; r=hazardous waste; x=multi-media

APPENDIX II

Compliance Information Project

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Appendix

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Source: **Monitoring and Enforcement of Environmental Policy** by
Mark A. Cohen, Owen Graduate School of Management, Vanderbilt University (August 1998)

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