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The Comparative Effectiveness of Government Interventions on Environmental Performance in the Chemical Industry[‡]

by Robert L. Glicksman* and Dietrich H. Earnhart**

__ STANFORD ENVTL. L.J. __ (forthcoming 2007)

I. INTRODUCTION

Beginning in 1970 with the enactment of the Clean Air Act,¹ Congress embarked upon an ambitious effort to restrict the damage to human health and the environment caused by pollution of the air, water, and land. Most of the federal pollution control statutes, including both the CAA and the Clean Water Act (CWA),² establish a program of “cooperative federalism” pursuant to which the federal and state governments each play a role in achieving the statutory environmental protection goals.³ Part of this cooperative effort is shared responsibility among the federal

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¹Pub. L. No. 91-604, 84 Stat. 1676 (1970) (codified as amended at 42 U.S.C. §§ 7401-7671q).

²Pub. L. No. 92-500, 86 Stat. 816 (1972) (codified as amended at 33 U.S.C. §§ 1251-1387). The 1972 statute was named the Federal Water Pollution Control Act Amendments of 1972. Congress changed the name to the CWA in 1977. OLIVER A. HOUCK, *THE CLEAN WATER ACT TMDL PROGRAM: LAW, POLICY, AND IMPLEMENTATION* 7 n.2 (1999) (citing Pub. L. No. 95-217, § 2, 91 Stat. 1566 (1977)).

³For a discussion of the history of cooperative federalism under federal environmental legislation, see generally Robert L. Glicksman, *From Cooperative to Inoperative Federalism: The Perverse Mutation of Environmental Law and Policy*, 41 WAKE FOREST L. REV. 719 (2006).

government and the states for enforcing statutory and regulatory provisions.⁴

Effective enforcement of the obligations created by federal and state laws is crucial to achieving the objectives of the environmental statutes. According to one U.S. Senator, without effective enforcement, “most of the rest of environmental protection lacks meaning, lacks truth, lacks reality.”⁵ Similarly, another observer characterized enforcement as “the centerpiece of regulation. . . . Both symbolically and practically, enforcement is a capstone, a final indicator of the [government’s] seriousness of purpose and a key determinant of the barrier between compliance and lawlessness.”⁶ The federal Environmental Protection Agency (EPA) shares these views on the importance of effective enforcement, calling it a critical aspect of environmental governance and committing itself to the maintenance of a “credible deterrent to pollution and . . . greater compliance

⁴See, e.g., 33 U.S.C. § 1319 (CWA enforcement provision); 42 U.S.C. § 7413 (CAA enforcement provision). Private citizens also may initiate enforcement action as a supplement to federal and state initiatives. See, e.g., 33 U.S.C. § 1365 (CWA); 42 U.S.C. § 7604(CAA).

Victor B. Flatt, *A Dirty River Runs Through It (The Failure of Enforcement in the Clean Water Act)*, 25 B.C. ENVTL. AFF. L. REV. 1 (1997), documents the different levels of stringency that characterize various state enforcement programs under the CWA. Cf. Clifford Rechtschaffen, *Enforcing the Clean Water Act in the Twenty-First Century: Harnessing the Power of the Public Spotlight*, 55 ALA. L. REV. 775 (2004) (documenting divergent track record among the states in renewing and updating NPDES permits under the CWA and in enforcing regulatory obligations). Great variations also exist among the different EPA regional offices in the kinds of actions they take to enforce alleged regulatory violations. These differences may be attributable to factors such as differences in philosophical approach among enforcement staff; responses among the regional offices to differences in state laws; variations in resources available to regional and state agencies; the flexibility afforded enforcement personnel by EPA policies and guidance; and inadequate and incomplete compliance data. See UNITED STATES GENERAL ACCOUNTING OFFICE, ENVIRONMENTAL PROTECTION – MORE CONSISTENCY NEEDED AMONG EPA REGIONS IN APPROACH TO ENFORCEMENT, GAO/RCED 00-108, 2000 WL 1089220 (June 1, 2000) [hereafter, GAO, MORE CONSISTENCY NEEDED]. For example, some EPA regional offices rely much more heavily on administrative monetary penalties than others. See William Funk, *Close Enough for Government Work? Using Informal Procedures for Imposing Administrative Penalties*, 24 SETON HALL L. REV. 1, 43-44 (1993) (stating that in fiscal year 1990, Regions 4 and 6 each accounted for more than one-third of all proposed Class I administrative penalty orders issued by EPA under the CWA). Professor Funk claims that these differences are due to different regional enforcement strategies and differences in state environmental enforcement.

⁵JOEL A. MINTZ, ENFORCEMENT AT THE EPA: HIGH STAKES AND HARD CHOICES 2 (1995) (quoting Senate Comm. on Environment and Public Works, *Oversight of the Environmental Protection Agency’s Enforcement Program: Hearings before the Subcomm. On Toxic Substances, Environmental Oversight, Research and Development*, 101st Cong., 1st Sess., S. Hrg. 101-503, Nov. 15, 1989, at 2 (statement of Sen. Joseph I. Lieberman)). Somewhat more colorfully, a former employee of the federal Environmental Protection Agency described the enforcement process as the place “where the rubber hits the road and everything else hits the fan.” *Id.* at 9 (quoting interview with Douglas Farnsworth, a former supervisor with EPA’s steel task force).

⁶*Id.* at 2 (quoting PETER C. YEAGER, THE LIMITS OF LAW: THE PUBLIC REGULATION OF PRIVATE POLLUTION 251 (1990)).

with the law.”⁷

Despite the central role of enforcement in the implementation of environmental legislation, relatively little is known about why regulated entities either do or do not comply with their regulatory obligations. In particular, “[u]ntil recently, there have been surprisingly few empirical studies of environmental enforcement,” in part because comprehensive data on compliance and enforcement have been difficult to obtain.⁸ EPA and state environmental agencies typically proceed on the assumption that rigorous enforcement will provide a deterrent to noncompliance by regulated firms.⁹ Other participants in the environmental enforcement process, including the courts, seem to agree.¹⁰ Yet, others have interpreted the available evidence to suggest “that economic sanctions do not play a major role in encouraging compliance” with environmental regulations.¹¹ Even assuming that government enforcement efforts have the potential to induce regulated firms to improve their performance, relatively little is known about what kinds of enforcement actions are more effective at deterring noncompliance than others.¹²

Against this backdrop, EPA has periodically expressed an interest in learning more about the comparative effectiveness of different forms of government action on the performance of regulated entities at individual facilities.¹³ These actions include inspections, fines, injunctions, and supplemental environmental projects (referred to collectively in this article as government

⁷ROBERT L. GLICKSMAN ET AL., ENVIRONMENTAL PROTECTION: LAW AND POLICY 933 (5th ed. 2003) (quoting U.S. EPA STRATEGIC PLAN 2000, at 55).

⁸Mark A. Cohen, *Empirical Research on the Deterrent Effect of Environmental Monitoring and Enforcement*, 30 ENVTL. L. REP. (ENVTL. L. INST.) 10245, 10245 (2000).

⁹See, e.g., Jon D. Silberman, *Does Environmental Deterrence Work? Evidence and Experience Say Yes, But We Need to Understand How and Why*, 30 ENVTL. L. REP. (ENVTL. L. INST.) 10523, 10523 (2000) (stating that “[t]he principle of deterrence underlies [EPA’s] compliance monitoring and enforcement program” and that the deterrence principle “is referenced expressly in virtually every EPA enforcement response and penalty policy”).

¹⁰See, e.g., *Friends of the Earth v. Laidlaw Env’tl. Servs. (TOC), Inc.*, 528 U.S. 167, 185-86 (2000) (stating that civil penalties can provide a means of effectively abating illegal conduct and preventing its recurrence).

¹¹WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW 678 (2d ed. 1994).

¹²According to two researchers involved in assessing the effects of enforcement actions on environmental compliance, “[t]he number of claims in the regulatory enforcement literature about the effectiveness of different approaches far outstrips empirical evidence.” Peter J. May & Soren Winter, *Regulatory Enforcement and Compliance: Examining Danish Agro-Environmental Policy*, 18 J. OF POL’Y ANALYSIS & MGMT. 625 (1999).

¹³See, e.g., Dietrich Earnhart, *Regulatory Factors Shaping Environmental Performance at Publicly-Owned Treatment Plants*, 10 J. ENVTL. ECON. & MGMT. 655, 655 (2003) (stating that EPA’s recent interest in assessing the effectiveness of government interventions “echoes concerns about compliance with environmental protection laws and the adequacy of environmental enforcement previously expressed in government reports”).

interventions or simply interventions). EPA has financed research, for example, concerning “corporate environmental performance and the effectiveness of government interventions on performance and compliance with environmental regulations.”¹⁴ In doing so, EPA sought to

(1) identif[y] the determinants, or motivators, of regulated entities’ environmental behavior and performance, and (2) assess[] the influence of various governmental interventions on this behavior/performance.¹⁵ Better understanding of these issues is needed to help federal, state, tribal and local governments effectively allocate resources to achieve the greatest degree of environmental and health protection and improvement. This understanding is hampered by a lack of empirical data on the motivations influencing corporate environmental behavior and the effectiveness of a range of government interventions. . . . Therefore, research is critical that will create data sources and examine the effectiveness of both traditional and alternative environmental implementation approaches on regulated entity behavior.¹⁶

This article responds to the need for additional insights into the comparative effectiveness of government interventions on the performance of regulated entities by focusing on facilities in the industrial sector of chemical and allied products that are regulated under the federal Clean Water Act

¹⁴National Center for Environmental *Research, Corporate Environmental Performance and the Effectiveness of Government Interventions* (April 2000), available at <http://es.epa.gov/ncer/rfa/archive/grants/00/corpp00.html> [cited hereinafter as *Corporate Environmental Performance*].

¹⁵EPA defined environmental performance as:

the physical environmental results of actions taken by regulated entities, i.e., quantities and concentrations of air emissions, water discharges, waste generation and on- and off-site health and environmental risks posed by industrial or chemical management processes. Environmental performance may exceed or fall short of performance standards established by laws or regulations. Performance is affected by pollution prevention and abatement activities.

Id. The agency defined compliance as “achievement of environmental standards set by law or regulations.” *Id.*

¹⁶*Id.* EPA indicated that it was interested in the following questions:

What are the effects of compliance assurance measures (e.g., penalties, inspections, and enforcement) on: (I) compliance with regulatory requirements; and (ii) environmental performance beyond regulatory requirements? What compliance assurance approaches are appropriate for different corporate characteristics and situations? . . . What is the comparative effectiveness of various intervention strategies on compliance and environmental performance for different types of corporations and situations? What are appropriate measures of effectiveness for each of these strategies?

Id.

(CWA)'s National Pollutant Discharge Elimination System (NPDES) permit program.¹⁷ The article assesses whether some interventions are likely to be more or less effective than others in improving environmental performance on the basis of two related analyses. First, the article analyzes the effects of specific deterrence, as stemming from actual interventions, and general deterrence, as stemming from the threat of interventions, on the level of wastewater discharges relative to facility-specific effluent limitations. Second, the article analyzes the self-reported perceptions of intervention efficacy provided as responses to a survey administered to facilities in the chemical manufacturing industry. Part II of the article describes the methods that the authors use (1) in analyzing available data on wastewater discharge levels by regulated facilities in the chemical industry, and (2) in constructing, administering, and evaluating the survey of chemical industry facilities.

Part III describes our findings on the comparative effectiveness of government interventions on the performance of point sources in the chemical industry subject to NPDES permit requirements. For each form of government intervention, we postulate why each kind of intervention can be expected to generate improvements in environmental performance and then summarize previous empirical studies, if any, on the effectiveness of that intervention. Finally, we assess for each form of intervention whether our two-pronged empirical investigation into wastewater discharge levels and self-reported chemical industry perceptions of the comparative efficacy of the interventions comports with or diverges from our expectations based on theory and previous empirical studies.

We conclude in Part III, based on our analysis of CWA-related performance by the chemical industry, that federal *inspections* provide an effective specific deterrent and a marginally effective general deterrent yet state inspections provide a counterproductive specific deterrent and provide no general deterrent. Moreover, our analysis of CWA-related performance indicates that federal inspections are significantly more effective than state inspections as both a specific and general deterrent at improving environmental performance. The responses to our survey of the chemical industry conform to the theoretical literature postulating that the threat of inspections should result in improved environmental performance. The survey responses are inconsistent with the results of our analysis of CWA-related performance, however: more respondents believe that state inspections are more effective than federal inspections than vice versa.

With respect to *monetary fines*, our analysis of discharge levels relative to NPDES permit limits in the chemical industry indicates that (1) federal administrative fines are more effective specific deterrents than federal judicial fines but (2) federal judicial fines are more effective general deterrents than federal administrative fines. Our analysis also reveals that (1) federal fines are more effective specific deterrents than state fines and (2) federal fines and state fines are comparable in their general deterrence effect (*i.e.*, no statistically significant difference exists between the effectiveness of federal fines and the effectiveness of state fines), despite the results indicating that federal fines prove effective as general deterrents while state fines prove ineffective as general

¹⁷The NPDES permit program is governed by § 402 of the CWA, 33 U.S.C. § 1342.

deterrents . Most of the respondents in our survey of the chemical industry perceive monetary fines as an effective way to induce compliance with CWA discharge permit limits. Respondents are pretty evenly split between those who think there is no difference in the effectiveness of administrative and judicial monetary fines and those who think there is a difference. Of those who perceive a difference, judicial fines dominate administrative fines in their effectiveness. In contrast to the distinction between federal judicial and administrative fines, a very large portion of the respondents think there is no difference in the effectiveness of federal and state fines.

Our analysis of CWA-related performance indicates that *injunctive relief* improves environmental performance as both a general and a specific deterrent, although the latter effect is only marginally significant. We find that injunctions and fines are comparably effective as specific deterrents (*i.e.*, no statistically significant difference exists between their effectiveness) but fines are more effective than injunctions as general deterrents. The survey responses are consistent with this last empirical finding. Slightly more than half of the respondents in our survey find injunctive relief sanctions to be an effective deterrent, a percentage that is significantly lower than the percentage who view monetary fines as effective.

Finally, our analysis of CWA-related performance indicates that *supplemental environmental projects* (SEPs) improve environmental performance from the perspective of specific deterrence but are counterproductive as a general deterrent. Accordingly, the threat of receiving an SEP based on the issuance of an SEP to another facility is not likely to improve environmental performance, but an SEP may act as a specific deterrent to the firm subject to that SEP. In addition, we find that fines and SEPs are comparably effective as specific deterrents (*i.e.*, no statistically significant difference exists between the effectiveness of fines and the effectiveness of SEPs) but fines are more effective than SEPs as general deterrents. Responses to the survey are consistent with the identified specific deterrence effects on CWA-related performance. A majority of the survey respondents believe that SEPs are an effective means of inducing compliance with NPDES permits. In addition, the respondents view the effectiveness of SEPs and the effectiveness of fines comparably.

Part IV of the article sets forth some concluding remarks about the need for further research on the effects of government interventions on environmental compliance.

II. RESEARCH METHODS

As indicated in the introduction to this article, our assessment of the comparative efficacy of various government interventions on facilities in the industrial sector of chemical and allied products that are regulated under the NPDES permit program is based on two sets of analyses. This part describes the research methods we use in the two sets of analyses.

Both sets of our analysis relate to a specific type of environmental performance: wastewater discharges by facilities in the chemical industry that are regulated under the CWA. We chose to

focus on this measure of environmental performance because federal and state regulators systematically record both wastewater discharge limits, which are critical for calculating the level of compliance (or noncompliance), and actual discharges. We chose the industrial sector of chemical and allied products as the focus of our study because it serves as an excellent vehicle for examining the efficacy of government interventions on corporate environmental performance. EPA has demonstrated a strong interest in this sector,¹⁸ and regards one of the sub-sectors, industrial organics (SIC-code 2869), as a priority industrial sector.¹⁹ The chemical industry is responsible for a significant component of the nation's industrial output and a significant portion of all wastewater discharges by facilities subject to CWA regulation. Nevertheless, the chemical industry is not necessarily representative of all industrial sectors. Indeed, its unique attributes contribute to our interest in studying it. Some firms in the chemical industry, for example, have demonstrated an interest in promoting pollution reduction and prevention through efforts prompted by the Responsible Care program, which is a voluntary management initiative supported by the American Chemical Council.²⁰ Finally, our study focuses on discharges of two of the pollutants most common to regulated facilities: biological oxygen demand (BOD) and total suspended solids (TSS),²¹ thereby maximizing the number of facilities for which data on wastewater discharge levels are available. Rather than examining each pollutant separately, we examine a composite measure of BOD and TSS discharges, with each level of discharge scaled relative to its pollutant-specific effluent limitation, *i.e.*, relative discharges. The level of the limitation varies across facilities and varies over time for several facilities in the sample. The combination of BOD relative discharges and TSS relative discharges represents a comprehensive measure of environmental performance because it considers two of the most common pollutants and captures the full extent of both noncompliance and over-compliance.

A. Analysis of Wastewater Discharge Levels

¹⁸See, e.g., Environmental Protection Agency & Chemical Manufacturers Association, *Root Cause Analysis Pilot Project*, Doc. No. EPA-305-R-99-001 (May 1999); Environmental Protection Agency, *Chemical Industry Environmental Baseline Report, 1990-1994*, Doc. No. EPA-305-R-96-002.

¹⁹See, e.g., Paul S. Farber et al., "EPA's Multi-Media Enforcement & Inspection Program," in *A Survival Guide to Multimedia Inspections*, 10 ENVTL. PROT. MAG. No. 1 (1999), available at <http://www.kerleyink.com/technology/MULTI-ME.htm>

²⁰See <http://www.dow.com/commitments/care/> (describing Responsible Care, "a voluntary initiative within the global chemical industry to safely handle our products from inception in the research laboratory, through manufacture and distribution, to ultimate disposal, and to involve the public in our decision-making processes").

²¹BOD and TSS are regarded as conventional pollutants under the CWA. 33 U.S.C. § 1314(a)(4). Because EPA considers BOD to be the most damaging of the conventional pollutants, that pollutant had been the focus of the agency's control efforts. Eric Helland, *The Enforcement of Pollution Control Laws: Inspections, Violations, and Self-Reporting*, 80 REV. OF ECON. & STAT. 141 (1998); Wesley A. Magat & W. Kip Viscusi, *Effectiveness of the EPA's Regulatory Enforcement: The Case of Industrial Effluent Standards*, 33 J. L. & ECON. 331 (1990). TSS is also damaging.

1. *Selection of Sample*

To examine the comparative effectiveness of government interventions on facilities in the chemical industry, we examine wastewater discharges by the 499 major chemical manufacturing facilities across the U.S. during the years 1995 to 2001. We chose major facilities for several reasons. First, EPA focuses its regulatory efforts on facilities that it classifies as “major” (*i.e.*, those that either possess a discharge flow of one million gallons per day or that cause a significant impact on the receiving waterbody).²² According to one source, “[t]he distinction between a major and minor permit is of critical importance because it has a direct impact on the subsequent enforcement process. Enforcement priority is given to major permittees, meaning that NPDES personnel generally act first on major permittees.”²³ Second, the EPA’s Permit Compliance System (PCS) database only systematically records wastewater discharges and effluent limits for major facilities in the NPDES program. Information on wastewater discharge levels similar to that contained in the PCS database is therefore unavailable in federal databases for minor facilities. Third, the 499 major facilities represented 20.1% of the 2,481 chemical facilities in the NPDES program in 2001. Moreover, they represented the bulk of wastewater discharges from this sector. Therefore, the results from this sample of facilities should be strongly representative of the chemical industry as far as pollution control is concerned.

2. *Data Collection*

To examine the comparative effectiveness of government interventions on the environmental performance of U.S. chemical manufacturing facilities, we gather data from various databases maintained by federal and state environmental agencies. In this part of our research, we seek to gauge the comparative effectiveness of various government interventions using multivariate regressions, which attempt to isolate and identify the effects of government interventions on wastewater discharges. The PCS database maintained by EPA provides information about effluent limitations applicable to individual facilities under NPDES permits as well as amounts actually

²²See Marilyn Lee Nardo, *Feedlots – Rural America’s Sewers*, 6 ANIMAL L. 83, 98 (2000). See also SUSAN HUNTER & RICHARD W. WATERMAN, ENFORCING THE LAW: THE CASE OF THE CLEAN AIR AND WATER ACTS 36 (1996) (stating that “[t]he main distinction between the two types of permits involves the amount of water discharged into nearby waters”). *But cf.* 40 C.F.R. § 122.2 (defining “major facility” as “any NPDES ‘facility or activity’ classified as such by the Regional Administrator, or, in the case of ‘approved State programs,’ the Regional Administrator in conjunction with the State Director”). There are far fewer major facilities than minor facilities that are subject to effluent limitations under the CWA. As of January 1999, for example, there were 6749 major facilities with NPDES permits and 82,560 minor facilities. David L. Markell, *The Role of Deterrence-Based Enforcement in a “Reinvented” State/federal Relationship: The Divide Between Theory and Reality*, 24 HARV. ENVTL. L. REV. 1, 56 (2000).

²³HUNTER AND WATERMAN, *supra* note 22, at 36.

discharged by those facilities.²⁴ The PCS database also includes data on inspections performed by federal and state regulators.²⁵ Both the PCS and the EPA Docket databases include data on federal fines imposed by federal administrative agencies and courts. In addition, the EPA Docket database includes data on federal injunctive relief sanctions and supplemental environmental projects (SEPs).²⁶ Our study integrates these two databases. When examining the comparative effectiveness of federal fines and state fines, our analysis focuses on the four states with the largest populations of chemical manufacturing facilities regulated by the CWA: West Virginia, Texas, Louisiana, and New Jersey. Each of these states' environmental protection agencies provided their state-specific

²⁴Our data collection process focused on certain information within these databases. Facilities monitor discharge levels and facility-specific effluent limits restrict discharges according to two pollution measures: monthly average and monthly maximum. Both conversations with government officials and EPA's definition of significant noncompliance, however, suggest that regulators especially care about the average limit. See, e.g., GENERAL ACCOUNTING OFFICE, WATER POLLUTION: MANY VIOLATIONS HAVE NOT RECEIVED APPROPRIATE ENFORCEMENT ATTENTION, Rep. # GAO/RCED-96-23 (1996). For purposes of the CWA, EPA defines "significant noncompliance" (SNC) conventional pollutants such as biological oxygen demand and total suspended solids as "exceeding an average monthly limit by 40% in any two months of a six-month period." Clifford Rechtschaffen, *Enforcing the Clean Water Act in the Twenty-first Century: Harnessing the Power of the Public Spotlight*, 55 ALA. L. REV. 775, 781-82 (2004) (citing U.S. Gen. Acct. Office, Water Pollution: Many Violations Have not Received Appropriate Enforcement Attention 3 (1996)).

According to EPA, SNC is "not regulatory," but is used by the agency "solely for management purposes and contains those instances of noncompliance . . . that EPA feels merit special attention from NPDES administering agencies. These priority violations are tracked through the Strategic Planning and Management (SPMS) to ensure timely enforcement." EPA Office of Water Enforcement and Permits, Guidance for Preparation of Quarterly and Semi-Annual Noncompliance Reports (Per Section 123.45, Code of Federal Regulations, Title 40, at iv (Mar. 13, 1986)). See also Hunter & Waterman, *supra* note 22, at 36 (stating that regulated point sources found to be in SNC "must receive a formal enforcement response or return to compliance within a fixed period of time unless an acceptable justification is established for not taking action"); 40 C.F.R. § 123.45 (describing requirements for reporting noncompliance and establishing deadlines for doing so). Thus, our study focuses on the average discharge and limit.

Further, facilities may monitor discharge levels and facility-specific effluent limits may restrict only quantities, only concentrations, or both. By focusing on compliance levels, our study is able to compare across all facilities regardless of the form of their discharge measurement and effluent limit. The analysis calculates relative discharges – the ratio of absolute discharges and effluent limits – regardless of the type of discharge and limit. If both quantity and concentration limits apply, the analysis calculates the mean level of compliance.

²⁵The PCS database provides the following data elements for each permitted chemical facility: (1) permit issuance dates, (2) type of discharge limit (initial, interim, or final), (3) indication of changes to a permit during the current five-year issuance period, (4) monthly wastewater flow (in millions of gallons/day), (5) biological oxygen demand (BOD) and total suspended solids (TSS) monthly discharge limits, (6) BOD and TSS monthly discharges, (7) indicator of effluent limit exceedance for each regulated pollutant, (8) four-digit SIC code, and (9) location.

²⁶For a definition of SEPs, see *infra* note 95 and accompanying text..

databases on state fines.²⁷

Our study sample for effluent limit exceedances includes all major chemical facilities for all months across the entire sample period. This broad sample includes 499 facilities that were active at some point over the sample period: January 1995 to October 2001. Of these 499 facilities, 456 were active throughout the entire sample period. Even though most major chemical facilities discharge both BOD and TSS (389 facilities), several discharge only one or neither. Eighty-six facilities discharge only TSS, five facilities discharge only BOD, and 42 facilities discharge neither. To remain in the sample, a given facility must discharge either of the two particular pollutants at least once during the seven-year sample period. Based on this restriction, the sample contains 457 facilities. Moreover, not all facilities discharging either BOD or TSS (or both) possess a permit that imposes effluent limits on these specific pollutants. Given the focus on compliance level as a measure of environmental performance, to remain in the sample, a given facility must be subject to an effluent limit for one of the two relevant pollutants in the particular month of discharge.²⁸

B. The Chemical Industry Survey

The original population of facilities chosen for administration of our survey is drawn from EPA's PCS database as of September, 2001.²⁹ This original population includes 2,596 chemical facilities, which were supposed to have NPDES permits for pollution discharge into water. Of these facilities, 499 were designated as major facilities and 2,097 as minor facilities. We included in the survey sample only facilities that met the following criteria: (1) they were still in operation as of 2002; (2) they held an NPDES permit; (3) they discharged regulated pollutants into surface water bodies; and (4) their contact information was available from either EPA or alternative sources, such as phone books.³⁰

²⁷The state agencies that provided data on state fines are the Texas Commission on Environmental Protection, the Louisiana Department of Environmental Quality, the New Jersey Department of Environmental Protection, and the West Virginia Department of Environmental Protection.

²⁸See *Shaping Corporate Performance*, *supra* note †, at § 5.2, for a more complete description of the data collection process. This document also includes a full description of the statistical approach used to analyze the effects of government interventions on environmental performance. See *id.* § 5.3.

²⁹The survey questionnaire was developed with the assistance of Mark Cohen, the Director of the Vanderbilt Center for Environmental Management, a hired consultant on the research project. The survey was pre-tested with a sample of 20 facilities in the Kansas City metropolitan area. For a full copy of the survey, see *EPA Grant Facility Survey, Spring 2002*, <http://www.ku.edu/pri/CEP/EPA/surveyinstrument.pdf>.

³⁰The CWA prohibits the discharge of a pollutant without a permit. 33 U.S.C. §§ 1311(a), 1342(a)(1). The discharge of a pollutant is defined, in relevant part, as the "addition of any pollutant to navigable waters from any point source." *Id.* § 1362(12)(A). The term navigable waters means "the waters of the United States." *Id.* § 1362(7).

After excluding the facilities that did not fit the relevant criteria, the population surveyed is 1,003 facilities. Based on this group of eligible respondents, the response rate for the survey is 26.6 percent: 267 facilities completed at least 90 percent of the survey. Although this rate may seem fairly low, it is comparable to previous large-scale surveys of industrial sectors.

We find no systematic state or regional bias in participation when we compare the original sample of 1,003 potentially eligible facilities to the 267 facilities that actually completed the survey. For example, only the Midwest region is slightly over-represented in the response group, and only the Northeast region is slightly under-represented. These differences, however, are small. In addition, across most of the states the difference between representation in the original sample and representation in the response group averages less than two percent.

There is some difference in the participation of major versus minor facilities. In the original sample, 69 percent of facilities are minor facilities and 31 percent were major facilities. In the group of survey respondents, major facilities are slightly over-represented at 39 percent. Because this difference is significant, we choose not to compare the responses of major and minor facilities.³¹

III. THE COMPARATIVE EFFECTIVENESS OF GOVERNMENT INTERVENTIONS

The purpose of our analysis of CWA-related performance and our analysis of the administered survey is to determine how different forms of government interventions affect performance by regulated entities. In this part of the article, we examine the results of our research efforts and place them in the context of previous theoretical and empirical research on the effectiveness of government interventions that include federal and state inspections, federal and state fines, federal injunctive relief, and federal SEPs. The first section provides a general description of the theoretical basis for believing that government interventions have the potential to affect environmental performance by regulated entities. In the following sub-sections, for each of the intervention types, we summarize the following: (1) the literature that describes the theoretical understanding how a particular intervention should affect environmental performance; (2) previous empirical studies on the effects of that intervention on environmental performance; and (3) a statement of the anticipated effect of the intervention on environmental performance based on the relevant theoretical and empirical literature. We then describe in each sub-section the degree to which the results of our analysis of discharge levels by the chemical industry and our analysis of the chemical industry survey conform to or diverge from the anticipated effects.

A. Rational Choice Theory and General and Specific Deterrence

³¹Other statistical analysis indicates that only the distinction between minor and major facilities proves important for explaining whether or not a contacted facility completed the administered survey.

1. *Rational Choice Theory and Environmental Performance*

The theoretical explanation for why government intervention might induce better environmental performance is typically derived from the deterrence model of enforcement.³² The deterrence model is based on the application of rational choice theory to environmental compliance. The model proceeds on the assumption that, because regulated entities will seek to maximize expected utility, they will comply with environmental requirements only if the costs of noncompliance (measured as the product of the certainty and severity of legal sanctions) exceed the benefits.³³ Absent the threat of legal sanctions, regulated entities will lack motivation to comply with those requirements. The deterrence model predicts that low levels of certainty and severity of sanctions will produce low rates of compliance.³⁴

2. *The Distinction Between General and Specific Deterrence*

The deterrent effect of government interventions on regulatory noncompliance takes two different forms: general and specific deterrence. EPA describes its compliance and enforcement programs as providing both forms of deterrence. The agency engages in interventions “not only to identify specific violators and return them to compliance, but also to deter the violators and all other similarly situated regulated entities from future noncompliance.”³⁵ Underlying this paradigm is the

³²“The ultimate aim of an enforcement policy is presumably to deter violations of an underlying regulatory command.” Colin Diver, *A Theory of Regulatory Enforcement*, 27 PUB. POL’Y 257, 262 (1980).

³³See CLIFFORD RECHTSCHAFFEN & DAVID L. MARKELL, REINVENTING ENVIRONMENTAL ENFORCEMENT AND THE STATE/FEDERAL RELATIONSHIP 60-61 (2003) (stating that “[t]he deterrence model is premised on the idea that regulated entities are rational economic actors that act to maximize profits. Decisions regarding compliance are based on self-interest; businesses comply when the costs of noncompliance outweigh the benefits of noncompliance.”).

³⁴Michael P. Vandenburgh, *Beyond Elegance: A Testable Typology of Social Norms in Corporate Environmental Compliance*, 22 STAN. ENVTL. L.J. 55, 61, 63-64 (2003). Vandenburgh asserts, however, that, “[d]espite the small risks of inspection and the small size of sanctions, compliance rates are widely regarded to be higher than predicted by the standard deterrence model.” *Id.* at 126-27. See also Karen Nyborg & Kjetil Telle, *A Dissolving Paradox: Firms’ Compliance to Environmental Regulation* (Department of Economics, University of Oslo 2004), available at http://ideas.repec.org/p/hhs/osloec/2004_002.html (discussing the “Harrington paradox,” which addresses why compliance with environmental regulation is higher than predicted by standard theory).

³⁵The courts have recognized the potential utility of government interventions in achieving both specific and general deterrence. In *United States v. Hill*, 98 F. Supp. 2d 280, 283 (N.D.N.Y. 2000), for example, the court explained that “one of the main purposes of the civil penalty sought is deterrence. . . . Perhaps Hill [the defendant] and other like him will not choose the errant path in the future.” The reference to Hill relates to the specific deterrent function of civil penalties, while the reference to “others like him” relates to the general deterrent function.

assumption that most regulated entities will comply with the law when the costs of noncompliance exceed the benefits.”³⁶

General deterrence captures corporate responses to the underlying “threat” of receiving a government intervention. It involves deterring the broader regulated community from noncompliance.³⁷ General deterrence is based on two components of penalty imposition: likelihood and size. Seen through the lens of general deterrence, a facility should respond to a specific penalty because it indicates an increase in one or both components of general deterrence: (1) increased *subsequent* penalty likelihood due to greater monitoring scrutiny and/or (2) increased *subsequent* penalty size (*i.e.*, recidivist facilities receive higher *subsequent* penalties). In our study of wastewater discharge-related performance, we measure this “threat” of receiving an intervention by using separate measures of inspections performed at or sanctions imposed upon other facilities in a given state or EPA region within a given calendar year (*e.g.*, average number of federal inspections against other major chemical facilities in each EPA region for a given year). When generating these measures, we separately consider federal inspections and state inspections and separately consider federal administrative fines, federal civil fines, federal injunctions, and federal SEPs. We also separately consider state fines when comparing the effectiveness of state fines and the effectiveness of federal fines. (To confirm, when examining state interventions, the analysis considers interventions against other facilities in a given state; when examining federal interventions, the analysis considers interventions against other facilities in a given EPA region.)

Specific deterrence represents corporate responses to specific government interventions against particular facilities at given moments in time.³⁸ Facilities may be able to respond to actual interventions within the same month that the intervention occurs. However, facilities most likely need at least a month, if not several months, to respond to interventions. Accordingly, our analysis of the CWA-related performance uses lagged measured values of interventions as explanatory factors in the multivariate regression analysis to capture the effect of specific deterrence on wastewater discharges. In the case of inspections, the analysis separately generates the cumulative count of inspections performed by EPA and the cumulative count of inspections performed by state agencies aimed at a specific facility in the preceding 12-month period. In the case of enforcement, the analysis separately generates the cumulative dollar value of EPA administrative fines, cumulative dollar value of federal civil fines, cumulative dollar value of federal injunctions, and the cumulative

³⁶Silberman, *supra* note 9, at 10523.

³⁷RECHTSCHAFFEN & MARKELL, *supra* note 33, at 60-61. *See also* Cohen, *supra* note 8, at 10246 (stating that “[g]eneral deterrence refers to the effect of an enforcement activity on the behavior of a large number of persons or firms”).

³⁸*See* RECHTSCHAFFEN & MARKELL, *supra* note 33, at 60-61. *See also* Cohen, *supra* note 8, at 10246 (stating that “[s]pecific deterrence refers to the effect that an inspection or enforcement activity targeting a particular firm has on that firm’s subsequent environmental performance”).

dollar value of SEPs imposed against a specific facility in the preceding 12-month period. When comparing federal fines and state fines, we also generate the cumulative dollar value of state fines imposed against a specific facility in the preceding 12-month period.

With this distinction in mind, the following sub-sections examine each type of intervention in turn.

B. Inspections

1. *Theoretical Literature*

Inspection mostly serve as a tool for assessing a facility's compliance with CWA provisions.³⁹ The extent of surveillance and the frequency of enforcement action would appear to influence the perceptions of regulated entities as to the probability of detection and punishment. Accordingly, an increase in the intensity of surveillance should cause surveillance targets to raise their estimates of the risks of detection and punishment and to react by reducing the incidence of noncompliance with applicable environmental regulations and permit provisions.⁴⁰ In addition to increasing the likelihood of an eventual sanction, inspections may impose costs on the facilities being inspected by disrupting production or requiring employees to spend time accompanying inspectors or generating information for them instead of fulfilling their normal responsibilities.

Professor Michael Vandenburg explains that:

[t]he deterrence model suggests that the government can improve corporate compliance by increasing monitoring, decreasing the standards necessary for imposing legal sanctions, or increasing the magnitude of the sanctions. Increased monitoring is commonly believed to be the most expensive of the three options to the government. Nevertheless, monitoring frequency and rigor are commonly used as indicators of the success of deterrence-based environmental enforcement programs, and deterrence advocates point to the need to increase inspections and other monitoring activities.⁴¹

³⁹For discussion of the various purposes of EPA inspections and of the kinds of inspections EPA conducts, see Arnold W. Reitze & Carol S. Holmes, *Inspections Under the Clean Air Act*, 1 ENVTL. LAW. 2, 36-37, 45-49 (1994) (discussing inspections under all statutes administered by EPA, not just the Clean Air Act).

⁴⁰Diver, *supra* note 32, at 263.

⁴¹Vandenburg, *supra* note 34, at 64-65. See also RECHTSCHAFFEN & MARKELL, *supra* note 33, at 62 (stating that standard deterrence theory predicts that "the mere fact of conducting inspections, even very simple inspections, increases the rate of industry compliance").

Government inspections and other forms of compliance monitoring thus serve the function not only of identifying specific violators and accelerating their compliance with applicable discharge limits, but also of deterring future noncompliance by the inspected facilities and other similarly situated regulated facilities.⁴² In this manner, inspections should act as a general deterrent. If a particular facility that has been inspected perceives the likelihood of future inspections at that facility or enforcement action against the facility to have increased as a result of the initial inspection, the inspection should also act as a specific deterrent.

No previous theoretical literature examines the distinction between federal inspections and state inspections. In lieu of preceding studies, we generate expectations about this distinction. First, proximity of the inspector may affect behavior: state inspectors are more likely to be part of the community than federal inspectors, so firms might care more about reacting positively to someone who is part of the community than to an outsider. Second, it is possible that state regulators provide more technical assistance and take a more cooperative approach to working with regulated facilities to eliminate compliance problems. If so, regulated entities may be loathe to undermine such cooperative relationships and therefore may believe that they should make extra efforts to improve performance. Third, states may choose to inspect more frequently and more thoroughly.⁴³ In support of this third claim, Hunter and Waterman report that in a study of CWA inspections between June 1988 and April 1989, states were more active in conducting inspections and resorted to more “vigorous” types of inspections.⁴⁴ These first three aspects indicate that state inspections would tend to be more effective at inducing compliance. On the other hand, state regulators may be more averse to following up inspections with rigorous enforcement for fear that a state with a reputation for strong environmental enforcement may become comparatively less attractive to new business than a state with a reputation for weak environmental enforcement. (Some evidence supports this

⁴²Silberman, *supra* note 9, at 10523.

⁴³Major facilities subject to the NPDES permit program are only inspected approximately once a year. See David R. Hodas, *Enforcement of Environmental Law in a Triangular Federal System: Can Three Not Be a Crowd When Enforcement Authority Is Shared by the United States, the States, and Their Citizens?*, 54 MD. L. REV. 1552, 1603 n.290 (1995); Derek A. Yeo & Roy A. Hoagland *United States v. Smithfield: A Paradigmatic Example of Lax Enforcement of the Clean Water Act by the Commonwealth of Virginia*, 23 WM. & MARY ENVTL. L. REV. 513, 516 n.24 (1999).

⁴⁴HUNTER & WATERMAN, *supra* note 22, at 146-148. The “vigorousness” of an inspection might be relevant if more thorough inspections provide agencies with a greater chance of discovering noncompliance than less thorough inspections. Compare 2 RODGERS, *supra* note 11, at 590 (citing “authoritative” reports that “EPA routinely relies on state agencies for compliance monitoring, although it knows that some states themselves are unable to monitor with sufficient frequency and reliability”); Joel A. Mintz, *Scrutinizing Environmental Enforcement: A Comment on A Recent Discussion at the AALS*, 17 J. LAND USE & ENVTL. L. 127, 130 (2001) (quoting Clifford Rechtschaffen as stating that many states have been “less than enthusiastic” about deterrence-based enforcement).

notion.⁴⁵) This notion implies that, in the case of specific deterrence, a federal inspection may generate a greater effect on environmental performance if the particular facility inspected perceives the likelihood of follow-up enforcement action by the federal government to be higher than similar action by the state in the case of state inspection.⁴⁶ Alternatively, this perception may stem from the notion that the EPA regional office possesses more gravitas than state inspectors. In other words, the involvement of the EPA regional office indicates greater scrutiny.

2. *Previous Empirical Studies*

For the most part, the available empirical evidence relating to inspections bears out the theoretical expectations. Some previous empirical studies support the conclusion that increases in monitoring lead to increases in compliance and improvements in performance. With respect to specific deterrence, a study of discharges by the pulp and paper industry in Quebec between 1985 and 1990 finds that past inspections resulted in a 28 percent reduction in discharges of BOD.⁴⁷ Another study of discharges of BOD from pulp and paper mills between 1982 and 1985 finds that EPA inspections decrease the probability of noncompliance at the plant inspected.⁴⁸ Two studies of nonpoint source control programs in twenty states indicate that the frequency of inspections

⁴⁵Cf. Robert R. Kuehn, *The Limits of Devolving Enforcement of Federal Environmental Laws*, 70 TUL. L. REV. 2373, 2377 (1996) (asserting that states are engaged in “cannibalism” in their competition to attract new businesses, wooing them with tax breaks and other taxpayer-financed economic incentives” and arguing that “[i]n the present climate of economic rivalry between states, one would be naive not to believe that without the power of federal intervention, some states would purposefully reduce their enforcement efforts as an economic incentive”); *id.* at 2384 (arguing that a federal enforcement presence “appears absolutely essential in a state where relaxed environmental enforcement is seen as a way to induce economic development”). See also Mark Atlas, *Laws of the Lands: Determinants of State Environmental Enforcement Stringency*, at 1-2 (manuscript on file with authors) (expressing concern “that inconsistent enforcement among states might indicate a veiled ‘race-to-the-bottom’ in environmental protection” and speculating that “although federal minimum environmental standards might prevent states from racing to the bottom in their laws, such a race might be occurring in their enforcement of the laws”). A state intent upon weak enforcement might avoid inspections because inspections might provide evidence of noncompliance, putting pressure on state regulators to initiate enforcement action.

⁴⁶See Earnhart, *supra* note 13, at 658-59.

⁴⁷Benoit Laplante & Paul Rilstone, *Environmental Inspections and Emissions of the Pulp and Paper Industry in Quebec*, 31 J. ENVTL. ECON. & MGMT. 19 (1996). The same study showed that these inspections also increased reporting. See Jeremy Firestone, *Enforcement of Pollution Laws and Regulations: An Analysis of Forum Choice*, 27 HARV. ENVTL. L. REV. 105, 138 (2003).

⁴⁸See Magat & Viscusi *supra* note 21; Firestone, *supra* note 47, at 138 (discussing the Magat & Viscusi study).

positively affects compliance.⁴⁹ Lastly, one study examines the distinction between state inspections and federal inspections. This study analyzes wastewater discharges by publicly-owned treatment works (POTWs) in Kansas between 1990 and 1998. With respect to specific deterrence, this study finds that federal and state interventions against specific facilities were similarly ineffective at improving environmental performance.⁵⁰ The same study finds that, while an increased threat of state inspections did not significantly lower discharges relative to permit limitations, an increased threat of federal inspections did significantly lower relative discharges. Moreover, the threat of a federal inspection improved performance more effectively than did the threat of a state inspection, *i.e.*, the effect of a federal inspection threat is significantly more powerful than the effect of a state inspection threat.

3. *The Effectiveness of Inspections – Specific Deterrence and General Deterrence – in the Chemical Industry*

The theoretical and the empirical literature generates expectations that the threat of inspections should result in improved environmental performance among dischargers in the chemical industry that are subject to regulation under the CWA. In addition, this literature leads one to expect that a particular facility will reduce its discharges relative to permit levels if it regards a past inspection as increasing the probability of future inspections or enforcement actions. For these reasons, some researchers have concluded that inspections are an important components of an effective environmental enforcement program.⁵¹ As two legal experts on environmental enforcement have put it, “[o]ne of the consistent findings of the empirical research about enforcement is that enforcement presence matters; more frequent inspections promote compliance. Thus, agencies

⁴⁹RECHTSCHAFFEN & MARKELL, *supra* note 33, at 243 (citing Raymond J. Burby, *Coercive Versus Cooperative Pollution Control: Comparative Study of State Programs to Reduce Erosion and Sedimentation Pollution in Urban Areas*, 19 ENVTL. MGMT. 359, 359 (1995)). In another study, Burby and a colleague concluded that “where compliance with specification standards is sought, deterrence – principally through frequent inspections of compliance – may be adequate to ensure a reasonable degree of compliance, and not much will be gained by supplementing deterrence with cooperative enforcement techniques.” Raymond J. Burby & Robert G. Patterson, *Improving Compliance with State Environmental Regulations*, 12 J. OF POL’Y ANALYSIS & MGMT. 753, 765 (1993). A recent study of energy intensive manufacturing plants in Norway, however, found that while an increase in the estimated probability of an inspection increases the probability of plants’ compliance, emissions are unchanged or may even increase when the expected probability of an inspection increases. See Kjetil Telle, *Effects of inspections on plants’ regulatory and environmental performance - evidence from Norwegian manufacturing industries*, Discussion Papers 381, Research Department of Statistics Norway (2004), available at <http://ideas.repec.org/p/ssb/disrap/381.html>.

⁵⁰See Earnhart, *supra* note 13, at 678.

⁵¹Magat & Viscusi, *supra* note 21, at 335. See also *id.* at 359 (stating that “inspections are associated with less nonreporting of pollutant discharge levels. Judged with respect to its legislative mandate to improve water quality, this effort is clearly a success.”).

should consider . . . conduct[ing] more inspections.”⁵² In addition, theoretical considerations generate an ambiguous distinction between the effectiveness of federal inspections and state inspections, while the single previous empirical study provides mixed evidence on this distinction.

a. Analysis of Wastewater Discharges

In analyzing the information on wastewater discharges, we seek to assess the specific and general deterrent effects of federal and state inspections on such discharges relative to permit limits. In this assessment, we interpret the sign and statistical significance of the estimated coefficients associated with inspection-related specific and general deterrence generated by our multivariate regression analysis. A deterrence is effective if the coefficient is negative, *i.e.*, an increase in deterrence leads to a lower relative discharge level. Moreover, a deterrent is significantly effective (or significantly ineffective) if the coefficient’s statistical significance lies at or below accepted levels, *e.g.*, 10 % significance level. We assess statistical significance based on the p-value associated with the t-test of whether the null hypothesis of a zero coefficient magnitude can be rejected. Thus, a deterrent is significantly effective if the coefficient sign is negative and the p-value lies at or below 0.10. As part of this assessment, we also test whether or not federal inspections and state inspections differ in their impact on CWA-related performance. In particular, we construct an F-test that tests the null hypothesis of equal coefficient magnitudes: the federal inspection-related coefficient equals the state inspection-related coefficient. We identify significantly different effects if statistical significance lies at or below accepted levels, *e.g.*, 10% significance level. We assess statistical significance based on the p-value associated with the F-test of whether the null hypothesis of equal coefficient magnitudes can be rejected. Thus, one deterrent is more significantly effective than another deterrent if the first deterrent’s coefficient magnitude is more negative than the second deterrent’s coefficient magnitude and the p-value lies at or below 0.10.

Our analysis shows that, in the case of specific deterrence, state inspections are counterproductive (*i.e.*, relative discharges increase at a facility after it is inspected by the state).⁵³ Federal inspections provide an effective specific deterrent, however.⁵⁴ In the case of general deterrence, state inspections are again counterproductive but insignificantly so given a p-value of 0.21, while federal inspections are almost marginally effective, given a p-value of 0.11. Consistent with this first set of results, we demonstrate that federal inspection-related specific deterrence is statistically more effective than state inspection-related specific deterrence; similarly, we show that

⁵²RECHTSCHAFFEN & MARKELL, *supra* note 33, at 252. See also Clifford Rechtschaffen & David L. Markell, *Improving State Environmental Enforcement Performance Through Enhanced Government Accountability and Other Strategies*, 33 ENVTL. L. REP. (ENVTL. L. INST.) 10559, 10568 (2003) (“repeated studies show, among other things, that more frequent inspections promote compliance (as well as reduced emissions)”).

⁵³The coefficient is positive and statistically significant given a p-value of 0.0001.

⁵⁴The coefficient is negative and statistically significant given a p-value of 0.02.

the federal inspection general deterrent is statistically more effective than the state general deterrent.⁵⁵

Our findings concerning the difference between the effectiveness of federal and state inspections as deterrents seem to support the proposition that a federal inspection of a facility may have a greater specific deterrence effect on environmental performance if the particular facility inspected perceives the likelihood of follow-up enforcement action by the federal government to be higher than similar action by the state.⁵⁶ With respect to general deterrence, our findings appear to support the notion that EPA regional offices possess more “gravitas” than state inspectors.

Our findings concerning the difference between the effectiveness of federal and state inspections as deterrents at least partially conform with our expectations. In particular, our findings seem to support the proposition that a federal inspection of a facility may have a greater specific deterrence effect on environmental performance if the particular facility inspected perceives the likelihood of follow-up enforcement action by the federal government to be higher than similar action by the state.⁵⁷

b. Analysis of Chemical Industry Survey Responses

As a complement to our analysis of facility-level wastewater discharges, we designed our survey to elicit the views of chemical plant personnel involved in compliance with the facility’s CWA responsibilities on the efficacy of various government interventions in improving environmental performance.⁵⁸ The survey inquires whether the respondents thought that government inspections are effective ways for inducing individual chemical facilities to comply with permitted water discharge limits.⁵⁹ 35.6% of those surveyed said “probably yes.” Another 52.1% said

⁵⁵ The p-values associated with the two F-tests are 0.0002 and 0.0940, respectively.

⁵⁶See J. Kambhu, *Regulatory Standards, Noncompliance and Enforcement*, 1 J. REGULATORY ECON. 103 (1989); S. Kadambe & Kathleen Segerson, *On the Role of Fines as an Environmental Enforcement Tool*, 19 J. OF ENVTL. PLANNING & MGMT. 72 (1998).

⁵⁷See Earnhart, *supra* note 13, at 658-59.

⁵⁸The survey questions eliciting the respondents’ opinions on the efficacy of government interventions are questions 12a-12j. See *EPA Grant Facility Survey*, *supra* note 29.

⁵⁹We phrased the survey questions relating to the effects of government interventions on performance in terms of whether the respondents thought that the particular interventions concerned “are effective ways for inducing individual chemical facilities to comply with permitted water discharge limits.” This phrasing captures both specific and general deterrence, as the respondents could have interpreted it as asking whether an inspection at a particular facility will induce compliance with permitted discharge limits in the future at that same particular facility (specific deterrence). Alternatively, the respondents might have interpreted the question as asking whether an inspection at one facility will induce compliance at other facilities within the industry. This interpretation would assess the

“definitely yes.” Only a total of 10.9% said “probably not” or “definitely not.” Thus, the survey respondents answered this question in a manner consistent with the description of the expected effect of inspections on environmental performance described in the theoretical literature and consistent with the results of most previous empirical studies of the effect of inspections on industry performance. The overwhelming majority of the respondents perceived inspections to be an effective way to improve environmental performance.⁶⁰

As a follow-up to the question on whether inspections are effective at inducing compliance, the survey also asked whether it matters that inspections are performed by a state regulator or EPA. 33.6% said “definitely not,” and another 27.9% said “probably not.” 15.5% said “probably yes,” and another 21.5% said “definitely yes.” As a further follow-up, the survey asked those who said that it matters whether inspections are performed by state or federal regulators which type of inspection is more effective. Of those who said the source of the inspection matters, 59.6% said that state inspections are more effective. Only 18.1% said federal inspections are more effective. 21.6% said they did not know which was more effective.

These results seem to indicate that the survey participants overwhelmingly thought that inspections are effective deterrents. A majority of the respondents thought it does not matter whether inspections are performed by state or federal officials. This is the expected response, assuming that federal and state agencies are equally likely to perform inspections and equally likely to follow upon the results of those inspections with enforcement action. But of those who perceived a difference, more believed that state inspections are more effective than those who believed that federal inspections are more effective. These results support the proposition that the proximity of the inspectors affects behavior: state inspectors are closer than federal inspectors. Alternatively, these results support the proposition that regulated entities are loathe to undermine their cooperative relationships with state regulators and that they make greater efforts to improve their performance following a state inspection. Of course, these results may simply support the proposition that state agencies implement more “vigorous” types of inspections. In contrast, these results are inconsistent with the proposition that state regulators are more averse to following up inspections with rigorous enforcement for fear that a state with a reputation for strong environmental enforcement may become comparatively less attractive to new business than a state with a reputation for weak environmental enforcement.

4. *Conclusions*

respondents’ views of the general deterrent effects of inspections. We drafted the survey questions so as to cover both the specific and general deterrent effect of government interventions on performance.

⁶⁰We also assess whether there exist any regional patterns to the responses to the question on the efficacy of inspections on performance. Facilities located in southern states (especially Texas) are somewhat more likely to say that inspections are effective than in other regions of the country. Facilities in Midwestern states like Iowa and Illinois are more likely to say that inspections are not effective.

The theoretical and empirical literatures generate expectations that the threat of inspections should result in improved environmental performance among regulated facilities in the chemical industry. This literature also leads one to expect that a particular facility will reduce its discharges relative to permit levels if it regards a past inspection as increasing the probability of future inspections or enforcement actions. Theoretical considerations generate an ambiguous distinction between the comparative effectiveness of state and federal inspections. A previous empirical study comparing the effects of federal and state inspections finds that an increased threat of federal inspections lowers relative discharges significantly more than does an increased threat of state inspections, while actual federal inspections and actual state inspections comparably fail to alter significantly discharges.⁶¹

The results of our analysis of CWA-related discharges conform partially with our expectations. Our analytical results show that federal inspections provide an effective specific deterrent and an a marginally effective general deterrent. In contrast, state inspections provide a counterproductive specific deterrent (*i.e.*, discharges increase at a facility after it is inspected by the state). This final result conforms with findings from a previous study of discharges by POTWs. Most important, our analysis of comparative effectiveness indicates that federal inspections are more effective than state inspections. These results seem to support the proposition that federal inspectors possess greater gravitas and that a particular facility that has been inspected seems to perceive the likelihood of follow-up enforcement action higher after a federal inspection than after a state inspection.

The responses to our survey of the chemical industry conform to the theoretical literature postulating that the threat of inspections should result in improved environmental performance. An overwhelming majority of the respondents stated that inspections are an effective way for inducing individual chemical facilities to comply with the effluent limitations contained in NPDES permits. The survey responses, however, are inconsistent with the results of our analysis of CWA-related performance since more respondents believe that state inspections are more effective than federal inspections than vice versa. The results of our analysis of wastewater discharges indicate that, during the period covered by our sample, federal inspections were more effective as both a specific and general deterrent at improving environmental performance.

C. Monetary Fines

1. *Theoretical Literature*

Monetary fines, whether imposed through an administrative order or by a court, also have the potential to induce regulated firms to change their behavior in ways that improve environmental

⁶¹See Earnhart, *supra* note 13.

performance.⁶² Fines have the potential to increase the direct costs attributable to noncompliance, thereby creating incentives to avoid noncompliance that may lead to the imposition of fines.⁶³ According to one EPA official:

[w]hile there is a dearth of data in this regard, the established wisdom is that the effectiveness of a legal threat depends on three related factors, (1) the certainty that a lawbreaker will be caught (“certainty”), (2) the nature and severity of the punishment (“severity”), and (3) the speed of apprehension and punishment (“celerity”), and that increases in each dimension correlate with increased deterrence and compliance. Arguably, a fourth, coequal factor is the lawbreaker’s *perception* of the first three.⁶⁴

According to the standard economic deterrence model, as applied to general deterrence, a regulated individual or entity seeks to maximize expected utility. It complies with an environmental law only when the costs of noncompliance (which are generally captured by the product of the certainty and severity of formal legal sanctions) exceed the benefits.⁶⁵ In other words, the threat of a monetary fine divides into two components: (1) the likelihood of such a fine, and (2) the size (or burden) of the

⁶²This point is illustrated by a more extensive quotation from the *Hill* case, quoted at note 35 above. The court in *Hill* justified its decision to impose a \$5 million civil penalty on the defendant for his violation of a federal pollution control statute by explaining that “one of the main purposes of the civil penalty sought is deterrence – both to Hill and others who might choose the path of wealth and greed over human decency. . . . Perhaps Hill and other like him will not choose the errant path in the future.” *United States v. Hill*, 98 F. Supp. 2d 280, 283 (N.D.N.Y. 2000).

⁶³*See* Silberman, *supra* note 9, at 10525.

⁶⁴*Id.* at 10528.

⁶⁵Vandenburgh, *supra* note 34, at 64. Similarly, one law professor has described the model as follows:

With the simplifying, albeit reasonable, assumption that individuals or their employing entities are utility maximizers, the economists' response to how to deter misconduct is to price any misbehavior. Assuming the entity and its agents are rational economic actors, misbehavior will occur only when its expected utility exceeds the disutility of its accompanying punishment. Central variables to this equation are the size of the fine and the joint probabilities of detection, prosecution, and conviction for the violation. Deterrence under the model occurs by affecting the violation's disutility by varying the amount of the fine and/or the probabilities associated with the sanction's imposition.

Because the probability of the sanction's imposition can always be expected to be less than unitary, the expected sanction must, under the model, be greater, and one would expect in most cases would have to be significantly greater, than the social harm caused by the violation if misconduct is to be deterred by assigning a price to its occurrence.

James D. Cox, *Corporate Misconduct Private Litigation and the Deterrence of Corporate Misconduct*, 60-Aut. L. & CONTEMP. PROBS.1, 2 (1997).

fine, conditional on its occurrence. An increase in the size of a monetary penalty therefore can be expected to have a deterrent impact because the increase raises the costs of noncompliance.

EPA has clearly stated its confidence in the utility of monetary sanctions as an effective deterrent to noncompliance. It has stated that “[p]enalties promote environmental compliance and help protect public health by deterring future violations by the same violator and deterring violations by other members of the regulated community,” that they “help ensure a national level playing field by ensuring that violators do not obtain an unfair economic advantage over their competitors who made the necessary expenditures to comply on time,” and that they “encourage regulated entities to adopt pollution prevention and recycling techniques in order to minimize their pollutant discharges and reduce their potential liabilities.”⁶⁶

Our study compares the effects of administrative and civil fines on environmental performance. Given that the size of the fine is equal, its source (administrative agency or civil court) in theory ought to be irrelevant, at least as a matter of specific deterrence, because dischargers should respond only to the size of the fine in determining whether to modify their behavior to avoid becoming the subject of future fines. Of course, civil fines might be perceived as a stronger indication of future scrutiny given the participation of the Department of Justice (DOJ) in a civil case. The effectiveness of the imposition of a fine as a general deterrent, however, might depend at least in part on the degree to which it is publicized; the more people know that a particular fine has been imposed, the more people will feel threatened by the possibility of fines being leveled against them if they violate their permit limits. If civil fines typically receive more publicity than administrative fines, then one would expect civil fines to act as stronger general deterrents than administrative fines.

In our analysis of CWA-related performance, we explicitly control for differences in fine sizes between administrative and civil fines by measuring both types in dollar value terms. In this way, the multivariate regression analysis identifies both the effect of an additional dollar from an administrative fine and the effect of an additional dollar from a judicial fine on wastewater discharges relative to permit limits. Then the analysis is able to compare the two effects in a common unit: reduction in relative discharges per dollar. (Implicitly, the analysis also controls for differences in fine imposition likelihoods between administrative and civil courts in the following way: when generating general deterrence measures, the analysis divides the dollar amounts by the number of all other similar facilities in both cases – administrative fines and judicial fines – rather than dividing each dollar amount by the number of facilities sanctioned by the associated court.) The survey addresses this concern directly by instructing respondents to consider equal fine sizes when comparing the effectiveness of administrative fine and judicial fines.

⁶⁶Steven Bonorris et al., *Environmental Enforcement in the Fifty States: The Promise and Pitfalls of Supplemental Environmental Projects*, 11 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 185, 202-03 (2005) (quoting EPA, Final Supplemental Environmental Projects Policy Issued, 63 Fed. Reg. 24,796, 24,796-97 (1998)).

Our study also compares the effects of fines levied by federal and state governments. One study asserts that:

Differences between federal and state agency objectives may also influence the effects of government interventions on polluters' environmental performance. If the federal agency cares more about the benefits of environmental protection, the effects of its interventions on polluter performance may be greater than the effects of state interventions. . . . The effect of a federal enforcement action may be greater than the effect of a state enforcement action, even one of equal size, because the former action more strongly signals greater future scrutiny from federal and/or state agencies. (Statements by federal and state agency officials confirm that facilities believe that federal involvement indicates greater future regulatory pressure.)⁶⁷

Similar to the distinction between administrative and judicial fines, the analysis of CWA-related performance and the survey instrument controls for differences in fine sizes and fine imposition likelihoods between federal fines and state fines.

2. *Previous Empirical Research*

There exists some research on the effects of monetary penalties on environmental compliance, but apparently not as much as there exists on the impact of inspections.⁶⁸ One study finds that both the threat of state enforcement and the threat of federal enforcement negatively influence relative discharges.⁶⁹ As important, this same study tests whether the threat of federal enforcement and the threat of state enforcement differ in their impacts on environmental performance. The study reveals that the threat of federal enforcement is more effective than the threat of state enforcement. This same study also demonstrates that enforcement-related specific deterrence (as captured by lagged enforcement measures) lowers relative discharges. Similarly, another study shows that lagged interventions (the sum of inspections and enforcement actions)

⁶⁷Earnhart, *supra* note 13, at 658-59. *Cf.* RECHTSCHAFFEN & MARKELL, *supra* note 33, at 247 (citing EVAN J. RINGQUIST, ENVIRONMENTAL PROTECTION AT THE STATE LEVEL: POLITICS AND PROGRESS IN CONTROLLING POLLUTION 135-50 (1993)) (reporting Ringquist's finding that "federal enforcement efforts, which generally tend to be more aggressive than state efforts, and state enforcement efforts that were 'consistent, focused and well-supported,' resulted in greater reductions than weak and inconsistent state programs").

⁶⁸*See* Rechtschaffen & Markell, *supra* note 52, at 10568-69 (supporting retention of deterrence-based indices as measures of state enforcement performance, such as imposition of "escalating and meaningful penalties in response to repeated violations, since experience suggests that these actions also promote compliance, although the evidence about this is less well-developed" than it is with respect to the impact of inspections).

⁶⁹Earnhart, *supra* note 13, at 679.

increases the likelihood of a steel mill's compliance.⁷⁰ When focusing on general deterrence, there is some empirical support for the conclusion that firms respond more to changes in the probability of being fined than to increases in the amount of the fine imposed.⁷¹ Lastly, studies of workplace safety also inform our analysis. According to Gray and Scholz, the imposition of monetary penalties by the federal Occupational Safety and Health Administration (OSHA) has caused facilities to pay more attention to plant safety, which in turn has resulted in permanent reductions in the level of injuries.⁷² In sum, these few empirical studies seem to indicate that both federal and state fines improve environmental performance, while one study indicates that federal enforcement is more effective than state enforcement.

While no previous empirical study examines separately the effects of administrative fines and judicial fines, the General Accounting Office concluded several years ago that judicial enforcement actions, including those that result in the imposition of civil monetary penalties, "tend to be taken more seriously by the regulated community" than administrative actions.⁷³ Perhaps this perception is because EPA pursues judicial fines far less frequently than it pursues fines in administrative proceedings.⁷⁴ Regulated entities may fear the less familiar more than they fear the more familiar form of enforcement and therefore may be more determined to avoid it. Another factor is the possibility that, even if the size of the fine is the same whether it is imposed administratively or judicially, the transactions costs (such as court costs or attorneys fees) involved in litigating or

⁷⁰Wayne B. Gray & Mary E. Deily, *Compliance and Enforcement: Air Pollution Regulation in the U.S. Steel Industry*, 31 J. ENVTL. ECON. MGMT. 96 (1996).

⁷¹RECHTSCHAFFEN & MARKELL, *supra* note 33, at 250 (citing John T. Scholz & Wayne B. Gray, *OSHA Enforcement and Workplace Injuries: A Behavioral Approach to Risk Assessment*, 3 J. RISK & UNCERTAINTY 283, 297 (1990); Montserrat Vildarich-Grau & Theodore Groves, *The Oil Spill Process: The Effect of Coast Guard Monitoring on Oil Spills*, 10 ENVTL. & RESOURCE ECON., 315, 315 (1997)). Professor Diver has explained that the expected cost of a violation includes factors other than the size of the penalty. As a result, "it may be necessary to increase the maximum penalty by an extremely large amount in order to effect a dramatic change in the violator's expected cost." Diver, *supra* note 32, at 292.

⁷²Wayne B. Gray & John T. Scholz, *Does Regulatory Enforcement Work? A Panel Analysis of OSHA Enforcement*, 27 L. & SOC'Y REV. 177, 197 (1993). *See also id.* at 200 (speculating "that OSHA penalties, like major accidents or unusually high injury levels, refocus managerial attention on safety and health problems that may have been ignored or overlooked. The initial focus on specific OSHA violations, though perhaps annoying to busy managers, triggers a broader review of performance that we suspect goes far beyond a legalistic response to OSHA standards").

⁷³GAO, MORE CONSISTENCY NEEDED, *supra* note 4, 2000 WL 1089220, at *18.

⁷⁴About ten percent of EPA's enforcement efforts occur in the federal courts. *See* Jeffrey G. Miller, *Variations in Statutory Preclusions Against Successive Environmental Enforcement Actions by EPA and Citizens, Part One: Statutory Bars in Citizen Suit Provisions*, 28 HARV. ENVTL. L. REV. 401, 415 (2004).

settling questions concerning the liability of the alleged violator and the size of the penalty owed might be greater in the judicial than the administrative context.

3. *The Effectiveness of Monetary Fines – Specific Deterrence and General Deterrence – in the Chemical Industry*

The theoretical and empirical literatures generate expectations that the threat of monetary fines should result in improved environmental performance among dischargers in the chemical industry that are subject to regulation under the CWA, as long as the costs of noncompliance (measured as the product of the certainty and severity of formal legal sanctions) exceed the benefits. In addition, these literatures lead one to expect that a particular facility will reduce its discharges relative to permit levels if it regards a past fine as increasing the probability of future government interventions.

a. Analysis of Wastewater Discharges

In this sub-section, we analyze wastewater discharges by the chemical industry for two purposes. The first purpose is to assess separately the effectiveness of administrative fines and judicial fines and then compare their effectiveness. The second purposes of this sub-section is to assess separately the effectiveness of federal fines and state fines and then compare their effectiveness at improving environmental performance. The analysis of state fines considers only the aforementioned states: West Virginia, Texas, Louisiana, and New Jersey.

First, we report on the assessment of federal administrative fines (*i.e.*, those imposed by EPA) and federal judicial fines (*i.e.*, those imposed by a federal court). When considering specific deterrence, administrative fines effectively induce better CWA-related performance, while civil fines do not affect performance.⁷⁵ Consistent with this depiction, administrative fine-related specific deterrence is more effective than civil fine-related specific deterrence, based on a F-test of equal effects.⁷⁶ When considering general deterrence, the impact of administrative fines is counterproductive, while the impact of civil fines is effective, but the effect is only marginally significant.⁷⁷ Even though the latter effect is not fully significant, civil fines are significantly more effective than administrative fines, in terms of their general deterrent, since the difference between

⁷⁵ The former effect has a negative coefficient and is statistically significant given a p-value of 0.0785. The latter effect has a positive coefficient but is statistically insignificant given a p-value of 0.11.

⁷⁶ The F-test statistic is 5.47 with a p-value is 0.0193.

⁷⁷ The former effect has a positive coefficient and is statistically significant given a p-value of 0.0074. The latter effect has a negative coefficient and is almost statistically significant given a p-value of 0.1438.

the two effects is statistically significant, based on a F-test of equal effects.⁷⁸ As reported below, the second comparison is consistent with the survey results.

Second, we assess separately the effectiveness of federal fines and state fines and then compare their effectiveness at improving environmental performance. For purposes of this assessment, we draw no distinction with respect to the source of the sanction – administrative court versus civil court – because data from West Virginia does not make this distinction and data from the other three states indicate an insufficient sample of state civil fines to draw any meaningful distinction.

The results of our analysis of CWA-related performance demonstrate the following conclusions. Federal fines are effective as general deterrents but ineffective as specific deterrents.⁷⁹ In contrast, state fines are ineffective as general deterrents and even counterproductive as specific deterrents.⁸⁰ The comparison of federal fines and state fines is similarly revealing. Our analysis shows that federal fines are more effective specific deterrents than state fines: state fines are counterproductive, while federal fines are only ineffective. Moreover, the difference between the two specific deterrence effects is statistically significant based on an F-test of equal effects.⁸¹ In terms of general deterrence, federal and state fines are comparable – based on an F-test of equal effects – even though only federal fines are effective.⁸² Put differently, while not significant, the threat of state fines negatively affects relative discharges. Thus, both the threat of federal fines and the threat of state fines negatively influence relative discharges, but only the threat of federal fines significantly influences relative discharges. More important, the threat of federal fines more negatively influences discharges than does the threat of state fines, but the effect of the state fine threat is so crudely estimated (as evidenced by its statistical insignificance) that we are not able to discern the two effects significantly with any confidence. In short, federal fine specific deterrence is at least not counterproductive like state fine specific deterrence and federal fine general deterrence is effective but comparable to the ineffective influence of state fine general deterrence.

⁷⁸ The F-test statistic is 7.14 (Rob, I am trying to edit within a passage that remains green: so my instructions are replace” and the” with “with a”) with a p-value is 0.0075.

⁷⁹The former coefficient is negative and statistically significant given a p-value of 0.0025, while the latter coefficient is positive but statistically insignificant given a p-value is 0.8862.

⁸⁰The former coefficient is positive but statistically insignificant given a p-value of 0.6082, while the latter coefficient is positive and statistically significant given a p-value is 0.0001.

⁸¹The F-test statistic equals 28.52 with a p-value of 0.0001.

⁸²The F-test statistic equals 0.35 with a p-value of 0.5539.

These results conform with our expectation that federal fines generate greater regulatory pressure and they are consistent with results of the only previous empirical study to compare the threat of federal enforcement and the threat of state enforcement.

b. Analysis of Chemical Industry Survey Results

In an effort to gauge the perceptions of the chemical industry respondents concerning the effectiveness of monetary fines on environmental performance, the survey asks a series of questions about different kinds of fines. The survey asks a general question about the effectiveness of fines in inducing compliance, and follows up that question by asking several other questions relating to the difference between administrative and civil fines and the difference between federal and state fines.

To test whether regulated point sources in the chemical industry share EPA's stated views about the efficacy of monetary sanctions in improving environmental performance, the survey asks generally whether the respondents thought that the imposition of monetary fines is an effective way for inducing individual chemical facilities to comply with permitted water discharge limits. The phrasing of the question allows the respondents to respond on the basis of a fine that had already occurred (*i.e.*, specific deterrence) or the imposition of a fine in the abstract (*i.e.*, general deterrence). The question refers to "individual" facilities, which carries the flavor of specific deterrence, but it refers to individual "facilities," which might be taken as a reference to the effect of fines at one facility on the industry as a whole. Had the survey asked about the fear or the threat of a fine, the thrust of the question would more clearly have pertained to the general deterrent effect of monetary fines.

A total of more than 21% of the survey participants said that fines are definitely not or probably not an effective way for inducing individual chemical facilities to comply with their CWA responsibilities, as shown in Table 1. The fact that a substantial percentage of the survey respondents did not view monetary fines as effective deterrents is consistent with Professor William Rodgers' assertion that many observers tend to believe that monetary penalties are "laughably puny," although he described the evidence as "strictly anecdotal."⁸³ In other words, perhaps fines tend to be low enough to make it cheaper for regulated facilities in some instances to violate applicable effluent limitations and run the risk of federal or state enforcement that culminates in the imposition of monetary fines than to spend money reducing discharge levels to conform to NPDES permit limits. The 21% figure is almost twice the percentage of the respondents in our survey that found inspections not to be effective. Still, more than three-quarters of the respondents (77.4%) said that

⁸³2 RODGERS, *supra* note 11, at 600.

monetary fines are an effective deterrent, as shown in Table 1. Again, this result is not surprising in light of both theory (the deterrence model) and previous empirical results.⁸⁴

We seek to determine whether the respondents view certain kinds of fines as likely to be more effective at inducing compliance than others. The survey asks whether it matters whether the monetary fines are levied by the federal or state governments, assuming the fines are the same size. 53.8% of those who responded said it definitely does not matter, and another 29.5% said it probably does not. That leaves only 13.7% saying that the identity of the government mattered. That was far fewer than the 37% who said that the identity of the governmental entity performing inspections mattered. The fact that only 13.7% of the respondents felt that the identity of the governmental entity that levied the fine matters is consistent with what economic analysis would predict. If the size of the fine is the same regardless of who imposes it, it should not matter who the enforcer is – a dollar owed to the federal government has the same impact on the regulated entity required to pay it as a dollar owed to the state government. In other words, given the explicit equality of the size of the fine assessed by each level of government, the noted result conforms to expectations that two fines of equal size should have the same impact on a facility's bottom line, regardless of who is responsible for imposing the fine.

The survey also asks those who thought the identity of the government imposing the fine does matter which type of monetary fine is more effective, state or federal. The responses are closely divided. 25.4% of those answering this question said they thought state fines were more effective, while 21.6% said they thought federal fines were more effective. 48.5% said they did not know.

The survey also inquires of those who said that it matters whether the fine is federal or state why they thought it matters. The answers lend some support to the conclusion that regulated entities perceive federal fines to have a greater adverse impact on the violator's business even if the size of the fines is the same, as explicitly stated in the survey. The following responses are typical among those who indicated that they view federal fines as more effective at inducing compliance than state fines:

- the company is a national company;
- the corporate entity is affected as a whole;
- the federal government is usually the last one to come in, and if they are there for an extended period of time, it is bad;
- when the feds are involved, it's a bigger issue;

⁸⁴Earnhart, *supra* note 13; Dietrich Earnhart, *Panel Data Analysis of Regulatory Factors Shaping Environmental Performance*, 86 REV. OF ECON. AND STAT. 391 (2004).

- the federal government has greater authority;⁸⁵
- federal fines have a higher level of notoriety;
- the federal government seems to have more power to enforce regulations; and
- there is more publicity with federal fines.

One common thread in many of these responses is that federal fines tend to generate more adverse publicity than state fines and therefore have adverse effects that go beyond the direct impact of the fine itself on the violator's bottom line.

Those who said that state fines are more effective at inducing compliance said things like:

- the state regulators are closer to home;
- state fines have local impact and publicity and damage corporate image and community relations;
- people pay more attention to state regulations;
- state regulators are probably more stringent than federal regulators;
- companies spend more time with state regulators so state fines affect the regulator-regulated relationship more; and
- the state will work with you to use the money better for the community – you know where the money goes.

Those who thought that state fines are more effective seem to have focused on the proximity of the regulators to the firm and the possibility that state fines may actually generate more adverse publicity locally, even if publicity at the national level is not as great.

In sum, the survey respondents seemed to view monetary fines as an effective deterrent, but as one that is comparatively less effective than inspections as a deterrent to noncompliance with effluent limitations incorporated into NPDES permit. They also viewed the identity of the government entity imposing the fine as less important than the identity of the entity conducting an inspection. Perhaps that is because, as regards specific deterrence, the respondents perceived state inspectors as more likely than federal inspectors to follow up with enforcement action, whereas once a monetary penalty has been imposed, the firm suffers (at least directly) to the same extent whether the fine is state or federal in origin. Of course, the adverse consequences of monetary fines for the sanctioned facility may very well extend beyond their direct effects (which would stem from the obligation to pay the amount assessed to the government). Indirect effects might include things like a reduction in future sales if consumers react adversely to publicity about the fine by reducing

⁸⁵It is not clear whether the respondent providing this explanation felt that “greater authority” translated into a greater likelihood that a fine would be imposed, or into a perception that the size of a federal fine would be greater than the size of a state fine. This latter explanation would have to be discounted because the team built into question the assumption that the size of the fines would be equivalent.

purchases of the violator's products or services. This kind of collateral damage might be significant for some facilities.

As a more refined follow-up question to the initial inquiry regarding the effectiveness of fines, the survey asked whether it matters whether a federal fine is administrative or judicial, explicitly stating that the fines are both the same size.⁸⁶ 49.4% of the respondents said “definitely not” or “probably not.” 41.5% of the respondents said “probably yes” or “definitely yes”, as shown in Table 1. The latter figure is a much higher number than the percentage who said that the identity of the government matters. (8.3% said that they “did not know”.) Of those who said that the source of the federal fine matters, in response to the next survey question, 25.7% said that administrative fines are more effective, while 39.1% said that judicial fines are more effective. Thus, there is a clear lack of consensus on whether the impact of an administrative fine differs from that of a judicial fine. However, conditional on a difference existing, the responses provide some support for judicial fines dominating administrative fines. In general, the survey responses support the conclusion that the difference between federal administrative and federal judicial monetary fines as deterrents seems more important to the respondents than the difference between federal and state fines.

The survey poses a follow-up question to those respondents who said that it matters whether a fine is imposed administratively or judicially. This follow-up question asks the respondents why it matters. Those who found judicial fines to be more effective provided reasons such as these:

- a fine that comes from a court tends to attract a higher level of management action;
- civil court fines generate more publicity; administrative fines do not seem as nasty;
- it's better to avoid the court system; a court fine means a judgment against the company;
- court fines seem more directly tied to individual conduct;
- issues that get to court are more important;
- because it is directly tied to the judicial criminal system;
- the plant is less likely to respond in the same manner once you get to court;
- courts are more effective to get people to comply;
- federal court fines carry a stigma;
- “if it gets to court it's gone too far”; and
- there are likely to be more legal fees if you're in court.

Thus, it seems that one of the factors that made some respondents perceive judicial fines to be comparatively stronger deterrents than administrative fines was fear of adverse publicity. Indeed, it seems that, in general, the imposition of a fine by a federal court for CWA violations is more likely

⁸⁶For a description of the process of federal civil enforcement under statutes such as the CWA, see John C. Cruden & Bruce S. Gelber, *Federal Civil Environmental Enforcement: Process, Actors, and Trends*, 18-Spg. NAT. RESOURCES & ENV'T 10 (2004). See also Joseph J. Lisa, *EPA Administrative Enforcement Actions: An Introduction to the Consolidated Rules of Practice*, 24 TEMPLE J. SCI., TECH. & ENVTL. L. 1 (2005) (providing an overview of administrative enforcement procedures at EPA).

to wind up being reported in print media such as local newspapers⁸⁷ than the imposition of a fine by EPA.⁸⁸ Other factors also may be at work. Some respondents, for example, thought that company employees were at greater risk of individual liability, including criminal liability in a related or follow-up enforcement proceeding, from judicial fines than from administrative fines.

As indicated above, 25.7% of the respondents who reported that it matters whether a fine is administrative or judicial stated that federal administrative fines are more effective. Some of these respondents provided the following reasons for this distinction:

- because of the name EPA; and
- it's putting the marker out that it's an EPA administrative fine.

It seems difficult to explain these responses. Perhaps these respondents reasoned that regulated entities have an ongoing relationship with federal and state regulatory agencies, but not with courts. The imposition of an administrative fine might have adverse effects that extend beyond the immediate impact of the fine on the violator's bottom line, such as more frequent inspections in the future. That explanation, however, seems to turn on the assumption that agencies perceive are more likely to engage in frequent inspections of facilities that have been fined administratively rather than in court. It is not clear why agencies would adopt that stance.

4. *Conclusions*

Both the theoretical and empirical literature generate expectations that monetary fines should improve environmental performance both as a general and a specific deterrent. Moreover, theoretical considerations reveal that federal judicial fines may be more effective than federal administrative fines. Similarly, theoretical considerations reveal that federal fines in general may be more effective than state fines in general. One previous empirical study supports this latter expectation. Our analysis of discharge levels relative to NPDES permit limits in the chemical industry indicates that federal administrative fines are more effective specific deterrents than federal judicial fines, yet federal judicial fines are more effective general deterrents than federal administrative fines. When comparing federal fines and state fines, our analysis of discharge levels reveals that federal fines are

⁸⁷One law professor went so far as to assert that "only judicially assessed penalties have a deterrent effect. The public nature of the large penalty assessments leads to their rapid dissemination to environmental lawyers and their clients, which immediately deters violations by others who wish to avoid the expense and public humiliation of judicially assessed penalties. In contrast, administratively assessed penalties are both too small and too private to motivate voluntary compliance." Hodas, *supra* note 43, at 1613-14. Hodas adds that "[f]or all practical purposes, administrative enforcement activity is not subject to public scrutiny; thus there is no independent public check on state and federal enforcement practices. In comparison, the judicial actions are open to the public." *Id.* at 1614.

⁸⁸Administrative fines are routinely reported, however, in trade publications such as the Bureau of National Affairs' *Environment Reporter*.

more effective specific deterrents than state fines. Similarly, our analysis of relative discharge levels finds that federal fines prove effective as general deterrents, while state fines prove ineffective as general deterrents; nevertheless, a direct comparison of federal and state fines reveals that they are comparable in terms of general deterrence.

Our survey of the chemical industry indicates that most of the respondents perceive monetary fines as an effective way to induce compliance with NPDES discharge permit limits. A significant percentage of the respondents (between a fifth and a quarter of the respondents), however, do not view monetary fines as effective deterrents. A large majority of the respondents do not think it matters whether a fine is imposed by federal or state regulators. Of those who indicate that the identity of the entity imposing the fine does make a difference, the respondents are relatively evenly divided between those who view federal fines as more effective deterrents and those who view state fines as more effective deterrents. When considering the source of federal fines, the respondents are pretty evenly split between those who think there is no difference in the effectiveness of administrative and judicial monetary fines in inducing compliance and those who think there is a difference. Of those who find a difference, a greater percentage believes that judicial fines are more effective than administrative fines.

D. Injunctive Relief

1. *Theoretical Literature*

In addition to monetary fines, this study consider other types of sanctions. In this sub-section, we examine injunctive relief. For purposes of this article, injunctive relief refers to an order requiring that a regulated facility take specific action as a means of coming into compliance with an effluent limitation with which a facility is not complying at the time of issuance.⁸⁹ Injunctive relief can take the form of an administrative order or a decree issued by a civil court. We are not aware of any theoretical literature that focuses on the effects of injunctive relief as a general or specific deterrent to noncompliance with federal regulatory obligations. Nevertheless, the use of injunctions ought to create a general deterrent effect if a regulated entity perceive their use as creating the threat of the issuance of an injunction in the future against that facility. This general deterrent might

⁸⁹Injunctive relief can take a variety of forms. See Zygmunt J.B. Plater, *Statutory Violations and Equitable Discretion*, 70 CAL. L. REV. 524, 540 (1982) (stating that “[i]njunctive relief, in their multiple variety, are merely remedial directives designed to implement the court's determinations on threshold questions, substantive liability, and future conduct, which may or may not include abatement. In fact, of course, the vast majority of abatements are implemented by injunction, and the vast majority of injunctions issued in the private law field are abatements.”). See also *id.* at 544 (providing examples of “the multifarious forms that injunctions may take”). Professor Farber states that “[n]ormally, the injunction should simply order the defendant to do what law-abiding citizens in the same situation would do voluntarily. That order might necessitate the immediate cessation of the offending conduct, depending on congressional intent.” Daniel A. Farber, *Equitable Discretion, Legal Duties, and Environmental Injunctions*, 45 U. PITT. L. REV. 413, 415 (1984).

disappear, however, if the facility regards the likely content of any injunction issued against it to be a requirement only that the facility take steps to comply with existing limitations. In that situation, the facility would be better off waiting until it receives the injunction because the facility would have use of the money needed to comply prior to issuance of the injunction. In other words, the facility may comply now or later; if an injunction is the only sanction, then it is better to wait until the injunction is issued. An injunction might serve as a specific deterrent if a facility that has received an injunction believes that regulators will engage in more frequent inspections than they would have in the absence of an injunction or are more likely to impose monetary fines or will seek to impose more onerous monetary fines on a facility that has previously been enjoined than on a facility that has not. Regulated facilities also may fear that corporate personnel could be exposed to criminal contempt sanctions if the a court finds that the facility has not complied with the provisions of an injunctive order.

2. *Previous Empirical Studies*

We are not aware of any empirical research that focuses on the effectiveness of injunctive relief as a deterrent to violations of environmental laws.⁹⁰

3. *The Results of Injunctive Relief on Specific and General Deterrence in the Chemical Industry*

Because of the paucity of theoretical and empirical studies on the deterrent effects of injunctive relief on facilities subject to environmental regulation, we have relatively little information upon which to generate expectations concerning the impact of injunctions on environmental performance by regulated facilities in the chemical industry. The absence of such studies, however, provide us with the opportunity to fill a gap in the literature.

a. *Analysis of Wastewater Discharges*

For our empirical analysis of CWA-related performance, due to data availability, we focus injunctive relief issued by the federal government. None of the four states examined for this study provide data on state-issued injunctions. While the EPA Docket database covers both administrative and civil injunctions, no facilities in our sample – those who discharge BOD and/or TSS – received a civil injunctive order during the chosen sample period. We are thus not able to assess the effect of specific deterrence stemming from civil injunctive relief sanctions. Moreover, very few civil

⁹⁰The absence of empirical research on the deterrent impact of injunctions in environmental cases is not unique. See, e.g., Dhaivat H. Shah, *The Care and Feeding of an SEC Cease-and-Desist Order: The Commission Defines its Authority Through In the Matter of KPMG Peat Marwick, LLP*, 25 HAMLINE L. REV. 271, 293 (2002) (bemoaning the lack of empirical research on the impact of cease and desist orders issued by the federal Securities and Exchange Commission). On the subject of environmental law and injunctions generally, see Farber, *supra* note 89; Plater, *supra* note 89.

sanctions were imposed on permitted major chemical manufacturing facilities who discharge pollutants other than BOD and TSS. Thus, our ability to assess the effect of general deterrence stemming from civil injunctive relief sanctions is highly limited. For these two reasons, we assess the effectiveness of injunctive relief with administrative and civil injunctions combined, *i.e.*, independent of the court imposing the federal injunction. Our empirical results demonstrate that injunctive relief improves environmental performance as both a general and a specific deterrent, although the specific deterrent is only marginally significant.⁹¹ We also assess the comparative effectiveness of injunctive relief and monetary fines. For both sanction types, we combine administrative and civil sanctions. We find that no difference exists between the effectiveness of injunctions and the effectiveness of fines as specific deterrents but fines are more effective than injunctions as general deterrents.⁹²

b. Analysis of Chemical Industry Survey Results

In an effort to gauge the perceptions of the chemical industry respondents concerning the effectiveness of injunctive relief on environmental performance, the survey inquires whether imposition of a federal injunctive relief sanction is an effective way to induce individual chemical facilities to comply with permitted water discharge limits. As shown in Table 1, a total of 18.6% of the respondents said “definitely not” or “probably not,” 29.2% said “probably yes,” 22.0% said “definitely yes,” and 28.8% said they “did not know.”

The percentage of respondents who view injunctions as effective (51.4%) – those answering “probably yes” or “definitely yes” – is much lower than the percentage of those who view monetary fines as effective (77.4%), as shown in Table 1. To explore this point, we directly compare the effectiveness of injunctions to the effectiveness of fines as reported by respondents. For this comparison, we examine the two relevant responses – reported effectiveness of injunctions and reported effectiveness of fines – for each respondent. Based on these two responses, we classify each respondent as granting a higher level of effectiveness to fines, a higher level to injunctions, or an identical level to both. Table 2.1 displays this classification and the sample distribution across the categories. Our analysis reveals that the proportion of the sample believing that fines are a more effective means of inducing compliance with CWA permit responsibilities than injunctions (31.0%)

⁹¹The general deterrent has a negative coefficient and is statistically significant given a p-value of 0.0017. The specific deterrent has a negative coefficient and is marginally statistically significant given a p-value of 0.13.

⁹²The former F-test of equal effects statistic is 0.45 with a p-value of 0.5021. The latter F-test of equal effects statistic is 6.77 with a p-value of 0.0093.

is significantly greater than the proportion believing that injunctions are more effective than fines (19.6 %).⁹³

This difference may be due to the perception of the respondents that injunctive remedies do relatively little to penalize violators for past illegal conduct. Injunctions by definition are prospective in orientation, as compared to the backward looking aspect of monetary fines, which penalize facilities for past violations. One observer has made a similar point about administrative compliance orders, asserting that when administrative enforcement action results in issuance of a compliance order without accompanying civil penalties, such action tends not to result in abatement of ongoing violations.⁹⁴

4. *Conclusions*

In conclusion, we do not find a voluminous theoretical literature on the deterrent effects of injunctions. It would seem, however, that the issuance of injunctions that directs a regulated facility to take specific measures to eliminate noncompliance should act as a deterrent. It should induce facilities that fear similar disruptions of their own operations to improve their performance and avoid noncompliance. It also should induce the facility that received the injunction to take steps to avoid similar disruptions of its own operations in the future. Indeed, our analysis of CWA-related performance indicates that injunctive relief improves environmental performance as both a general and a specific deterrent, although the effect on specific performance is only marginally significant. Based on the same analysis, we find no difference in the effectiveness of injunctions and fines as specific deterrents, but find that fines are more effective than injunctions as general deterrents. Analysis of the responses to our survey of the chemical industry generates results that are consistent with this last empirical finding. Only 51% of the respondents in our survey find injunctive relief sanctions to be an effective deterrent; yet, 77 % of the respondents view monetary fines as effective. Consistent with this comparison, our analysis reveals that the proportion of the sample believing that fines are a more effective means of inducing compliance with CWA permit responsibilities than

⁹³ For this statistical assessment, we denote each classified respondent with one of three values $\{-1, 0, +1\}$. We classify each respondent as granting a higher level of effectiveness to fines (+1), a higher level to SEPs (-1), or an identical level to both (0). Then we assess whether the mean response across all of the respondents is positive, i.e., fines are more effective than injunctions. The mean of 0.1141 is significantly greater than zero, with a p-value of 0.029. This conclusion is robust to the treatment of response levels as expressing the degree of enthusiasm. This alternative approach calculates the difference between the actual response levels and analyzes whether or not the difference for the average respondent is bigger than zero. Again, based on the overall sample mean, fines are viewed as more effective than injunctions.

⁹⁴Hodas, *supra* note 43, at 1610. Cf. Miller, *supra* note 74, at 448 (stating that state administrative compliance orders often merely extend the deadline for compliance instead of requiring specific means to achieve compliance). If a facility found to have violated its permit is subject to both a monetary fine and an injunction, the economic benefit of avoided compliance in the past will be minimized or eliminated, depending on the size of the fine.

injunctions is significantly greater than the proportion believing that injunctions are more effective than fines.

E. Supplemental Environmental Projects.

The final kind of government intervention that we study is the supplemental environmental project (SEP). SEPs are environmentally beneficial projects that a court or a regulatory agency allows a violator to implement in order to avoid a fine or to reduce the size of a fine.⁹⁵ This tool has been touted as a way to encourage greater cooperation between regulators and regulated entities.⁹⁶

1. *Theoretical Literature*

There is some support in the theoretical literature for the proposition that SEPs are likely to be relatively weak deterrents. According to Professor David Dana, SEPs may actually lower the cost to regulated entities of regulatory violations, which may result in “underdeterrence of regulatory violations where there previously was none and worsen underdeterrence where there previously was some.”⁹⁷ Moreover, the risk that SEPs will result in underdeterrence is exacerbated by the fact that SEPs create additional regulatory uncertainty in that SEP costs are typically assessed and reported by the violator, and it is difficult for regulators to verify those figures. Violators have obvious incentives to overestimate the costs of SEP implementation as a means of receiving greater mitigation from the penalty that would otherwise apply or to maximize the business benefits of SEPs.⁹⁸

⁹⁵See RECHTSCHAFFEN & MARKELL, *supra* note 33, at 65 (quoting U.S. EPA, Supplemental Environmental Projects Policy 79 (1998)) (“[EPA’s] SEPs policy might be described as a ‘kinder, gentler stick.’ It allows violators to reduce the size of the penalty they would otherwise be required to pay by reaching agreement with EPA to implement an appropriate SEP. SEPs are ‘environmentally beneficial projects which a defendant/respondent agrees to undertake in settlement of an enforcement action, but which the defendant is not otherwise legally obligated to perform.’”); Bonorris et al., *supra* note 66, at 187 (describing SEPs as “environmentally beneficial projects voluntarily undertaken by violators of environmental laws, for which EPA may partially mitigate the civil penalties they would otherwise face”).

⁹⁶See Bonorris et al., *supra* note 66, at 215 (stating that SEPs “are highlighted as a tool in this collaborative effort through their use as a negotiated settlement, their community involvement, and the prospect for the creation of innovative environmental solutions by the regulated community, in contrast to penalties meted out by enforcement personnel”).

⁹⁷David A. Dana, *The Uncertain Merits of Environmental Enforcement Reform: The Case of Supplemental Environmental Projects*, 1998 WIS. L. REV. 1181, 1184 (1998). See also Bonorris et al., *supra* note 66, at 205 (stating that “SEPs raise the possibility of underdeterrence by opening up the possibility for opportunistic violators to reduce the actual cost of the environmental penalty, as well as the possibility of tax deductions for SEP costs”).

⁹⁸Bonorris et al., *supra* note 66, at 206.

2. *Previous Empirical Studies*

We are not aware of any previous empirical work that assesses the impact of SEPs on environmental performance generally or on performance by those subject to effluent limitations contained in an NPDES permit in particular.⁹⁹

3. *The Results of Injunctive Relief on Specific and General Deterrence in the Chemical Industry*

Based on the theoretical literature discussed above, it is reasonable to expect that, even if SEPs serve as general or specific deterrents, they will not do so as effectively as monetary fines. Our findings only partially bear out these expectations. Most of our findings do not support these expectations.

a. *Analysis of Wastewater Discharges*

Based on our analysis of CWA-related performance, we assess the absolute effectiveness of SEPs and the comparative effectiveness of SEPs relative to fines. For comparability with our survey and with our evaluation of the effects of injunctive relief on performance, we assess administrative SEPs and judicial SEPs jointly, *i.e.*, we do not distinguish between the type of court issuing the SEP. First, our analysis reveals that SEPs improve environmental performance from the perspective of specific deterrence.¹⁰⁰ From the perspective of general deterrence, however, SEPs are counterproductive.¹⁰¹ Second, our analysis reveals that fines weakly dominate SEPs. As specific deterrents, fines and SEPs are comparably effective. In other words, we find no statistically significant difference between the effectiveness of fines and the effectiveness of SEPs as specific deterrents.¹⁰² Fines are more effective than SEPs, however, as general deterrents.¹⁰³

⁹⁹For discussion of the use of SEPs in connection with CWA violations, see generally Quan B. Nghiem, Comment, *Using Equitable Discretion to Impose Supplemental Environmental Projects Under the Clean Water Act*, 24 B.C. ENVTL. AFF. L. REV. 561 (1997).

¹⁰⁰The coefficient is negative and statistically significant given a p-value is 0.10.

¹⁰¹The coefficient is positive and statistically significant given a p-value of 0.0043.

¹⁰²The F-test of equal effects statistic is 2.44 with a p-value of 0.1186. This p-value indicates that the effect of SEPs on performance is marginally significantly more negative than the effect of fines. However, this result appears to stem heavily from the combining of administrative and judicial fines. The comparison of SEPs and fines, in the realm of specific deterrence, clearly reveals a comparability once the analysis distinguishes between administrative and judicial sanctions.

¹⁰³The F-test of equal effects statistic is 16.46 with a p-value of 0.0001.

b. Analysis of Chemical Industry Survey Results

In an effort to gauge the perceptions of the chemical industry respondents concerning the effectiveness of SEPs on environmental performance, the survey inquires whether a federal requirement to complete a SEP is an effective way to induce individual chemical facilities to comply with permitted water discharge limits. As shown in Table 1, 9.1% said that these projects are “definitely not” an effective way to induce compliance and another 14.8% said they are “probably not” effective. A total of 69.2% said that SEPs “probably are” or “definitely are” effective. 5.7% of the respondents did not know whether SEPs are an effective means of inducing compliance.

A majority of the respondents view SEPs as effective deterrents. This result would appear to conflict with the theoretical criticisms of this kind of intervention as a means of improving environmental performance and with the general deterrence-related results from our analysis of CWA-related performance. (This result is consistent with the specific deterrence-related results.) However, the percentage of respondents viewing SEPS as effective – those answering “definitely yes” or “probably yes” – is lower than for any of the other kinds of government interventions covered by the survey except for injunctions. Thus, even if the respondents view SEPs as an effective deterrent, they may perceive SEPs as a comparatively weak one. To explore this point, similar to injunctions, we compare the effectiveness of SEPs to the effectiveness of fines as reported by respondents. For this comparison, we examine the two relevant responses for each respondent. Based on these two responses, we classify each respondent as granting a higher level of effectiveness to fines, a higher level to SEPs, or an identical level to both. Table 2.2 displays this classification and the sample distribution across the categories. Our analysis reveals that the proportion of our sample believing that fines are a more effective means of inducing compliance with CWA permit responsibilities than SEPs (33.2 %) is not significantly greater than the proportion believing that SEPs are more effective than fines (27.1 %).¹⁰⁴ Thus, our analysis of the survey responses does not support the initial conclusion concerning the comparative effectiveness between SEPs and fines.¹⁰⁵

¹⁰⁴For this statistical assessment, we denote each classified respondent with one of three values $\{-1, 0, +1\}$. We classify each respondent as granting a higher level of effectiveness to fines (+1), a higher level to SEPs (-1), or an identical level to both (0). Then we assess whether the mean response across all of the respondents is positive, i.e., fines are more effective than SEPs. The mean of 0.0615 is insignificantly greater than zero, with a p-value of 0.217. This conclusion is robust to the treatment of response levels as expressing the degree of enthusiasm. This alternative approach calculates the difference between the actual response levels and analyze whether or not the difference for the average respondent is bigger than zero. Again, based on the overall sample mean, fines and SEPs are viewed as equally effective.

¹⁰⁵One interesting question is why the survey respondents perceive injunctions as even weaker deterrents than SEPs. One possibility is that SEPs typically are the product of negotiation between the enforcing authority and the regulated entity. The latter therefore is likely to have more input into the contents of an SEP than the obligations imposed by an injunction. Perhaps the respondents feel that injunctions are more adversarial in nature than SEPs. Therefore, injunctions are more likely to generate hostility towards, or at least undermine cooperation with, regulators. Consequently, future violations are more likely to occur following the issuance of an injunction than an

4. *Conclusions*

The theoretical literature indicates that SEPs are not likely to be as effective in improving environmental performance as other kinds of government interventions. Our analysis of CWA-related performance indicates that SEPs improve environmental performance from the perspective of specific deterrence. However, SEPs are actually counterproductive as a general deterrent. We find no significant difference between the effectiveness of fines and the effectiveness of SEPs as specific deterrents. Yet, our analysis demonstrates that fines are more effective than SEPs as general deterrents, consistent with the counterproductive effect of SEPs noted above. This set of results leads to these two conclusions. The threat of receiving an SEP based on the issuance of an SEP to another facility is not likely to improve environmental performance, especially in comparison with the threat of a fine. An SEP, however, may act as a specific deterrent to the firm subject to that SEP. A majority of our survey respondents believe that SEPs are an effective means of inducing compliance with NPDES permits. Moreover, respondents view the effectiveness of SEPs and the effectiveness of fines comparably, based on our statistical analysis of the survey responses.

IV. CONCLUSIONS ABOUT THE COMPARATIVE EFFECTIVENESS OF GOVERNMENT INTERVENTIONS

The importance of enforcement to the vitality of the federal pollution control programs justifies EPA's quest for additional empirical information about the impacts of different kinds of enforcement initiatives and approaches on corporate environmental performance and on compliance by regulated entities with their regulatory responsibilities. The study described in this article provides new information on the way that the chemical industry perceives the efficacy of different kinds of government interventions on compliance with the CWA's NPDES permit program. Similarly, our analysis of CWA-related performance provides information that should be useful to federal and state regulators in choosing what kinds of interventions are best suited to achieving optimal levels of environmental compliance with NPDES permits. As the article demonstrates, the choice of intervention technique may make a significant difference in the government's efforts to improve environmental performance, although the degree to and the manner in which it does so may depend on the level of government responsible for the intervention (federal or state) and the forum in which the government pursues the intervention (civil or administrative)

Our results conform in many respects to expectations generated by theoretical literature on environmental enforcement and to the results of past empirical studies. They diverge from these expectations and results in some instances, however. Moreover, the responses provided by our survey respondents are not always consistent with the results of our analysis of CWA-related

SEP. Conversely, if the formulation of an SEP signals the beginning of a more cooperative relationship between regulator and regulated entity, the latter may work harder to avoid future violations so as not to lose the good will that may have been generated by negotiation and issuance of the SEP.

performance in the chemical industry. For example, our analysis of CWA-related performance during the period covered by our sample demonstrates that federal inspections are more effective than state inspections, both as a specific and a general deterrent. Yet, the percentage of the survey respondents who perceive state inspections as more effective at inducing compliance than federal inspections is higher than the percentage that found federal inspections more effective. Similarly, our analysis of CWA-related performance indicates that federal fines are more effective deterrents than state fines, yet most of the survey respondents find no difference between the two.

These results highlight the need for additional empirical research on the effectiveness of government interventions on environmental performance. Further research on the effects of government interventions on environmental performance is essential if federal and state enforcement personnel are to make informed choices about whether and how to undertake enforcement initiatives. That research is equally essential to enable regulated entities to make rational decisions about how to avoid or respond to different kinds of interventions. In the future, researchers might fruitfully analyze the effects of federal and state interventions on performance and compliance with NPDES permit obligations by the chemical industry during a period different from the one we chose to analyze; by other industrial sectors regulated under the NPDES permit program; and by different industries under pollution control regimes established under statutes other than the CWA. These additional studies may shed light on whether the discrepancies we found between our results and prior studies, and between our results on CWA-related performance and the results of our survey of the chemical industry are anomalous or are instead part of a larger pattern.

If it is accurate to say that environmental protection efforts lack “meaning,” “truth,” or “reality” in the absence of effective enforcement,¹⁰⁶ then the considerable investments of time and resources needed to engage in empirical investigations of the kind describe here are not only justifiable, but essential to the pursuit of goals such as the CWA’s objective of achieving fishable/swimmable waters.¹⁰⁷ Some three and a half decades after the commencement of the modern era of environmental law, fundamental questions about the efficacy of enforcement techniques cry out for further illumination.

¹⁰⁶*See supra* note 5 and accompanying text.

¹⁰⁷*See* 33 U.S.C. § 1251(a)(2).

Table 1

**Imposition of Federal Sanctions
as an Effective Way for
Inducing Individual Chemical Facilities
to Comply with Permitted Water Discharge Limits:**

Distribution of Responses from a Survey of Chemical Manufacturing Facilities

Response	Monetary Fines (%)	Injunctive Relief (%)	SEPs (%)
Definitely not effective	9.77	7.95	9.13
Probably not effective	11.28	10.61	14.83
Probably effective	38.72	29.17	33.46
Definitely effective	38.72	21.97	35.74
Don't know	1.50	30.31	6.84

Table 2

**Comparison of Reported Effectiveness of Various Federal Sanctions for
Inducing Individual Chemical Facilities to Comply with Permitted Water Discharge Limits:**

Distribution of Paired Responses from a Survey of Chemical Manufacturing Facilities

Table 2.1. Monetary Fines vs. Injunctive Relief

Comparison of Fines and Injunctions	Percent of Sample (%) ¹
Injunctions more effective than Fines	19.57
Injunctions and Fines equally effective	49.46
Fines more effective than Injunctions	30.98

Table 2.2. Monetary Fines vs. Supplemental Environmental Projects (SEPs)

Comparison of Fines and SEPs	Percent of Sample (%) ¹
SEPs more effective than Fines	27.05
SEPs and Fines equally effective	39.75
Fines more effective than SEPs	33.20

¹ For this classification, the analysis excludes respondents who do not respond to one or both of the relevant questions or are not able to evaluate the effectiveness of one or both of the federal sanctions.