FINAL TECHNICAL REPORT

WHY DO CORPORATIONS OBEY ENVIRONMENTAL LAW? ASSESSING PUNITIVE AND COOPERATIVE STRATEGIES OF CORPORATE CRIME CONTROL

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ABSTRACT

Punitive strategies for corporate crime control emphasize the use of formal legal sanctions, especially but not exclusively those found in criminal law, to deter current and future offenders from similar acts of misconduct. Cooperative crime control strategies emphasize the use of regulatory persuasion to facilitate and enhance legal compliance. These strategies emphasize pro-social norms, informal sanction threats, and intra-organizational controls to motivate firm compliance. In this study, we use a triangulated research strategy that incorporates interviews with environmental inspectors, secondary data analysis, and a vignette survey to shed light on the relative merits of these strategies aimed at companies that fail to comply with environmental regulation (specifically, the National Pollutant Discharge Elimination System as authorized by the Clean Water Act). Our results reveal that inspectors adopt both cooperative and punitive strategies as they interact with the regulated community. Only some of this regulatory activity is "officially" recorded, with an even smaller percent reported in the Permit Compliance System—the database we utilized for our secondary data analysis. Analysis of the firm-level data found little evidence of a deterrent effect for either punitive or cooperative intervention strategies. Firms with the worst environmental records are inspected and sanctioned more often, with little effect on company recidivism. Larger companies (those with more employees) and firms that owned more facilities were inspected more often. Facility ownership was positively associated with more severe sanctions. Overall, more profitable companies had better environmental records. Our survey results were more promising regarding compliance strategies. Formal legal sanctions and compliance strategies that build on ethical evaluations of managers and effective internal compliance systems have a substantial effect on managerial decision-making. The surveys also reveal that pro-social environmental actions by managers (such as responsiveness to terrorism threats and a strategy of "over-compliance") are more likely when there is shared agreement and consistent communication within the firm about environmental goals.

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Overview

Sally S. Simpson and Carole Gibbs

Rationale for the Present Study

In 1997, the U.S. Department of Justice, Office of Justice Programs published "Preventing Crime: What Works, What Doesn't, What's Promising." In this research report, numerous crime prevention programs within multiple institutional areas (including corrections, markets, policing, families, and schools) were assessed as to their respective successes. This evidence-based approach to crime prevention has had a tremendous impact on how scholars and policy-makers think about traditional crime intervention and control programs. Unfortunately, we have seen little spill-over into nontraditional crime areas-- including the prevention and control of corporate offending.

The goal of this research project is to offer evidence on the relative merits of cooperative and punitive strategies aimed at a particular kind of corporate offender, those that fail to comply with environmental regulations. We examine, through a variety of analytic techniques, individual and firm-level factors that increase and decrease the risk of corporate noncompliance. In addition, we explore whether there are distinct types of corporate citizens (extreme volunteers, mere compliers, bad citizens) and whether there are differences in how legal interventions are applied according to citizenship type or firm characteristics. Finally, we evaluate the effectiveness of various interventions (by source and type) especially in regard to future offending.

Data and Methods

Three kinds of data were collected to address these questions: (1) interviews with environmental inspectors were conducted to learn more about the context of enforcement, inspector perceptions of successful and unsuccessful enforcement strategies, and the correspondence between inspector reports of noncompliance and official records; (2) secondary data for a sample of U.S. companies was used to track each firm's economic, environmental and enforcement compliance history; and (3) a factorial survey was developed and administered to company managers tapping into perceptions of the costs and benefits of pro-social (e.g., over-compliance, responsiveness to counter-terrorism initiatives) and anti-social (noncompliance) conduct for themselves and their companies.

Each data component presents a unique picture of corporate offending and compliance from three different perspectives. Specifically, the interview data help us to understand what EPA inspectors do, their views about environmental compliance and different kinds of interventions (e.g., cooperative and punitive), and the relationship between their actions and official compliance records. The vignette survey of corporate managers gives us some insight into how environmental decisions are made as well as the individual and company factors that affect compliance, including informal and formal mechanisms of control. Finally, using firm-level longitudinal data, we can observe how economic and structural characteristics of companies are related to noncompliance and enforcement actions in the NPDES system. The water media is of particular interest in this study; specifically the National Pollutant Discharge Elimination System (NPDES) permit program. Because of this focus, we describe the NPDES system and its enforcement in greater detail below.

The NPDES permit program was authorized by the Clean Water Act in 1972. The Clean Water Act prohibits the discharging of pollutants through point sources into waters of the United States without a NPDES permit. The NPDES permit translates general requirements of the Clean Water Act into specific requirements for each facility. The permit contains effluent limitations on what and how much a facility can discharge as well as monitoring and reporting requirements. Facilities are required to take various measures of discharges into the water and submit reports of both permitted levels and actual effluent discharges to the EPA; these reports are called discharge monitoring reports (DMR). The Permit Compliance System (PCS) holds these data and allows the EPA to calculate whether the facility is in violation of permitted levels (effluent or measurement violations); the level of violation; and whether the DMR report was late (reporting violations). PCS also contains information on other types of violations, including compliance schedule and single event violations. Compliance schedules are negotiated agreements between a pollution source and the EPA that specify dates and procedures by which a source will reduce emissions and, thereby, comply with a regulation. When facilities do not fulfill the agreement by the specified date they can be found in violation. The term "single event violation" characterizes a variety of violation types that result from a single instance; these include (among others) improper operation and maintenance, violations detected during inspection, and a fishkill. The date and type of inspection is also available in the data. Finally, PCS contains information regarding state and federal enforcement actions against facilities that have violations of any type, including cooperative intervention strategies (e.g., phone calls, warning letters)[i] and more formal actions by EPA (e.g., administrative order, enforcement conference, and emergency order) and other legal authorities.

The primary aim of this study is to provide researchers and policy-makers with systematic information about the origins of company non/over-compliance, whether specific regulatory interventions and informal crime prevention strategies affect the behavior of managerial decision-makers and, in the aggregate, the firms in which they operate. The report is divided into three chapters or sections; each section describes the different research methodologies employed, data analysis, and findings and conclusions for the distinct study components (e.g., interviews, secondary data analysis, and factorial survey). Because the Report is lengthy, we have also prepared an Executive Summary in which the main results and conclusions of the study are highlighted.

Chapter 1

Understanding Nature and Context of Local Environmental Enforcement
What We Learned from Interviews with Inspectors

By Joel Garner

As part of this project's three pronged approach to improving our understanding of organizational compliance with environmental laws and regulations, we interviewed a dozen officials whose current responsibilities include the enforcement of industrial permits issued under the Federal Clean Water Act.

State enforcement officials play a crucial but often underappreciated role in the nation's environmental policy. Under the Clean Water Act, State agencies issue the vast majority of all discharge permits, conduct most inspections and are responsible for most environmental enforcement and compliance activities.[ii] State permitting and enforcement activities are conducted under an annual plan submitted by the States to the Federal government through EPA regional offices. This plan is the basis for Federal funding of State environmental protection agencies.

In the States we studied, the enforcement function was separated from the permitting functions—that is, permits are negotiated by one set of staff, often in the State central office--and enforcement of those permits is conducted by another set of staff—often in sub-state regional offices. While there are some consistent elements to water discharge permits, the standards imposed in particular permits can vary from industry to industry and from State to State.

A core element of the enforcement program is the self monitoring of water quality by the permitted facility and the monthly reporting of this monitoring to the State environmental protection agency. These reports are sent to the sub-state enforcement offices and data extracted

from these reports are sent by the State agency to the Federal EPA. These self-monitoring reports and agency reports of inspections and enforcement actions become the basis for the Federally maintained PCS data system.[iii]

We conducted these structured qualitative interviews (See attached outline) for three interrelated purposes. First, we wanted to learn more about the day to day operations of street level enforcement activities. For instance, do individual inspectors work a set group of facilities or firms? Are inspections typically done by individuals or teams? Criminological research on policing has reported great varieties in enforcement approaches noting that the ability of police to obtain compliance varies with the style and demeanor of individual officers (Mastrofski, 1996; Engel, Sobol, and Wordon, 2000). In addition, the corporate crime literature suggests that the "policing" model brought to bear (lenient, legalistic, or persuasive) can affect firm compliance (Braithwaite and Makkai, 1991; Makkai and Braithwaite, 1994).

Our second purpose was to ask experienced inspectors what they thought about the relative effectiveness of their own activities. Our review of the literature revealed some speculation about the relative effectiveness of various regulatory actions and statistical analyses of official records of compliance and enforcement to explore these ideas. These studies made certain assumptions about what an inspection entailed, how it was decided to inspect, inspect repeatedly or not inspect a facility, and the extent to which inspections could be interpreted as official sanctions or threats of sanctions. We thought that interviews with experienced inspects might provide additional insight into the validity of these assumptions and the extent to which inspectors believe their enforcement behavior does and does not encourage environmental compliance.

Third and perhaps most important, we wanted to learn about the full range of enforcement and compliance assistance activities and the extent to which these activities were captured in the existing EPA official data systems. The second prong of this project involves statistical analyses of data derived from the PCS and we thought it would be informative—both for data collection and analysis purposes, to have a better understanding of how those data are generated and the extent to which they accurately reflect street level behavior. A major contribution of criminological research is a healthy appreciation of the non-uniform nature of official crime and enforcement records, especially during the initial development of national level official records. The recent growth and integration of these data systems and EPA enforcement and inspection functions suggested some areas of caution.

Exploratory Design and Scope of this Research

Our approach to obtaining this information by interview was designed to be exploratory. We sought out opportunity samples of inspectors in States and EPA regions near the principal investigators. In jurisdictions where we received permission to conduct interviews, we met at their field offices and spoke with inspectors in groups of two to five in size and in the presence of their immediate supervisors. We interviewed twelve individuals in two states in three sub-state regional offices whose current responsibilities involve conducting inspections. We also interviewed four individuals whose current positions involve managing programs of environmental enforcement and compliance at the State or sub-state level. In addition, we spoke with officials from the Environmental Coalition of the States, a Washington-based association of State environmental enforcement officials and with Environmental Compliance Consortium, a multi-state project housed at the University of Maryland School of Public Affairs with support from the Environmental Law Institute and the National Academy of Public Administration.

These qualitative measures from unsystematic samples have several known and severe limitations for hypothesis testing but our goals here are more modest. We want to determine the feasibility of interviewing inspectors and the kinds of information that might be obtained from more structured interviews with more systematic samples. In addition, our efforts have been limited to inspectors with responsibility for only one program--industrial water permits. This focus provides some similarity in the types of individuals interviews but it also further limits the generalizibility of our findings. Although limited in number and narrow in focus, our interviews were intended to provide a useful perspective on environmental enforcement activity, how inspectors view the effectiveness of their work and how their activities are and are not captured by existing EPA records of compliance and enforcement.

Confidentiality of Interviewees

We anticipated a number of legal impediments to interviewing inspectors, dealing mostly with the confidentiality of information about individuals and organizations that we might obtain from inspectors. Using the protections the Congress has established to make some criminological research data "immune from legal process" and unavailable for "any purpose in any action, suit, or other judicial, legislative, or administrative proceeding" (42 U.S.C. §3789(g)) and the institutional procedures at the University of Maryland for insuring the protection of research subjects, we promised anonymity to the individuals who agreed to be interviewed and have maintained that anonymity in this report. For this reason, specific names or locations of the interviewed inspectors are not reported here.

Interviews with Environmental Inspectors

Work Context

1) Most inspectors are State employees and are based in sub-state regional workgroups.

Inspectors tend to specialize in specific media–air, water, solid waste, etc. and to a lesser degree within programmatic areas of specific media, such as industrial water permits, municipal water permits, storm water construction permits. Official State and Federal reports show that more than 90 percent of all individuals conducting inspections under the Federal Clean Water Act are State employees. We contacted State Departments of Environmental Enforcement to inform them of our project and to obtain permission to interview their employees. Once we obtained this permission at the State level, we then identified and located the individuals that actually conduct Clean Water Act inspectors. We found that the regular base of operations for these employees is typically a small office located hundreds of miles from the State department of environmental enforcement.

Despite the physical separation, the interviewees reported that there is regular contact with a variety of State environmental officials and, when necessary, with State run laboratories that perform chemical tests on water samples obtained during inspections. They also have in person and telephone contacts with other State environmental employees who have responsibilities for establishing or renewing Clean Water Act permits or for following up on enforcement activities.

Some of our interviewees, however, had been trained in conducting multimedia inspections but they reported that these types of inspections tended to be rare and conducted only in larger facilities that had multiple permits. Some inspectors reported that they had previously been organized in offices with responsibilities for other media, such as clear air programs, solid waste programs, etc. More experienced inspectors reported that, over the life of their career, the sub-state regional boundaries, Federal and State standards and procedures, and the sub-state region's range of programmatic responsibilities had changed several times over their careers.

The budget and personnel allocations for each sub-state regional office are set by the State agency but the day to day division of work within the sub-state region is typically set by the local manager. The planned work schedule, however, could easily be disrupted by the need to respond immediately to incident reports of specific problems. These reports can come from permitted facilities themselves or from complaints from the public about problems for which the source may or may not be known and may or may not be a permitted facility. Although the exact procedures varied by state, citizen complaints carried a high priority for local inspectors. In each State, there were special procedures and strict time limits for reporting the resolution of these complaints to the central office of the State environmental agency.

Inspectors report that they typically work alone in casual civilian dress and travel to facilities in state owned vehicles. Some inspections involve on site testing or the collection of samples for delivery to State run labs for testing. Some interviewees reported that some inspections can be more complicated, involve trucks full of equipment, involve the handling of toxic chemicals, or include other state environmental inspectors with specialized training or experience. In some sub-state regions, some inspectors focused exclusively on particular industries, such as coal mining, while others had responsibilities for a wide range of industries and facilities.

2) Though certain inspections of major facilities are required as part of annual State–Federal agreements, most inspectors set their own day to day work schedules. The timing of specific inspections or compliance assistance can be influenced by citizen complaints, self-reports from facilities, or proximity of one permitted facility to another. The day-to-day workload is dominated by the more numerous by typically smaller sites or facilities which are not covered under Federal permitting regulations.

Most of the inspectors we interviewed currently specialized in a specific media, in this case, clean water programs. Within this specialization, however, individual inspectors typically had a wide range of responsibilities beyond conducting on site inspections at relative small number of large industrial facilities required by their agreements with the Federal government. In describing their day to day activities, our interviewees frequently commented on inspections and other enforcement activities at the relatively more numerous local permits for storm water runoff and shorter term permits for erosion and sediment control at construction sites. The inspectors spent more time, per inspection, preparing for visits to larger facilities and spent more time on site when inspecting these facilities but the large number of smaller facilities contributed to their workload.

The annual budgetary approval process for Federal grants typically involves annual emphases on particular industries, such as dry cleaning or ready mix concrete facilities. These emphases can be implemented throughout a multi state EPA region or be specific to a particular State. In either case, these annual priorities can have differential impacts on sub-state regions, depending on the number of such facilities in a particular region.

3) The inspectors are college-educated, career State employees. They tend to conduct inspections and other work alone but can and do call upon other local or State officials for some technical tasks. However, our interviews did not reveal any inspectors who had previously worked or currently worked for regulated industries.

The inspectors we interviewed were all college educated professionals, with degrees in a variety of fields including environmental sciences, engineering, biology, and forestry. Their government careers tended to specialize in the inspection and enforcement side of environmental

regulation. One of the more senior interviewees had previously worked issuing permits but this did not appear to be a common career path.

According to the inspectors we interviewed, the actual field work of inspecting a permitted facility started by reviewing the specific provisions of the current permit or permits at a particular facility, the past record of inspections and self-report data. Depending on the nature of the facility, its permit, and its compliance record, the office work involved in reviewing the paper copies of permits and in preparing for an inspection can take from several hours to over half a day. Actual inspections themselves tended to be one person operations but the inspectors we interviewed sometimes called upon other local inspectors or State officials who had special training or expertise. Some inspectors had received some training in multimedia inspections and this type of inspection tended to involve more than one inspector.

We asked about career movement from government employment in environment enforcement to working for private companies as environmental officials or vice versa. None of our interviewees knew of anyone who had worked as inspectors and had worked for regulated industries.

4) Inspections tend to involve advance notification to the facility. Notification is seen as insuring that the appropriate facility managers are available. Some interviewees reported providing more advanced notification given heightened security concerns at major facilities following the terrorist attacks on September 11, 2001.

Our interviewees said that they had the authority to conduct inspections with and without prior notice to the facility. The inspectors indicated that they would usually call ahead unless information from self-reported data or from prior inspections suggested specific procedural problems. Calling ahead helped to insure that the facility personnel responsible for

environmental compliance would be present for the inspection. Increased security concerns following the September 11, 2001 terrorist attacks were another reason for them to provide the facility with prior notification that they would be arriving at a particular facility on a particular day.

In any given calendar year, only about half of all industrial facilities with surface water charge permits are inspected. The inspectors we interviewed said that a number of factors determine if and when a facility would be inspected and how detailed that inspection would be. According to the inspectors, the primary factors were the size of the facility and its compliance history, with large facilities with prior noncompliance behavior more likely to be inspected.

Some facilities must be inspected annually as part of the Federal–State agreement on environmental enforcement. Inspections are also conducted in response to complaints about discharges or conditions at specific sites. Our interviewees thought that complaint driven inspections were less prevalent at industrial sites as opposed to construction sites or violations of other clean water act programs. Our interviewers pointed out that some facilities are inspected or inspected more frequently because they are physically close to unrelated facilities that happen to be scheduled for an inspection. The inspectors we interviewed said that typically they did not record the reasons why or when a particular facility was or was not inspected.

Effectiveness of Enforcement

5) The individuals we interviewed understand their activities as part of a generally effective system for protecting the environment; a process that involves issuing permits, self-reports, responsiveness to citizen complaints, inspections, compliance assistance, and enforcement actions. Respondents said that they saw their activities as part of a generally effective system for protecting the environment. They spoke of their activities as one part of a number of established

procedures for determining permitted discharge levels, occasionally validated self-reports, responsiveness to public complaints about specific violations, and their onsite inspections of procedures and discharge limits. The one complaint raised by several inspectors was the reductions in resources and staffing and the resulting increase in their workload.

Amidst these generally positive assessments of the existing system, a few inspectors did raise mild concerns about the fact that they and other inspectors were not always as involved in the setting of original permit conditions or in decisions about whether or not to proceed with enforcement actions as they might prefer. On the other hand, several inspectors spoke positively about instances where they had been consulted on renewals of permits and on the appropriate level of response to reporting and discharge violations.

Our interviewees said there were many reasons why facilities complied with their permits but that they thought that the threat of detection, either by self-report, public complaint or their inspections increased corporate compliance. They also said that the threat of detection was more effective when it was clear that enforcement actions were available to penalize persistent or acute noncompliance in procedures, reporting practices or violations of discharge limits.

The inspectors conveyed a generally positive appreciation for the effectiveness of their role in a much larger system of environmental protection and for the larger system itself. The inspectors we spoke with identified a variety of corporate and marketing reasons why industrial facilities tended to have high rates of compliance but noted that they thought that the threat of enforcement actions played an important role in corporate decision making. Some inspectors reported that, even with high rates of compliance and low rates of enforcement actions, it was not uncommon for personnel at one facility to learn about enforcement actions against other nearby facilities, even if they were not in the same industry.

Some inspectors reported that they generally had fewer problems with industrial facilities that had long-standing permits than with smaller facilities with relative new permits. Other inspectors suggested that the facilities without permits or those with short term permits (e.g., construction permits) had more problems.

6) Inspectors regularly work with facilities to improve compliance in a variety of informal ways that do not involve more formal enforcement actions; they also initiate enforcement actions. They report that effectiveness of their informal actions is enhanced by the threat of reporting violations and the possibility of formal sanctions.

The inspectors we interviewed described their interactions with facilities as involving a mixture of more formal actions, typically some written notice of violation or an actual sanction and less formal actions, that would not involve written notices or sanctions but would involve working with the facility to help them meet either the procedural and the substantive provisions of their permits. At the time of these interviews, the States and the Federal government were actively promoting and trying to figure out ways to count less formal "compliance assists" efforts conducted by inspectors; all the inspectors we interviewed agreed on the importance of these less formal mechanisms in promoting compliance; on occasion, inspectors would speak of having established working relationships with some of the personnel at the permitted facilities and their ability to use this rapport to obtain corrective actions and compliance with existing permits. Some inspectors spoke of providing technical advice and even direct assistance to facility personnel as an important part of their job.

7) The inspectors we interviewed consistently describe their inspection as "observations" or audits but not as "sanctions" **per se**. We asked our interviewees about how the extent to which they saw inspections as enforcement actions. Virtually all of our interviewees rejected this

notion. They said that routine inspections were not enforcement actions, though they did have a rarely used authority to order facilities to stop operations under certain conditions. The individuals we spoke with saw on-site inspections as "observations" or "audits" that were not in themselves sanctions but brought with them the threat of some enforcement actions. Inspections were seen by our interviewees as one way to provide assistance to facility managers about whether they were or were not following appropriate procedures.

8) Citizen complaints of pollution typically have high priority and require immediate responses from local enforcement officials. The inspectors we interviewed reported that their States had strong policies that required them to make formal reports about how and when they responded to complaints from the public. The inspectors also reported that not all complaints turn out to be founded and that it is sometimes difficult to connect specific environmental violations with specific facilities; still, most inspectors stated that it was helpful to them and to their environmental enforcement programs to have extra eyes, noses, and ears reporting potential problems. One group of inspectors estimated that as many as 20 percent of their inspections occurred when they were responding to specific complaints.

Relationship to Official Record Systems

9) Inspectors typically review permit requirements and self-reports prior to inspecting permitted facilities. Monthly self reports are sent to state offices and transmitted from them to regional offices. In some agencies, detailed reports prepared by the state's central office assist in the preparation of site inspections.

According to the inspectors we interviewed, the work involved in inspecting large industrial facilities begins in the office reviewing the current permit documentation and the facility's recent compliance history. Depending on the size of the facility, the number of

discharge pipes or permits, special permit conditions, and the past compliance history, this office work alone can consume up to half a day's work. In one State, the effort involved in this preparation appeared to be reduced by the production of automated reports by the central office. These reports listed the permitted levels of specific chemicals and the self-report histories for individual facilities for each facility. Inspectors use a mixture of locally based paper files, field-based computers for producing inspection reports and automated systems of compiling historical records of self-reported discharge

The processes for sending the monthly self-reports of water discharges seemed to vary by State and region. While standard EPA requirements are for facilities to send their monthly reports to the State environmental agency within a month (e.g., reports for June are due by August 1), the processes within the State agency for sending the monthly reports to the sub-state regional offices vary. Some inspectors reported that the actual delivery to them of the paper copies of self-reports could be delayed, sometimes for months. However, in at least one State, self-reports from facilities were regularly reviewed in the central office and field inspectors were notified quickly if these documents included violations of permitted levels. In addition, our interviewees reported that facilities with major pollution violations will sometimes directly call the sub-state regional inspectors directly to inform them of the nature of an immediate problem and what the facility has done or is currently doing to correct this problem.

Both the field-based inspectors and the central office manager we spoke with reported the not yet fulfilled need to capture the full range of activities by State environmental agencies to achieve compliance with environmental laws and regulations. There was much agreement among the people we interviewed about the value of compliance assistance efforts as well as inspections

and enforcement activities. There was also agreement about the difficulty in creating distinctive performance measures for each of those activities.

10) The inspectors we interviewed did not use, have knowledge about, or regular access to the Performance Compliance System.

None of our interviewees knew what inspection information was included in the PCS system or were familiar with the specific information entered into the Performance Compliance System about the facilities they inspected. Similarly, they did not know that the PCS contained self reports from the facilities, information about the nature of the inspections they or others conducted, or the types of enforcement actions taken. The inspectors we interviewed said that they knew this information and kept records of it in their offices; some of the records were automated but most were paper files. They also reported that they kept records of their inspection reports and that they would use these files to review past compliance of a facility.

State officials reported to us how they organized the entry of permitted levels, self-report, inspection and enforcement information into the Performance Compliance System. They reported that this system was originally designed as a mainframe-based information system that was used primarily as a mechanism to report to the EPA. The PCS was universally described by State and Federal officials as needing an upgrade and this effort was underway at the time we were conducting these interviews. Officials in the two states we visited reported that they had developed and were continuing to develop state specific automated information systems that captured more detailed permit, self-report, inspection, and enforcement information across a wider range of environmental programs then those included in the performance compliance system or other EPA operated information systems. At the time of our interviews, there was some evidence of automated information being provided to some inspectors but the inspectors

we interviewed reported that their primary involvement with these systems was to provide reports of their activity that others in the central office then used to report to the Federal government.

What Have We Learned?

Environmental enforcement is heavily information based, with specific quantitative limits set for the discharge of specific amounts of chemicals or oxygen levels in water. The nature of required processes and permitted behavior varies greatly by facility and sometimes even by time of year. Inspectors play and see themselves as playing a crucial role in determining the extent to which facilities remain in compliance with the provisions of their permit or permits. Inspectors are primarily State employees operating out of sub-state regional offices whose reports to State level officials are entered into an automated information system that they themselves do not see or use. Performance Compliance System data is produced by officials in the central office of state environmental agencies using information provided by field-based inspectors.

Inspections are viewed as observations or audits and the nature and timing of those observations are determined in great part by available resources, reported noncompliance, physical proximity to other facilities, and public complaints as well as expectations set in annual Federal State agreements. Inspectors reject the notion that inspections are sanctions; inspections are seen by inspectors are part of a system that, among other things, threatens sanctions if facilities fail to comply with their permits.

This understanding is derived from a small number of interviews with opportunity samples of inspectors in one program area in two states. However, it suggests some real strengths and some potential weaknesses in using the Performance Compliance System data to assess the effectiveness of environmental enforcement. For instance, the use of central office personnel

provides the opportunity for consistent statewide reporting of inspections and enforcement activities. The lack of review of this information by field level inspectors means that the data have not been verified by some of the individuals whose behavior is being described.

Perhaps more important, our interviews have identified that the timing and nature of inspections can, with some regularity, be in response to reports of violations, either from the public or the facility itself. This raises concerns about time sequencing of violations and enforcement actions. It also suggests the value of understanding better how specific facilities are selected for inspection at particular times. At a minimum, statistical analyses of PCS data need to be attentive to these potential problems and include caveats about time sequencing and the process of selecting facilities for inspections.

Many of the issues and ideas gleaned from our interviews guided the secondary data collection and analysis component of this study described in chapter 2, especially concerns about the temporal ordering of violations and enforcement actions (we use quarterly data as a consequence and are cautious in our interpretation of results), data deficiencies (e.g., not all enforcement activities are reported in the PCS; there is inconsistency between reporting and recording agents), and facility selection (we purposively focus on facilities that are permitted and designated as “majors” by the EPA). Finally, we took useful ideas from these interviews to guide dimension construction for our factorial survey (described in Chapter 3).

Chapter 2

Company Characteristics, Compliance, and Recidivism: An Analysis of Secondary Data

By Sally S. Simpson and Carole Gibbs

The Environmental Protection Agency (EPA) sets national pollution standards and implements environmental laws enacted by Congress by developing and enforcing regulations. When national standards are not met, the agency can issue sanctions, ranging from warning letters to filing criminal cases. Environmental programs are organized into various media, or specific environments--air, water, soil--that are the subject of regulatory concern and activities (U.S. EPA, 2003) As already mentioned, the water media is of particular interest for this study; specifically the National Pollutant Discharge Elimination System (NPDES) permit program. (Please refer to the overview chapter in this Report for a detailed discussion of this program and the PCS data system in which the NPDES data are collected and held.)

The PCS data, while providing extensive information regarding plant/facility-level compliance and enforcement, do not translate readily into company-level information. Because our conceptual and empirical interests lie with the firm and not the facility, we aggregated facility information to the firm-level—matched to specific companies in our sample (see below). Additional information about firm noncompliance was drawn from EPA Docket and CrimDoc systems. EPA Docket provides case-specific details regarding ongoing or closed administrative and civil cases while CrimDoc is a data base of ongoing and closed criminal court cases in which companies are defendants. In the latter case, we gained access to closed case information only. Finally, financial and other data was collected about these companies, including information on firm size, structure, and profitability. This includes a firms' standard industrial classification,

number of employees, number of facilities owned, and assorted profit measures (e.g., total assets, total stockholders equity, etc).

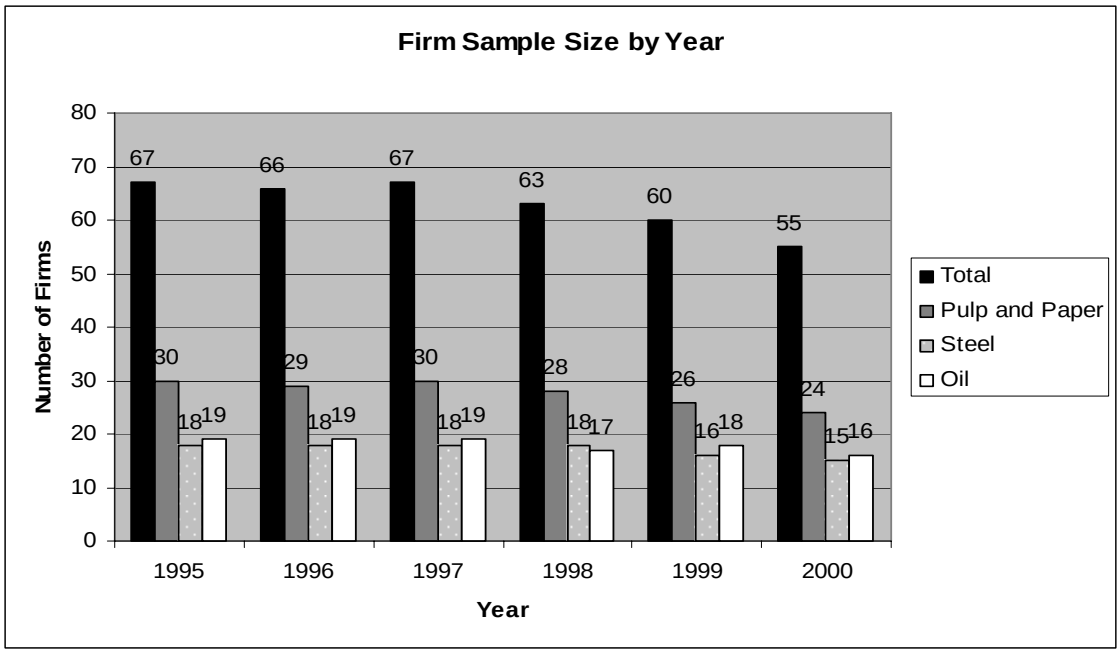
We begin this chapter with a description of the company and facility samples complied for this project, beginning with a thorough description of the firm-level data over time and by industry. To place the data in context, the manufacturing processes that create water pollution in each industry also are described. Patterns of violation counts (effluent/numeric, compliance schedule, single event, and reporting) follow. In this section, we also highlight how we created a violation *rate* for these analyses. Next, the trends in EPA sanctioning over time, across industry, and for each violation type are given followed by a description of firm characteristics. The chapter concludes with findings (and discussion) regarding the relationship between firm characteristics, enforcement, and recidivism.

SAMPLE AND INDUSTRIES

Sample: Firms and Plants

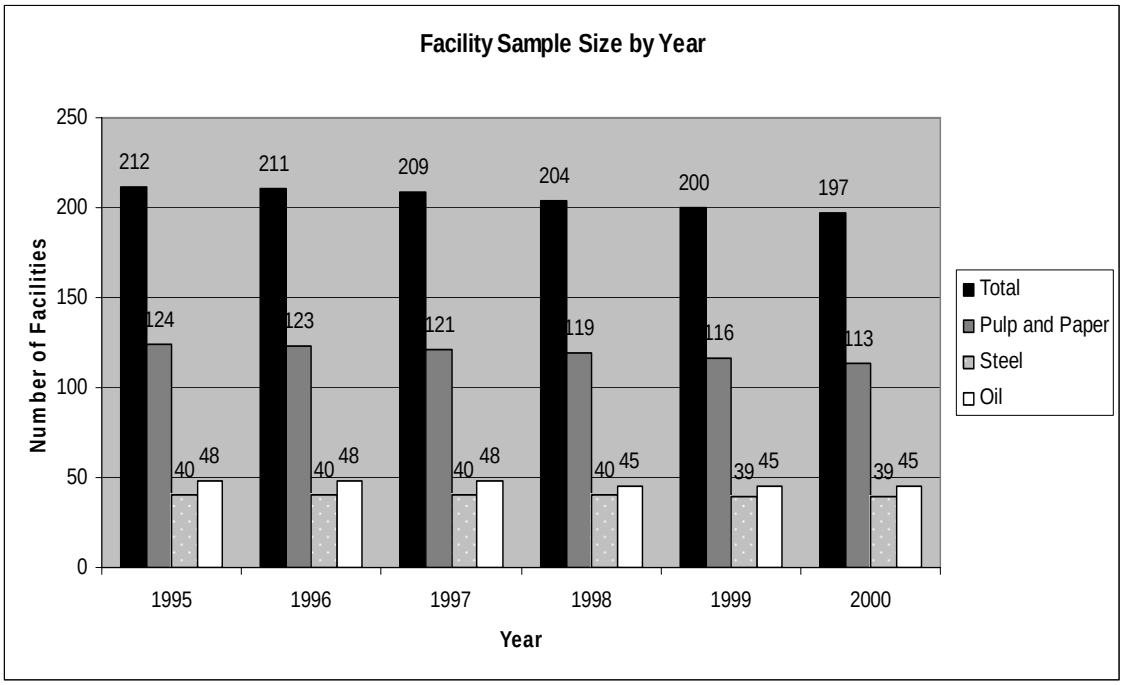
As Figure 2-1 shows, the sample period begins in 1995 with 67 firms in four industries: pulp, paper, steel, and oil.[iv] Pulp and paper were collapsed into one industry because of the substantial degree of overlap in the firms and facilities in the two industries, leaving 30 pulp and paper companies, 18 steel companies, and 19 oil companies. By the end of the sample period in 2000, due mostly to mergers, the number of firms is reduced to 55 (24 pulp and paper; 15 steel; 16 oil). Many of the absorbed firms were purchased by companies that were already in the sample; other firms merged with international companies after which they were no longer tracked.

Figure 2-1



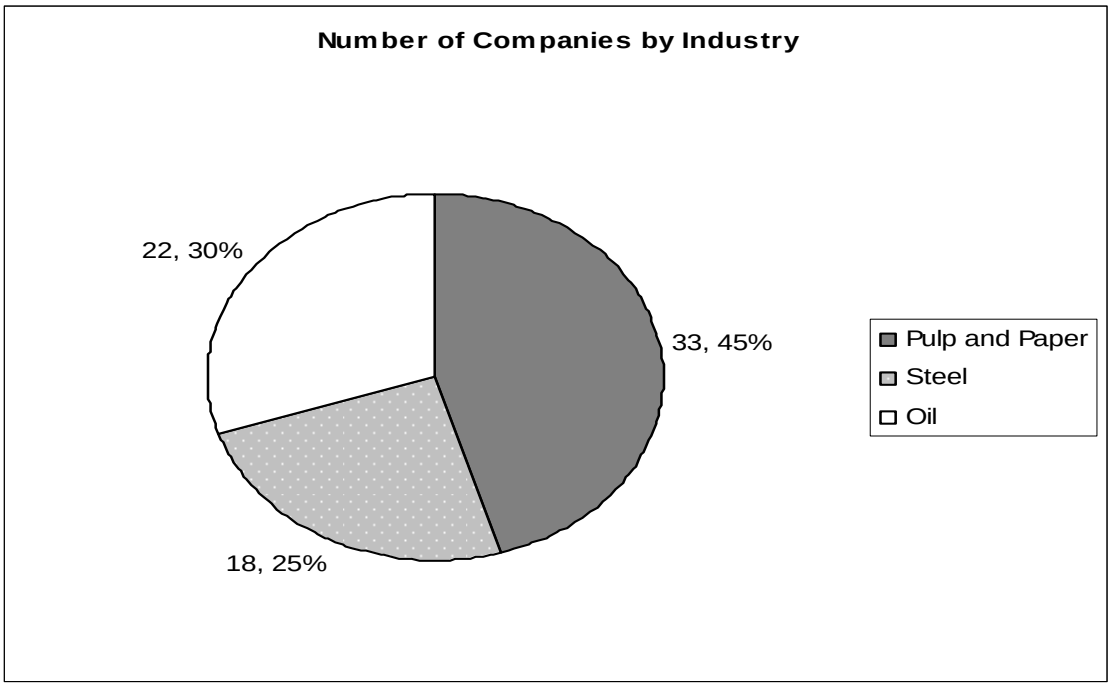
Two hundred and fourteen permits were matched to this universe of firms. These permits identified 212 unique facilities (2 facilities were assigned 2 permits). Like the firm sample size, Figure 2-2 shows that the facility sample size also drops over time. The sample period (1995) begins with 212 facilities (124 pulp and paper; 40 steel; and 48 oil). By the year 2000, the number of facilities has dropped to 197 (113 pulp and paper; 39 steel; and 45 oil). In many cases facilities were lost from the sample when firms merged with other companies that were outside the sample. The facilities transferred to new ownership with the parent company. In other cases firms sold one or two individual facilities to companies outside of the sample.

Figure 2-2



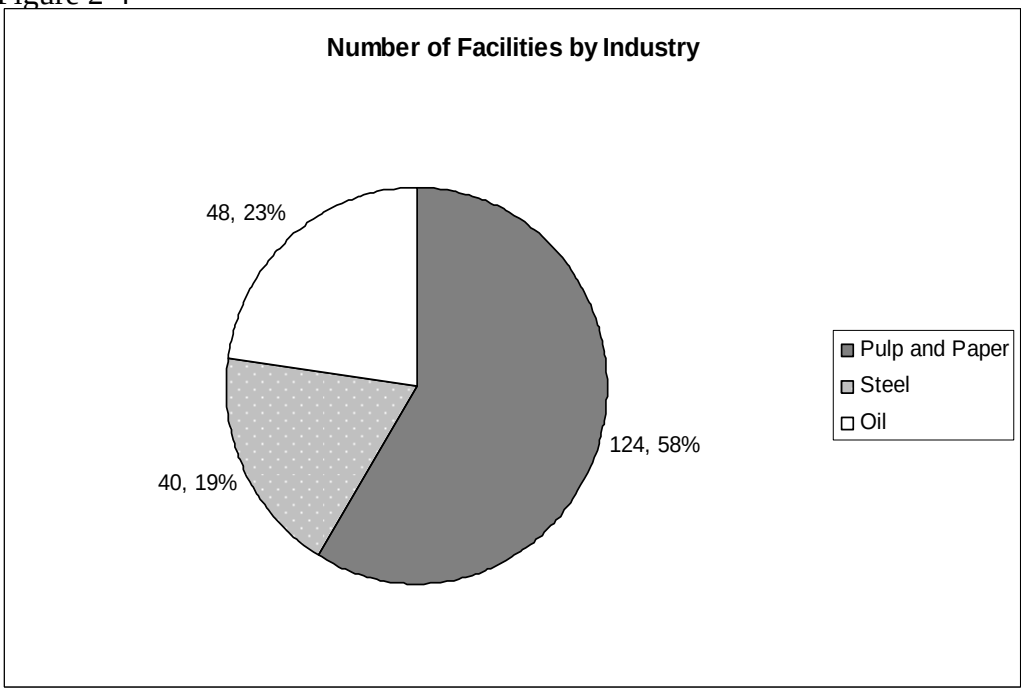
Although the sample begins with 63 companies in 1995, a total of 73 companies are included in the sample at some point in the six year period.[v] As Figure 2-3 shows, the pulp and paper companies make up the largest portion. Forty-five percent of the companies are pulp and paper; 25 percent are steel; and 30 percent are oil.

Figure 2-3



The data contain 212 facilities over the six year period. Again, Figure 2-4 demonstrates that the pulp and paper industry is the largest. Fifty-eight percent of the facilities are in the pulp and paper industry; 19 percent are steel; and 23 percent are oil.

Figure 2-4



The manufacturing process varies by industry, but each creates water pollution. The use of water in the manufacturing processes (and thus the creation of water pollution) is described in the following section.

Industry Descriptions

Pulp and Paper. The pulp and paper industries work together to produce paper. The pulping process involves breaking down raw wood into wood fiber that is used to make paper (papermaking). Specifically, pulp mills break down and separate the fibers of wood from one another and from other impurities (e.g., rags, straw, etc) using chemical, semi-chemical, or mechanical (grinders) methods. Once the wood fibers are separated they are usually bleached, combined with other additives, and mixed with water to create "slurry." Paper mills "dewater" the mixture, leaving the fibers spread on a wire conveyor that presses and heats the mixture into the final paper product. Integrated mills engage in both pulping and papermaking; other paper mills purchase pulp or recycle wastepaper to make paper (U.S. EPA, 1995c; 2000).

Both the pulp and the paper production processes use water; in fact, the pulp and paper industry is the largest industrial process water user in the U.S. The resulting wastewater can reduce water quality and/or (depending on the process) introduce toxic pollutants into the waterway. The pulping process has the greatest pollution potential through the pulping process and the bleaching stages (U.S. EPA, 1995c; 2000).

Steel. Steel production processes contain several steps that vary by the type of technology used in the mill. When the basic oxygen furnace (BOF) is used, cokemaking and ironmaking precede steelmaking. Coal is converted into "coke" in large oven batteries; the coke is burned to reduce iron; and the molten iron is melted and refined into steel in the BOF. When the electric arc furnace (EAF) is used, the primary input material is scrap steel and the coking

process is not necessary. The scrap metal is melted and refined. The later parts of the process are similar regardless of the technology initially used. The molten steel from either furnace type is formed into slabs that are rolled into finished products. During the rolling process, the steel may be reheated, cleaned, and/or coated. Fully-integrated mills (i.e., those using BOF) create coke, produce steel, and roll and finish it. Non-integrated mills do not have the necessary equipment to produce steel from coal, iron ore, or scrap metal; these mills purchase raw materials in processed form. The current sample contains both types of mills (U.S. EPA, 1995a).

The type of environmental threat varies according to the type of mill. Water is used in both the coking process and the steel finishing process, but the largest pollution threat is associated with the coking process. This wastewater is most likely to contain contaminants (U.S. EPA, 1995a).

Oil. Petroleum refining refers to the physical, thermal, and chemical separation of crude oil into distillation fractions which are then further processed into finished petroleum products. Petroleum refineries contain multiple complex operating systems. The specific operations depend on the properties of the crude oil to be refined (the composition of crude oil can vary significantly by source) and the desired products; thus, no two refineries are identical. Large volumes of water in the refining process and four types of wastewater are produced: surface water runoff, cooling water, process water, and sanitary wastewater. Water used for cooling and water used in processing operations account for significant portions of the total wastewater. Process water often comes into direct contact with oil and is usually highly contaminated; cooling water typically does not come into direct contact with oil and contains fewer contaminants. Surface water runoff can contain pollutants from spills to the surface, leaks in equipment, or any materials that may have collected in drains. After primary treatment, the

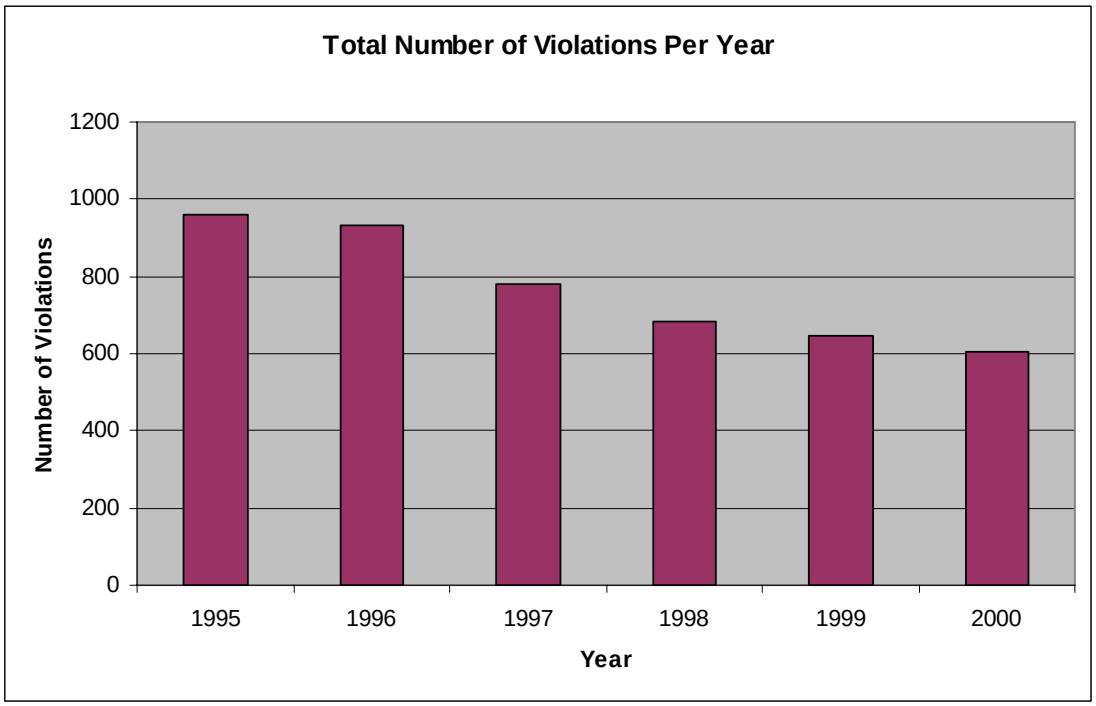
wastewater can be discharged to a publicly owned treatment works or undergo secondary treatment before being discharged directly to surface waters. The wastewater discharged directly to surface water is regulated under the National Pollution Discharge Elimination System (U.S. EPA, 1995b).

EFFLUENT/MEASUREMENT VIOLATIONS

The firms/facilities in each industry are required to keep water pollution below a certain limit. When these limits are violated, the facility can be cited for an effluent/numeric violation. The EPA provided data on all facilities operating in the industries of interest in 1995. After reducing the sample to (major) facilities that were owned by the universe of companies, the data was structured to fit our purposes. First, the data file was reduced to those monitoring locations that are associated with effluent output (reduced by 15 percent data). For instance, upstream and downstream monitoring was excluded and the focus was limited to the water the facility was directly discharging into the waterways (effluent gross value). Second, cases in which the facility was being monitored by the EPA but did not have a specific limit on pollution were excluded, as there is no real opportunity for violation.[vi] Federal regulations specify five different kinds of limits that can be placed on pollution (i.e., quantity average, quantity maximum, concentration minimum, concentration average, concentration maximum). However, all five limit types are not required for every pollutant; the regulations specify certain measurements/limits for each kind of pollutant. If every pollutant had a required numeric value for all five limit types, the data would contain 1,982,395 opportunities for violation to occur. However, the bulk of the limits required the facility to monitor and report pollution levels, but did not have enforceable limit values. Across limit types, the data contains 382,902 opportunities for violation.[vii]

With these reductions, the final sample included 4,608 violations over the six year period. The trends over time are shown in Figure 2-5. The number of total violations declines each year, from nearly 1000 violations in 1995 to 600 in 2000.

Figure 2-5



Effluent Violations by Industry

Although it has fewer companies than any other industry, the steel industry accounts for the largest percent of pollution violations. As Figure 2-6 demonstrates, steel is responsible for 41 percent of the violations; oil for 32 percent; and pulp and paper (the largest industry in the sample) for 27 percent.

Figure 2-6

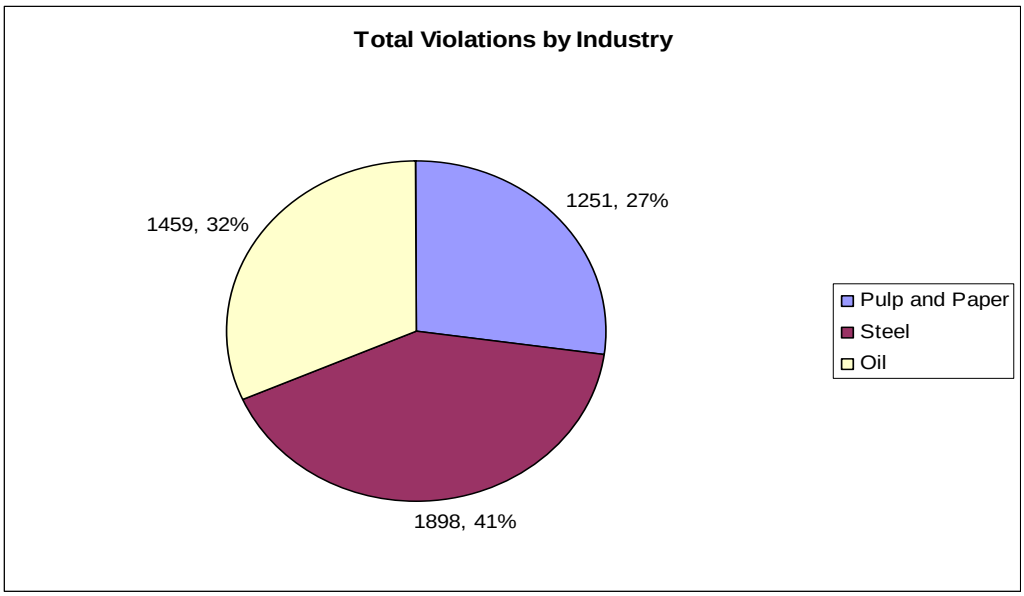


Figure 2-7 provides the specific numbers and percentage by industry for each year and shows that the industry differences are remarkably stable over time. The steel industry accounts for the largest number and percent of violations every year (followed by oil and then pulp and paper). As shown in Figure 2-8, the number of violations in each industry declines over time.

Figure 2-7

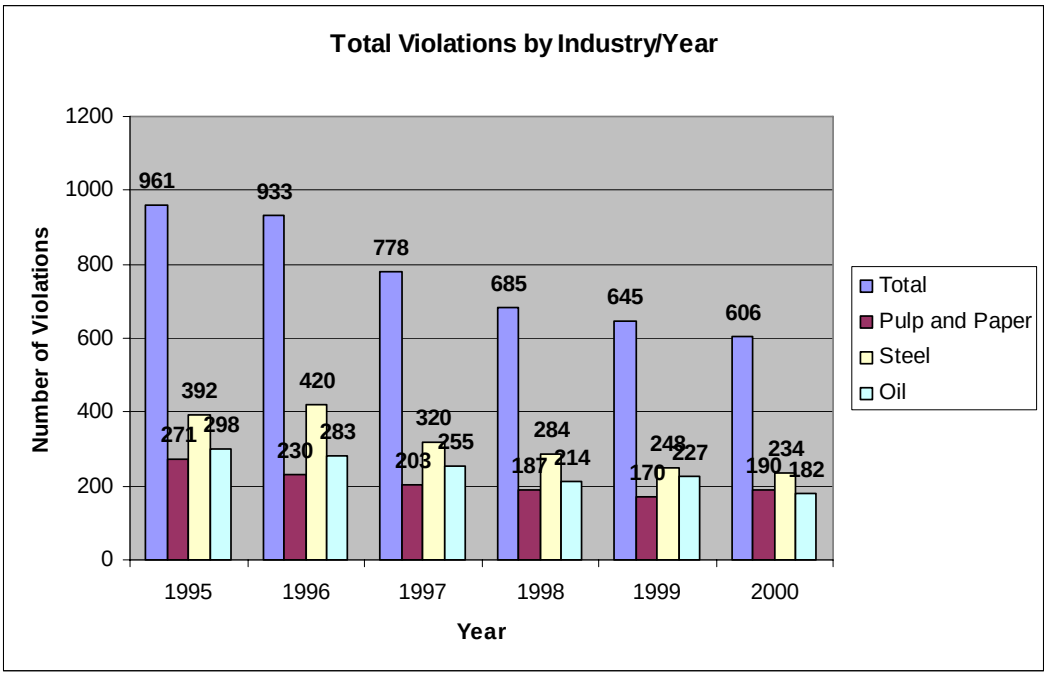
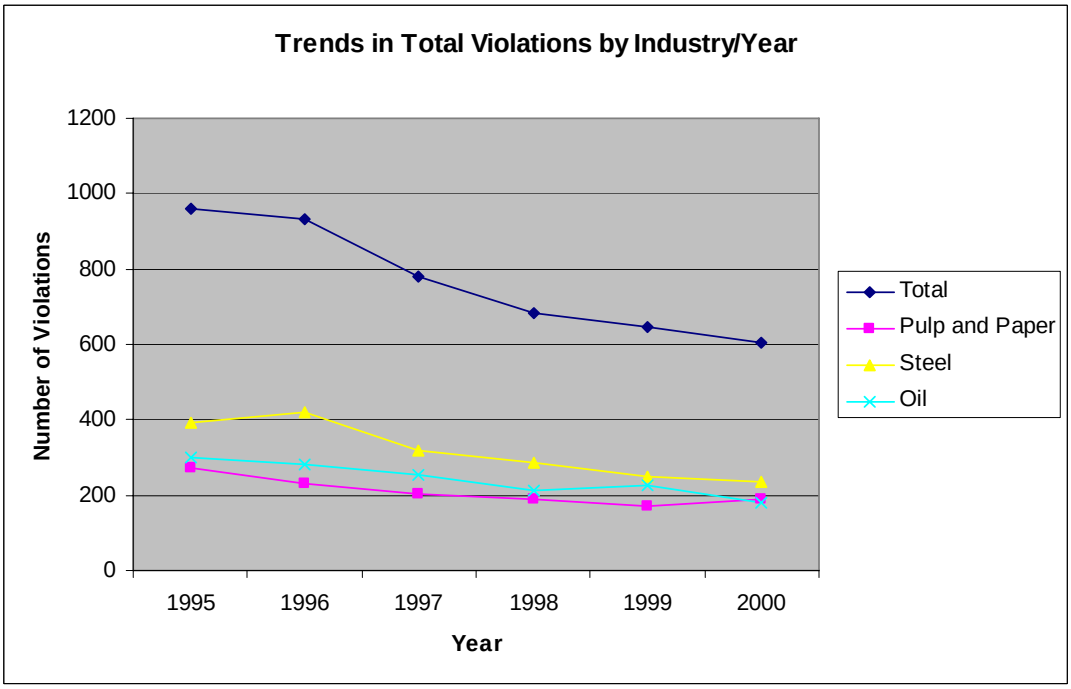


Figure 2-8



Effluent Violations for Specific Pollutants

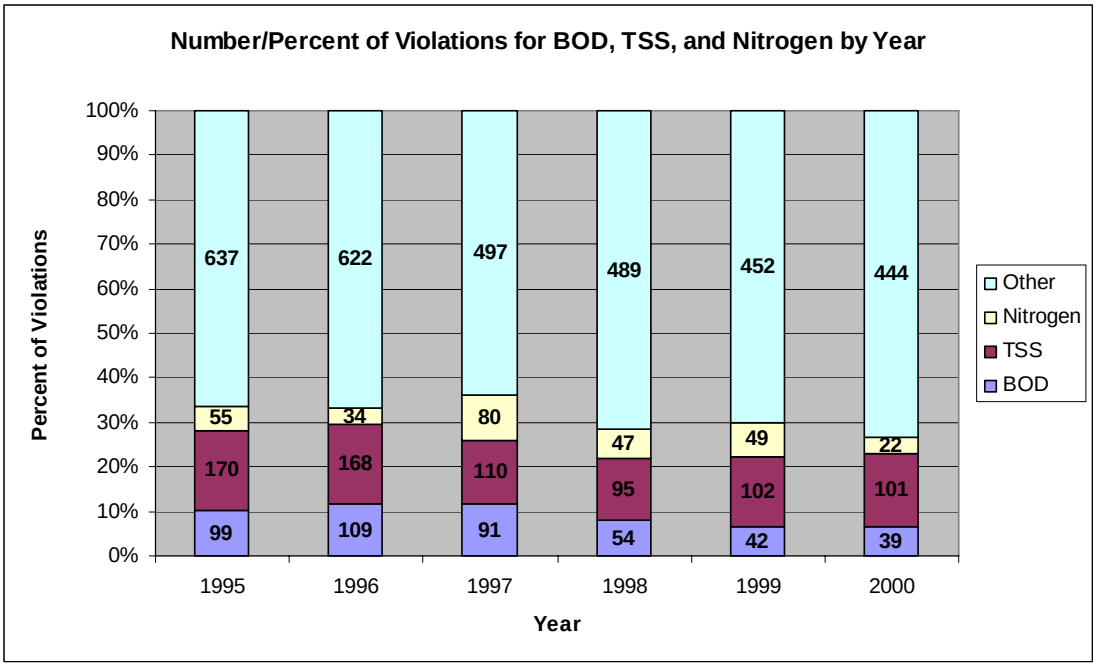
Previous studies of water violations generally limit the outcome to one type of water pollution—biochemical oxygen demand (BOD)—for one industry (pulp and paper). A few studies have also examined total suspended solids (TSS). BOD is a measure of the amount of oxygen consumed in the biological processes that break down organic matter (organic pollutant content of the water); the greater the BOD, the greater the degree of pollution. TSS is a standard measure of the particulate content of the water (Kagan, Gunningham, and Thornton, 2003). Both BOD and TSS are standard measures of water quality (Kagan et al., 2003) and all three are classified as conventional pollutants. To compare the results to the prior literature, these two pollutants are examined as separate outcome measures. Consultations with EPA staff, information in the industry sector notebooks (Environmental Protection Agency 1995a; 1995b; 1995c), and use and violation patterns in the data suggested that each pollutant is problematic across industry. The data also indicate that nitrogen is problematic for the steel industry and is therefore included as a separate measure. Nitrogen is a gas that is discharged into the water.

Figure 2-9 shows the portion of violations for each pollutant for each year. Approximately eight percent of the violations each year are BOD violations. In 1995, 10 percent of the total violations were related to BOD. By 2000 this percentage dropped to only five percent. TSS violations account for a somewhat higher percent of the total violations, approximately 16 percent each year. In 1995, 18 percent of the total violations were TSS violations. Although the percent drops a bit in 1997 and 1998 (to about 15 percent), it is fairly stable over time. In 2000, seventeen percent of the total violations were TSS violations. Nitrogen makes up a small portion of the total violations each year, approximately five percent

each year. In 1995, six percent of the total violations were nitrogen violations. In 2000, four percent of the total violations were nitrogen violations.

All three of these pollutants are classified as conventional pollutants (see definition below). There are a total of 69 different conventional pollutants in the data that account for approximately 50 percent of the violations each year. BOD, TSS, and nitrogen make up thirty to thirty five percent of the total violations each year.

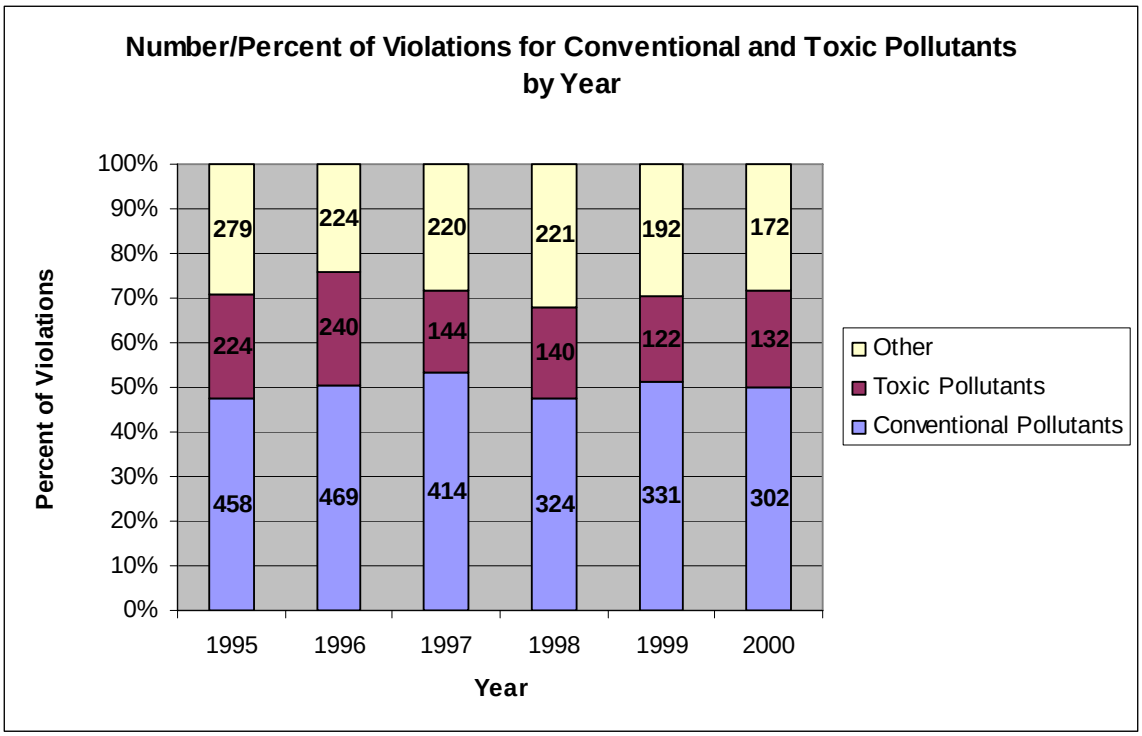
Figure 2-9



In addition to these two specific pollutants, two categories of pollutants are included to provide a more general idea of firm pollution. Conventional pollutants are common pollutants, such as organic waste, acid, bacteria, oil and grease, or heat that are well understood by scientists. These materials will naturally break down in the water (BOD and TSS are conventional pollutants). Toxic pollutants are materials that cause death, disease, or birth defects in organisms that ingest or absorb them (U.S. EPA, 2003).

As Figure 2-10 shows, these two groups of pollutants account for a substantial portion of the total violations each year. In 1995, conventional pollutants accounted for 48 percent of the violations. Twenty-three percent of the violations were for toxic pollutants. These patterns are fairly stable over time. In 2000, conventional and toxic pollutant violations respectively make up 50 and 21 percent of the total violations. Together these two groups of pollutants account for approximately 70 percent of the total violations each year.

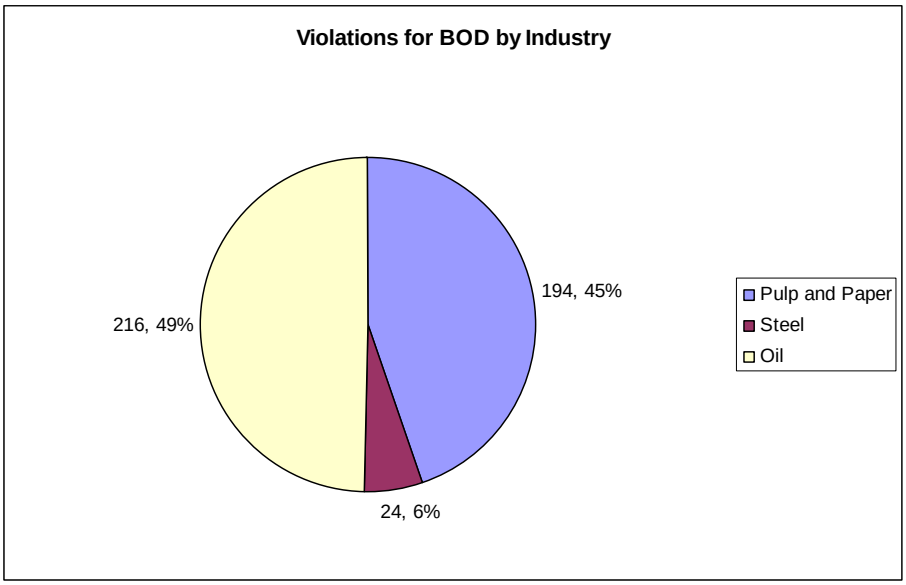
Figure 2-10



Effluent Violations for Specific Pollutants by Industry

As Figures 2-11 through 2-15 show, the industries vary in the extent to which they are responsible for different kinds of pollution violations. Figure 2-11 contains the distribution of violations for BOD. The pulp and paper and oil industries account for nearly equal portions of the BOD violations (45 and 49 percent respectively) while the steel industry accounts for a very small percent (six percent).

Figure 2-11



However, as Figure 2-12 demonstrates, the steel industry has the most violations for TSS. It accounts for 40 percent of the violations for TSS over the entire sample period, followed closely by the oil industry (35 percent). The pulp and paper industry trails somewhat, accounting for 25 percent of the TSS violations.

Figure 2-12

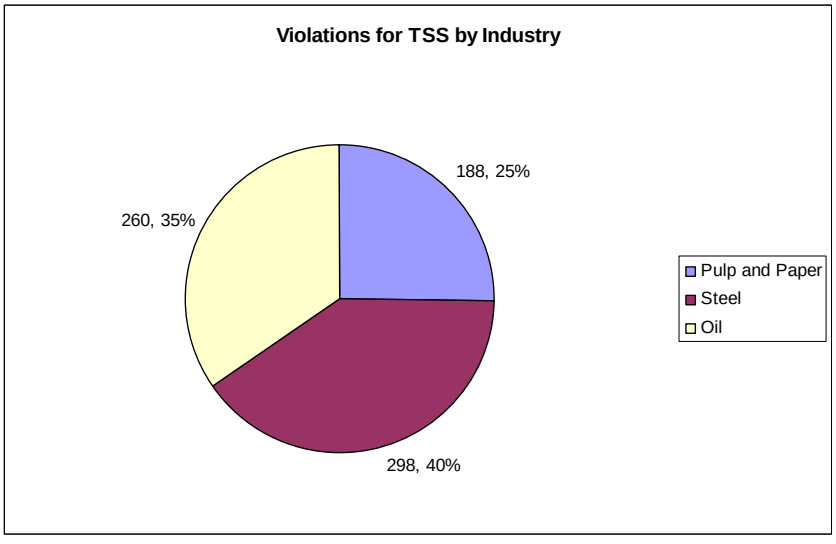
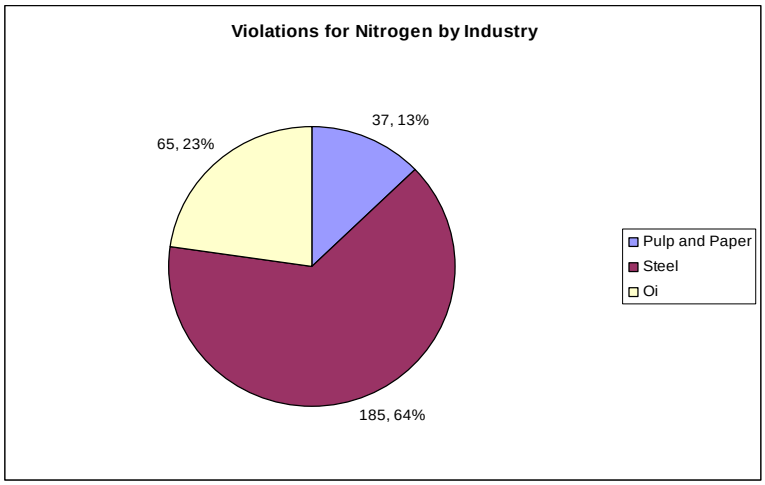


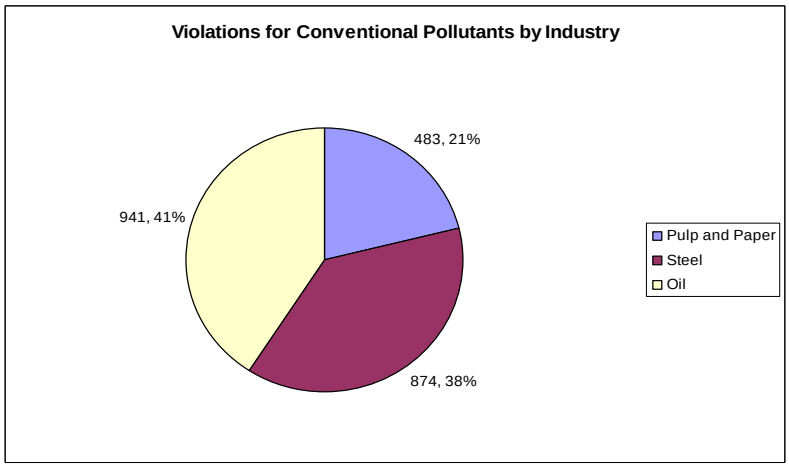
Figure 2-13 shows that the steel industry is also responsible for the bulk of the nitrogen violations, accounting for 64 percent. Although the oil industry has a sizeable number of violations (23 percent), meeting nitrogen limits does not appear to be a substantial problem for pulp and paper (13 percent of the violations).

Figure 2-13



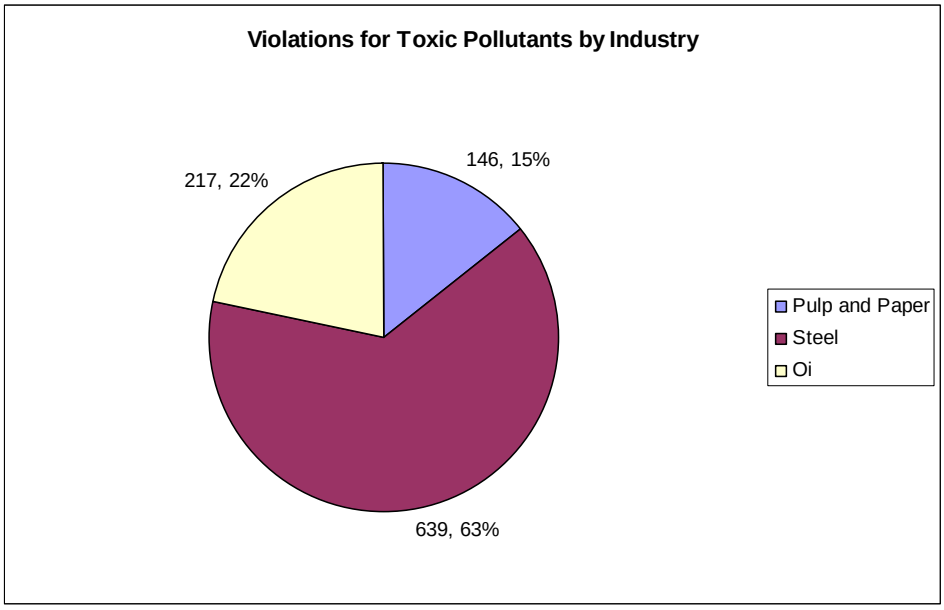
As presented in Figure 2-14, steel and oil are nearly equivalent in the percent of conventional pollutant violation—38 and 41 percent respectively. Pulp and paper is again somewhat underrepresented, with 21 percent of the violations.

Figure 2-14



In Figure 2-15, the steel industry emerges as the most likely source of toxic pollutant violations; the industry accounts for 63 percent of these violations. The oil industry follows with 22 percent of the violations and the pulp and paper industry is responsible for 15 percent.

Figure 2-15



While these numbers provide a general sense of the pattern of violations over time and across industry, it is important to construct measures that account for differences in opportunity (Simpson et al., 1993). Firms vary in size and larger firms generally are thought to have more opportunities to violate the law. Environmental compliance data are all the more complicated, as compliance is tracked at the facility-level. Firms own different numbers of facilities and thus have different levels of opportunity for violation to occur. With the current data, the dependent variable for each firm could be constructed as the number of violations divided by the number of facilities owned. However, facilities also differ in opportunity because they vary in size, production capacity, and amount of pollutants used. Simply counting the number of violations without a denominator that accounts for differences in opportunity by the number of facilities

owned and the size of facilities would be misleading. One might examine pounds released per tons of pulp and paper produced daily at the plant to account for differences in plant size (Magat and Viscusi, 1990). Unfortunately, information on these aspects of facilities that might lead to differences in opportunity is not collected by EPA. For the current analyses, the structure of the permit reporting requirements is used to account for variation in opportunity. In the following section, the construction of the violation rate is described.

Violation Rate

Although permits are given to facilities, there are lower-levels of aggregation within the facility that might provide some (albeit crude) indication of opportunity. Facilities may have one or more discharge points (e.g., pipes) that release polluted water directly into surface waters. Although one could use the number of pipes as a denominator (opportunity measure), pipes also vary in size. Thus, two facilities with five pipes each may not be equivalent. However, the data contain additional levels of (dis) aggregation within the pipes. Various measurements of polluted water discharged through the pipes must be taken; these measurements are called parameters. For example, BOD (defined above) is a common parameter/measurement. Parameters are grouped together for reporting purposes. Measurements taken from the same discharge point are grouped together and assigned a number, called a report designator (U.S. EPA, 2003). Thus, each discharge point contains multiple parameter groups/report designators and each report designator contains multiple parameters. Table 2-1 provides an example. In this hypothetical case, discharge point 001 contains two parameter groups/report designators (A and B). Parameter group A contains three parameters/measures and parameter group B contains only one.

Table 2-1

Facility	Discharge #	Report Designator	Parameter
A	001	A	BOD
A	001	A	TSS
A	001	A	pH
A	001	B	Zinc
A	002	A	BOD
A	002	A	Nitrogen
A	003	A	Oil & Grease

Multiple limits may apply to each parameter within the group—different parameters require different kinds of limits on pollution. The EPA may limit the quantity average, the quantity maximum, the concentration minimum, the concentration average, or the concentration maximum. Quantities represent total loads while concentrations are the percent of a pollutant in the water. Regulations specify the type of limits that must be assigned to each parameter, although the permit writers may add additional ones. Table 2-2 provides an example. In this hypothetical case, the BOD and TSS parameters have quantity average and quantity maximum limits. The specific limits differ for pH. For this parameter, the facility must report the concentration minimum and concentration maximum.

Table 2-2

Parameter	Quantity Average	Quantity Maximum	Concentration Minimum	Concentration Average	Concentration Maximum
BOD	204 Pounds/Day	371 Pounds/Day			
TSS	166 Pounds/Day	261 Pounds/Day			
pH			6.5 Standard Units		9.0 Standard Units

The number of parameters measured within the pipe and the number of limits that must be met provides some scale for pipes that have more or less activity. In addition, more frequent reports (usually monthly) are required for pipes that are more active. Reports may be required quarterly or only annually for less active pipes. These reporting requirements offer a crude measure of opportunity. A higher level of reporting requirements (more parameters reported and/or more frequent reporting) may indicate more activity that could produce violation (opportunity). Thus, the data were first aggregated to the facility-level to construct a count of the number of violations and the number of required reports. Facilities owned by the same firm were then combined, resulting in a firm-level measure of the number of violations per the number of reports required across all owned facilities (see Figure 2-16).[viii] Because many of the predictors of interest change on a yearly basis, the data were aggregated the data to the firm/year.

Figure 2-16

$$\text{VIOLATION RATE} = \frac{\text{Number of Violations}}{\text{Number of Reports Required}}$$

As shown in Table 2-3, the average violation rate per firm/year is very low. In any given year the average firm is in violation about two percent of the time. However, there is some

variation across firm and the maximums show that there are still firms that are in noncompliance a substantial amount of the time (as much as 75 percent)

Table 2-3

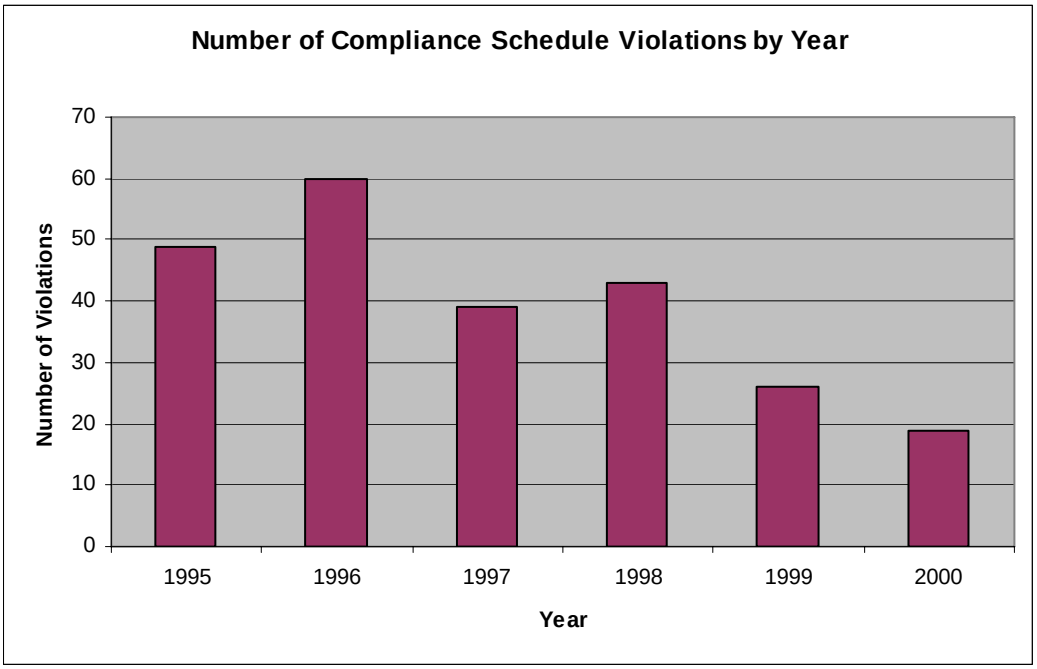
Pollutant	N (Company Years)	Min-Max	Mean	Std Dev
All	378	0% - 75%	2.2%	4.6%
Conventional Pollutants	368	0% - 24%	1.9%	2.9%
Toxic Pollutants	336	0% - 50%	2.1%	4.7%
BOD	277	0% - 60%	2.5%	6.2%
TSS	359	0% - 31%	2.2%	4.1%
Nitrogen	221	0% - 50%	2.6%	7.8%

Although the violation rate is low, pollution violations are only one type of violation that facilities may receive. In the following section, the distribution of compliance schedule violations is provided by industry and over time.

COMPLIANCE SCHEDULE VIOLATIONS

Compliance schedules are negotiated agreements between a pollution source and the EPA that specify dates and procedures by which a source will reduce emissions and, thereby, comply with a regulation. When facilities do not fulfill the agreement by the specified date they can be found in violation. There were a total of 236 compliance schedule violations over the six year period, a considerably smaller number than pollution violations. As Figure 2-17 demonstrates, the number of compliance schedule violations generally declines over time.

Figure 2-17



The industry differences are similar to those found for pollution violations. As shown in Figure 2-18, the steel and oil industries account for equal proportions of the compliance schedule violations (40 percent each) while the pulp and paper industry accounts for only 20 percent. Figure 2-19 shows that the industry breakdown is consistent across sample years.

Figure 2-18

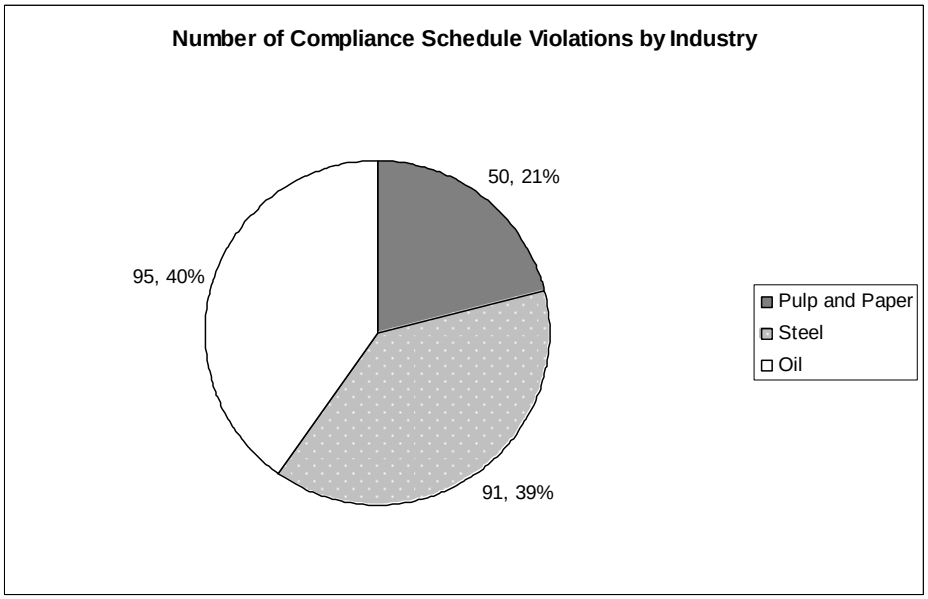
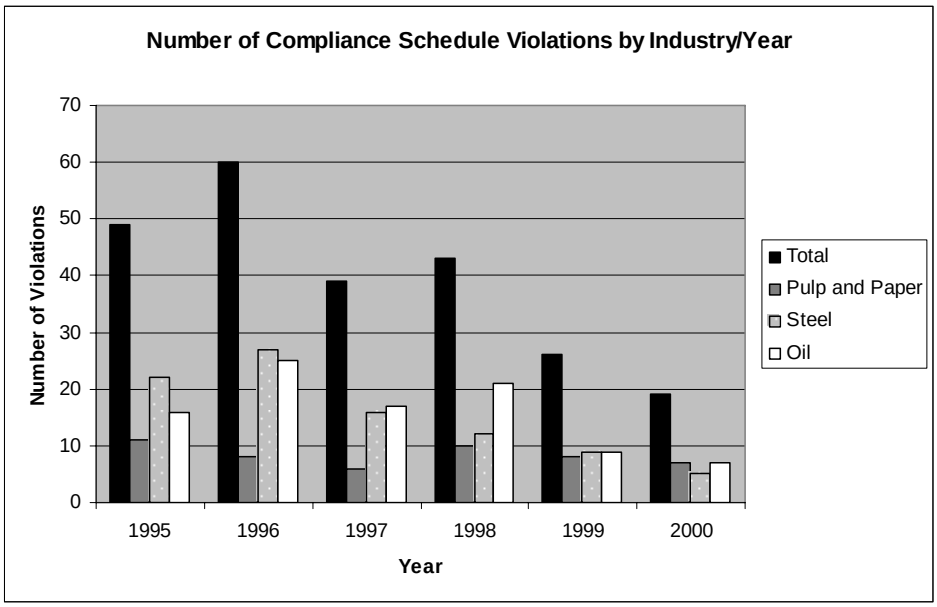


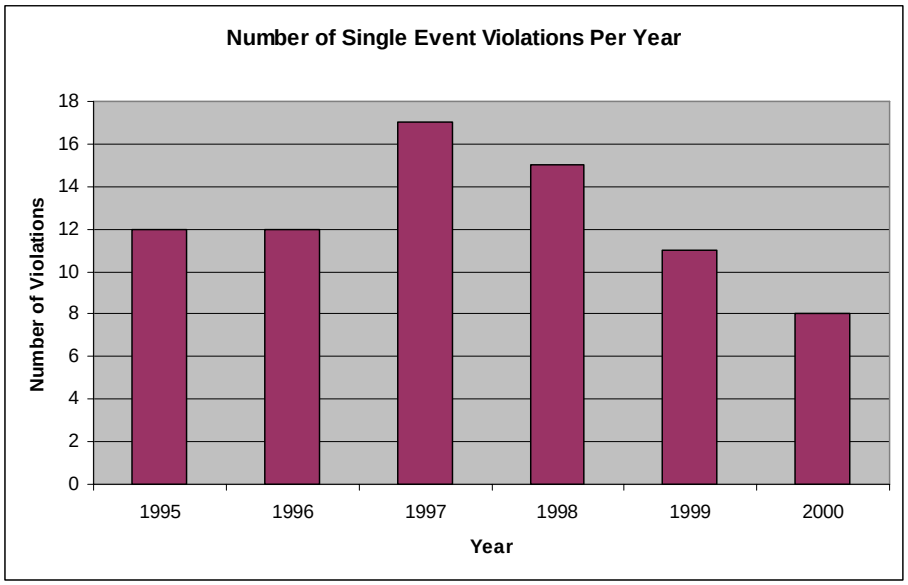
Figure 2-19



SINGLE EVENT VIOLATIONS

Single event violations are violations that cannot be otherwise classified (as compliance schedule or effluent violations). For example, a facility might receive a single event violation for an unexplained fish kill. Other examples include improper operation and maintenance and violations detected during inspection. Single event is the category of violations with the fewest incidents—seventy five across the six year period. Unlike the other violation categories, the distribution of single event violations does not follow a linear decline over time. As shown in Figure 2-20, the number of single event violations peaks in 1997.

Figure 2-20



The steel industry dominated the other types of violations. However, the pulp and paper industry accounts for nearly 70 percent of the single event violations (see Figure 2-21). The oil industry follows with 30 percent and the steel industry is responsible for only three percent of these violations.

Figure 2-21

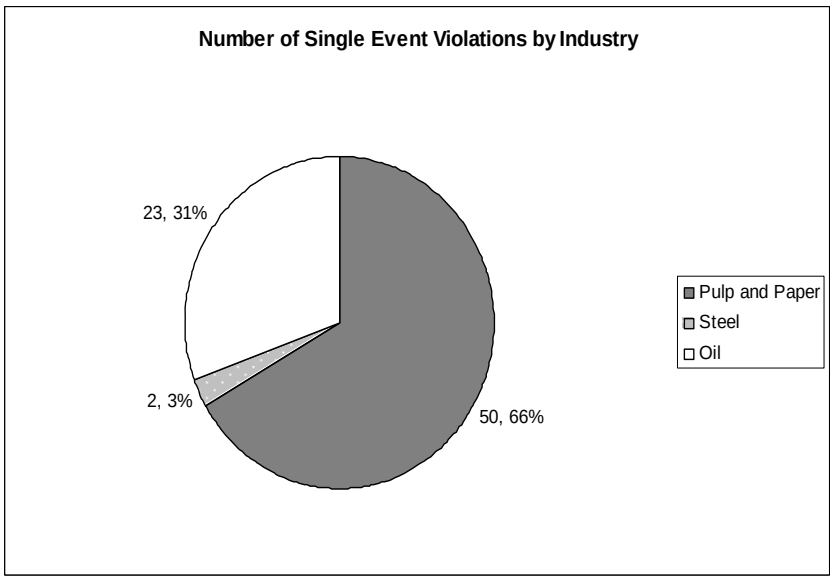
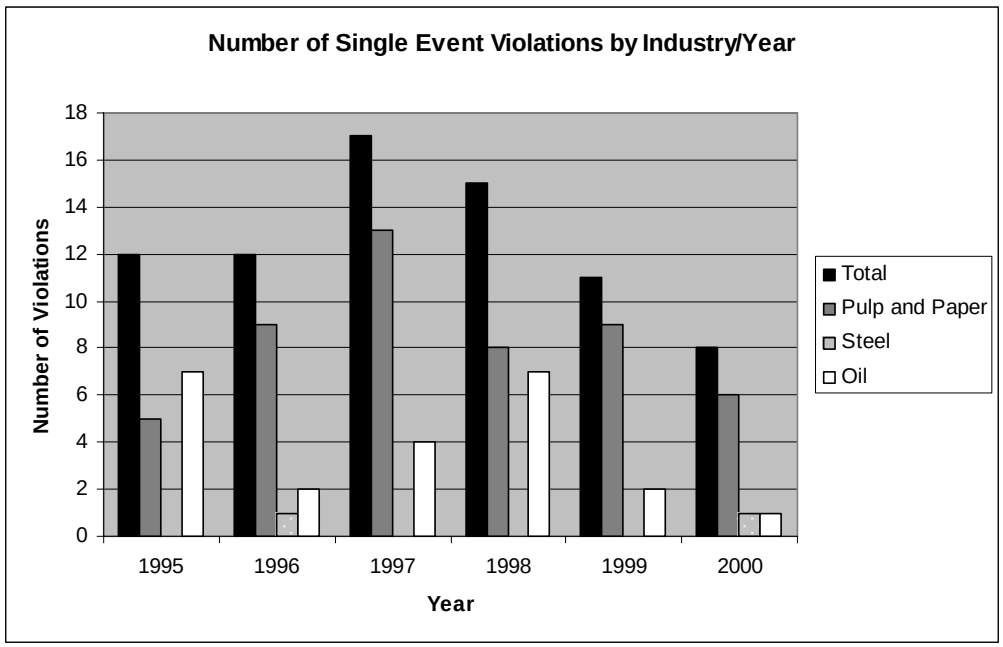


Figure 2-22 shows that these observed industry differences are fairly stable over time. The pulp and paper industry generally leads the other industries (with the exception of 1995) and the steel industry consistently has the fewest number of single event violations. The oil industry does exceed the pulp and paper industry in 1995 and 1998. However, the magnitude of the industry differences is small.

Figure 2-22



In addition to pollution, compliance schedule, and single event violations, a facility can also be in violation for incomplete or failure to submit DMR reports. In the following section the distribution of reporting violations is presented.

REPORTING VIOLATIONS

The number of opportunities for reporting violations differs from the number of opportunities for pollution violations. For example, facilities are often required to report pollution levels that have no specific numeric limit. The EPA might "add monitoring" above what regulations require without setting a numeric limit. Although there is no opportunity for a pollution violation (because there is no enforceable limit), the facility may still be in violation of reporting requirements. While these "reporting only" requirements can be determined (and coded) from the data, the number of opportunities for reporting violations is still somewhat unclear.

To create an opportunity measure, one must also know how many pieces of information are submitted in a single report. Reporting requirements are set by facility discharge point/parameter group (e.g., a facility may be required to report monthly on discharge point 1, parameter group A and annually on discharge point 1, parameter group B). Within a single discharge point, the parameters are grouped together for reporting purposes. Thus, it seems likely that discharge levels for every pollutant in Discharge Point 1, Group A (e.g., BOD, TSS, and PH) will be submitted in one DMR report. However, most facilities have multiple parameter groups within a discharge point and/or multiple discharge points. It is unclear whether these measurements would be reported on one or multiple DMRs (one versus many opportunities for violation) and this practice may vary by facility. Further, the number of opportunities would vary depending on the type of reporting violation. For late/overdue reports, the DMR would be the appropriate unit of analysis. However, facilities may also receive reporting violations if they submit a report on time but it is incomplete. Thus, single parts of the report may receive a violation.

Based on our examination of the data and the way reporting requirements are set, it seems reasonable to assume that a separate DMR report is submitted for each discharge point/parameter group. However, the patterns of flagging reporting violations (e.g., flags for significant noncompliance) do not always match the assumption. For example, the DMR report for one or two parameters might be flagged as late, but not all of the parameters within the parameter group. Because of this confusion, we do not attempt to approximate the number of opportunities for reporting violations. Each discharge point, parameter group and parameter is analyzed as though it is a separate report.

The PCS system contains several pieces of information to indicate that a reporting violation has occurred. The system includes the number of days late, a flag for the "worst violation" for a particular parameter, and a flag for significant noncompliance. The number of days late is the logical starting point for determining the number of late reporting violations. However, the system uses the DMR received date to calculate the number of days late and it is not always populated; the field is missing for 20 percent of the reports. When the received date is not entered, the PCS system defaults to zero days late. In these cases, it is impossible to tell whether the report was really on time or not with these pieces of information. However, other pieces of information provide some clues.

Out of the 78,824 instances without a DMR received date, 27,437 records have a code to indicate why there is no data. In addition, the worst violation field flags 323 records because they were incomplete, indicating that a report must have been filed at some point. Finally, the worst violation field flags 809 records because they were overdue, indicating that they were submitted and were late.

When the data are limited to the reports *with a received date*, 68 percent of the reports were on time. According to discussions with EPA staff, the EPA targets reports for late violations only when they are more than 30 days late. Approximately 27 percent of the reports were between 1 and 30 days late. Only six percent were more than 30 days late. According to the worst violation field, 1053 of these reports were incomplete.

The flag for significant noncompliance also contains information about reporting violations. However, the information on significant reporting violations is often inconsistent with the other fields. For example, there are some flags for significant reporting violations when the received date is populated and indicates that the report was one time. Across all reports (whether the DMR received date is populated or not), there are 8,492 flags for failure to receive a DMR report and 391 for non-receipt of a non-monthly average.

Using the data from the "number of days late "field (minus the 20 percent that did not have a received date), Figure 2-23 documents the number and percent of reports that were late over time. The patterns of reporting were fairly stable over time. Each year approximately 65 percent of the reports arrived on time and this increased slightly over time.[ix] Approximately 20 percent of reports were less than one month late each year and the number decreased slightly over time. The percent of "significantly late" reports (more than 30 days) was less stable. In 1995 nearly 20 percent of reports were over one month late. By 2000 this figure decreased to around five percent.

Figure 2-23: Reporting Violations over Time

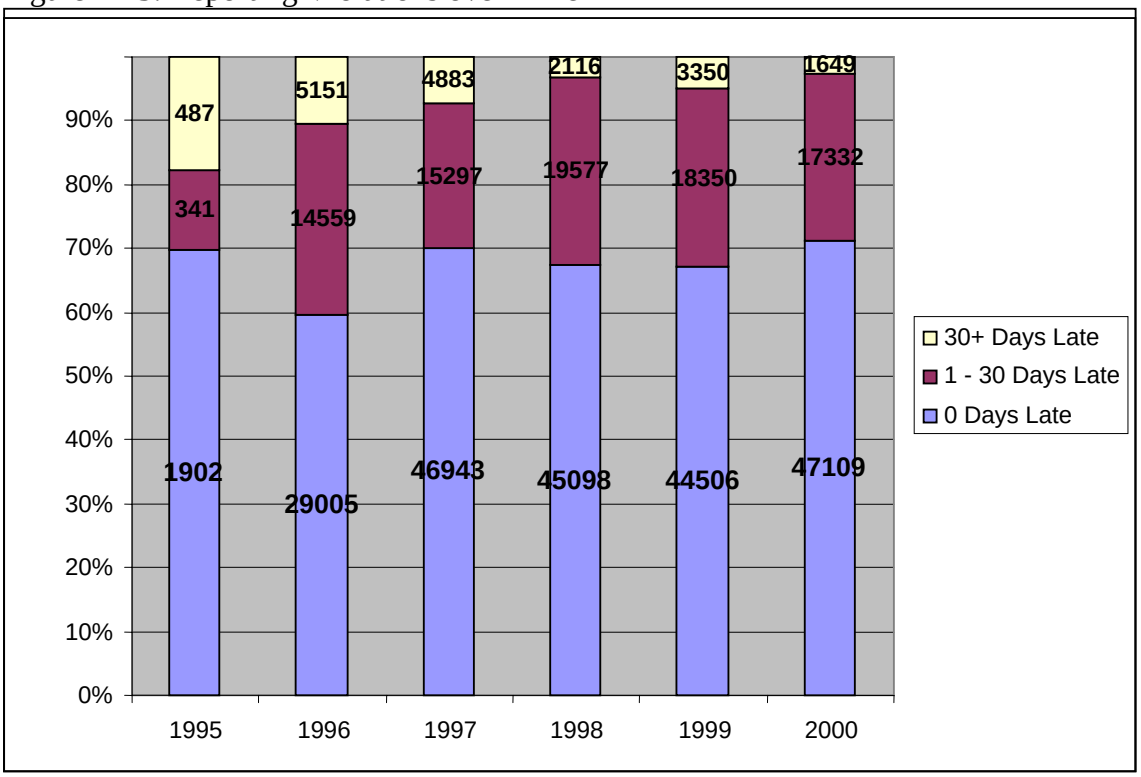
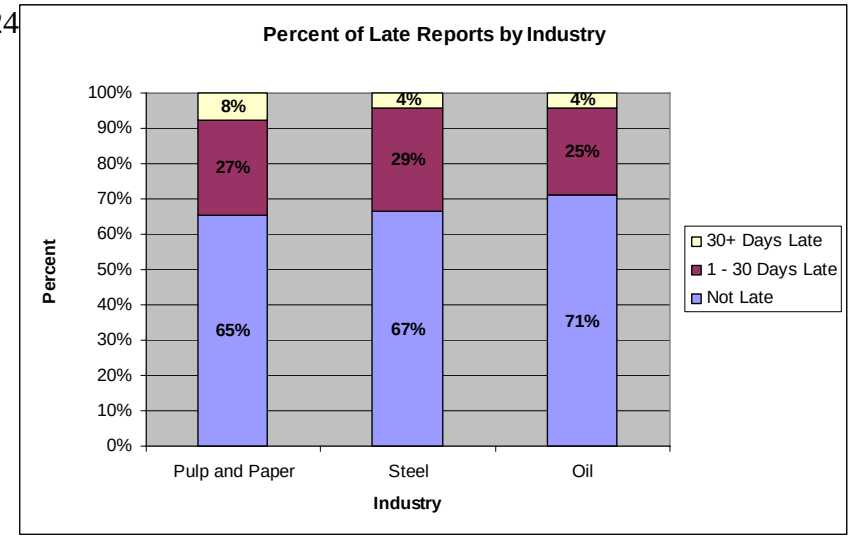


Figure 2-24 provides the number of reporting violations by industry for the records in which a received date is included (missing 20 percent). The figure shows some minor differences across industry. The pulp and paper industry has a slightly higher rate of significant reporting violations (eight percent versus four percent for oil and steel). Oil and steel have slightly higher rates of on time reports (67 and 71 percent respectively versus).

Figure 2-24



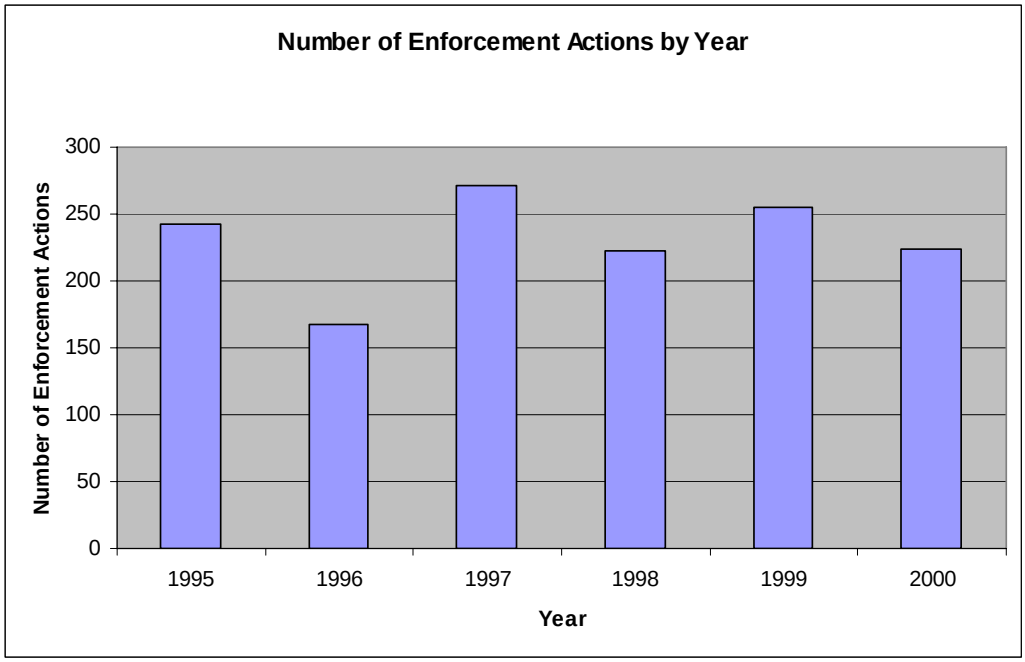
When any type of violation occurs, the EPA has the authority to issue sanctions to enforce the law. In the following section, EPA sanctions are described over time, by industry, and for specific violation types.

ENFORCEMENT DATA

The EPA conducts enforcement activities at the facility-level, although the parent company may be a defendant in court cases. There are two sources of enforcement actions in our data: 1) the enforcement file in PCS and 2) the docket (administrative and civil cases) and crimdoc (criminal) case files. It is likely that the information in these two files overlaps to some degree. For example, enforcement actions labeled "administrative orders with penalties stipulated" in the PCS data likely resulted from administrative cases in the docket file. In addition, the enforcement data in PCS may represent multiple actions for the same violation, as the EPA may escalate the severity of the enforcement action if a facility remains noncompliant. However, the data do not provide any method for tracking these links for the same violation.[x]

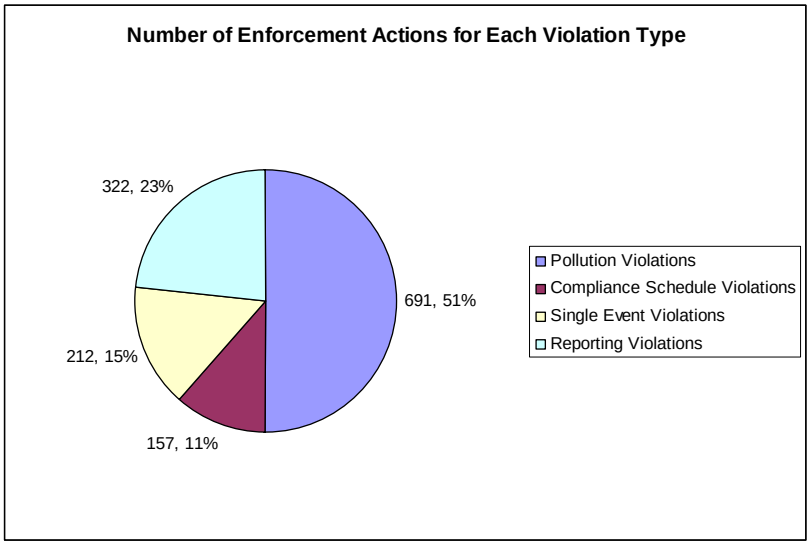
For this study, the enforcement data are also aggregated to the firm-level. In the PCS enforcement file (excluding case data), there were a total of 1382 enforcement actions over the six year period. As Figure 2-25 shows, the number of enforcement actions given varies by year. On average the EPA issued 230 enforcement actions per year, but this figure ranges from 168 to 271.

Figure 2-25



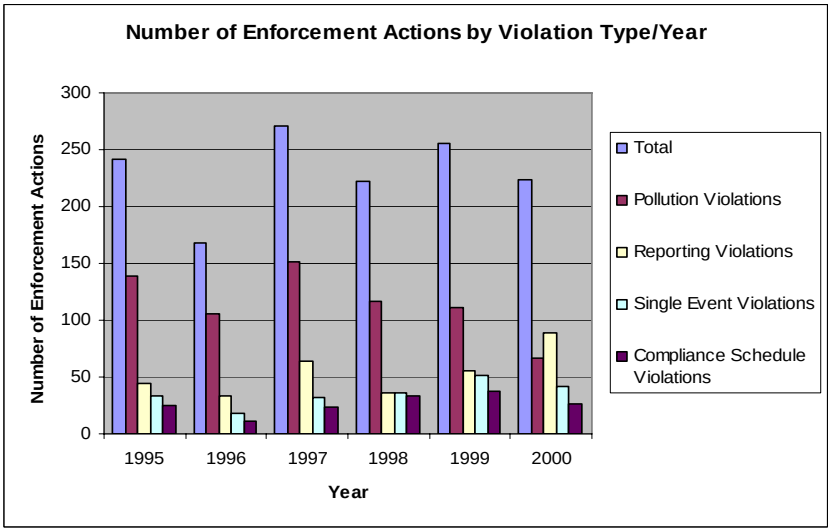
The EPA tends to focus enforcement attention on the most serious violations. Thus, as one might expect, Figure 2-26 shows that most sanctions are given for pollution violations. Half of the enforcement actions (51 percent) were in response to pollution violations. Twenty-three percent were given for reporting violations; 15 percent for single event violations; and 11 percent for compliance schedule violations.

Figure 2-26



As shown in Figure 2-27, the EPA issued sanctions for pollution violations most often over the entire sample period except for one year. The number of enforcement actions given in response to reporting violations exceeds the number given for pollution violations in 2000. The remaining distribution of enforcement actions is generally consistent over time: reporting violations receive the second highest number followed by single event violations and compliance schedule violations.

Figure 2-27



Despite industry differences in violations, Figure 2-28 shows that the number of enforcement actions is distributed fairly evenly across industry. Pulp and paper and oil received 39 and 37 percent of the violations respectively. The steel industry received somewhat less, 24 percent.

Figure 2-28

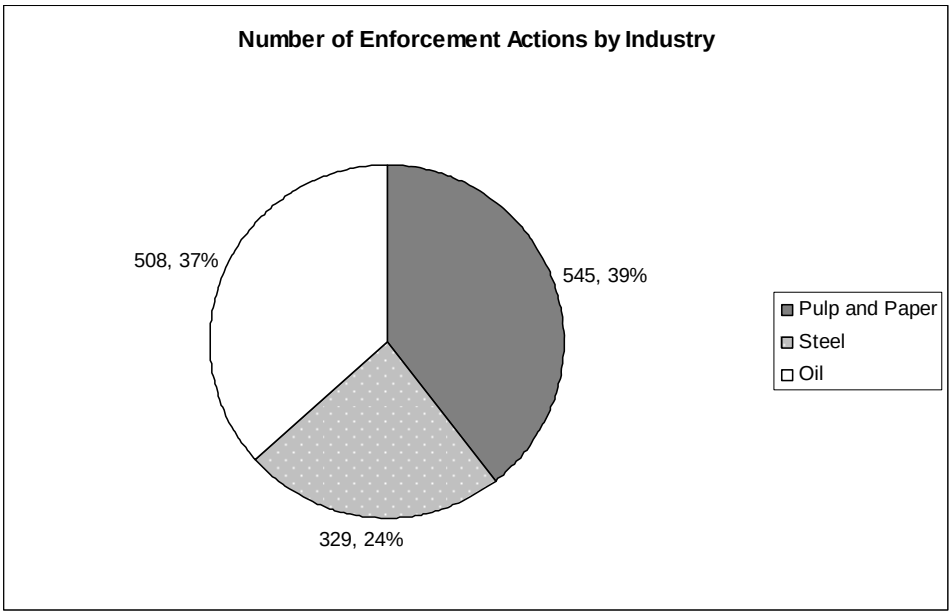
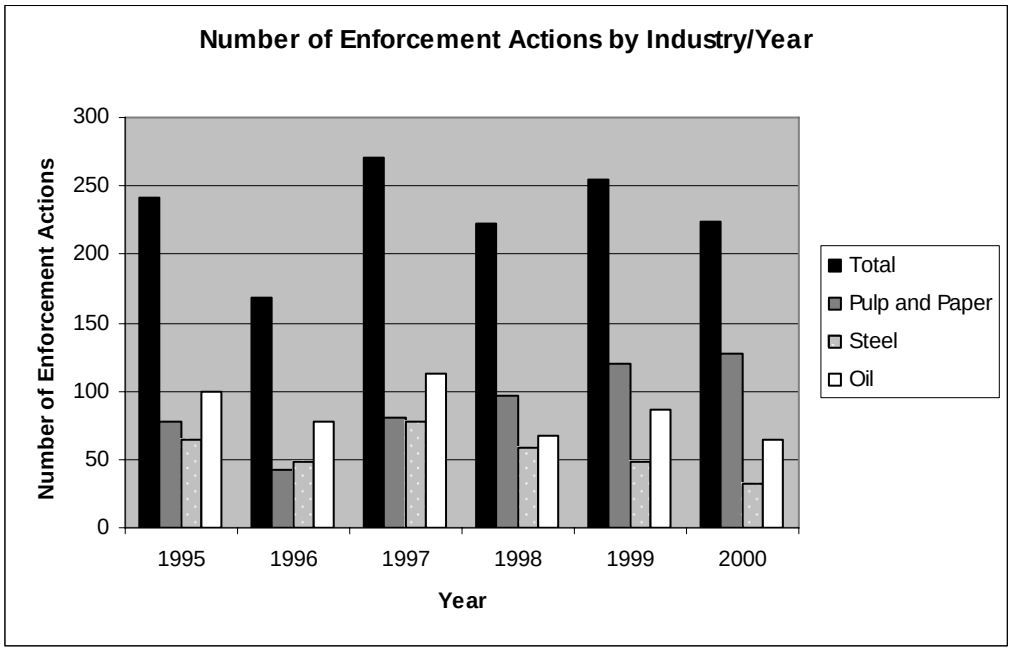


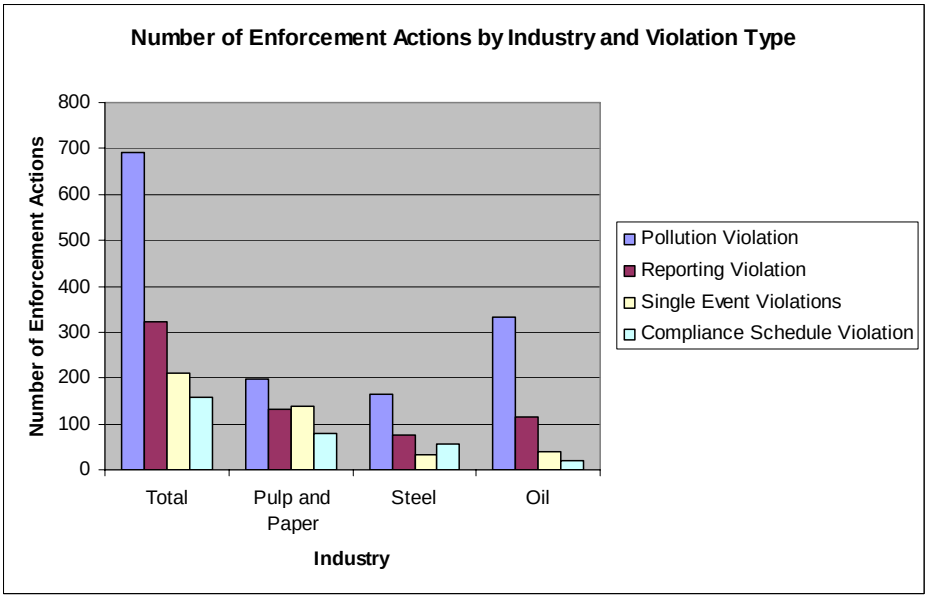
Figure 2-29 provides the industry differences in enforcement actions over time. The steel industry generally received the smallest number of enforcement actions each year (with the exception of 1996). Over time, the pulp and paper begins to account for a higher number of the enforcement actions, increasing from less than 50 in 1996 to approximately 125 in the year 2000.

Figure 2-29



As stated and demonstrated in Figure 2-30, the majority of the enforcement actions are given for pollution violations; this holds across industry.

Figure 2-30



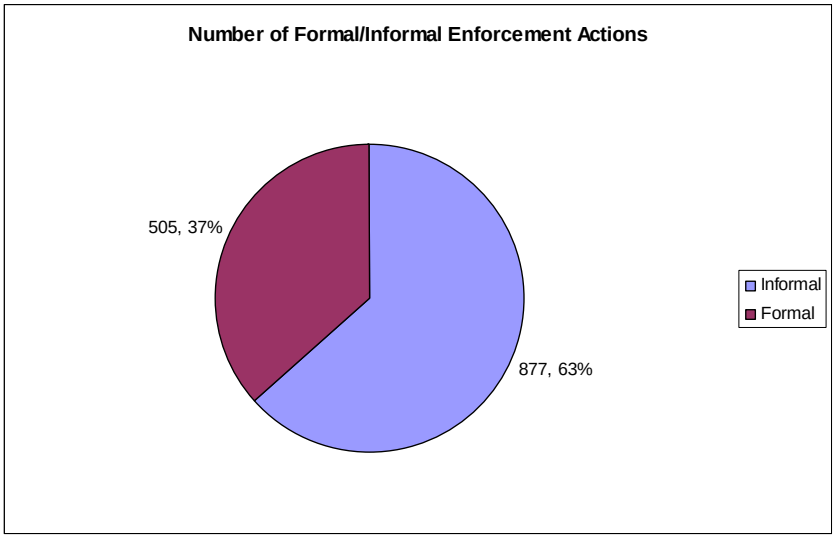
The EPA has the authority/discretion to use both formal and informal enforcement activity. The Hunter and Waterman (1996) severity scale was used to classify sanctions along a continuum from least serious (informal) to the most serious formal actions. We show in Table 2-4, the current data classified using the Hunter and Waterman scale. The scale ranges from 0 to 7, with more informal actions falling at the bottom of the scale. Informal sanctions tend to be more cooperative, as they deal with the violation outside of the formal system. Phone calls and warning letters are examples of informal sanctions. Formal sanctions, however, are more punitive. They are not designed to push the facility back into compliance, but to punish the facility for violations. Formal sanctions include enforcement conferences, administrative orders, and formal penalties (as well as court cases, discussed below).

Table 2-4

Action	Frequency	Percent
(0) Comment, Permit Mod Request	197	14.25%
(1) Phone Call, Meeting with Permittee, Enforcement Notice Letter	88	6.37%
(2) Final Order of the Board, Letter of Violation-Effluent, Section 308 Letter, Warning Letter, Notice of Violation (multiple types—letter), Notice of Noncompliance (multiple types—letter)	592	42.84%
(3) Administrative Action Planned, Administrative Action Pending, Under Review by State Agency, Under Enforcement Review	50	3.62%
(4) Enforcement Conference, Enforcement Conference Letter	12	0.87%
(5) AO Stipulated Penalty, Amended Administrative Order, 308 Administrative Order, Administrative Order, Administrative Consent Order, Jud Action Planned, Referred to Higher Level Review, Notice of Potential Penalty, Compliance Inspection Compliance Order	276	19.97%
(6) Jud Action Pending, Consent Decree, Stipulation Court Order, Stipulation Court Order, Stipulation Agreement, Order of Revocation, Emergency Order (Governor)	65	3.86%
(7) NPDES Penalty AO Category I, NPDES Penalty AO Category II, Penalty AO Issued by State	102	7.38%

For further analysis, the 7-part scale was collapsed into formal and informal actions. As shown in Figure 2-31, the majority of the enforcement actions (63 percent) were informal in nature.

Figure 2-31



This trend continues and even grows over time. Although not perfectly linear, generally the EPA has increased its use of informal sanctions over time (see Figure 2-32)—at least with this sample of companies. In 1995, 52 percent of the enforcement actions were informal; this number increased to 75 percent by the year 2000. Figure 2-32 provides the specific numbers and Figure 2-33 provides a visual picture of the trend.

Figure 2-32

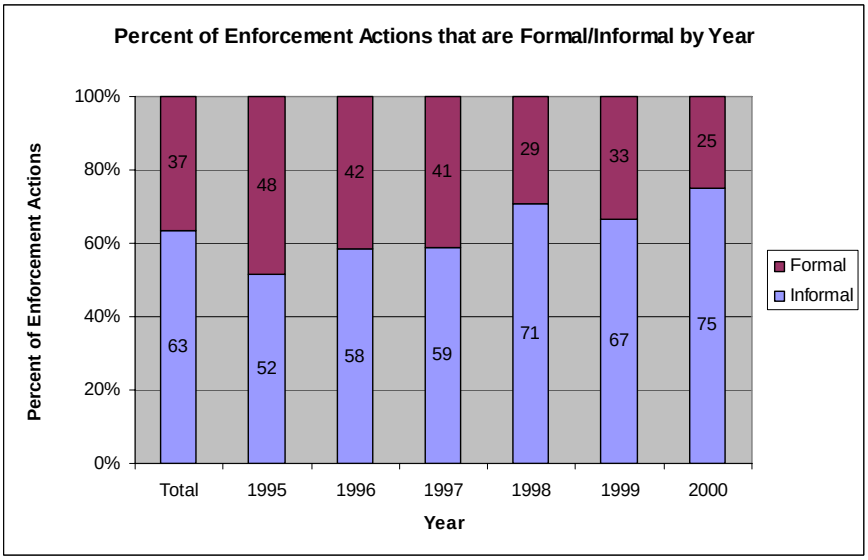
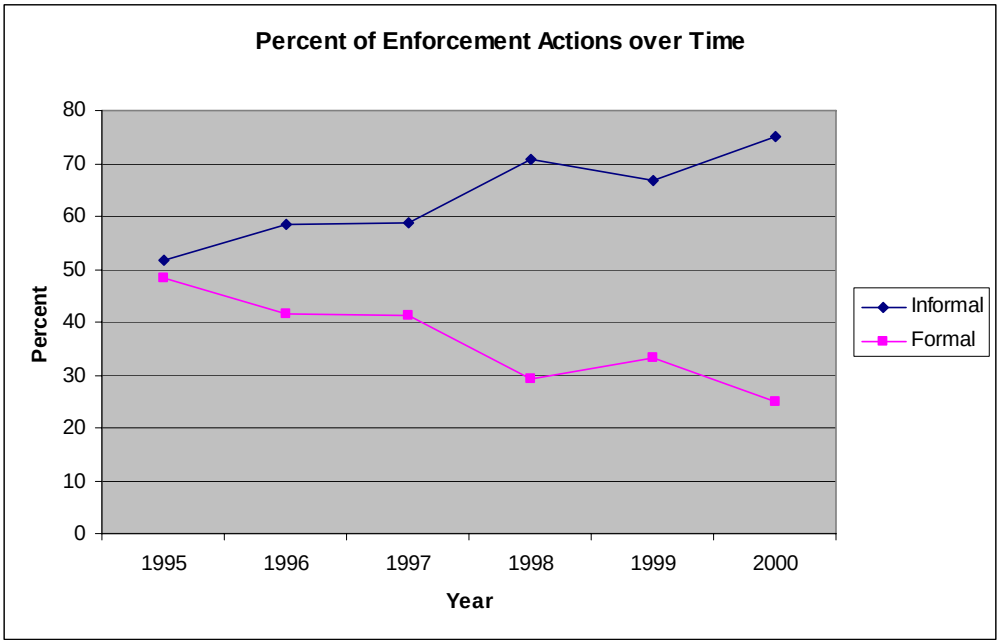
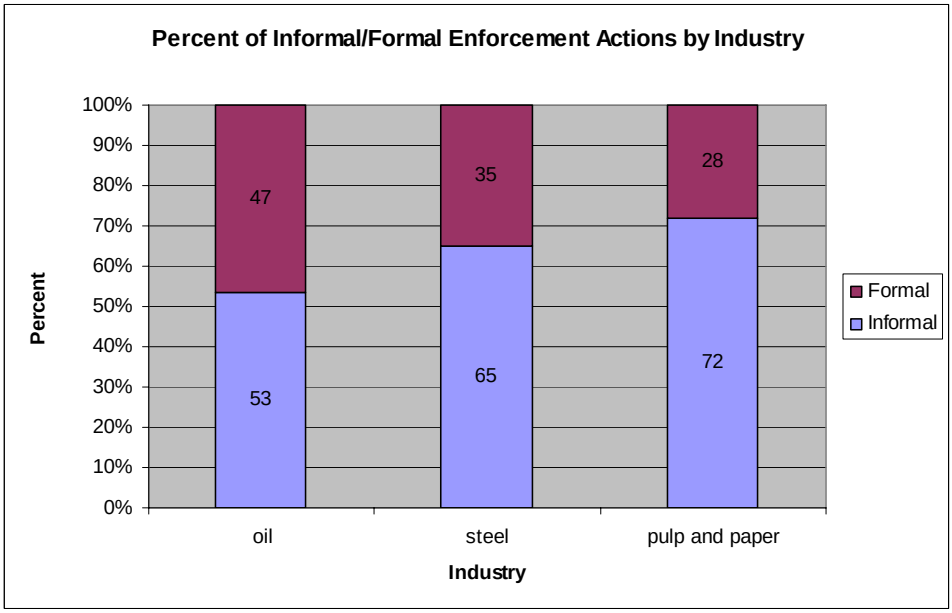


Figure 2-33



Next, we break these data down by industry (shown in Figure 2-34). It is clear that the EPA relies on informal sanctions across all three industries, although the oil industry receives somewhat fewer informal actions than the steel or pulp and paper (53 percent versus 65 and 72 percent respectively).

Figure 2-34



Tables 2-5 through 2-8 show the range of enforcement actions along this scale for each violation type. The patterns are easier to discern when the categories are collapsed into informal/formal sanctions issued for each violation types in Figure 2-35. In these enforcement data (from PCS), the number/percent of informal enforcement actions is greater than the number/percent of formal enforcement actions for each violation type. However, the difference varies by the type of violation. The percentage of informal enforcement actions is smallest for pollution violations (53 percent), followed by single event violations (59 percent), compliance schedule violations (61 percent), and reporting violations (90 percent).

Table 2-5: Sanctions for Pollution Violations

Action	Frequency	Percent
(0) Comment, Permit Mod Request	54	7.81
(1) Phone Call, Meeting with Permittee, Enforcement Notice Letter	13	1.88
(2) Final Order of the Board, Letter of Violation-Effluent, Section 308 Letter, Warning Letter, Notice of Violation (multiple types—letter), Notice of Noncompliance (multiple types—letter)	299	43.27
(3) Administrative Action Planned, Administrative Action Pending, Under Review by State Agency, Under Enforcement Review	17	2.46
(4) Enforcement Conference, Enforcement Conference Letter	5	0.72
(5) AO Stipulated Penalty, Amended Administrative Order, 308 Administrative Order, Administrative Order, Administrative Consent Order, Jud Action Planned, Referred to Higher Level Review, Notice of Potential Penalty, Compliance Inspection Compliance Order	196	28.36
(6) Jud Action Pending, Consent Decree, Stipulation Court Order, Stipulation Court Order, Stipulation Agreement, Order of Revocation, Emergency Order (Governor)	23	3.33
(7) NPDES Penalty AO Category I, NPDES Penalty AO Category II, Penalty AO Issued by State	84	12.16

Table 2-6: Sanctions for Compliance Schedule Violations

Action	Frequency	Percent
(0) Comment, Permit Mod Request	48	30.57
(1) Phone Call, Meeting with Permittee, Enforcement Notice Letter	17	10.83
(2) Final Order of the Board, Letter of Violation-Effluent, Section 308 Letter, Warning Letter, Notice of Violation (multiple types—letter), Notice of Noncompliance (multiple types—letter)	31	19.75
(3) Administrative Action Planned, Administrative Action Pending, Under Review by State Agency, Under Enforcement Review	15	9.55
(4) Enforcement Conference, Enforcement Conference Letter	1	0.64
(5) AO Stipulated Penalty, Amended Administrative Order, 308 Administrative Order, Administrative Order, Administrative Consent Order, Jud Action Planned, Referred to Higher Level Review, Notice of Potential Penalty, Compliance Inspection Compliance Order	19	12.11
(6) Jud Action Pending, Consent Decree, Stipulation Court Order, Stipulation Court Order, Stipulation Agreement, Order of Revocation, Emergency Order (Governor)	22	14.01
(7) NPDES Penalty AO Category I, NPDES Penalty AO Category II, Penalty AO Issued by State	4	2.55

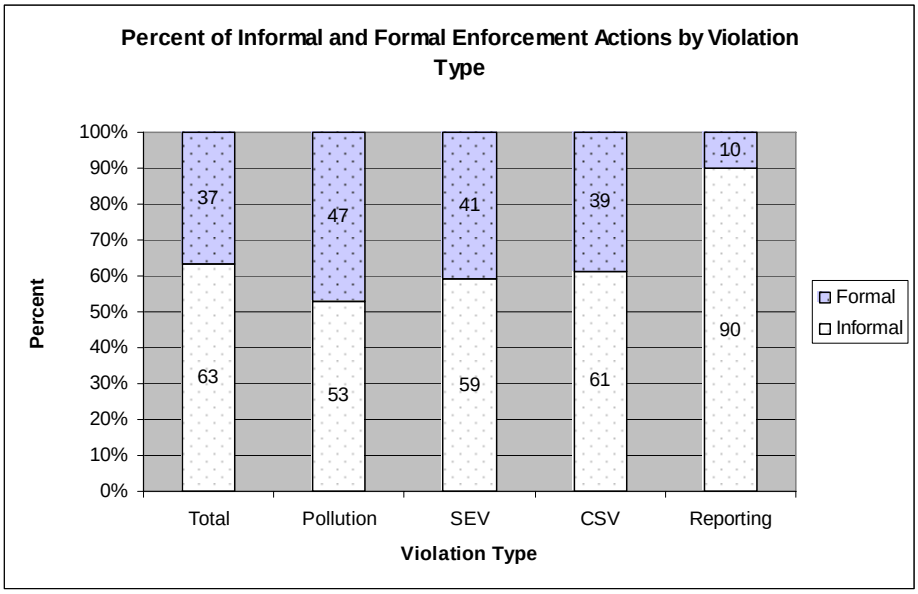
Table 2-7: Sanctions for Single Event Violations

Action	Frequency	Percent
(0)		
Comment, Permit Mod Request	43	20.28
(1)		
Phone Call, Meeting with Permittee, Enforcement Notice Letter	9	4.25
(2)		
Final Order of the Board, Letter of Violation-Effluent, Section 308 Letter, Warning Letter, Notice of Violation (multiple types—letter), Notice of Noncompliance (multiple types—letter)	73	34.43
(3)		
Administrative Action Planned, Administrative Action Pending, Under Review by State Agency, Under Enforcement Review	8	3.77
(4)		
Enforcement Conference, Enforcement Conference Letter	4	1.89
(5)		
AO Stipulated Penalty, Amended Administrative Order, 308 Administrative Order, Administrative Order, Administrative Consent Order, Jud Action Planned, Referred to Higher Level Review, Notice of Potential Penalty, Compliance Inspection Compliance Order	42	19.81
(6)		
Jud Action Pending, Consent Decree, Stipulation Court Order, Stipulation Court Order, Stipulation Agreement, Order of Revocation, Emergency Order (Governor)	19	8.96
(7)		
NPDES Penalty AO Category I, NPDES Penalty AO Category II, Penalty AO Issued by State	14	6.60

Table 2-8: Sanctions for Reporting Violations

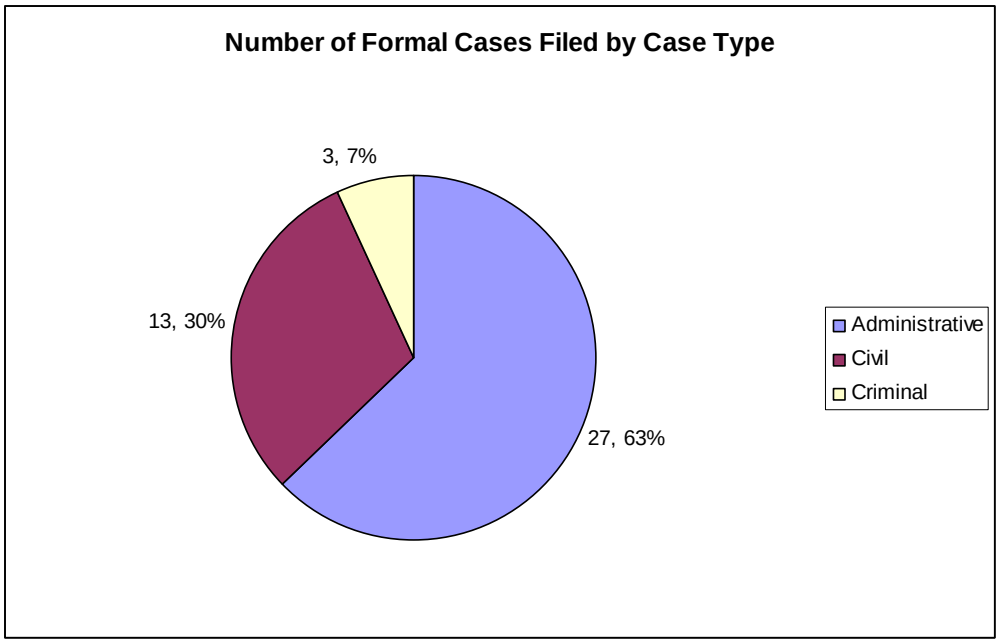
Action	Frequency	Percent
(0) Comment, Permit Mod Request	52	16.15
(1) Phone Call, Meeting with Permittee, Enforcement Notice Letter	49	15.22
(2) Final Order of the Board, Letter of Violation-Effluent, Section 308 Letter, Warning Letter, Notice of Violation (multiple types—letter), Notice of Noncompliance (multiple types—letter)	189	58.70
(3) Administrative Action Planned, Administrative Action Pending, Under Review by State Agency, Under Enforcement Review	10	3.11
(4) Enforcement Conference, Enforcement Conference Letter	2	0.62
(5) AO Stipulated Penalty, Amended Administrative Order, 308 Administrative Order, Administrative Order, Administrative Consent Order, Jud Action Planned, Referred to Higher Level Review, Notice of Potential Penalty, Compliance Inspection Compliance Order	19	5.90
(6) Jud Action Pending, Consent Decree, Stipulation Court Order, Stipulation Court Order, Stipulation Agreement, Order of Revocation, Emergency Order (Governor)	1	0.31
(7) NPDES Penalty AO Category I, NPDES Penalty AO Category II, Penalty AO Issued by State	0	0.00

Figure 2-35



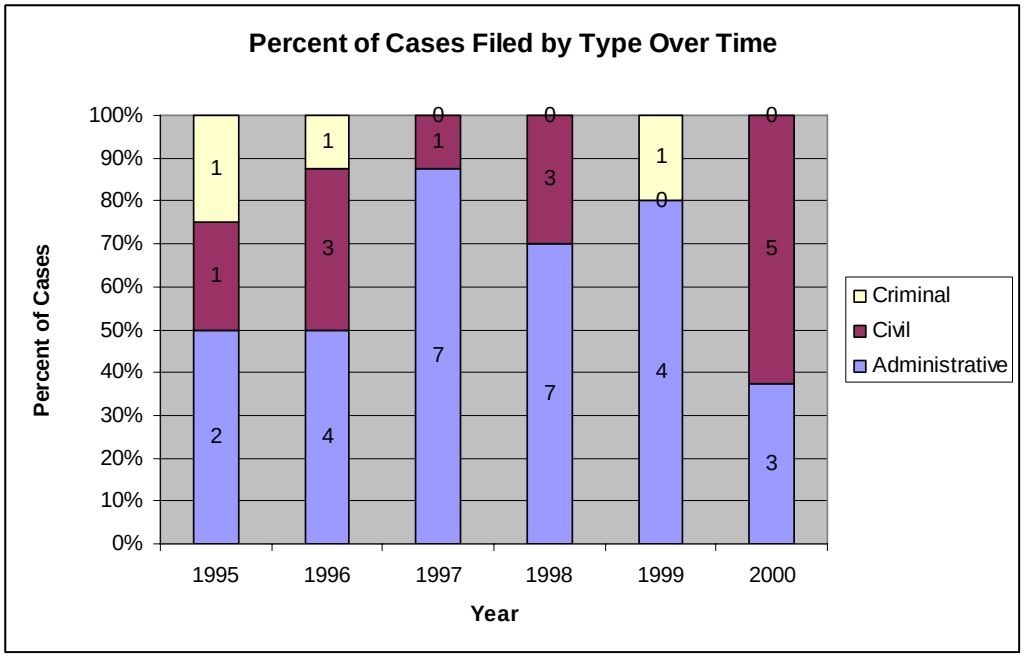
In addition to issues warning letters and phone calls, the EPA has several options for pursuing violators through the court systems. Under regulatory law, the EPA may handle the case internally. These are administrative (civil) cases. The EPA may also refer cases to the Department of Justice (DOJ) for external civil (judicial) or criminal prosecution. Figure 2-36 depicts the number of cases filed against the firms in the sample for violations of the Clean Water Act. As this figure reveals, formal enforcement options are not used very often. Only 43 cases (civil, administrative, and criminal) were filed during these six years. Administrative cases are the most common type of case, representing 63 percent of the cases filed during the sample period. Thirty percent of the cases were civil (DOJ) and only seven percent were filed for criminal prosecution through the DOJ.

Figure 2-36



Over time, with the exception of the year 2000, administrative cases were the most common type of case filed in every sample year (Figure 2-37). Again, in each year the number of cases filed (of any type) is small.

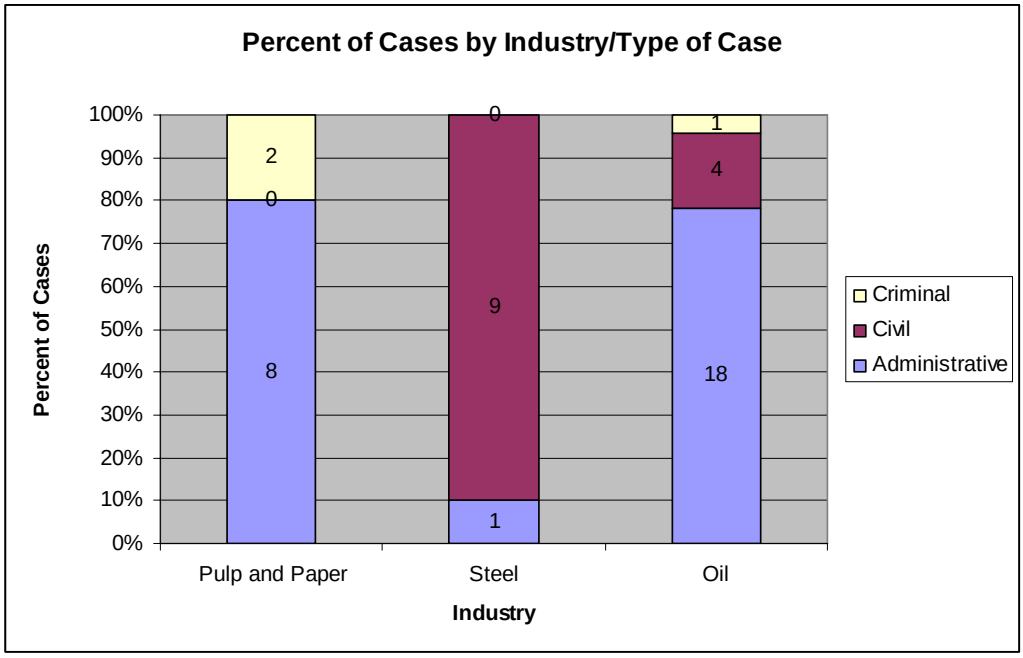
Figure 2-37



As Figure 2-38 demonstrates, there is some variability in formal case processing by industry. The oil industry is more likely to be formally sanctioned by the EPA, accounting for 78 percent of the cases filed. The pulp and paper and oil industries are more likely to have cases handled administratively (internally) than the steel industry. Firms in the steel industry cases are more often prosecuted by the DOJ (civilly). Specifically, 80 and 78 percent of the cases filed in pulp and paper and oil (respectively) are handled administratively while only 10 percent are handled administratively in the steel industry. Ninety percent of the cases in the steel industry are civil (DOJ) compared to zero in pulp and paper and four percent in the oil industry. The industry differences are likely due to violation patterns and EPA sanctioning practices. The EPA

tends to sanction effluent violations more seriously and the steel industry has a higher number of effluent violations for several pollutant types. Thus, the steel industry is probably referred for more serious prosecution.

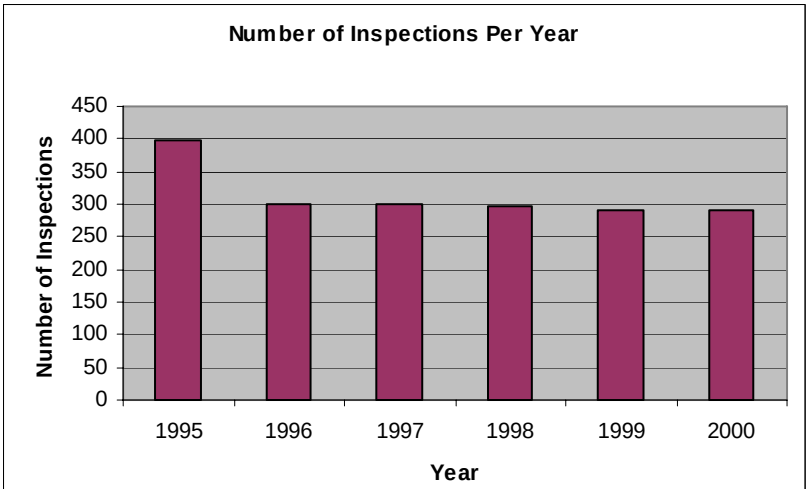
Figure 2-38



INSPECTIONS

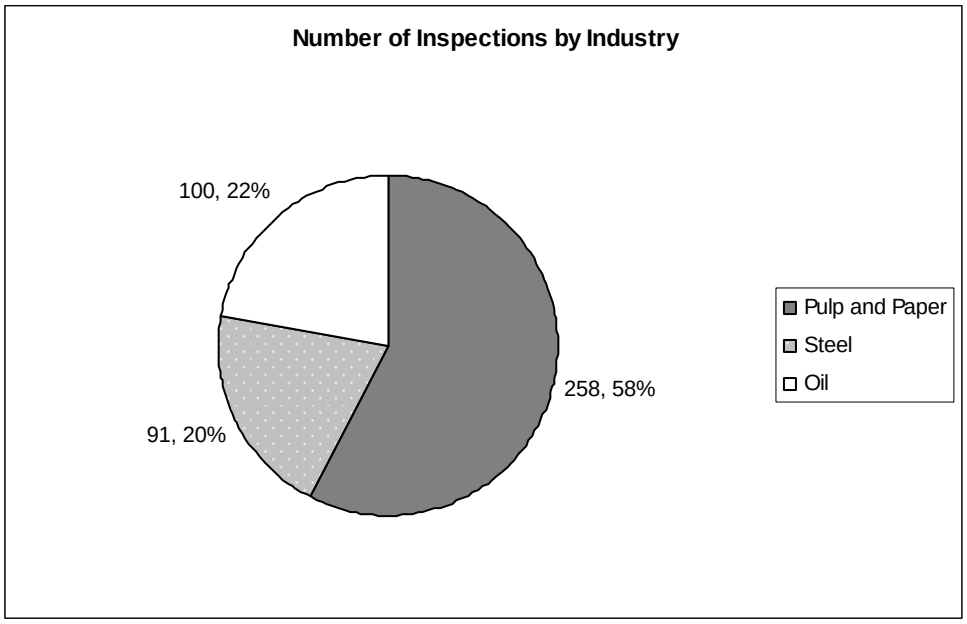
In addition to sanctioning capabilities, the EPA has the authority to inspect facilities to monitor compliance. In this next section, we describe the patterns of EPA inspections. As shown in Figure 2-39, the EPA conducted approximately 300 inspections of the sample facilities each year. The number of inspections was higher in 1995. Approximately 400 inspections were conducted in that year.

Figure 2-39



In Figure 2-40, we present the number of inspections conducted in each industry. The facilities in the pulp and paper industry were inspected most often and accounted for 50 percent of the inspections. This is not surprising given that the pulp and paper industry has more facilities in these data than steel or oil. The steel facilities were inspection second most often and account for 30 percent of the inspections. The oil facilities accounted for 20 percent of the inspections.

Figure 2-40



The EPA can conduct several different kinds of inspections. The compliance evaluation inspection (CEI) is the most common type of inspection (38 percent). It is a non-sampling inspection but includes record reviews in addition to visual observations and evaluations. The Compliance Sampling Inspection (CSI) is the second most common (26 percent). It involves actual sampling. Samples are taken by the inspector and then compared to the samples required

to be taken by the facility. The results are compared to verify accuracy, determine the water quality, and (sometimes) to collect evidence for enforcement proceedings. Reconnaissance inspections (RI) are the third most common (24 percent). The RI is a visual inspection of the treatment facility, effluents, and receiving waters. It is a preliminary inspection designed to provide an overview of the facility's compliance program.

FIRM CHARACTERISTICS

Because one of the main research goals of this study was to examine the relationships between firm characteristics, violations, and enforcement, we collected financial and other information about the firms in our sample that would allow us to empirically assess these relationships. In the following section we describe the firm-level information we collected.

Conceptually, *firm performance pressure* has been linked to corporate crime and, in some studies, low profits and slow rates of growth seem to increase offending. When profit margins are declining or firms are failing to reach performance goals, managers and employees may resort to criminal practices to attain performance goals (Shover and Bryant, 1993). Another firm characteristic linked to offending is *organizational complexity*. Complexity refers to the degree of spread and segmentation in an organization's structure. It has been measured in terms of the number of plants owned (horizontal spread) or having more vertical spread (company owns a subsidiary which runs a plant). Complexity may provide opportunity because it decreases communication and control (Finney and Lesieur, 1982). *Organization size* has also been associated with misconduct. The literature suggests a positive relationship between size and offending (and explains this in terms of larger firms having more opportunities), but the relationship is often null when the dependent variable is constructed as a rate per unit size (for a discussion see McKendall and Wagner, 1997).

Firm Financial Performance

Profitability. A common measure of profitability (total firm profit) is total stockholders equity (TSE) (Simpson, 1986; Jamieson, 1994). TSE is the common and preferred shareholders' interest in the company; essentially it is total assets minus total liabilities and represents the amount stockholders might obtain if a corporation is liquidated. The mean TSE is approximately 3 billion with a standard deviation of 8 billion. Higher values indicate that the firm is more profitable.

Return on Assets. Return on assets (ROA) is a common measure of firm financial performance. ROA is commonly calculated as net income divided by total assets and captures how effectively management utilizes firm assets (Clinard and Yeager, 1980; Kieso and Weygandt, 1974; Deephouse and Carter, 2005). Profitability in relation to assets or investment reflects how efficiently the firm utilizes its resources (Keane, 1993). The mean is 0.03 with a standard deviation of 0.06. Higher values indicate that the firm is more efficient.

Return on Sales. Return on Sales (ROS), measured as total sales divided by total assets, is another common measure of firm performance (Altman 1968). ROS indicates the sales generating ability of firm assets (Clinard and Yeager, 1980). Altman (1968) refers to it as a measure of management's capability in dealing with competitive conditions. The mean is 1.20 with a standard deviation of 0.66. Higher values indicate that the firm is more efficient.

Liquidity. Liquidity is defined the difference between a firm's current assets and current liabilities divided by the total corporate assets. It captures a firm's working capital (Clinard and Yeager, 1980). The mean is 0.09 with a standard deviation of 0.12. Higher values indicate that the firm has more working capital.

Firm Structure

Complexity. In this study, firm structure is measured as the number of facilities owned by the firm that are operating in the same industry. This provides a proxy for complexity in that it captures the degree of horizontal spread in the company's structure. The mean number of facilities owned is 3 with a standard deviation of 3.

Firm Size. Firm size is measured as the number of employees. The mean number of employees is approximately 15,000 and the standard deviation is 20,000.

Table 2-9: Firm Characteristics

Variables	nT	Range	Mean (Std. Dev.) Median	Interquartile Range
Financial Performance				
Profitability: Total Stockholders Equity	358	-$1,838,428,928.00 – $70,756,999,168.00	$3,033,541,670.75 ($7,991,302,506.2) $1,016,388,992.00	2,021,462,032
Return on Assets: Net Income/Total Assets	352	-0.32 – 0.18	0.03 (0.06) 0.03	0.06
Return on Sales: Total Sales/Total Assets	339	0.30 – 5.02	1.20 (0.66) 1.02	0.53
Liquidity: TCA-TCL/TA	352	-1.00 – 0.44	0.09 (0.12) 0.08	0.11
Corporate Structure				
Complexity: Number of Facilities Owned	378	1 – 23	3.43 (2.96) 2.00	3.00
Size: Number of Employees	336	291 – 112,900	15,419.43 (19,666) 6,907.00	17,726.00

The previous section provided an overview of violation and enforcement patterns over time and across industry. In the next section, we use the secondary data to examine the primary

research questions. Specifically, we utilize correlations, bivariate regression, and multivariate regression models to address the relationship between firm characteristics and violations, sanctions and recidivism, and firm characteristics and sanctions.

FIRM CHARACTERISTICS AND VIOLATIONS

The organizational context is a key to understanding corporate crime (Braithwaite, 1985; Clinard and Quinney, 1973). Empirically, criminologists have found an association between a variety of company characteristics (e.g., corporate goals, structure, and culture) and corporate misconduct. The organizational goal most commonly linked to crime is profitability. In the context of slowing or falling profits, managers and employees may resort to criminal practices to attain financial performance goals (Shover and Bryant, 1993). Corporate structural complexity also has been linked to offending. Structural complexity refers to the degree of spread and segmentation in an organization's structure. Complexity may provide opportunity because it decreases communication and managerial control (Finney and Lesieur, 1982). Finally, the culture of a company, generally thought of as a shared set of norms and values that give rise to typical behavior patterns, may contain crime-facilitative components (Shover and Bryant, 1993). Although the empirical results are not always consistent, as a whole they suggest that firm-level factors are important to understand corporate crime.

Below, we address the association between firm characteristics and environmental violation rates using correlations and bivariate regression models that correct the standard errors for the lack of independence in the observations (using the STATA cluster command). Finally, significant variables from these preliminary analyses are included in multivariate regression models.

Correlations

Table 2-10 provides the correlations between the firm characteristics and the violation rate for each pollutant. Regardless of the specific pollutant examined, a few consistent patterns emerge. The relationship between corporate performance and violations depends on the specific measure of profitability that is used. The violation rate is lower among firms with higher total stockholders equity and among firms with lower liquidity. Structural complexity (more facilities and more employees), is negatively related to the violation rate. Results for other measures of profitability are mixed, but generally return on assets and return on sales are positively associated with the violation rates.

Generally, the associations are consistent across pollution type (but not all of these relationships are significant). Firms with a higher return on assets and higher liquidity tend to have higher *total* and *toxic* violation rates. Return on sales, on the other hand, is associated with *conventional* pollution. Firms with a higher return on sales tend to have higher violation rates for the specific conventional pollutants examined (BOD and TSS) as well as the group of conventional pollutants. Total stockholders equity is significantly related to *toxic* and *conventional* violation rates: firms with a higher equity tend to have lower toxic and conventional violation rates. OSHA violations are not consistently associated with any of the violation rates.

While the significance of the firm measures varies by pollutant type, several patterns are consistent. Although few of the financial measures are consistently associated with violation rates across pollution type, firm structural characteristics are significantly related to the violation rate for five of the six pollution measures. Firms with more employees and firms that own more facilities have lower violation rates. In addition, the firm characteristics are not as associated

with the BOD violation rate as with other types of pollution. BOD violations may be a consistent problem across firms regardless of financial performance or structure.

Table 2-10
Correlation Matrix: Firm Characteristics and Violation Rate

	1	2	3	4	5	6
1. Total Stockholders Equity	1.00					
2. Return on Assets	0.19** 348	1.00				
3. Return on Sales	-0.03 335	0.02 333	1.00			
4. Liquidity	-0.23** 349	0.19** 346	0.01 337	1.00		
5. Number of Facilities Owned	0.18** 358	0.06 352	-0.19** 339	-0.22** 352	1.00	
6. Number of Employees	0.66** 335	0.12* 328	-0.12* 321	-0.30** 334	0.74** 336	1.00
7. OSHA	0.02 332	-0.01 333	0.01 315	-0.07 327	0.18** 347	0.13* 315
8. Violation Rate ALL	-0.08 357	0.11* 351	0.07 338	0.23** 351	-0.16** 377	-0.13* 335
9. Violation Rate BOD	-0.01 265	-0.01 264	0.15* 246	0.01 260	-0.05 277	-0.02 243
10. Violation Rate TSS	-0.01 339	0.01 332	0.17** 319	0.05 333	-0.16** 358	-0.09 317
11. Violation Rate NIT	-0.09 213	0.03 207	-0.10 205	0.02 211	-0.13* 221	-0.14* 198
12. Violation Rate CON	-0.09+ 347	-0.07 341	0.16** 328	0.08 341	-0.21** 367	-0.14** 325
13. Violation Rate TOX	-0.13* 316	0.07 310	-0.09 307	0.17** 314	-0.12* 335	-0.16** 301

Table 2-10 (continued)

	7	8	9	10	11	12	13
1. TSE							
2. ROA							
3. ROS							
4. Liquidity							
5. # of Facilities Owned							
6. # of Employees							
7. OSHA	1.00						
8. Violation Rate ALL	-0.00 346	1.00					
9. Violation Rate BOD	0.04 256	0.37** 277	1.00				
10. Violation Rate TSS	0.10^{+}	0.60** 358	0.34** 277	1.00			
11. Violation Rate NIT	0.03 202	0.56** 221	0.20** 171	0.15* 221	1.00		
12. Violation Rate CON	0.04 336	0.84** 367	0.52** 277	0.68** 358	0.61** 221	1.00	
13. Violation Rate TOX	0.03 307	0.48** 335	0.09 245	0.13* 326	0.04 214	0.19** 329	1.00

Regression Models

In Table 2-11, we provide the bivariate regression models. [xi] After controlling for the non-independence of the observations over time, the results are generally the same. The negative

association between total stockholders equity and conventional and toxic pollution violation rates remains significant. The association also becomes significant for total violation rate. Thus, firms with higher stockholders equity have significantly lower total, conventional, and toxic pollution violation rates.

Once the standard errors are adjusted, return on assets is no longer significantly associated with any of the violation rates. Return on sales and liquidity retain the significant positive association with certain pollution types. Firms with a higher return on sales have significantly higher conventional pollution violation rates, although the relationship is weak. Firms with higher liquidity have significantly higher toxic pollution violation rates. Once again, the OSHA violations are not significantly associated with any of the violation rates. Findings for the structure measures remain consistent. Generally, firms with more facilities and more employees have significantly lower violation rates. The association is not significant for BOD.

Table 2-11
Bivariate Pooled OLS Regression Models: Firm Characteristics and Violation Rate

	All	BOD	TSS	Conv Poll	Tox Poll
TSE					
Model A	-4.80 e-11 (2.05 e-11)*	-8.50 e-12 (2.43 e-11)	-4.81 e-12 (2.11 e-11)	-3.37 e-11 (1.39 e-11)*	-5.92 e-11 (1.99 e-11)**
Model B	-5.73 e-11 (2.62 e-11)*	-1.51 e-12 (2.57 e-11)	1.48 e-11 (3.13 e-11)	-4.08 e-11 (1.85 e-11)*	-7.56 e-11 (2.46 e-11)**
Return on Assets					
Model A	8.38 (8.01)	-1.20 (5.59)	0.43 (4.15)	-3.59 (3.29)	4.82 (6.17)
Model B	10.88 (9.19)	6.56 (4.27)	6.21 (5.39)	-1.55 (3.24)	15.49 (7.11)*
Return on Sales					
Model A	0.54 (0.41)	1.38 (1.18)	1.12 (0.63)$^{+}$	0.74 (0.40)$^{+}$	-0.52 (0.40)
Model B	0.76 (0.56)	1.41 (0.85)$^{+}$	1.07 (0.55)$^{+}$	0.83 (0.42)*	-0.50 (0.46)
Liquidity					

Model A	9.16 (7.35)	0.32 (3.70)	1.87 (2.32)	1.99 (1.89)	5.65 (2.66)*
Model B	9.09 (7.29)	-0.60 (2.93)	2.40 (2.54)	1.82 (2.01)	5.63 (2.69)*

Model A= Contemporaneous; Model B= Firm characteristics lagged by one year

Table 2-11 (cont)

# of Facilities Owned					
Model A	-0.24 (0.11)*	-0.09 (0.11)	-0.22 (0.07)**	-0.20 (0.07)**	-0.19 (0.11)$^{+}$
Model B	-0.26 (0.13)*	-0.12 (0.09)	-0.21 (0.08)**	-0.21 (0.08)**	-0.18 (0.12)
# of Employees					
Model A	-0.00 (0.00)$^{+}$	-00 (0.00)	-0.00 (0.00)	-0.00 (0.00)**	-0.00 (0.00)$^{+}$
Model B	-0.00 (0.00)$^{+}$	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)**	-0.00 (0.00)$^{+}$
OSHA violations					
Model A	-0.00 (0.02)	0.02 (0.04)	0.03 (0.02)	0.01 (0.02)	0.01 (0.03)
Model B	-0.01 (0.01)	-0.01 (0.02)	-0.01 (0.01)	-0.01 (0.01)	0.00 (0.02)

Model A= Contemporaneous; Model B= Firm characteristics lagged by one year

To test the relative power of each of these firm characteristics, multivariate regression is utilized. However, certain firm characteristics cannot be included in the same model due to multicollinaraity. For example, the correlation coefficient for total stockholders equity and number of employees is 0.66. The correlation between number of facilities and number of employees is 0.74. When possible, the significant bivariate predictors are included in the multivariate models.

The multivariate regression results are presented in Table 2-12. Total stockholders equity continues to show a significant association with total, conventional pollutant and toxic pollutant violation rates in the multivariate model. Controlling for return on sales and number of facilities, firm/years with higher stockholders equity have lower violation rates the following year.

Number of facilities also remains a significant predictor of violation rates. Firm/years with more facilities are followed by significantly lower total, TSS, and conventional pollution violation rates the following year. However, facility ownership is not significantly associated with toxic violation rates in the multivariate models. In fact, financial performance is the only significant predictor of toxic pollution violation rates. In addition, although return on sales was associated with conventional pollutant violation rates in the bivariate models, it is no longer significant in the multivariate regressions.

Table 2-12
Multivariate Pooled OLS Regression Models: Firm Characteristics and Violation Rate[#]

	All	BOD	TSS	Conv Poll	Tox Poll
Model A					
TSE	-3.76 e-11 (1.53 e-11)*	5.74 e-12 (2.05 e-11)	3.06 e-11 (2.51 e-11)	-2.26 e-11 (9.80 e-12)*	-6.27 e-11 (1.92 e-11)**
Return on Sales	0.55 (0.51)	1.46 (0.87)+	0.92 (0.58)	0.66 (0.46)	-0.70 (0.47)
# of Facilities Owned	-0.23 (0.11)*	-0.09 (0.09)	-0.20 (0.08)*	-0.19 (0.08)*	-0.18 (0.12)
Model B					
TSE					-7.75 e-11 (3.06 e-11)**
Return on Assets					17.18 (7.84)*
Liquidity					2.12 (2.99)
# of Facilities Owned					-0.15 (0.13)

[#]Firm characteristics lagged by one year

In an additional set of multiple regression models we examined the association between the other significant firm characteristics and violation rates. Specifically, we discovered that return on assets was correlated with toxic pollution violation rates in the bivariate regression

results. Thus, an additional toxic violation model was run to include this measure. Both total stockholders equity and return on assets significantly predict toxic pollution violation rates. Firm/years with higher total stockholders equity have significantly *lower* toxic violation rates. However, firm/years with higher return on assets have significantly *higher* toxic violation rates.[xii]

In sum, total stockholders equity and number of facilities owned are most consistently associated with firm violation rates. One of these relationships is consistent with prior research while the other is not. Like others, we discovered a negative relationship between firm profitability and violation rates. It may be that profitable firms are able to dedicate more resources (e.g., compliance officers, technology upgrades, etc) to environmental compliance than less profitable firms and thus "prevent" crime from occurring. However, another explanation is that profitable firms have less motivation to offend.

Counter to the prior literature, however, we find that firms with more facilities have a consistently lower violation rate. This association is likely a result of how we constructed the dependent variable. Firms with more facilities have more opportunities for violation and, therefore, the denominator of the dependent variable is larger. Because the denominator is larger, the overall violation rate is smaller. In fact, for several pollutant types the number of facilities owned is positively associated with the *number of violations*.

Finally, in the toxic pollution model the direction of the association between financial performance and the violation rate varies depending on the financial measure. While this may seem counter-intuitive, each measure is thought to capture a different aspect of financial performance. For instance, total stockholders equity is the amount stockholders would obtain if a corporation is liquidated. It represents newer assets. Return on assets, however, is the net

income generated from total (and perhaps older) assets. Facilities are a part of the assets owned by companies. Firms with additional older facilities/assets may have more of a problem with toxic pollution. Toxic pollutants have only recently become an EPA focus and older facilities may not be as well equipped to control this type of pollution. Firms with newer assets (TSE), however, may be better able to reduce toxic pollution violations.

Overall the results in this section are consistent with the prior literature. More profitable firms have a lower violation rate. And although larger firms have a lower violation rate, they have more violations overall. In the next section, we begin to explore whether there is an association between sanctions and recidivism.

SANCTIONS AND RECIDIVISM

Most of the existing studies of environmental deterrence have examined the effect of regulation on plant-level compliance. Prior studies have assessed the specific deterrent effect of EPA inspections (Deily and Gray, 1991; Gray and Deily, 1996; Laplante and Rilstone, 1996; Liu, 1995; Magat and Viscusi, 1990; Nadeau, 1997); EPA enforcement (Nadeau, 1997); and OSHA plant and industry inspections (Cooke and Gautschi, 1981; Gray and Scholz, 1993; Robertson and Keeve, 1983; Scholz and Gray, 1990). Although the corporate crime literature suggests that the parent company is another relevant unit of analysis, there is relatively little work on deterrence at the firm-level. The existing firm-level studies, none of which examine environmental enforcement, provide inconsistent results. Some studies show a deterrent effect while others find little enforcement response (Block, Nold and Sidak, 1981; Braithwaite and Makkai, 1991; Jamieson, 1994; Simpson and Koper, 1992). In the following section, the association between EPA enforcement, inspections, and firm-level violation patterns is examined. In addition to examining each type of EPA action (monitoring and enforcement),

enforcement actions are also split into informal and formal categories to determine whether the two enforcement strategies are equally effective.

To be consistent with EPA sanctioning practices, the monthly monitoring and enforcement data are aggregated to the quarter rather than the year (the EPA sanctions facilities in significant noncompliance every three months plus the longer period avoids some of the temporal order problems identified in Chapter 1). As Table 2-13 demonstrates, sanctions are rare. The average facility received 0.5 sanctions each quarter. In addition, the median number of sanctions received is zero. The lack of variability limits our analysis. Thus, we provide exploratory analysis to examine the effect of sanctions on recidivisms but recognize and acknowledge the limitations of the data. The relationship between sanctions and recidivism is first addressed using correlations. A violation count is used in the regression models rather than the violation rate.

Table 2-13: Quarterly Sanctions

Variables	nT	Range	Mean (Std. Dev.) Median	Interquartile Range
PCS Sanction Data				
# of Informal Sanctions	1483	0 – 9	0.25 (0.78) 0.00	0.00
# of Formal Sanctions	1483	0 – 21	0.22 (1.12) 0.00	0.00
# of Total Sanctions	1483	0 – 21	0.47 (1.41) 0.00	0.00
Case Sanction Data				
# of Administrative Cases	1483	0 – 1	0.02 (0.13) 0.00	0.00
# of Civil Cases	1483	0 – 2	0.01 (0.11) 0.00	0.00
# of Criminal Cases	1483	0 – 1	0.00 (0.05) 0.00	0.00

Correlations

As Table 2-14 shows, the *violation rates* are not highly correlated with the number of informal and formal sanctions or the case data.[xiii] Given that the EPA sanctioning practices of targeting the most frequent offenders, this seems illogical. However, the correlations between sanctions and the *number of violations* are much stronger. It seems that the EPA is less concerned with the percent of reports in violation and instead focuses on the frequency of violations. Thus, the violation count is used in this section.

Regardless of the specific outcome measure, it is difficult to disentangle the association between sanctions and violation because the EPA targets the worst violators for sanctions. Therefore, sanctions may be positively related to violations simply because sanctions are given to the high frequency violators. In fact, as shown in Table 14, the number of total, informal, and formal sanctions as well as the number of cases is positively associated with the number of total, TSS, conventional, and toxic pollutant violations.[xiv] Because this association may reflect who EPA targets for sanctions and not the effect of sanctions themselves, the association is further explored using regression analysis with appropriate temporal ordering and additional controls for prior behavior.

Table 2-14
Correlations: Sanctions and Violations

	1	2	3	4	5	6
1. # of Informal Sanctions	1.00					
2. # of Formal Sanctions	0.07** 1483	1.00				
3. # of Total Sanctions	0.61** 1483	0.83** 1483	1.00			
4. # of Administrative Cases	0.04 1483	0.58** 1483	0.49** 1483	1.00		
5. # of Civil Cases	0.04 1483	-0.01 1483	0.01 1483	-0.01 1483	1.00	
6. # of Criminal Cases	-0.01 1483	-0.00 1483	-0.02 1483	-0.01 1483	-0.00 1483	1.00
7. Violation Rate ALL	0.05^{+} 1474	0.02 1474	0.04 1474	0.01 1474	0.00 1474	0.03 1474
8. Violation Rate BOD	0.02 1078	0.00 1078	0.01 1078	-0.02 1078	0.07* 1078	0.09** 1078
9. Violation Rate TSS	0.08** 1400	0.07** 1400	0.09** 1400	0.08** 1400	0.03 1400	0.04 1400
10. Violation Rate NIT	-0.01 837	-0.00 837	-0.01 837	-0.05 837	-0.03 837	-0.01 837
11. Violation Rate CON	0.08** 1441	0.02 1441	0.06* 1441	0.04 1441	0.01 1441	0.05* 1441
12. Violation Rate TOX	0.03 1261	0.00 1261	0.02 1261	0.01 1261	-0.01 1261	-0.01 1261

Table 2-14 (continued)

	1	2	3	4	5	6
13. Violation Count ALL	0.18** 1474	0.08** 1474	0.17** 1474	0.08** 1474	0.06* 1474	0.02 1474
14. Violation Count BOD	0.07* 1078	0.01 1078	0.05 1078	0.02 1078	0.00 1078	0.09** 1078
15. Violation Count TSS	0.12** 1400	0.09* 1400	0.14** 1400	0.08** 1400	0.08** 1400	0.02 1400
16. Violation Count NIT	-0.01 837	-0.01 837	-0.01 837	0.06^{+} 837	0.04 837	0.07* 837
17. Violation Count CON	0.13** 1441	0.05* 1441	0.12** 1441	0.06* 1441	0.04^{+} 1441	0.03 1441
18. Violation Count TOX	0.11** 1261	0.06* 1261	0.11** 1261	0.04 1261	0.04 1261	-0.02 1261

Regression Analysis

Several steps are taken to obtain more accurate estimates of the relationship. First, pooled regression models with a correction for multiple observations on the same company over time are used. We also incorporate contemporaneous and lagged sanction models to demonstrate how/whether the effects change as appropriate temporal ordering is established. Second, a control variable for prior offending is included as a measure of prior "sanction risk." Finally, we include those firm characteristics that were significantly associated with violation record in the model as additional controls.

Once again, Table 2-15 shows that sanctions have a positive relationship with violations in the contemporaneous models. The positive association remains when sanctions are lagged by one quarter and some of these results remain even when sanctions are lagged by two quarters. Table 2-16 provides the results when *significant* violations are regressed on sanctions. The results are the same. The number of sanctions received is positively associated with the number of significant violations. Because the data contain some company/year outliers in terms of

sanctions and violations, regression results were also analyzed with both variables dichotomized. In the probit models (tables not shown), the association between receiving both sanction types and violations remained positive and significant.

Table 2-15
Pooled OLS Regression Models: Sanctions and Recidivism (*Number of Violations*)
Continuous Measure of Sanctions

	All	BOD	TSS	Conv Poll	Tox Poll
MODEL A					
Informal Sanctions	1.05 (0.38)**	0.08 (0.04)$^{+}$	0.19 (0.09)*	0.51 (0.19)**	0.27 (0.18)
Formal Sanctions	0.30 (0.21)	0.00 (0.01)	0.12 (0.08)	0.12 (0.11)	0.11 (0.05)*
MODEL B					
Informal Sanctions	0.89 (0.34)**	0.04 (0.05)	0.11 (0.05)*	0.32 (0.14)*	0.25 (0.16)
Formal Sanctions	0.36 (0.25)	0.06 (0.02)**	0.11 (0.04)**	0.20 (0.13)	0.17 (0.05)**
MODEL C					
Informal Sanctions	0.72 (0.29)**	0.05 (0.04)	0.15 (0.06)**	0.31 (0.17)$^{+}$	0.14 (0.10)
Formal Sanctions	0.27 (0.21)	0.00 (0.03)	0.03 (0.03)	0.07 (0.08)	0.11 (0.06)$^{+}$

Model A=Sanctions, contemporaneous
Model B=Sanctions, lagged by one quarter
Model C=Sanctions, lagged by two quarters

Table 2-16
Pooled OLS Regression Models: Sanctions and Recidivism (*Number of **Significant** Violations*)
Dichotomous Measure of Sanctions

	All	BOD	TSS	Conv Poll	Tox Poll
MODEL A					
Informal Sanctions	1.06 (0.42)**	0.14 (0.08)$^{+}$	0.20 (0.11)$^{+}$	0.45 (0.23)$^{+}$	0.63 (0.35)$^{+}$
Formal Sanctions	0.73 (0.36)*	0.00 (0.06)	0.09 (0.13)	0.30 (0.23)	0.46 (0.24)*
MODEL B					
Informal Sanctions	0.99 (0.33)**	0.09 (0.09)	0.16 (0.09)$^{+}$	0.38 (0.23)	0.63 (0.27)*
Formal Sanctions	1.18 (0.43)**	0.06 (0.06)	0.25 (0.13)$^{+}$	0.56 (0.27)*	0.47 (0.23)*
MODEL C					
Informal Sanctions	0.84 (0.35)*	0.11 (0.09)	0.23 (0.10)*	0.40 (0.23)$^{+}$	0.37 (0.22)$^{+}$
Formal Sanctions	0.63 (0.30)*	0.02 (0.06)	0.05 (0.12)	0.29 (0.19)	0.28 (0.18)

Model A=Sanctions, contemporaneous
Model B=Sanctions, lagged by one quarter
Model C=Sanctions, lagged by two quarters

As previously noted, we chose to include a measure of prior offending as a control for "sanction risk" (or for the targeting of high frequency offenders) in our pooled regression models (Table 2-17, Model A). When this variable is included, some of the positive associations between sanctions and offending remain significant. Formal sanctions and informal sanctions are associated with significantly more violations in the following quarter for some of our pollution types. When additional covariates (firm characteristics) are added in Model B, the positive relationship between offending and informal sanctions becomes insignificant. The association between formal sanctions and violations remains for most pollution types (total, BOD, conventional, and toxic).[xv]

Table 2-17
Pooled OLS Regression: Sanctions and Recidivism (*Number of Violations*) [#]

	All	BOD	TSS	Conv Poll	Tox Poll
MODEL A					
Informal Sanctions	0.65 (0.32)*	0.11 (0.10)	0.09 (0.11)	0.14 (0.23)	0.23 (0.09)*
Formal Sanctions	0.42 (0.18)*	0.07 (0.05)	0.15 (0.08)$^{+}$	0.24 (0.14)$^{+}$	0.14 (0.09)
Lagged Y	0.65 (0.03)**	0.35 (0.07)**	0.43 (0.06)**	0.61 (0.04)**	0.63 (0.03)**
MODEL B					
Informal Sanctions	0.07 (0.17)	-0.02 (0.03)	0.03 (0.04)	-0.05 (0.08)	0.07 (0.06)
Formal Sanctions	0.28 (0.13)*	0.07 (0.02)**	0.06 (0.04)	0.18 (0.08)*	0.12 (0.03)**
Lagged Y	0.64 (0.03)**	0.27 (0.05)**	0.44 (0.07)**	0.61 (0.05)**	0.61 (0.03)**
Stockholders Equity	-7.06 e-12 (5.95 e-12)	3.34 e-12 (2.24 e-12)	7.39 e-14 (2.48 e-12)	2.30 e-12 (5.01 e-12)	-6.73 e-12 (2.59 e-12)*
# of Facilities Owned	0.01 (0.04)	0.02 (0.01)	-0.01 (0.02)	-0.02 (0.03)	-0.02 (0.01)

[#]Independent Variables Lagged by One Quarter

It is logical that sanctions might decrease or have no effect on violations, but the remaining positive relationship is odd given the nature of the pollution process. In order for sanctions to increase violations, a firm would have to deliberately reduce equipment maintenance and undermine safety controls with full knowledge of pollution reporting requirements. Barring a deliberate bypass of the pollution control systems, any changes (positive or negative) are likely to occur over a longer period of time. Thus, this association is explored further.

Table 2-18 shows that sanctions are no longer related to violations when the lag structure is two quarters. Thus, it appears that EPA sanctions have little impact on future offending.

Instead, the results suggest that firms simply take more than one quarter to correct whatever problem is creating more violations in the first place.[xvi]

Table 2-18
Pooled OLS Regression: Sanctions and Recidivism (*Number of Violations*)[#]

	All	BOD	TSS	Conv Poll	Tox Poll
Informal Sanctions	0.15 (0.16)	0.02 (0.04)	0.12 (0.06)*	0.18 (0.13)	-0.04 (0.05)
Formal Sanctions	0.10 (0.09)	-0.01 (0.03)	-0.00 (0.03)	-0.02 (0.04)	0.02 (0.05)
Lagged Y	0.65 (0.04)**	0.27 (0.05)	0.44 (0.07)**	0.61 (0.05)**	0.62 (0.03)**
Stockholders Equity	-6.25 e-12 (7.45 e-12)	3.52 e-12 (2.01 e-12)	-2.96 e-13 (3.01 e-12)	2.08 e-12 (6.70 e-12)	-6.37 e-12 (2.69 e-12)*
# of Facilities Owned	0.02 (0.04)	0.02 (0.01)	-0.01 (0.02)	-0.02 (0.03)	-0.01 (0.02)

[#]Sanctions lagged by two quarters

The association between sanctions and violations is next explored using the docket case data. Because of the low frequency with which the EPA resorts to court cases, all three types (administrative, civil, and criminal) had to be combined into one measure. The results are similar to those found with the PCS sanction data. In the initial model in Table 2-19 (Model A) the number of cases brought against a firm is positively associated with subsequent violations. As shown in the second model, only one of the associations remains marginally significant when the lagged violation measure is included. Using a different measure of sanctions, results indicate that EPA sanctions have no effect on future violations.

Table 2-19
Pooled OLS Regression: Court Cases and Recidivism (*Number of Violations*)[#]

	All	BOD	TSS	Conv Poll	Tox Poll
MODEL A					
# of cases	2.92 (0.86)**	0.36 (0.14)**	0.51 (0.25)*	1.63 (0.55)**	0.43 (0.26)[+]

MODEL B					
# of cases	0.78 (1.04)	0.25 (0.13)$^{+}$	-0.16 (0.39)	0.19 (0.61)	-0.04 (0.32)
Lagged Y	0.67 (0.03)**	0.33 (0.06)**	0.47 (0.06)**	0.63 (0.04)**	0.61 (0.03)**

[#]Independent Variables Lagged by One Quarter

Finally, the association between sanctions and violations is explored using a combined measure of the formal sanctions from the PCS system and the formal case data. Once again, the patterns are similar. Table 2-20 shows that both sanction types (formal and informal) are associated with an increase in the number of violations in the following quarter (significance varies by pollution type). With one exception (formal sanctions and BOD violations), the sanctions coefficients are reduced to insignificance when the control for prior offending is included. However, the positive association between formal sanctions and BOD violations remains significant even after the firm level covariates are included in the model. In this model, formal sanctions are associated with more BOD violations in the following quarter. Thus, in Table 2-21 sanctions are lagged by two quarters. Unlike the earlier models that excluded the case data, the effect of formal sanctions on the number of BOD violations remains positive and significant even when lagged by two quarters. Furthermore, formal sanctions are significantly related to the number of toxic and total violations in the subsequent two quarters.

The association between formal sanctions and total violations only becomes significant when additional covariates are included in the model. This pattern may suggest that the association is due to a reduction in error (when additional predictors are included) rather than a substantive relationship. However, the positive associations between formal sanctions and toxic pollution and formal sanctions and BOD violations are significant in both the bivariate and multivariate models.

Despite the remaining positive effects, we believe that EPA sanctions are ineffective rather than criminogenic. Although criminologists theorize that sanctions may create defiance and increase crime (Sherman, 1993) that interpretation is unlikely in this case. As stated, firms would have to deliberately remove pollution controls for sanctions to increase violations. In addition, the effect of formal sanctions only remains significant when the case data are included with the other sanction data. Court cases (the most serious penalties) are filed against the most egregious violators. The models used in the current analysis do not completely correct for this targeting practice. Therefore, the relationship between formal sanctions (when cases are included) and future violations may still reflect this sanctioning practice.

Table 2-20
Pooled OLS Regression: Total Sanctions (PCS and Case Data) and Recidivism (*Number of Violations*) [#]

	All	BOD	TSS	Conv Poll	Tox Poll
MODEL A					
Informal Sanctions	0.85 (0.33)*	0.04 (0.05)	0.12 (0.06)*	0.32 (0.14)*	0.24 (0.16)
Formal Sanctions	0.20 (0.17)	0.06 (0.02)*	-0.00 (0.02)	0.05 (0.07)	0.13 (0.04)**
MODEL B					
Informal Sanctions	0.19 (0.16)	0.01 (0.04)	0.05 (0.04)	0.04 (0.08)	0.09 (0.06)
Formal Sanctions	-0.00 (0.07)	0.05 (0.02)*	-0.03 (0.03)	-0.03 (0.05)	0.03 (0.03)
Lagged Y	0.65 (0.03)**	0.35 (0.08)**	0.42 (0.07)**	0.60 (0.05)**	0.64 (0.03)**
MODEL C					
Informal Sanctions	0.08 (0.18)	-0.02 (0.03)	0.04 (0.04)	-0.02 (0.08)	0.07 (0.07)
Formal Sanctions	0.12 (0.12)	0.07 (0.03)**	-0.04 (0.03)	0.00 (0.09)	0.06 (0.03)*
Lagged Y	0.65 (0.04)**	0.27 (0.05)**	0.44 (0.07)**	0.61 (0.05)**	0.61 (0.03)**

Stockholders Equity	-7.44 e-12 (6.06 e-12)	3.32 e-12 (2.30 e-12)	-1.26 e-13 (2.59 e-12)	1.84 e-12 (5.16 e-12)	-6.86 e-12 (2.62 e-12)**
# of Facilities Owned	0.02 (0.04)	0.02 (0.01)	-0.01 (0.02)	-0.01 (0.03)	-0.01 (0.01)

[#]Independent Variables Lagged by One Quarter

Table 2-21
Pooled OLS Regression: Total Sanctions (PCS and Case Data) and Recidivism (*Number of Violations*) [#]

	All	BOD	TSS	Conv Poll	Tox Poll
Informal Sanctions	0.15 (0.16)	0.01 (0.04)	0.12 (0.06)*	0.18 (0.13)	-0.05 (0.05)
Formal Sanctions	0.18 (0.09)+	0.08 (0.03)*	0.01 (0.03)	0.06 (0.06)	0.12 (0.05)*
Lagged Y	0.64 (0.03)**	0.27 (0.05)**	0.44 (0.07)**	0.60 (0.05)**	0.62 (0.03)**
Stockholders Equity	-6.35 e-12 (7.14 e-12)	3.79 e-12 (1.99 e-12)+	-2.83 e-13 (2.95 e-12)	2.35 e-12 (6.55 e-12)	-6.30 e-12 (2.43 e-12)**
# of Facilities Owned	0.01 (0.04)	0.02 (0.01)	-0.01 (0.02)	-0.02 (0.03)	-0.01 (0.02)

[#]Sanctions Lagged by Two Quarters

Although generally considered monitoring rather than enforcement, inspections may also impact violations. Facilities are generally informed in advance of inspection dates and may take steps to correct existing problems prior to the actual inspections. In addition, inspectors may uncover procedural problems during inspections that are subsequently corrected. Thus, the threat of or the actual inspection may result in a reduction in violations. We explore this relationship in the following section.

INSPECTIONS AND RECIDIVISM

As we discovered through our interviews with inspectors, there are many different kinds of inspections that may differentially impact future behavior. In this section, inspections are broken into two types: sampling and non-sampling. Sampling inspections are more invasive and

thorough and thus represent a larger “violation” risk to companies. We speculate, therefore, that sampling inspections could have a greater impact on violations than non-sampling inspections.

Correlations

As Table 2-22 demonstrates, the number of inspections is negatively associated with the violation rate across pollutant (with the exception of BOD). Firm/quarters with an inspection have lower reported violation rates. With one exception, the negative correlation is consistent for both sampling and non-sampling inspections across the various pollution types. However, Table 2-23 shows that inspections are *positively* correlated with the number of violations in the inspection quarter. The negative correlation suggests that either inspections decrease the violation rate or facilities with a lower violation rate are inspected more often. However, we believe that neither of these interpretations is correct. This difference in findings is best explored with regression analysis to establish temporal ordering and control for "inspection risk” (prior record).

Table 2-22
Correlation: Inspections and Violation Rate

	1	2	3	4	5	6
1. # of Inspections	1.00					
2. # of Sampling Inspections	0.64** 1492	1.00				
3. # of Non-Sampling Inspections	0.89** 1492	0.21** 1492	1.00			
4. Violation Rate ALL	-0.08** 1474	-0.05+ 1474	-0.07** 1474	1.00		
5. Violation Rate BOD	0.09** 1078	-0.06* 1078	0.16** 1078	0.40** 1078	1.00	
6. Violation Rate TSS	-0.06* 1400	-0.04 1400	-0.05+ 1400	0.53** 1400	0.24** 1078	1.00
7. Violation Rate NIT	0.04 837	-0.02 837	0.06 837	0.50** 837	0.15** 642	0.11** 837
8. Violation Rate CON	-0.05* 1441	-0.06* 1441	-0.03 1441	0.83** 1441	0.52** 1078	0.63** 1400
9. Violation Rate TOX	-0.07* 1261	-0.03 1261	-0.07* 1261	0.49** 1261	0.07* 907	0.10** 1228

Table 2-23
Correlations: Inspections and Recidivism (*Number of Violations*)

	# of Inspections
1. # of Total Violations	0.11** 1474
2. # of BOD Violations	0.11** 1078
3. # of TSS Violations	0.01 1400
4. # of Conventional Pollutant Violations	0.07** 1441
5. # of Toxic Pollutant Violations	0.02 1261

The bivariate regression models (with corrected standard errors) provided in the next section largely confirm the correlation results. The more contextualized multivariate regression results help to explain the difference in the findings with each violation measure.

Regression Analysis

The results in the contemporaneous regression models confirm the correction results. With the exception of BOD, Table 2-24 shows that the number of inspections (sampling or non-sampling) in a quarter is associated with a contemporaneous decrease in the violation rates. When inspections are lagged by one quarter, however, many of the coefficients become insignificant.

Table 2-24
Bivariate Pooled OLS Regression: Inspections and Recidivism *(Violation Rate)*[#]

	All	BOD	TSS	Conv Poll	Tox Poll
Total Inspections					
Model A	-0.19 (0.09)*	0.47 (0.65)	-0.20 (0.11)+	-0.12 (0.07)+	-0.22 (0.11)*
Model B	-0.20 (0.10)*	0.58 (0.73)	-0.17 (0.11)	-0.12 (0.08)	-0.13 (0.12)
Sampling Inspections					
Model A	-0.24 (0.15)	-0.65 (0.28)*	-0.29 (0.20)	-0.28 (0.12)*	-0.21 (0.23)
Model B	-0.28 (0.16)+	-0.22 (0.24)	-0.27 (0.22)	-0.23 (0.16)	-0.12 (0.25)
Non-Sampling Inspections					
Model A	-0.21 (0.11)*	1.13 (1.15)	-0.22 (0.14)	-0.09 (0.10)	-0.28 (0.12)*
Model B	-0.22 (0.11)*	1.12 (0.21)	-0.18 (0.13)	-0.11 (0.10)	-0.17 (0.13)

[#]Model A= Contemporaneous; Model B= Inspections lagged by one quarter

The findings for total violations also remain the same. Table 2-25 shows a positive but insignificant relationship between the total number of inspections and violations. However, when lagged the association only remains significant for BOD violations.

Table 2-25
OLS Pooled Regression: Inspections and Recidivism (*Number of Violations)*[#]

	All	BOD	TSS	Conv Poll	Tox Poll
Total Inspections					
Model A	0.31 (0.17)+	0.06 (0.03)*	0.01 (0.04)	0.13 (0.09)	0.02 (0.06)
Model B	0.25 (0.17)	0.06 (0.02)**	0.01 (0.04)	0.11 (0.10)	0.05 (0.07)

[#]Model A= Contemporaneous; Model B= Inspections lagged by one quarter

Thus far, our results reveal that inspections are associated with a decrease the violation rate overall but increase the number of BOD violations. These findings appear contradictory but recall that the dependent variable is measured differently. As we show below (Table 2-26), firms with more employees and more facilities are more likely to be inspected and the *violation rate is smaller* for these firms because the denominator in the violation rate is bigger (they submit more reports). It appears that inspections decrease the total violation rate (even when lagged one quarter), but the effect is actually again due to the EPA targeting practices. Firms with a *lower* violation rate are *more* likely to be inspected because they have more facilities. In fact, when the number of facilities is included in the model, the association between inspections and the violation rate disappears. Thus, inspections seem to have no effect on self-reported environmental behavior.

Table 2-26
Multivariate OLS Pooled Regression: Inspections and Recidivism *(Violation Rate)*

	All	BOD	TSS	Conv Poll	Tox Poll
# of Inspections	-0.03 (0.07)	0.78 (0.74)	-0.03 (0.12)	0.05 (0.08)	-0.11 (0.09)
# of Facilities Owned	-0.19 (0.07)**	-0.29 (0.13)*	-0.21 (0.08)**	-0.20 (0.07)**	-0.13 (0.10)

Clearly, the EPA sanctioning process has enormous implications for sorting out the effect of sanctions on recidivism. To more fully understand the sanctioning process, the association between firm characteristics (including violation record) and the number of inspections and the type of sanction (i.e., informal versus formal) received is explored in the following section.

FIRM CHARACTERISTICS AND FREQUENCY OF INSPECTION

While firm characteristics may produce differences in environmental record, firm structure and profitability may also influence the type of sanctions received for violations. In the following section the association between firm characteristics and frequency of inspections is explored. The analysis begins with an examination of the correlation between firm characteristics and inspections. Regression analysis is also provided to establish appropriate temporal ordering and control for relevant covariates (e.g., prior record).

Correlations

Table 2-27 shows that a few firm characteristics are correlated with the number of inspections. Two financial performance measures are inversely related to inspections: firms with higher returns on sales and firms with higher liquidity have *fewer* inspections. However, firms that own more facilities and firms that have more employees are subject to *more* inspections. In the following section, the bivariate associations are explored using regression analysis with covariates and standard error adjustments.

Table 2-27
Correlations: Firm Characteristics and Inspections

	1	2	3	4	5	6
1. # of Inspections	1.00					
2. TSE	0.04 1411	1.00				
3. ROA	0.00 1389	0.20** 1373	1.00			
4. ROS	-0.13** 1337	-0.03 1321	0.02 1313	1.00		
5. Liquidity	-0.11** 1389	-0.23** 1377	0.18** 1365	0.00 1329	1.00	
6. # of Facilities Owned	0.47** 1483	0.19** 1411	0.07* 1389	-0.19** 1337	-0.21** 1389	1.00
7. # of Employees	0.34** 1323	0.66** 1322	0.13** 1296	-0.12** 1268	-0.29** 1320	0.74** 1326

Regression Results

As shown in Table 2- 28, once again we see that the number of violations is positively (but insignificantly) associated with inspections. However, firms/quarters with a higher violation rate have fewer inspections. While this may seem counterintuitive, the association between violation rate and inspection is explained by the correlation between violation rate and other firm characteristics.

Table 2-28
OLS Pooled Regression: Violations and Inspections[#]

	All	BOD	TSS	Conv Poll	Tox Poll
Number of Violations					
Model A	0.04 (0.03)	0.17 (0.10)	0.01 (0.06)	0.04 (0.03)	0.01 (0.05)
Model B	0.03 (0.03)	0.17 (0.10)	0.05 (0.07)	0.03 (0.03)	0.02 (0.05)
Violation Rate					
Model A	-0.03 (0.01)**	0.02 (0.02)	-0.02 (0.01)+	-0.02 (0.01)+	-0.02 (0.01)*
Model B	-0.02 (0.01)	0.02 (0.02)	-0.01 (0.01)+	-0.03 (0.01)+	-0.02 (0.01)*

[#]Model A= Contemporaneous; Model B= Inspections lagged by one quarter

At the bivariate level, firms with more facilities and more employees and firms with higher return on sales and higher liquidity have more inspections per quarter (see Table 2-29). Once these covariates are included in the model (as shown in Table 2-30), the association between violation rate and the frequency of inspections is rendered insignificant. When return on sales and the number of facilities owned are included in the same model, the number of facilities remains significant but return on sales does not (data not shown). These findings are consistent with EPA policy as they tend to target the larger facilities/firms for inspection.

Table 2-29
OLS Pooled Regression: Firm Characteristics and Inspections[#]

Total Stockholders Equity	
Model A	9.24 e-12 (1.61 e-11)
Model B	1.21 e-11 (1.88 e-11)
Return on Assets	
Model A	-0.00 (1.15)
Model B	-0.12 (1.25)
Return on Sales	
Model A	-0.33 (0.16)*
Model B	-0.34 (0.16)*
Liquidity	
Model A	-1.57 (0.69)*
Model B	-1.39 (0.74)+
# of Facilities Owned	

Model A	0.27 (0.02)**
Model B	0.28 (0.02)**
# of Employees	
Model A	0.00 (7.29 e-06)**
Model B	0.00 (9.49 e-06)**

#Model A= Contemporaneous; Model B= Lagged by one quarter

Table 30
Multivariate OLS Pooled Regression: Firm Characteristics and Inspections

Return on Sales	-0.32 (0.16)*
Total Violation Rate	-0.03 (0.02)*
Liquidity	-1.22 (0.75)
Total Violation Rate	-0.03 (0.02)+
# of Facilities	0.28 (0.02)**
Total Violation Rate	-0.01 (0.01)
# of Employees	0.00 (9.12 e-06)**
Total Violation Rate	-0.02 (0.01)

FIRM CHARACTERISTICS AND SANCTION TYPE

In addition to the frequency of inspection, firm characteristics may also influence the type of sanction received for similar violations. In the final section, we explore whether the type of sanction received (i.e., informal versus formal) is related to firm characteristics.

Correlations

We begin our exploration with correlational analysis (see results in Table 2-31). Looking at the correlation between firm characteristics and the number of informal sanctions and the number of formal sanctions, several patterns emerge. For example, there is a *positive* relationship between total stockholders equity, return on sales, and liquidity with *informal* sanctions but a *negative* association with *formal* sanctions. However, the magnitude of the associations is small. When the sanctions counts are used as outcomes in multivariate regression models (with adjusted standard errors), firm characteristics do not significantly predict the number of informal or formal sanctions.

Table 2-31 Correlations: Sanctions and Firm Characteristics

	1	2	3	4	5	6
1. # of Informal Sanctions	1.00					
2. # of Formal Sanctions	0.07** 1483	1.00				
3. # of Total Sanctions	0.61** 1483	0.83** 1483	1.00			
4. # of Administrative Cases	0.03 1483	0.31** 1483	0.27** 1483	1.00		
5. # of Civil Cases	0.01 1483	0.00 1483	0.01 1483	0.00 1483	1.00	
6. # of Criminal Cases	-0.01 1483	-0.01 1483	-0.02 1483	-0.01 1483	-0.01 1483	1.00
7. TSE	0.05^{+} 1411	-0.02 1411	0.01 1411	0.05* 1411	0.03 1411	0.01 1411
8. ROA	0.05+ 1389	-0.06* 1389	-0.02 1389	-0.05+ 1389	-0.03 1389	-0.00 1389

Table 2-31 (continued)

	1	2	3	4	5	6
9. ROS	-0.03	0.08**	0.05^{+}	0.09**	0.02	-0.02
	1337	1337	1337	1337	1337	1337
10. Liquidity	0.04	-0.01	0.01	-0.01	-0.02	-0.02
	1389	1389	1389	1389	1389	1389
11. # of Facilities Owned	0.06*	0.01	0.04	0.12**	0.01	-0.00
	1483	1483	1483	1483	1483	1483
12. # of Employees	0.01	-0.02	-0.01	0.12**	-0.03	0.05^{+}
	1326	1326	1326	1326	1326	1326

To explore whether firm characteristics are related to *the type of sanction received* (rather than the number), a single sanction measure was created. It is coded as zero if the firm received zero sanctions in the quarter; one if the firm received an informal sanction; and two if the firm received a formal sanction. The first set of analysis explores the relationship between violations, firm characteristics, and sanction type when court cases are excluded from the sanction measure.

Recall that earlier analysis revealed that sanctions are only sporadically correlated with the violation rate but more consistently (and positively) correlated with the number of violations. Thus, it is likely that the EPA is more interested in the number of violations rather than the number per opportunity when making sanctioning decisions. As Tables 2-32 and 2-33 show, the pattern of association is similar when sanction type is used. Although a few of the violation *rate* measures are positively correlated with sanction type, the correlations between sanction type and violation *counts* are more consistent and larger in magnitude.

Table 2-32
Correlation: Firm Characteristics, Violations, and Sanction Type

	Sanction Type
1. TSE	0.01 1414
2. ROA	-0.02 1392
3. ROS	-0.01 1340
4. Liquidity	0.03 1392
5. # of Facilities Owned	0.10** 1486
6. # of Employees	0.04 1329
7. Violation Rate ALL	0.06* 1474
8. Violation Rate BOD	0.04 1078
9. Violation Rate TSS	0.08** 1400
10. Violation Rate Nitrogen	0.04 837
11. Violation Rate Con Poll	0.08** 1441
12. Violation Rate Tox Poll	0.03 1261

Table 2-33
Correlations: Number of Violations and Sanction Type

1. Violation Count ALL	0.21** 1474
2. Violation Count BOD	0.08** 1078
3. Violation Count TSS	0.12** 1400
4. Violation Count Nitrogen	0.01 837
5. Violation Count Con Poll	0.15** 1441
6. Violation Count Tox Poll	0.17** 1261

Regression Results

The regression models in Table 2-34 show the same trend. Although the TSS and conventional pollutant violation rates are positively correlated with sanction type, the findings are much more consistent for violation counts. A higher number of violations increase the severity of the sanction for every pollutant type both contemporaneously and when lagged one quarter.

Table 2-34
OLS Pooled Regression: Violation Record and Sanction Type[#]

	All	BOD	TSS	Conv Poll	Tox Poll
Violation Rate					
Model A	0.01 (0.01)	0.00 (0.00)	0.01 (0.00)*	0.01 (0.01)*	0.01 (0.01)
Model B	0.02 (0.01)	0.01 (0.01)	0.02 (0.00)**	0.03 (0.01)**	0.01 (0.01)
Number of Violations					
Model A	0.03 (0.01)**	0.06 (0.02)**	0.05 (0.02)*	0.03 (0.01)*	0.05 (0.01)**
Model B	0.04 (0.01)**	0.12 (0.03)**	0.09 (0.03)**	0.05 (0.01)**	0.06 (0.01)**

[#]Model A= Contemporaneous; Model B= Lagged by one quarter

The correlation between firm size and sanction type remains significant in the regression models with adjusted standards errors. Table 2-35 shows that firms that own more facilities receive significantly harsher sanctions at the bivariate level. None of the other firm characteristics are significantly association with sanction type.

Table 2-35: Firm Characteristics and Sanction Type[#]

Total Stockholders Equity	
Model A	6.33 e-13 (2.51 e-12)
Model B	7.00 e-13 (2.83 e-12)
Return on Assets	
Model A	-0.15 (0.36)
Model B	0.05 (0.38)
Return on Sales	
Model A	-0.00 (0.06)
Model B	-0.01 (0.06)
Liquidity	
Model A	0.19 (0.22)
Model B	0.22 (0.22)
# of Facilities Owned	
Model A	0.02 (0.01)**
Model B	0.02 (0.01)**
# of Employees	
Model A	1.39 e-06 (1.37 e-06)
Model B	1.60 e-06 (1.45 e-06)

[#]Model A= Contemporaneous; Model B= Lagged by one quarter

When the relevant covariates are included in multivariate models in Table 2-36 total violations remain a consistent and significant predictor of sanction severity. The number of facilities owned also remains significant, even when controlling for total violations. In addition, liquidity becomes significant. Liquidity was positively correlated with sanction severity and was nearly significant in the bivariate model. Thus, firms with more violations, more facilities, and higher liquidity tend to receive more severe (formal) sanctions. However, only eight percent of the variation in sanction type is explained by total violations and the variance explained increases very little when the firm characteristics are included in the model. (When firm characteristics are entered as the only covariates, only 0 to 1 percent of the variance is explained.)

Table 2-36
Multivariate Pooled OLS Regression: Firm Characteristics and Sanction Type[#]

Total Stockholders Equity	1.37 e-12 (2.66 e-12)
Violation Count ALL	0.04 (0.01)**
Return on Assets	0.08 (0.32)
Violation Count ALL	0.04 (0.01)**
Return on Sales	-0.02 (0.05)
Violation Count ALL	0.04 (0.01)**
Liquidity	0.17 (0.18)
Violation Count ALL	0.04 (0.01)**
# of Facilities	0.02 (0.01)**
Violation Count ALL	0.04 (0.01)**
# of Employees	1.74 e-06 (1.18 e-06)
Violation Count ALL	0.04 (0.01)**

[#]All Measures Lagged One Quarter

The final set of models offer a different dependent variable measure. Here, we include the court case information in our measure of sanction type. The patterns are very similar even with this new outcome measure. The violation count is more consistently and significantly correlated with sanction type than the violation rate and this difference is also present in the regression analysis. Firms with more violations receive more severe sanctions. As with the previous measure of sanction type, firms that own more facilities are more likely to receive formal sanctions. In addition, firms with more employees receive more serious sanctions. In the multivariate analysis, these two firm characteristics remain significant even with the total violation count included. Although the financial performance of the firm is not significantly related to the type of sanction received, larger firms (whether measured as facilities or employees) tend to receive more serious sanctions as well as firms with more violations (of any kind). In sum, the results do not change when the formal cases are included in the sanction type measure (Tables 2-37 through 2-41).

Table 2-37
Correlations: Firm Characteristics, Violations, and Sanction Type (with cases)

	Sanction Type (with cases)
1. TSE	0.03 1411
2. ROA	-0.01 1392
3. ROS	-0.01 1340
4. Liquidity	0.03 1392
5. # of Facilities Owned	0.12** 1486
6. # of Employees	0.06* 1329
7. Violation Rate ALL	0.06* 1474
8. Violation Rate BOD	0.07* 1078
9. Violation Rate TSS	0.10** 1400
10. Violation Rate Nitrogen	-0.00 837
11. Violation Rate Con Poll	0.09** 1441
12. Violation Rate Tox Poll	0.02 1261

Table 2-38
Correlation: Violation Count and Sanction Type (with cases)

1. Violation Count ALL	0.21** 1474
2. Violation Count BOD	0.10** 1078
3. Violation Count TSS	0.12** 1400
4. Violation Count Nitrogen	-0.02 837
5. Violation Count Con Poll	0.15** 1441
6. Violation Count Tox Poll	0.15** 1261

Table 2-39
Pooled OLS Regression: Violations and Sanction Type (with cases)[#]

	All	BOD	TSS	Conv Poll	Tox Poll
Violation Rate					
Model A	0.01 (0.01)	0.01 (0.00)**	0.01 (0.00)**	0.01 (0.01)*	0.00 (0.00)
Model B	0.02 (0.01)	0.01 (0.00)$^{+}$	0.01 (0.00)**	0.01 (0.01)	0.00 (0.00)
Number of Violations					
Model A	0.03 (0.01)**	0.07 (0.02)**	0.06 (0.03)**	0.03 (0.01)*	0.05 (0.01)**
Model B	0.04 (0.01)**	0.14 (0.03)**	0.10 (0.03)**	0.05 (0.01)**	0.06 (0.01)**

[#]Model A= Contemporaneous; Model B= Lagged by one quarter

Table 2-40
OLS Pooled Regression: Firm Characteristics and Sanction Type (with Cases) [#]

Total Stockholders Equity	
Model A	2.61 e-12 (2.83 e-12)
Model B	3.19 e-12 (2.75 e-12)
Return on Assets	
Model A	0.11 (0.39)
Model B	-0.38 (0.42)
Return on Sales	
Model A	-0.01 (0.06)
Model B	0.02 (0.07)
Liquidity	
Model A	0.20 (0.22)
Model B	0.18 (0.23)
# of Facilities Owned	
Model A	0.03 (0.01)**
Model B	0.04 (0.01)**
# of Employees	
Model A	2.08 e-06 (1.60 e-06)+
Model B	2.28 e-06 (1.73 e-06)

[#]Model A= Contemporaneous; Model B= Lagged by one quarter

Table 2-41
Multivariate OLS Pooled Regression: Firm Characteristics and Sanction Type (with cases) [#]

Total Stockholders Equity	3.33 e-12 (2.49 e-12)
Violation Count ALL	0.04 (0.01)**
Return on Assets	0.15 (0.33)
Violation Count ALL	0.04 (0.01)**
Return on Sales	-0.02 (0.06)
Violation Count ALL	0.04 (0.01)**
Liquidity	0.15 (0.18)
Violation Count ALL	0.04 (0.01)**
# of Facilities	0.03 (0.01)**
Violation Count ALL	0.04 (0.01)**
# of Employees	2.44 e-06 (1.41 e-06)*
Violation Count ALL	0.04 (0.01)**

[#]All Variables Lagged One Quarter

SUMMARY AND MAIN CONCLUSIONS

The secondary data analysis was designed to explore the association between firm characteristics, sanctions, and environmental crime and recidivism. We had several key research questions in this analysis. First, we wanted to know whether firm characteristics were associated with environmental violations. Second, we wondered if sanctions affected firm recidivism. Finally, the secondary data allowed us to examine the application of the law. Did firm

characteristics and violation history affect the type of sanction and amount of monitoring received? Below, we summarize what our empirical analysis revealed and offer our interpretations of these findings.

Firm Characteristics and Violations

Firm characteristics are significantly associated with environmental violations.

- Firm Profits: Consistent with prior research, firms with higher profits (i.e., total stockholders equity) have a lower violation rate. However, return on assets is also positively (and significantly) associated with t*oxic pollution violation rates*.
- Firm Structure: Firms with more facilities have a consistently lower violation rate but a higher number of violations.

Sanctions and Violations

EPA monitoring (i.e., inspections) and sanctions (i.e., informal and formal enforcement actions) have little impact on violations.

- The association between enforcement actions and noncompliance is positive when sanctions are lagged by one quarter, but sanctions are no longer related to violations when sanctions are lagged by two quarters.
- The results are null for both informal and formal sanctions.
- Formal sanctions remain positively associated with noncompliance when court cases are included in the formal sanctions category. This likely reflects EPA policy of filing cases against only the most egregious offenders.
- Associations between inspections and violations seem largely due to the EPA policy of targeting large facilities for inspection.

Firm Characteristics and Sanctions

EPA decisions to inspect and to apply sanctions are largely based on the firm's violation history.

- Firms with more violations are more likely to be inspected.
- Firms with more violations receive more serious punishments.

Some firm characteristics are significantly associated with sanctions, but the effects are small.

- Firms with more employees are more likely to be inspected.
- Firms with more facilities are more likely to be inspected.
- Firms with more facilities tend to receive more severe (formal) sanctions.
- Firms with higher liquidity tend to receive more severe sanctions.

Although all results should be considered preliminary, these findings do have important implications. Overall our results suggest that although pollution is produced at the plant-level, firm characteristics are related to environmental performance. The organizational approach drawn from the corporate crime literature is relevant to environmental studies. Further, the substantive findings are consistent with prior research linking firm profits and firm structure to patterns of corporate crime.

Second, our results suggest that EPA sanctions are ineffective. Perhaps the null findings reflect that EPA sanctions are too lenient to create changes in behavior. However, the null effect is not just limited to informal (and more cooperative) intervention strategies but extend to formal (and potentially more punitive) sanctions as well. We know that most firms in our sample did not offend often and many were in compliance or exceeded compliance levels by a substantial margin during the study period. Previous command and control policies may have successfully reduced the level of pollution and violations so that point sources are no longer a major source of pollution (Vandenbergh, 2004). However, previous studies have found a significant deterrent

effect associated with EPA inspections. Thus, the firm-level approach taken in the current research may mask sanction effects. Consistent with this interpretation, it may be that EPA sanctions are ineffective because they often fail to target the parent company and instead focus on the facility level. If parent companies maintain a substantial amount of control, the EPA may be more effective in targeting sanctions further up the organizational chain of command.

Third, our results indicate that the application of EPA monitoring and enforcement is primarily determined by legal factors (i.e., violations). Firms with more violations are targeted for inspection and are given more severe enforcement actions. However, company characteristics do play a small role influencing which firms are sanctioned and inspected: those that own more facilities are inspected more often and are given more serious sanctions. However, this outcome is likely a reflection of EPA policies that target larger facilities and firms for enforcement.

Although data problems placed some limitations on the current statistical methods, future researchers will benefit from some of the lessons we learned in this study. Different sampling strategies and approaches can overcome some of the problems we encountered, but it also may be necessary for EPA to change some of its data collection and coding strategies. For instance, it would be quite helpful if EPA systematically collected information about parent company ownership of facilities and track more completely when ownership changes. In addition, PCS should require that States forward information about informal, cooperative, actions taken by EPA inspectors as a means to better compare and assess enforcement strategies.

This research makes a contribution to several bodies of literature on environmental compliance and corporate crime. Drawing on the corporate crime literature, we explored the relevance of the firm as a unit of analysis—a unit that has largely been ignored in other

environmental literature. This research also makes a contribution to the corporate crime literature. Few studies have explored firm environmental record and the existing studies have used federal case data as a measure of crime. Moreover, we used self-reports of pollution (monthly monitoring reports) to measure crime. This type of data may better capture the true number of violations. In addition, few studies have explored the impact of sanctions (from any agency) on firm recidivism. Despite the data limitations, we believe that our findings add significantly to these bodies of research.

Chapter 3
Compliance and Managerial Decision-Making: An Analysis of Vignette Data

By Sally S. Simpson

INTRODUCTION

One problem with the use and analysis of official data (like that described in the secondary data analysis of this project) is that researchers are forced to interpret results absent what anthropologists call "thick description" (Geertz, 1973). Firm-level deterrent processes are inferred from an observed negative relationship between official punishment and state recorded recidivism. Effective intervention strategies are assumed when one kind of intervention at time ^{1} is associated with the absence of an officially recorded offense at time ^{2}. The secondary data we collected includes both self-reported and official indicators of firm noncompliance, so our analysis avoids some of these difficulties. However, neither self-report or official data sources tells us anything about what managers actually think, believe, and do. In other words, most studies of corporate deterrence/compliance that rely on official data (including our own) fail to penetrate the organizational black box to learn what decision-makers actually are thinking and doing.

As part of this project, a factorial survey was developed and administered to corporate managers in an effort to learn more about how company decision-makers evaluate and respond to environmental scenarios. As initially conceived, this survey would manipulate indicators of punitive and cooperative intervention strategies to assess the relative impact of each on a manager's decision to violate environmental law. Results from the factorial survey would then

supplement and inform interpretations drawn from the secondary analysis described in the previous chapter. As noted below, this initial strategy was broadened to include pro-social environmental decisions and, unfortunately, we were unable to link our factorial survey data with the secondary data collected from the sample of U.S. companies due to limited survey participation by firms.

SURVEY DESIGN

Factorial surveys combine experimentally manipulated hypothetical scenarios followed by survey questions to measure respondent' intentions, decisions, attitudes, or judgments (Rossi and Nock, 1982). Factorial designs, unlike more traditional survey techniques, allow researchers to experimentally manipulate a full range of circumstances that may affect a decision choice--essentially taking into account "the complexity and richness in the way people approach decisions and evaluations" (Weber, Sellers, and Rossi, 1988, pp. I3-I4).

These surveys have been used to avoid some of the temporal ordering and perceptual instability problems identified in earlier deterrence research (Saltzman, Paternoster, Waldo, and Chiricos, 1982) and to assess the conditions and circumstances under which subjects would violate the law, such as drive while intoxicated, cheat on taxes, steal, or commit rape (Klepper and Nagin, 1989; Bachman, Paternoster, and Ward, 1992; Nagin and Paternoster, 1993). Factorial surveys also have been used to evaluate the appropriateness of corporate crime punishments (Miller, Rossi, and Simpson, 1991), public perceptions of white-collar crime seriousness (Frank, Cullen, Travis, and Borntrager, 1989), and ethical decision making in business (see Weber, 1992 for a review and critique of these studies).

Environmental Survey Construction

Scenarios

One of the first steps in factorial survey construction is to determine the "domain" of the judgment or decision. The vignette domain is identified through the relevant theoretical and empirical literature and consists of factors known to affect the respondent's (in this case, the manager's) decision to engage in corporate offending. Consistent with this strategy, the survey vignettes in this research are composed of individual and company-level dimensions identified in earlier research (Paternoster and Simpson, 1996). Yet, because we focus explicitly on environmental behavior in this research (a more particular case of corporate offending), the dimensions also are tailored to this particular context.

Conversations with EPA inspectors, officials, and environmental scholars helped us identify additional vignette dimensions. Environmental marketing (does a firm market itself as "green"); facility characteristics (how many facilities are owned, their condition and location); EPA designation as a minor or major discharger; and the company's previous environmental record (including participation in EPA voluntary programs) were all highlighted as potentially relevant building blocks to account for environmental offending within our vignettes.

Meetings with these sources were also informative for other reasons. We learned, for instance, that regulators and policy-makers wanted to know more about the flip side of noncompliance, the so-called "*extreme volunteers.*" Extreme volunteers are firms that take steps to move significantly beyond "mere" compliance (Harrington, 1988; Magat and Viscusi, 1990). These companies far exceed the required levels of compliance in their facility discharges. Although economists offer a number of possible explanations for this phenomenon, our review of the empirical literature revealed little evidence to support or refute these claims (exceptions include Arora and Carson, 1996; Bandyopadhyay and Horowitz, 2006, along with more recent work by Shimshack and Ward, 2005).

In addition, the post 9/11 environment created a pressing policy concern regarding terrorism risk and vulnerability management. S*ecurity risks associated with toxic chemical storage sites* emerged as national and regulatory priority. Multiple federal agencies were involved in identifying vulnerabilities and drafting plans for protecting critical infrastructure and key resources (see, e.g., NIJ Special Report, 2002) with ultimate responsibility for these tasks shifting from the EPA to Homeland Security in December of 2003 (GAO, 2006). Consistent with the focus of our research, regulators and environmental scholars wondered which firms would be receptive to counter-terrorism initiatives and how to distinguish cooperative from uncooperative companies (see Simpson, Cohen, and Vandenbergh, 2003). Was there a relationship between the environmental norms of a company and counter-terror responsiveness? Were responsive firms also likely to be EPA compliant (or over-compliant) companies?

Because there was little in the empirical literature to answer these questions, we decided to expand the parameters of the factorial design to incorporate some of these concerns. These "pro-social" environmental questions had a substantial influence on the survey design. Instead of focusing solely on firm noncompliance as our outcome of interest, we decided to have managers evaluate and respond to additional scenarios describing firm over-compliance and counter-terrorism responsiveness. With these additions, several new research questions emerged: (1) under what set of conditions are managers responsive to pro-social initiatives? (2) How are these managers (and contexts) similar and different from those who engage in illegal activities? (3) Are managers more responsive to one type of pro-social behavior than the other? If so, which factors (individual or firm-level) differentiate the two outcomes?

To develop a set of dimensions applicable to different outcome sets (noncompliance and pro-social behavior), we used a "risk/protective factor" approach to crime prevention (Shader,

2003). This approach is mainly inductive, marshalling together known conditions and characteristics that increase or decrease (insulate against) the risk of crime (see, e.g., Agnew, 2005; Hawkins et al., 2003). Often these factors are the mirror opposite of one another (e.g., individuals who are well-integrated and bonded within social networks are insulated from crime while those with few social connections and attachments are vulnerable to crime).

Generally, risk factors are defined as "characteristics, variables, or hazards that, if present for a given individual, make it more likely that this individual, rather than someone selected from the general population, will develop a disorder" (Mrazek and Haggerty, 1994:127). Using the risk/protective factor conceptual model, we assumed that the pro-social behaviors in which we were interested (over-compliance and security consciousness) could be explained by a set of protective factors associated with non-crime. What constitutes a protective factor is debatable, but one approach emphasizes "buffers" between risk factors and illegal behavior (Shader, 2003). Consistent with some views, we also expected that many of these factors would be the opposite of those that increase the risk of noncompliance (Office of the Surgeon General, 2001). So, for instance, an effective internal compliance system might enhance pro-social behavior whereas an ineffective system could increase the risk of noncompliance. Finally, there is no *a priori* reason to privilege individual (managers) over company risk/protective factors, so we include both in this study.

Risk and protective factors are understood as contexts or situational factors that affect managerial decision-making within a rational-choice framework (Paternoster and Simpson, 1993, 1996). Managerial judgments are rational, based on the likely costs and benefits of the act--to themselves and their companies (Paternoster and Simpson, 1993). Under this rational choice model, manager's scenario assessments are assumed to vary by the type of event that is

described and its situated context (Clarke and Felson, 1993, p. 6). Therefore, each factorial survey contained two noncompliance vignettes and two pro-social vignettes. One noncompliance scenario describes a technical violation (e.g., failure to act/comply with an environmental agency's compliance order) while the other depicts a more substantial pollution event (the intentional release of a toxic substance that exceeds permitted levels by 200%). The two pro-social vignettes describe an initiative to protect and secure toxic storages sites around the plant and an over-compliance situation in which EPA emissions are kept 40% lower, on average, than permitted levels (Bandyopadhyay and Horowitz, 2003). Each respondent received one of each scenario type (e.g., one technical noncompliance, one significant noncompliance event, one over-compliance, and one counter-terrorism scenario).

All scenarios are created from the same set of dimensions. The dimensions capture theoretically relevant constructs that have been found or are theorized to predict environmental decision-making. Dimensions are orthogonal, each containing specific indicators (levels) of that construct. According to Rossi and Anderson (1982:29), "the distribution of levels among any dimension, k, will be rectangular; that is, any level within a dimension will appear in the factorial universe as frequently as any other level within that dimension." The elements (or levels) contained within the dimensions are experimentally manipulated and randomized across each scenario. Thus, every vignette will contain information about a firm's environmental record, but the type of record (level) is randomly assigned to each scenario (e.g., the firm has exceeded regulatory compliance standards, the firm generally has met EPA compliance standards, or the firm routinely has violated EPA compliance standards). This type of design allows the researcher to disentangle the effects of specific dimensions and the weights and preferences given them in decision-making.

The specific dimensions that make up each hypothetical scenario include: (1) Management Location; (2) Locus of Control, (3) Corporate Culture, (4) Firm Competitive Position; (5) Firm Ownership; (6) Firm Environmental Marketing; (7) Facility Ownership; (8) Facility Location; (9) Facility Condition; (10) EPA Discharge Classification; (11) Firm Environmental Record; (12) Firm EPA Volunteer Status; (13) Company Economic Status; (14) Environmental Constrains on the Firm; (15) Public Awareness; (16) Managerial Ethics; (17) Subsidiary Status; (18) Internal Compliance Structure; and (19) Internal Compliance Operation. The randomized levels within each of these dimensions are listed in Appendix III.

Survey Questions

Following each vignette are a set of survey questions. The same set of questions is asked after each *noncompliance* scenario. Similarly, the *pro-social* vignettes are followed by a set of questions specifically designed for them. Although there is some overlap between the two sets of questions, there are unique questions for each behavioral type (anti-social and pro-social). For instance, drawing from Simpson's earlier research (2002), the questions following the *noncompliance scenarios* discriminate the risk of formal sanction (discovery risk) by source and target (criminal, civil, and regulatory interventions directed toward the individual manager and the company). Common questions following *all* vignettes ask respondents to assess scenario realism, their willingness to behave as the depicted manager (who always offends or acts in a pro-social manner), manager's perceptions of discovery likelihood, and likely consequences (costs and benefits) of engaging in the depicted act. We also ask managers to evaluate the ethics of the depicted act using a multi-dimensional ethics scale (see, Reidenbach and Robin, 1990).

Questions not linked to a specific vignette include measures of respondent attitudes regarding environmental norms (see, Vandenbergh, 2003) and demographic information about

respondents, their work, and company specific information. The demographic and environmental norms questions appear only once on each survey. A copy of the web-based survey, including the relevant questions that follow each scenario type (i.e., noncompliance and pro-social) is attached to the end of this Report. Survey variables along with their codes are included in Appendix III.

Pre-Test and Administration

A draft of the environmental survey was pre-tested using a class of graduate students at the University of Maryland. Based on their comments, the instrument was redesigned and then vetted again with environmental scholars, regulators, and executives. The instrument was modified to address any remaining concerns raised by this group and then adopted for web-based administration. The web-based survey instrument was tested by members of the research team before it was implemented more broadly.

The sampling frame for our survey was the 55 firms that we followed (1995-2000) in the secondary data analysis. Only 48 of the 55 companies were still operating in the SIC codes of interest in 2004-05 (this number was reduced to 47 once firm contact was established, see below). These 48 companies became our universe of firms for follow-up purposes. A modified version of the Dillman Technique for mail and telephone surveys was adopted for the web-based survey administration (Dillman, 1978). The research team collected relevant company information from annual reports and company websites to identify the most likely person for initial contact (usually the Director of Environmental Management, General Counsel, or Director of Communications/Public Affairs). We sent a letter to this person describing the research project, including a copy of the technical noncompliance scenario and follow-up questions. Two

letters of support for the research from ASIS International and NIJ were sent along with this packet of materials. (Examples of these letters are attached in Appendix III.)

Shortly after mailing the packet, a member of the research team telephoned the corporate contact to make certain that the packet had arrived and to answer any questions about the survey. Those company contacts who did not initially decline participation in the survey were forwarded to the project team leader. The team leader then made follow-up telephone calls to discuss the research goals of the project and its policy relevance. Survey logistics and possible benefits to participants were also highlighted.

Description of Sample

Sixteen companies were identified for follow-up telephone calls. These companies reflected a mix of firms operating in all four SIC codes of interest (steel, pulp and paper, and oil refining). Of this group, nine ultimately declined participation and one firm reported that it was no longer in the pulp and paper business and therefore was ineligible to participate.

There were several reasons for nonparticipation. In most cases, our contact sought participation permission from top management and/or legal offices, but permission was not granted. Another firm expressed interest in the project but the timing was not optimal. Six firms (evenly split between pulp and paper and the steel industry) out of the sixteen originally forwarded to the project leader agreed to participate in the survey.

The original design of the project targeted a minimum of 100 respondents (most of whom would have some environmental knowledge or experience) across all areas of the business. However, because several firms planned to administer the survey within a single facility, it was unlikely that the desired minimum number of participants could be obtained. Thus, company contacts were instructed to get as many respondents from as many subunits as possible.

Once the survey was web ready, each contact was sent an e-mail message that would be forwarded to potential respondents within his or her company. This message had three main parts: (1) a brief description of the research project; (2) assurances regarding participant and company anonymity/confidentiality (the web survey also contained similar information); and (3) the company-specific web-link to the survey. (A generic copy of this e-mail is attached as Appendix III.). (Some contacts requested the survey link before forwarding this information to potential respondents. This link was provided to those who requested it.)

In spite of promises to the contrary, only three of the six companies participated in the survey[xvii] and one of the three withdrew from participation due to several technical glitches that occurred during administration.[xviii] Therefore, the final sample is made up of 60 respondents from a pulp and paper company and 17 participants from a steel company (N=77). We do not know how many potential respondents were sent the survey information and thus it is impossible to calculate a response rate. Informally, however, we were told that participation was high at one firm. According to our contact at the participating pulp and paper company, almost all potential respondents who received the survey participated in the study.

Respondents read and responded to a total of 386 vignettes, 192 of which were noncompliance scenarios and 194 that described pro-social situations.[xix] As shown in Table 1, survey respondents are a highly educated group. Only six respondents report obtaining less than a 4 year college education and a substantial proportion have taken graduate classes or achieved a graduate degree. Most are from the United States; almost all are married and male. This is a group of experienced managers who have worked, on average, 19 years for their current employer and 23 years in total. The majority report routine (63%) involvement in the environmental decision-making of their firms. We expect, given these characteristics, that

respondents will be familiar with the environmental conditions and situations described in the survey.

Table 3-1 about here

Most of the mangers described themselves as "middle" level (compared with lower and upper level management). Relatively few of the respondents work at corporate headquarters (only 1/3rd). The most common area of employment is manufacturing and production (54 out of 77). When asked about the kinds of compliance systems operating in their own firms, survey participants reported an ethics code most often (96%), followed by a hotline in which violators could be anonymously reported (95%), and mandatory ethics training (88%). Relatively few thought that their company practiced random ethics audits (26%). Finally, the majority of respondents believed that top management at their company took ethics and ethics violations seriously (88%) and that the environmental commitment of the firm was "about right" (86%).

ANALYSIS

Mean Differences

This sample is much smaller than we would have preferred (especially given the limited the number of companies represented). However, because vignettes are the unit of analysis in factorial surveys, there are enough cases for us to analyze and explore the research questions of interest. We will not be able, however, to tie the survey responses to the official compliance and enforcement records of the companies in our secondary data analysis—as we had originally proposed to do. There simply are not enough companies who participated in the survey to make this a worthwhile endeavor.

Behavioral Intentions

As a first analytic step, in Table 2, mean comparisons tests (t-tests) are used to examine similarities and differences in responses to questions of interest (across and within outcome types). One of our key variables measures the respondent's willingness to engage in the behavior described in the vignettes (**MGRACT**), so we begin with a discussion of this measure. Not surprisingly, mangers are much more willing to engage in pro-social than anti-social acts, but there are also notable variations within behavior type that are statistically significant ($p<.05$). On average, managers are rarely willing to defy an EPA compliance order (less than 10% likely) and even fewer would participate in a significant toxic pollution event (less than 5%).[xx] There is substantial range in respondents' willingness to engage in a technical environmental violation (0-80% on a 0-100% likely scale), but there is much less variation for the significant noncompliance scenario (0-10% range on the same scale).

Managers are more receptive and willing to participate in the pro-social behaviors. Approximately 70% (on average) of respondents were willing to exceed permitted levels by 40% (over-comply). An even higher proportion of managers agreed to undertake counter-terrorism initiatives (83%). These differences are statistically significant. The range and standard deviation for both of the pro-social behaviors, however, are quite large indicating that managers are far from one opinion about these activities.

--Table 3-2 about here--

Perceived Risks and Consequences

When we compare our measures of perceived risks and consequences associated with the anti-social behaviors, it is clear that managers associate significant negative consequences with the depicted acts of environmental noncompliance. *Legal sanctions* were perceived to be likely and severe regardless of legal authority (e.g., regulatory, civil, or criminal authorities), but there

were some perceptual differences in risk and consequence by sanction target (individual manager versus company). Detection risks, for instance, were perceived to be greater for the company while negative consequences were estimated to be slightly greater for the individual. In other words, respondents thought that noncompliant companies had a greater risk of discovery than the responsible managers within them but that the consequences of being caught would be more severe for themselves than for the firm. These perceptual differences in sanction certainty and severity were significant regardless of sanction source ($p<.05$).

As one might expect, the perceived risks associated with acting illegally were higher for the significant pollution incident than for the "technical" violation. This more serious form of noncompliance was believed to be a greater danger to human life (mean value of 4.7 compared to 6.4) and other wildlife (mean of 5.9 compared with 7.7) and was described by respondents as a more undesirable behavior than the failure to comply scenario (although both are evaluated to be on the high end of the undesirability scale with a mean of 9.7 and 9.1, respectively). All of these noted differences are statistically significant (at the .05 level). In addition, managers thought it would be more difficult to avoid discovery for the significant pollution event (all mean differences by sanction source are significant except for firm discovery by a regulatory agency).

Moving next to how managers perceive the *informal costs and consequences* associated with the different behaviors, most felt that engaging in illegal activities would have negative consequences even if the acts were not "officially" discovered and legally sanctioned. Under the assumption that the act would become known informally (but not to legal authorities), respondents believed that both types of environmental noncompliance would negatively affect careers, their relationships with significant others, and the reputation of their firm. Although these impressions appeared to be somewhat stronger and more consequential for the toxic

pollution event than for the act of regulatory noncompliance (for instance, estimates for the chance of being dismissed from the company varied from an average of 80% probability for the technical noncompliance scenario to 85% probability for the significant noncompliance scenario), few of these informal consequence variables showed significant mean differences between the two types. The only variable that was significantly different measured respondent perceptions of negative family outcomes (losing respect and good opinion of family members). Here, the significant pollution event was perceived to increase the risk of this negative outcome more so than for the technical offense (mean values equal 8.0 versus 7.2 on a 0-10 scale).

Perceived benefits

In the case of the pro-social vignettes, managers assessed both types of actions to be desirable behaviors but over-compliance was evaluated slightly lower on the desirability scale than increasing security around toxic storage sites. For instance, respondents were asked to rate the desirability of each on a scale of 0-10 where 0 is described as very desirable and 10 not desirable at all. The mean value for over-compliance was 3.5, but the security scenario was 2.5 (a significant difference). Similarly, respondents appeared to be more comfortable with "security" as a reasonable environmental strategy than with the idea of extreme volunteerism. When respondents were asked, "do you think the environmental strategy described in this scenario is reasonable for firms to pursue," on a 0-10 scale (with 0 representing unreasonable and 10 reasonable) managers generally rated an over-compliance strategy near the middle of a 0-10 scale (4.8-- neither reasonable or unreasonable) but the average rating for enhanced security was substantially higher (7.1). This difference was statistically significant.

Consistent with these results (but **not** significant), managers perceive somewhat lower personal benefits associated with over-compliance compared with counter-terrorism

responsiveness. On the whole, managers think they are somewhat more likely to gain the respect and good opinion of significant others and feel good about their action if it became known that they enhanced security around toxic storage sites compared with others learning of over-compliance behavior.

The sole exception to the more positive assessment of counter-terrorism responsiveness compared with over-compliance centers around employment/career benefits. Respondents are somewhat more likely to think that they will improve their own employment situation (e.g., career advancement, promotion, future job prospects) and their firm's reputation if they over-comply. Over-compliance was thought to better enhance the positive reputation of their company (6.1 versus 5.8) even though respondents indicated that they would (on average) feel a greater sense of internal pride for enhancing security around toxic storage sites than moving toward extreme volunteerism. These differences may signify recognition among respondents that managers who provide environmental leadership in the direction of over-compliance are a valuable commodity, both within their company and externally. However, because none of the mean comparisons for any of these "benefits" are significant, we should be careful not to make too much of these patterns.

Ethical Evaluations

Finally, we contrast results regarding how managers view the ethical/moral dimensions of noncompliance and pro-social environmental strategies. According to business ethics scholars, ethical reasoning is informed by several moral domains. Thus, a business decision may not be seen as normatively prohibited (and thus culturally acceptable), but it may violate an implied contract (see, Reidenbach and Robin, 1990). Recognizing that our scenarios may tap into different ethical domains, respondents were asked to give their beliefs about the manager's

action by situating the behavior on a scale of ethical opposites (e.g., culturally acceptable versus culturally unacceptable; just versus unjust; morally right versus not morally right). Rankings on the scale items range from 1 to 7; a score of 4 indicates a neutral value.

The measures of ethical reasoning tap into several distinct elements, including *moral equity* (just/unjust, fair/unfair, morally right/not right, acceptable/unacceptable to family), *relativism* (culturally acceptable/unacceptable, traditionally acceptable/unacceptable), and *contractualism* (violates/does not violate unspoken promise, unwritten contract). Respondents rate both of the noncompliance behaviors as highly unethical across the different ethical dimensions. As one might expect, significant noncompliance (the release of substantial amounts of toxic pollution into a local waterway) is rated to be more immoral and unethical, on average, than technical noncompliance. Mean differences between the two acts of noncompliance show significant differences across all ethical domains except for one measure of ethical relativism (culturally acceptable/unacceptable).

Moving next to our pro-social behaviors, managers view both acts to be ethical and moral. Evaluations are fairly consistent for the contractualism dimension of ethics and there are no significant differences in the mean values of the items. However, there are fairly substantial evaluative differences in some elements of relativism (traditionally acceptable/unacceptable and a global measure of ethical behavior ($p<.01$). Respondents tend to see security responsiveness as more traditionally acceptable and ethical overall than over-compliance. There are also smaller (but significant) differences in appraisals of act morality ($p<.05$), whether the act is just/unjust ($p<.05$), or fair/unfair ($p<.05$). Again, vignettes that describe managers as security conscious are viewed as more just, moral, and fair than those depicting extreme volunteerism. Thus, although

respondents generally evaluate the two illegal acts as "unethical" and the two pro-social acts as "ethical," the relative assessments of each type of act vary by degree and dimension.

Other measures

Most of the scenarios, as shown in Table 2, were perceived as realistic by respondents. However, those portraying pro-social behaviors were deemed more realistic than the hypothetical situations depicting noncompliance.[xxi] We did not observe any differences in respondent assessments of scenario realism within categories (i.e., prosocial and antisocial). There also were no differences in estimates of how exciting or thrilling it would be for managers to engage in the behaviors.

Correlations

Before moving to a more complex multivariate analysis, in the next section we examine whether our predicted relationships have bivariate support. Specifically, we examine whether risk and protective factors are correlated with reported anti-social and pro-social behavioral intentions. Pearson correlations coefficients for key variables are listed in Table 3 (A and B).

Coding

As noted earlier, there are multiple indicators for formal and informal sanction risks, including certainty and severity of sanctions. Many individual items are highly collinear and, because our mean difference tests did not reveal substantial differences within analytic levels (see above), we produced several scaled and combination variables before conducting our correlational analyses. Therefore, before conducting variable correlations, several scaled and combination variables were produced. Several different scale measures were created for formal sanctions and informal sanctions, distinguishing perceived individual sanction risk and consequence from those estimated for the company (formal only for the firm). For instance, a

standardized scale was created for individual formal sanction threats (iformal) wherein criminal and civil regulatory measures of perceived certainty and severity were multiplied, the product terms standardized, summed (perceived regulatory certainty was included),[xxii] and divided by 3 (alpha=.94).

Another scale was created for individual informal threats (informal).[xxiii] At the firm level, a formal sanctions scale was created by multiplying criminal sanction certainty with criminal severity added to similar product terms for civil sanctions and regulatory sanctions (fformal). We also created a scale measure that captured individual level benefits (ireward). This item was calculated in a similar manner, by multiplying the certainty of all individual level benefits by their estimated value and then adding the items together. Potential benefits for individuals include promotion, improved job prospects, positive attention by top management, gaining the respect of friends, family, and business associates. Alpha reliabilities for these other scaled variables are high (ranging from .92 to .97).

In addition to the scale measures, several new variables were created to capture firm informal costs and benefits. Firm reward (freward), for instance, is the product of reward certainty and severity measured at the firm level. Informal costs at the firm level (finformal) are measured as the product of firm informal costs certainty and severity.

As previously noted, managers were also asked to evaluate various ethical dimensions as they applied to the depicted acts. Rather than use the individual questions in our analyses, we followed standard procedure and scaled the items to correspond to the specific ethical domains of contractualism (alpha=.76 for antisocial behavior, .94 for prosocial), equity (.87 antisocial, .96 prosocial), and relativism (.73 antisocial, .83 prosocial).[xxiv] Ethical evaluations are reverse coded depending on the dependent variable of interest. For example, for the antisocial

behaviors, higher values on these items represent more negative evaluations of the behaviors. For the pro-social regressions, higher values represent more positive evaluations of the behaviors.

Table 3-3 about here

As shown in Table 3, many variables are not associated with respondent's behavioral intentions. Several correlations are noted for variables within one behavioral type but not the other. For instance, pro-social intentions increase when the scenario conditions are perceived to be realistic but this relationship does not hold for the noncompliance scenarios. Only a few demographic variables are related to respondent intentions to engage in the activity. A respondent's reported level of religiosity is positively related to pro-social intentions but is unrelated to illegal behavior. In other words, respondents who report higher levels of religiosity are significantly more willing to over-comply with standards and respond to security threats around their facilities. We also see that where managers currently work (in production/manufacturing) is associated with pro-social intentions. Yet, since most of our respondents work in these areas, the relationship is not a particularly informative one. Two relationships that may be more important are the slight negative correlations ($p<.06$) between (1) the number of years a respondent has worked for his/her current employer and (2) a manager's involvement in environmental decision making within his or her company and anti-social behavior. Working longer for an employer appears to decrease the risk of noncompliance while greater environmental decision-making experience inhibits noncompliance.

One set of variables consistently related to pro-social behavioral intentions measure the type of internal compliance program at the company *where the respondent works*. Each element of internal compliance (an ethics code, mandatory ethics training, random ethics audits,

anonymous hotline, and top management that treats ethics and ethics violations seriously) is positively associated with respondents' willingness to act as the depicted manager in the pro-social vignettes (all but one of the elements are significant at $p<.05$). Similarly, respondents who report that their company has a corporate environmental management system are more willing to behave in a pro-social manner. None of these workplace components (i.e., where the respondent works) affect behavioral intentions to engage in noncompliance. Finally, there is a positive relationship between work location and prosocial intentions. Managers who report working in a subsidiary (as opposed to corporate setting) report higher behavioral intentions. Firm ownership (publicly-owned companies), facility location (suburban, not urban) and condition (not old) are also associated with manager's willingness to enhance security and/or over-comply.

When different elements of an internal compliance program are experimentally rotated across *the vignettes* (i.e., internal compliance structure and operation), a somewhat different picture emerges. Under the vignette conditions, internal compliance characteristics are significantly correlated with noncompliance behavioral intentions (but not pro-social ones). Unexpectedly, there is a positive correlation between mandatory ethics training and the intent to offend. A more consistent theoretical finding is that respondents are sensitive to a compliance system that takes ethical violations seriously--thus there is a significant negative correlation between environmental noncompliance and vignette information that shows a strong punitive response to previous noncompliance (i.e., managers who engaged in similar acts of noncompliance were fired from the company).

Other vignette items that are significantly correlated with behavioral intentions include managers being asked by their supervisor to do something (relative to supervisors making that decision themselves)—this variable increases behavioral intentions in both kinds of scenarios

(pro-social and noncompliant). Scenarios in which the firm is depicted as a subsidiary show a slight increased risk of noncompliance ($p < .07$) as do those that depict firms as having mandatory ethics training—perhaps a cynical recognition that mandatory training in ethics may be no more than window-dressing for some companies.

Many of our survey variables are associated with environmental noncompliance. In fact, items found to be related in other studies of corporate offending are also significant here (for a summary, see, Simpson, 2002). Intentions are positively associated with career benefits, sensate thrills (when the behavior is perceived to be more exciting), and perceived act desirability. Noncompliance is reduced when the acts carry negative ethical evaluations by managers; when managers perceive the law to be overly strict and formal sanctions as likely and consequential; when the behavior is associated with negative environmental consequences (danger to human and aquatic/other wildlife); and when noncompliance increased the risk of informal costs and consequences (e.g., harming an individuals relationships with significant others, feeling guilty and embarrassed, and damaging their firm's reputation). We also find strong relationships between survey items and pro-social intentions. For instance, intentions are higher when the hypothetical situations are perceived as realistic, more exciting, and career enhancing. Managers report a greater responsiveness to pro-environmental actions when the behaviors are evaluated as ethically, morally, and socially desirable—and deemed a reasonable environmental strategy. Additionally, respondents report higher intentions when rewards are perceived to be higher (feeling good about oneself and garnering positive feedback from significant others).

Finally, many of the "attitudinal" norm questions are associated with noncompliant intentions but not with the intent to act pro-socially. For instance, respondents who believe that individuals should comply with the law even if it goes against what s/he thinks is right *are less*

likely to violate EPA regulations. Similarly, managers are more likely to report intentions to offend if they think compliance with the law has moral limits (i.e., individuals should comply as long as it does not go against what s/he thinks is right), and if they believe firms and individuals should be free from government intervention (absent blameworthy activity) Those who more strongly believe that individuals and firms should not cause harm to the environment are significantly less likely to engage in noncompliant acts. Finally, managers who believe that individuals and firms should act as others (individuals or firms respectively) do are slightly more likely to report noncompliant intentions. None of the environmental questions are related to pro-social intentions.[xxv]

In the next section, we examine whether these observed relationships hold in multivariate models. To increase statistical power, the noncompliance scenarios are analyzed together. Most models include controls for behavioral type (technical noncompliance is coded as 1, significant noncompliance as 0; response=1 for counter- terrorism and 0 for over-compliance) and scenario realism (1=yes, 0=no).

There is relatively little variability in behavioral intentions across the noncompliance scenarios, so our dependent variable is coded as a categorical variable (1=willing to act as manager in the scenario, 0=unwilling to act as manger in the scenario). These data are analyzed using multivariate logistic regression. Because there is more variability in the pro-social behavioral intentions (even though the dependent variable is skewed toward higher values), Ordinary Least Squares regression is utilized to explore potential predictors of counter-terrorism responsiveness and over-compliance. Each research subject responds to four vignettes and thus, observations are not independent of one another. What we have, in effect, is a repeated measurement design in which the error terms across observations may be correlated. Therefore,

in our multivariate analysis, the data are adjusted for clustering which corrects the standard errors when the units of observation are homogeneous.

Multivariate Results

Analysis

Results for both sets of regression analyses (logistic and OLS) are presented in four different models.[xxvi] The first analysis is conducted using only the randomized vignette items as independent variables (see Table 4). Next, in Table 5, anti-social and pro-social behavioral intentions are regressed on the survey questions. There are two models reported for the survey questions. The first model contains measures of perceived costs/benefits associated with the different environmental behaviors while the second model reports results for the environmental norms questions. The impact of the demographic variables on behavior intentions is reported in Table 6. In Table 7, we include a summary regression for each intention type (pro-social and antisocial), including all significant variables from the earlier models.

Table 3-4 about here

As shown in Table 4, few of the vignette variables are associated with illegal environmental behavior (model 1). Only four items are significantly predictive of offending at a $p<.05$ level. Respondent offending risk increases when scenario managers are asked by a supervisor to violate the law ($p <.01$) and when facilities are located in urban areas (compared with rural). Contrary to other research on corporate offending (Paternoster and Simpson, 1996), survey participants are less apt to offend when the illegal act is described in the scenario as "strengthening the competitive position of the firm" compared with scenarios when the illegal act was associated with weakening the firm's competitive position. The risk of offending is lowered significantly ($p<.05$) when the offending manager in the vignette works for a firm where

ethical considerations "guide top management" actions (such as hiring decisions, performance evaluations, and promotions) compared to vignettes where ethical considerations are described as "mostly irrelevant" to business decisions at the firm.

In addition to these variables, four additional measures are significant when we relax the .05 significance level to a 90% confidence interval ($p<.10$). The structure and operation of internal compliance systems modestly affects offending risks. For instance, when firms are required to self-report pollution levels to EPA and companies take action against employees who are environmental violators (i.e.., violators are fired), the odds of offending are reduced. These relationships are relative to other components of internal compliance (e.g., ethics training, random audits, and a hotline) and compliance system responses (no action taken against violating employees). We also see a positive relationship between suburban location (relative to rural) and noncompliance but a negative relationship between offending intentions and facility ownership. Noncompliance is greater when firms own and operate one as opposed to several facilities.

Looking next at pro-social environmental behaviors (model 2) fewer variables are associated with this dependent variable. Once again, as in the offending scenarios, mangers are more willing to follow these environmental strategies when asked to do so by a superior. But, in these scenarios, management level also matters. When vignettes depict the managerial position of the actor as "middle level" (compared with someone higher in the authority chain), respondents are less willing to pursue these behaviors. Importantly, even after controlling for all of these vignette dimensions, there is still a positive and significant effect for scenario type. *Ceteris paribus*, respondents are much more responsive and willing to enhance security around toxic storage sites than they are to voluntarily over-comply with regulations. Finally, one odd finding is that managers appear less willing to act pro-socially when firms in the vignettes are

depicted as following ethical considerations in their hiring, performance, and promotion decisions (compared to firms where ethical considerations were mostly irrelevant to business decisions). One might expect the opposite—that ethically driven firms would be more proactive environmentally, but our results do not support this prediction. A possible interpretation is that "ethically" managed companies are also more tightly controlled and risk averse. As such, managers would not be encouraged or rewarded for pursuing or adopting "innovative" environmental strategies.

In the next set of regressions, we explore the relationship between behavioral intentions and manager's cost-benefit perceptions and support for environmental norms. The first model in each set of columns shows regressions for a variety of perceived costs and benefits while the second model lists the results for the environmental norms variables.

Table 3-5 about here

As seen in the logistic regression results reported in column one of Table 5, a number of factors affect the risk of environmental noncompliance. Controlling for scenario realism, the odds of offending go up when respondents believe their career will benefit and when the act is ranked higher on the social desirability scale. There is also a negative and significant relationship between perceptions of regulatory law and noncompliant intentions. Respondents who think the law is too strict are significantly less likely to engage in noncompliant behavior (implying a deterrent effect for regulatory strictness and not a criminogenic defiant effect). The risk of noncompliance is increased when evaluations of the depicted behavior move toward moral equity (i.e., the act is just, fair, and moral). None of the other ethical dimensions (contractualism and traditionalism) are related to noncompliance nor are the measures of informal sanctions (direction at the firm or individual managers). However, when mangers

perceive the act to be not at all unethical, they are significantly *less likely* to do it (a counter-intuitive result).

There is a deterrent effect for formal sanctions directed at the *company*, but only when formal sanctions directed at the individual are omitted from the model. Similarly, formal sanctions directed at the *individual* inhibit noncompliance, but only when firm level formal sanctions are dropped from the analysis. When formal sanctions directed at the company and individual are not included in the analysis, the negative relationship between informal individual sanction threats and noncompliance becomes significant. These results indicate that formal and informal sanction threats overlap substantially in their capacity to inhibit offending.

Moving on to the pro-social behavioral intentions, only two variables have much of an impact. First, when respondents believe that the environmental behaviors are fair, moral, and just, intentions increase. Similarly, pro-social intentions go up with the perceived social desirability of the behavior--the more socially desirable the behaviors are perceived to be, the more willing respondents are to participate in them. Interestingly, none of the perceived benefits (for the individual manager or his/her company) are associated with these actions. Yet, once again, collinearity among items may account for this result (especially between rewards for the individual manager and firm benefits, correlated at .84). In subsequent analyses (not reported here), step-wise regression was conducted to determine which of the highly correlated variables had the strongest relationship with pro-social behavioral intentions. In these runs, individual reward was dropped in favor of moral equity and social desirability.

In the second columns reported in Table 5, results are reported for the environmental norms. Consistent with the bivariate results, environmental attitudes are unrelated to pro-environmental actions but are closely associated with noncompliant behavior. Again, because of

model collinearity, we ran our analyses separately for items that tap *individual*-level items and those that are *company*-level. The same norms were significant in both individual and firm analyses with the same directional relationships. Because we have a few more cases and results are more robust in the firm-specific models, these results are reported in Table 5. (The individual-specific items can be found in Table 1, Appendix II.) Findings indicate that managers who express stronger pro-environmental sentiments (e.g., individuals/companies should not cause harm to the environment) have a lower probability of offending. Probabilities are lower as well for managers who believe in legal adherence even if it is contrary to personal beliefs. The risk of noncompliance is higher, however, for managers with stronger anti-regulatory attitudes (i.e., "individuals/firms should be free from government intervention absent blameworthy activity"). Finally, managers who score lower on the question, "firms should not be treated arbitrarily or deprived of opportunity" appear more susceptible to noncompliant behavior (perhaps a residue of regulatory defiance, Sherman, 1993). To reiterate, *none* of these environmental norms are related to pro-environmental actions.

Lastly, in Table 6, we examine whether environmental intentions are related to demographic characteristics. Several results are noteworthy here. Looking first at noncompliance, results indicate that less experienced managers are at greater offending risk than long term employees. However, lower level managers and those who are routinely involved in environmental decision-making have a lower offending risk than mangers with less environmental experience but more authority.

Table 3-6 about here

In contrast, the willingness to engage in pro-environmental actions is lower among those who do not plan to remain long in their current company position. Long time employees report

slightly higher pro-social intentions as do those who work in manufacturing (compared with other subunits or divisions). The most powerful predictor, however, is whether the respondent's current employer has a corporate environmental management system. Those who report yes are significantly more willing to take on pro-environmental actions absent regulatory requirements. No other demographic variables are related to this set of behavioral intentions.

As noted earlier, the sample size is relatively small and therefore it was not feasible to include all relevant variables in one saturated model. Because several variables are significantly related to environmental behavior within each of the above models (using a generous $p<.10$ criterion), we analyze these variables in a parsimonious model reported in Table 7. We recognize that this summary technique can be problematic (Bushway, Sweeten, and Wilson, 2006), but it is one way to assess whether the observed relationships hold when other theoretically relevant (and significant) variables are included in one model.

Table 3-7 about here

In the noncompliance "summary" model, many of the variables that were significant in the previous analyses still affect respondent's reported intentions to violate the law. Controlling for type of noncompliance and scenario realism, offending risk goes up when one's supervisor asks the manager to violate the law, when the firm owns only one facility (instead of multiple) that is located near an urban or suburban area (compared with a rural location). Consistent with the earlier findings, the risk of noncompliance is lowered when firm internal compliance systems are depicted as taking environmental offenses seriously (i.e., employees are fired or severely reprimanded when laws are violated) and when legal sanctions (directed at the firm) are perceived to be certain and severe. None of the environmental norms attain significance in this model and few of the demographic variables matter. Lower-level managers have lower odds of

offending as do those who have more responsibility for environmental decision-making within their firms. Finally, this analysis uncovers an unanticipated positive relationship between moral evaluations and noncompliance, suggesting that offending is *more likely* when managers place the acts higher on the ethical evaluation scale (i.e., toward highly unethical). This result is difficult to explain given that this particular measure of ethics is not highly correlated in our bivariate analyses with any other independent variables and only at .004 with antisocial intentions.

In the parsimonious model for pro-social environmental behavior, several variables continue to have a significant effect on reported intentions. Controlling for whether managers believe the vignette is realistic and scenario type, respondents are more willing to take action in response to counterterrorism requests or to over-comply when asked to do so by a company superior. They are also influenced by whether they believe these actions are fair and equitable (one of our moral dimensions) and when the behavior is perceived to be more socially desirable—these relationships are positive and highly significant. Middle managers are less willing to take these actions than upper-level managers.

Summary and Conclusions

The factorial survey was conducted to learn more about how managers view different environmental behaviors—some illegal and others best perhaps described as pro-environmental, and their willingness to participate in these actions. In particular, a key goal was to investigate cooperative and deterrence environmental strategies in the context of day to day decision-making. Which strategy produced greater compliance with environmental law? What other individual and firm-level factors increased or decreased the risk of noncompliance? We also were interested in learning more about pro-environmental behaviors that are not "regulated."

Under what situations will managers proactively exceed regulatory requirements? When might they respond positively to security threats around their facilities? Finally, we were interested in the extent to which noncompliance and pro-environmental behaviors were predicted by the same set of factors (albeit with opposing directional relationships). Although the level of participation in the survey was disappointing (only 77 participates from two companies), respondents were asked to evaluate four vignettes (77*4=308). Therefore, we had enough cases to explore our research questions of interest, broken down by outcome type (noncompliance versus pro-social). Below, we provide a bullet summary of the main findings.

Noncompliance

1. Few managers are willing to violate environmental laws, but willingness varies by type of offense. Managers are more willing to violate a technical order than release toxic pollutants into waterways.
2. Detection risks (formal sanctions) are perceived to be likely and severe regardless of legal authority (criminal, civil, or regulatory), with differences in risks found by sanction target. Companies are perceived to have somewhat higher discovery risks while the consequences of getting caught are thought to be more severe for individuals.
3. Managers believe that participating in illegal environmental behavior will have negative consequences for their careers, relationships with significant others, and the reputation of their company. With one exception (greater costs to relations with family for the toxic pollution event), there were no differences in perceptions of informal risks and consequences between the types of noncompliant acts.

4. Both manager and facilities/firms characteristics affect the risk of noncompliance. Managers with more work experience report lower offending intentions. Intentions are also somewhat lower when facilities are located in rural areas and companies own more than one facility.
5. Managers with stronger pro-environmental sentiments (e.g., individuals/companies should not cause harm to the environment) have a lower probability of noncompliance. Probabilities are lower as well for managers who believe in legal adherence even if it is contrary to personal beliefs. The risk of noncompliance is higher, however, when managers have stronger anti-regulatory and "defiant" attitudes (i.e., concerns about arbitrary treatment by regulators).
6. Summary analyses show that violations of environmental law are related to *company authority* and *compliance structures* (offending risks increase when managers receive instructions from a supervisor, risk decreases when companies take significant actions against prior violators), *personal beliefs* (odds increase when the behavior is perceived to be more socially desirable, mangers think their career will benefit, and they believe there is no obligation to follow the law if it is inconsistent with their personal beliefs), and *perceptions of formal sanction threats for the company* (offending odds go down when managers perceive greater likelihood and severity of formal sanctions for the firm).

Over-compliance and Counter-Terrorism Responsiveness

1. Managers generally are willing to participate in pro-social behaviors—especially taking action to enhance security around toxic storage sites. This action was rated by

respondents as a more reasonable environmental strategy to pursue than over-compliance.

2. Overall, managers believe security responsiveness is more traditionally acceptable and ethical and they tend to rate it higher on the other ethical dimensions (more just, moral, and fair) compared with over-compliance.
3. Pro-social intentions positively correlate with organizational compliance structures and operation. When managers describe their firms as having an ethics code, mandatory ethics training, random ethics audits, anonymous hotlines, and a corporate environmental management system, they report higher pro-social behavioral intentions.
4. Summary results consistently demonstrate the important role of *company authority structures.* Pro-social intentions are increased when the acceptability of the action is communicated down the authority chain (i.e., when managers are asked to engage in the activity by a supervisor). Intentions are increased as well when managers hold more positive ethical assessments of the behaviors (e.g., the action is viewed as fair, equitable, and socially desirable).
5. Managers who plan to stay in their current position for longer periods of time are more willing to engage in pro-social behaviors.

Overall, our vignette surveys reveal modest support that formal legal sanctions can work successfully to deter environmental noncompliance. (Formal sanctions are highly collinear with informal sanctions. Thus, formal and informal sanctions may work best in tandem.) However, the risks of noncompliance are also reduced by more cooperative strategies that build on ethical evaluations of managers (violations are undesirable activity) and when companies have internal

systems of compliance that communicate top management disapproval of illegal activity and significant consequences for environmental violators.

Few of our predictive factors played an equal but opposite role in promoting pro-social and inhibiting anti-social environmental behavior. An effective compliance system did decrease noncompliance while raising pro-social intentions. Career length also appears to have opposite effects by outcome type, but the two measures are not symmetrical across analyses (managers with more overall business experience are less apt to offend, managers who plan to stay in their current positions for a longer time report higher pro-social intentions). Generally, most of our variables had similar effects across outcomes. So, for instance, ethical reasoning and social desirability affected both outcomes in a similar direction. When managers thought the described behavior was ethical, fair, morally and socially acceptable, both sets of behaviors increased. Similarly, managers respond to requests from higher authorities regardless of whether that request involved illegal or pro-environmental activity.

For the most part, the variables we have identified and used in these models are associated more with noncompliance than environmental volunteerism. In other words, we do a better job predicting illegal behavior than pro-social environmental behaviors. Environmental attitudinal norms, for example—especially attitudes regarding legal obligations that challenge personal values, predict noncompliance but are completely unrelated to non-regulated behaviors (over-compliance or security enhancement). Similarly, managers who perceived career benefits are more apt to participate in illegal environmental behavior but none of the benefits measures (for individuals or the firm) was associated with pro-social intentions once other variables are added to the analysis (e.g., social desirability and ethical evaluations).

Overall, these results suggest that firms can develop consistent pro-environmental strategies that avoid illegal behavior, protect security, and move toward more proactive reduction of pollution when there is shared agreement and consistent communication about environmental goals. Long term managers appear to be in a somewhat better position to provide this guidance. But, more research is required to unravel the sources of proactive environmental strategies within firms because the phenomenon is not well-understood. Some economists assert that over-compliance (extreme volunteerism) is a utilitarian strategy that firms use to advance their own competitive position. Business ethicists, on the other hand, often assert the converse—companies and managers over-comply (and promote pro-green strategies) because it is the socially responsible and ethical thing to do. Our research offers more support for the latter than the former argument, but this study is exploratory. It may be that the firms who agreed to participate in this study had better environmental records than those that refused. Therefore, our results are best viewed as preliminary. Future research, conducted in more companies with a larger group of respondents, should concentrate on this important research question: Absent regulation, under what conditions do companies adopt pro-environmental strategies?

Table 3-1: Sample Characteristics (N=77)

Gender	Male 69 Female 5 Missing 3	
Nationality	United States 66 English 1 Missing 10	
Education	High School Graduate 2 Some College 4 4 Year College 43 Some Graduate 10 Graduate Degree 15 Missing 3	
Marital Status	Married 69 Divorced 1 Single 3 Missing 4	
Age		
Years with Current Employer		
Management Level	Lower 12 Middle 56 Upper 6 Missing 3	
Current Department	Manu/Production 56 Personnel 1 Safety 5 Legal 1 Other 11	
What is your work location?	Corporate 21 Subsidiary 51	
Describe the environmental commitment of your company.	Excessive 7 About Right 66 Could use work 1 Missing 3	
Involvement with Company Decision-Making	Not 3 Somewhat 22 Routinely 49 Missing 3	
	Yes	No
Does your current employer have a code of ethics?	74	3
Does your current employer have mandatory ethics training?	68	9
Does your current employer have random ethics audits?	20	57
Does your current employer have an anonymous hotline?	20	67
Does your current employer have top management that treats ethics	68	9

and ethnics violations seriously?		
Does your current employer have a Corporate Environmental Management System?	72	5

Table 3-2: Mean Difference Tests (Technical compared with Significant Violations; Security Enhancement compared with Over-compliance)

	Technical/Significant Violations			**Security/Over-compliance**	
Mgract	.91	.42*	Mgract	8.30	7.15*
Sitreal	.46	.50	Sitreal	.11	.24
Career	1.18	.90	Career	4.16	4.78
Thrill	.25	.18	Thrill	3.18	3.99
Moral 1	6.30	6.32	Moral 1	2.27	2.78**
Moral 2	6.49	6.71**	Moral 2	2.07	2.87*
Moral 3	6.50	6.77*	Moral 3	2.16	2.82*
Moral 4	2.00	1.39*	Moral 4	5.89	5.69
Moral 5	5.64	6.05**	Moral 5	2.54	3.11**
Moral 6	6.68	6.88*	Moral 6	2.17	2.82*
Moral 7	1.82	1.39*	Moral 7	5.74	5.42
Moral 8	6.67	6.87**	Moral 8	1.79	2.75*
Moral 9	2.01	1.51*	Moral 9	5.93	5.36**
Lawadqcy	4.75	4.71			
Dsrablty	9.13	9.65*	Dsrablty	2.49	3.46*
Dngerlife	4.72	6.38*	Envstrat	7.15	4.78*
Dngrwlife	5.96	7.69*	Feelgood	.11	.22**
CrimCh	6.22	7.36*	Promo	4.19	4.44
CrimFch	6.76	7.72*	GainFrnd	5.31	5.46
CivilCh	5.96	7.13*	GainBus	5.05	5.55
CivilFCh	6.97	7.91*	GainFam	5.65	5.90
RegCh	6.80	7.74*	JobAdv	4.64	4.99
RegFCh	7.87	8.19	Pride	.32	.31
Guilt	.03	.01	FirmRep2	5.77	6.11
KnownInf	9.32	7.19	Firmrepp	.16	.22
Dismiss	7.99	8.52	BenPromo	6.08	5.95
Friend	8.17	8.66	BenFrnds	5.77	5.63
Business	8.28	9.05	BenBus	5.89	5.87
Family	7.17	8.04**	BenFam	5.82	5.47
Jobcert	8.46	8.69	BenFirm	6.57	6.35
Shame	.05	.03	BenPride	6.12	5.74
Firmrep	8.28	8.74			
FirmReps	.04	.03			
Crimsev	9.81	9.79			
Crimfmsv	9.36	9.40			
Civilsev	9.83	9.72			
Civilfsv	9.31	9.31			
Regfmsev	9.17	9.22			
Discost	9.82	9.79			
Frndcost	8.81	9.01			
Buscost	8.28	9.05			

Famcost	8.84	8.99
Jobcost	9.32	9.44
Firmrpsv	8.99	9.12
Shamesev	9.00	9.12

* $p<.05$

** $p<.01$

Table 3-3: Correlation Matrix

A. **Pro-social** (Independent variables with security/over-compliance intentions, combined scenarios).

	Intentions		Intentions		Intentions
Intentions (Mgact)	1.00 (n=154)	Sitreal	.316 .001*** (n=155)	Female	-.121 .149 (n=143)
Response	.194 .016* (n=155)	Career	.422 .001*** (n=154)	Highgr	.015 .861 (n=143)
Midmgr	-.089 .327 (n=155)	Thrill	.471 .001*** (n=154)	Yrsbexp	.015 .865 (n=141)
Asked	.234 .003** (n=155)	Pscontrc	.634 .001*** (n=150)	Married	.056 .508 (n=141)
Comfirm	-.049 .546 (n=155)	Psequal	.832 .001*** (n=151)	Employer	.059 .486 (n=141)
Comind	.009 .912 (n=155)	Psrelat	.679 .001*** (n=150)	Empyears	-.047 .591 (n=133)
Str_comp	.046 .569 (n=155)	Psmoral9	.638 .001*** (n=151)	Relgimpt	.179 .034* (n=141)
Pub_own	.173 .032* (n=155)	Dsrblty	.793 .001*** (n=152)	Lowmgmt	-.119 .159 (n=143)
Greenmkt	.100 .218 (n=155)	Feelgood	.658 .001*** (n=151)	Upmgmt	.044 .601 (n=143)
Own_sev	-.047 .560 (n=155)	Pride	.566 .001*** (n=147)	Manufact	.194 .020* (n=143)
F_suburb	.147 .069+ (n=155)	Ireward	.492 .001*** (n=145)	Coinvolv	.123 .144 (n=143)
F_urban	-.209 .009** (n=155)	Envstrat	.576 .001*** (n=152)	Ethics1	.211 .011* (n=144)
Fac_old	-.141 .081+ (n=155)	Compgnst4 (n=147)	.134 .107 (n=147)	Ethics2	.224 .003** (n=144)

	Intentions		**Intentions**		**Intentions**
F_refurb	.053 .514 (n=155)	Compnoag4	-.088 .288 (n=147)	Ethics3	.185 .027* (n=144)
Minor	.129 .110 (n=155)	Compnoag4	.084 .314 (n=145)	Ethics4	.352 .001*** (n=144)
Excdstmd	.126 .117 (n=155)	Frmact4	.084 .314 (n=145)	Ethics5	.141 .092+ (n=144)
Violstnd	-.057 .484 (n=155)	Frmemv4	.023 .787 (n=147)	Ethics6	.366 .001** (n=144)
Vpl_prgm	.031 .706 (n=155)	Frmfaith4	.060 .471 (n=147)	Personex	-.024 .772 (n=143)
Inc_rev	.024 .771 (n=155)	Frmfrien4	-.002 .986 (n=147)	Wrksub	.183 .031* (n=139)
Econhlth	.092 .257 (n=155)	Frmnohrm4	.064 .445 (n=147)	envright	.019 .824 (n=143)
Ecdet	.038 .638 (n=155)	Frmrecip4	.149 .077+ (n=143)	Ethics	.182 .024* (n=154)
Pubinfo	-.068 .398 (n=155)	Frmtrtrb4	-.023 .784 (n=147)		
Ethguide	-.059 .488 (n=155)	Indact4	.076 .361 (n=145)		
Eth_dist	.002 .978 (n=155)	Indfaith4	.096 .253 (n=145)		
Subsid	-.011 .896 (n=155)	Ifreeint4	.013 .874 (n=147)		
Audits	.087 .282 (n=155)	Idhrmenv4	.072 .387 (n=147)		
Hotline	-.108 .182 (n=155)	Innoharm4	.048 .563 (n=147)		
Self_rep	.072 .372 (n=155)	Indreecip4	.088 .298 9N=147)		

Fired	.073 .367 (n=155)	Idtrtarb4	-.021 .795 (n=147)
Reprimand	-.044 .585 (n=155)	Noaction	.094 .244 (n=154)

B. Noncompliance (Independent variables with technical/significant noncompliance intentions, combined scenarios).

	Intentions		**Intentions**		**Intentions**
Intentions (Mgact)	1.00 (n=154)	Sitreal	.061 .451 (n=154)	Female	.076 .371 (n=141)
Technical	.013 .044* (n=154)	Career	.367 .001*** (n=154)	Highgr	-.049 .564 (n=141)
Midmgr	-.070 .389 (n=154)	Thrill	.246 .002** (n=154)	Yrsbexp	-.050 .564 (n=139)
Asked	.232 .004** (n=154)	Ascontrc	-.134 .099+ (n=153)	Married	-.092 .280 (n=139)
Comfirm	-.030 .709 (n=154)	Psequal	-.329 .001*** (n=153)	Employer	-.163 .056+ (n=139)
Comind	.029 .719 (n=154)	Asrelat	-.393 .001*** (n=154)	Empyears	-.100 .055+ (n=139)
Str_comp	-.168 .037* (n=154)	Asmoral9	.004 .964 (n=154)	Relgimpt	-.046 .589 (n=139)
Pub_own	.108 .182 (n=154)	Dsrblty	.281 .001*** (n=154)	Lowmgmt	.084 .324 (n=141)
Greenmkt	-.079 .329 (n=154)	Dngrlife	-.261 .001*** (n=153)	Upmgmt	-.121 .155 (n=141)
Own_sev	-.102 .209 (n=154)	Dgrwlife	-.220 .006** (n=154)	Manufact	.004 .967 (n=141)
F_suburb	-.046 .571 (n=154)	Iinform	-.381 .001*** (n=144)	Coinvolv	-.161 .057+ (n=141)

F_urban	.072 .378 (n=154)	Finform	-.266 .001*** (n=152)	Ethics1	.052 .501 (n=143)
Fac_old	-.094 .246 (n=154)	Iformal	-.368 .001*** (n=152)	Ethics2	.052 .541 (n=141)
F_refurb	.072 .377 (n=154)	Compnoag4	-.239 .004** (n=142)	Ethics3	.057 .501 (n=143)
Minor	-.023 .775 (n=154)	Compnoag4	.260 .002** (n=142)	Ethics4	.073 .383 (n=143)
Excdstmd	.024 .770 (n=154)	Frmact4	.207 .026* (n=142)	Ethics5	.065 .440 (n=143)
Violstnd	-.102 .211 (n=154)	Frmemv4	-187 .026* (n=142)	Ethics6	-.093 .269 N=143)
Vpl_prgm	-.026 .749 (n=154)	Frmfaith4	.105 .215 (n=142)	Personex	-.060 .478 (n=141)
Inc_rev	.070 .389 (n=154)	Frmfrien4	.215 .010 (n=142)	Wrksub	-.068 .433 (n=137)
Econhlth	.0162 .045* (n=154)	Frmnohrm4	.035 .680 (n=140	envright	-.005 .952 (n=141)
Ecdet	-.134 .098+ (n=154)	Frmrecip4	.043 .618 (n=139)	Guilt	.063 .439 (n=154)
Pubinfo	.003 .969 (n=154)	Frmtrtrb4	.046 ./587 (n=142)	Sshame	-.191 .018 (n=152)
Ethguide	.039 .634 (n=154)	Indact4	.225 .007** (n=140)	Firmreps	.032 .692 (n=154)
Eth_dist	-.105 .194 (n=154)	Indfaith4	.104 .221 (n=140)	Self_rep	-.017 .057+ (n=154)
Subsid	.149 .067+ (n=154)	Ifreeint4	.232 .005** (n=142)	Fired	-.154 .057+ (n=154)

Audits	-.072 .372 (n=154)	Idhrmenv4	-.207 .013* (n=142)	Noaction	.094 .244 (n=154)
Hotline	.019 .818 (n=154)	Innoharm4	.030 .722 (n=142)	reprimnd	.057 .487 (n=154)

p<.10 +
p<.05 *
p<.01 **
p<.001 ***

Table 3-4

Regression of Vignette Characteristics on Behavioral Intentions

Model 1 Logistic Results (Offending, N=133)				Model 2 OLS Results (Pro-Social, N=154)			
	Coef.	S.E.	T value		Coef.	S.E.	T value
Technical	.477	.418	1.14	Response	1.38	.486	2.85**
Midmgr	-.489	.557	-0.88	Midmgr	-1.12	.536	-2.08*
Asked	1.75	.597	2.93**	Asked	1.42	.499	2.83**
Comfirm	-.283	.597	-0.49	Comfirm	-.206	.657	-0.31
Comind	-.253	.572	-0.43	Comind	.203	.508	0.40
Str_comp	-.901	.425	-2.12*	Str_comp	.147	.523	0.28
Pub_own	.317	.529	0.60	Pub_own	.762	.503	1.52
Greenmkt	-.145	.475	-0.31	Greenmkt	.378	.540	0.70
Own_sev	-.856	.501	-1.71+	Own_sev	-.371	.495	-0.64
F_urban	1.77	.617	2.87**	F_urban	-.679	.596	-1.14
F_suburb	1.13	.621	1.82+	F_suburb	.457	.495	0.92
Fac_old	.011	.561	0.02	Fac_old	-.241	.588	-0.41
F_refurb	.523	.684	0.77	F_refurb	-.203	.583	-0.35
Minor	.709	.515	1.38	Minor	.553	.571	0.97
Excdstnd	.105	.494	0.21	Excdstnd	.503	.533	0.94
Violstnd	-.054	.581	-0.09	Violstnd	-.120	.675	-0.18
Vol_prgm	.381	.508	0.75	Vol_prgm	.311	.493	0.63
Inc_rev	.211	.455	0.46	Inc_rev	.078	.445	0.17
Ecdt	-.812	.685	-1.18	Econhlth	1.04	.762	1.37
Foreign	-.385	.492	-.78	Ecdt	.893	.668	1.34
Pubinfo	.269	.475	.57	Pubinfo	-.108	.470	-0.23
Ethguid	-1.24	.535	-2.31*	Ethguid	-1.39	.660	-2.11*
Eth_dist	-.557	.607	-.92	Eth_dist	-.286	.561	-0.51
Subsid	.528	.472	1.12	Subsid	.101	.490	0.21
Audits	-.758	.649	-1.17	Audits	.589	.642	0.92
Hotline	-.413	.634	-.65	Hotline	-.621	.766	-0.81
Self_rep	-1.08	.606	-1.79+	Self_rep	.587	.595	0.99
Fired	-1.06	.564	-1.89+	Fired	-.401	.693	-0.58
Reprimand	-.202	.609	-0.33	Reprimand	.056	.723	0.08
Constant	-1.79			Constant	5.83		

Log-Pseudo Likelihood = -67.73 R^2= .26

p<.10 +
p<.05 *
p<.01 **
p<.001 ***

Table 3-5

Regression of Survey Questions on Behavioral Intentions

	Model 1 Logistic Results (Offending, N=131)				Model 2 OLS Results (Pro-Social, N=136)		
	Coef	S.E.	T value		Coef	S.E.	T value
Sitreal	-1.42	.689	-2.06*	Sitreal	.299	.549	0.55
Career	.483	.163	2.96**	Career	.069	.075	0.92
Ascontrc	.205	.156	1.31	Thrill	.051	.052	0.98
Asequal	-.439	.203	-2.16*	Pscontr	-.067	.066	-1.01
Asrelat	.163	.174	0.94	Psequal	.157	.070	2.25*
Asmoral9	.481	.213	2.25*	Psrelat	.123	.091	1.36
Lawadqcy	-.352	.201	-1.75+	Psmoral9	.013	/13-	0.10
Dsrblty	.711	.235	3.03**	Dsrblty	.220	.118	1.86+
Dngrlife	-.087	.327	-0.27	Feelgood	.771	.926	0.83
Dgrwlife	-.058	.251	-0.23	Pride	-.074	.422	-0.18
Iinform	-.001	.001	-1.46	Ireward	-.001	.001	-0.56
Finform	.005	.015	0.34	Envstrat	.070	.048	1.45
Fformal	-.013	.005	-2.65**	Constant	1.46		
Sshame	.026	.173	0.15				
Thrill	.581	.557	1.04				
Constant	8.64						

Log Pseudo-Likelihood= -37.69 R^2 = .50

p<.10 +
p<.05 *
p<.01 **
p<.001 ***

Regression of Firm-Level Environmental Norms on Behavioral Intentions

	Model 1 Logistic Results (Offending, N=137)				Model 2 OLS Results (Pro-Social, N=141)		
	Coef.	S.E.	t-value		Coef.	S.E.	t-value
Compgnst4	-1.40	.557	-2.52*	Compgnst4	.383	.302	1.27
Compnoag4	.168	.127	1.32	Compnoag4	-.030	.115	-.027
Frmact4	-.044	.146	-0.30	Frmact4	.075	.148	0.51
Frmenv4	-.463	.241	-1.92+	Frmenv4	-.109	.243	-0.45
Frmfaith4	.109	.115	0.94	Frmfaith4	.097	.143	0.68
Frmfrein4	.273	.088	3.09**	Frmfrein4	-.004	.099	-0.04
Frmnohrm4	.597	.627	0.95	Frmnohrm4	.383	.548	0.70
Frmrecip4	.118	.077	1.54	Frmrecip4	.126	.115	1.09
Frmtrtrb4	-.271	.109	-2.49*	Frmtrtrb4	-.092	.095	-0.98
Constant	5.69			Constant	1.83		

Log Pseudo-Likelihood = -56.233 R^2 =.05

p<.10 +
p<.05 *
p<.01 **
p<.001 ***

Table 3-6

Regression of Demographic Characteristics on Behavioral Intentions

	Model 1 Logistic Results				Model 2 OLS Results		
	Coef.	S.D.	T-value		Coef.	S.D.	T-value
Female	.157	1.17	0.13	Female	-1.10	1.01	-1.09
HighGr	-.094	.341	-0.28	HighGr	-.053	.290	-0.18
Yrsbex	-.051	.058	-0.89	Yrsbex	-.006	.037	-0.17
Employer	.030	.048	0.63	Employer	.058	.032	1818+
Empyears	-1.00	.052	-1.95+	Empyears	-.031	.040	-0.79
Relgimp	-.054	.284	-0.19	Relgimp	.343	.219	1.57
Lowmgmt	-1.90	1.00	-1.89+	Lowmgmt	l-.664	.946	-0.70
Upmgmt	Dropped			Upmgmt	-.626	.867	-0.72
Manufact	-.069	.756	-0.09	Manufact	1.73	.653	2.65**
Coinvolv	-1.14	.690	-1.65+	Coinvolv	.242	.571	0.42
Ethics1	Dropped			Ethics1	Dropped		
Ethics2	.168	1.46	0.11	Ethics2	.028	.064	0.03
Ethics3	.054	.738	0.07	Ethics3	.615	.577	1.07
Ethics4	Dropped			Ethics4	Dropped		
Ethics5	Dropped			Ethics5	-.956	.858	-1.11
Ethics6	Dropped			Ethics6	10.06	1.92	5.22***
Personex	.654	1.39	0.47	Personex	.470	.762	0.62
Wrksub	-.620	.813	-0.76	Wrksub	.522	.691	0.76
Envright	-.241	.847	-0.28	Envright	.034	.656	0.05
Constant	2.80			Constant	-5.24		

Log Pseudo-Likelihood = -54.80 R^2 = .027

Dropped Variables predict failure perfectly or have missing data problems.

p<.10 +

p<.05 *

p<.01 **

p<.001 ***

Table 3-7

Parsimonious Regression Models

Model 1 Logistic Results (Offending, N=125)				Model 2 OLS Results (Pro-Social, N=132)			
	Coef.	S.E.	T-Value		Coef.	S.E.	T-Value
Techn	.625	.863	0.72	Sitreal	.428	.400	1.07
Sitreal	-2.06	1.58	-1.30	Response	.273	.259	1.06
Asked	4.38	1.42	3.08**	Midmgr	-.599	.250	-2.40*
Str_comp	-.018	1.06	-0.02	Asked	1.38	.251	5.49***
Own_sev	-2.71	1.01	-2.67**	Ethguide	-.361	.360	-1.01
F_suburb	1.21	1.55	0.78	Eth_dist	.043	.283	0.15
F_urban	5.06	1.31	3.11**	Psequal	.214	.040	5.30***
Ethguide	-2.28	1.46	-1.56	Dsrblty	.294	.082	3.57***
Eth_dist	-2.95	1.80	-1.64	Ireward	-.001	.001	-0.63
Self_rep	-1.57	2.12	-0.74	Freward	.008	.007	1.23
Audits	-1.14	2.10	-0.54	Ethics6	.655	.635	1.03
Hotline	-1.83	2.00	-0.91	Manufact	.020	.313	0.06
Fired	-.556	1.04	-0.53	Employer	.014	.013	1.09
Reprimand	-2.96	1.33	-2.22*	Constant	-.218		
Career	.739	.452	1.63				
Asequal	-.364	.258	-1.41				
Asmoral9	.740	.355	2.09*				
Dsrblty	.916	.619	1.48				
Lawadqcy	-.655	.403	-1.60				
Compgnst4	-1.02	.645	-1.58				
Env4	-.113	/459	-0.25				
Freeint4	-.063	.196	-0.32				
Trtarb4	-.273	.250	-1.09				
Empyears	-.149	.096	-1.55				
Lowmgmt	-4.91	2.03	-2.42*				
Coinvolv	-2.22	1.27	-1.74+				
Fformal	-.034	.012	-2.84**				
Constant	28.21						

Log Pseudo-Likelihood= -21.27 R^2 = .78

p<.10 +
p<.05 *
p<.01 **
p<.001 ***

APPENDIX I
RESEARCH METHODS: INSPECTOR INTERVIEWS

I. Interview Structure and Content Outline

As noted, inspector interviews were informal. Questions were asked to address the following subject areas:

Who are the Inspectors?

- How selected? How trained? (recruitment and in-service) How supervised? How monitored?
- Career Path Values (business, environment, policing)
- Qualifications? How Long on Job?

What is the Inspector work environment?

- Dress (civilian, uniform, EPA logo, etc.)
- Locus of Work (Office, Facilities, On road, Other)
- Regular Human Contact (Colleagues, Managers, Other EPA types)

Enforcement

- Programmatic
- The Regulated Community
- What do they do when they go on inspections?

--Range of activities
--Frequency of activities
--Timing of activities
--Work products

Future Plans

Who or What determines what they do?

II. Organizational Structure & Responsibilities

- Higher Management Set Production Schedule
- Professional Standards Set laws or regulations
- Interaction with regulated

How do inspections improve environmental compliance?

What part of their work is most effective?

Do facility personnel know about enforcement actions?

Work Products

- Records of Work Products
- Informal products
- Formal products

Types of Record Keeping

- Federal
- State
- Substate

How their work is captured in PCS or State records systems?

How are record systems used by inspectors?

What might improve the effectiveness of their efforts?

APPENDIX II:

Research Methods: Secondary Data

Collecting the Data

Data Decisions

Before creating the sample, several decisions were made regarding EPA data. First, although the initial plan was to use the national headquarters data, the decision was reconsidered because of a series of reports criticizing the data. State databases offered a potential alternative. For reasons outlined below, the national data were ultimately used. Second, the EPA operates programs across a variety of "media" (e.g., environments subject to regulation such as air, water, etc). Ideally the data would cover several media types, but it soon became clear that the data collection effort would be formidable. Thus, data on one media (water) was collected as well as identifiers that link the facilities to data on additional media types. For reasons discussed below, the secondary data was gathered for the years 1995 through 2000.

State versus EPA Data

In most cases, the EPA has delegated responsibility for the NPDES permit program to the states. Delegated states assume full responsibility for the NPDES permit program, although EPA (through it's regional offices) may conduct "oversight" of the states to determine the appropriateness of State actions. EPA also retains the option to conduct enforcement actions in states to which the NPDES program has been delegated (overfilling).

States with delegation are required to report enforcement statistics to the EPA. In fact, the Environmental Council of the States (ECOS) estimates that approximately 94 percent of the data in the six major EPA data systems is state data (ECOS, 2001). One might assume that the headquarter data would be identical to the state data. However, this is not always the case. In

response to several reports on state enforcement actions in the late 1990s, state officials pointed out several major flaws in the EPA state-by-state data.[xxvii] The bulk of the criticisms centered on mathematical errors that occurred in the transfer between state and national systems; differences in the definition of key terms (e.g., whether notices of violation constitute an enforcement action; and other discrepancies between state and national data (National Academy of Public Administration, 2001). Congress subsequently commissioned the ECOS (2001) to gather state data to assess the discrepancies. ECOS (2001) gathered state data but also surveyed states regarding the extent of and reasons for the data discrepancies. ECOS (2001) received 184 responses (multiple programs were surveyed) from 47 states and territories. States confirmed the presence of discrepancies and reported the following reasons for the discrepancies: guidance interpretation, differences in definitions, criteria differences, database flaws, data conversion problems, time and resources, human error, late submission, lack of submissions by state, data changing after being submitted, and time lags. In reviewing the ECOS (2001) report and additional information, the National Academy of Public Administration (2001) concluded that the EPA enforcement and compliance data are "seriously flawed." The data are often inaccurate, difficult to access, not up-to-date, and hard to compare between EPA and the states (ECOS, 2001).

This information led us to consider collecting data directly from the States. However, we elected to use the national EPA data for the following reasons. First, practically speaking it was not feasible for us to collect data from all 50 states. Even with a government mandate to collect the data, ECOS did not receive all of the requested information. ECOS did obtain data from 38 States on 217 programs (the ECOS report covered all EPA programs, not just NPDES). Although the purpose of the report was to provide a new picture of State contribution to

enforcement, ECOS (2001) was still forced to rely on national data to fill in the gaps. Collecting State-level data from a select number of states with progressive data systems was considered, but a firm-level study would not be possible with such a strategy. Second, even if unlimited resources were available, the data would inevitably suffer from some of the same weaknesses as the headquarters data. For example, differences in definitions across place would not be resolved by collecting the data directly from the States. Third, the States tend to use the Permit Compliance System (PCS) for their own purposes more so than the other environmental databases. If States enter their own data directly into the national system (using it as the primary system), it is less likely that there will be data discrepancies between the two (although a high percentage of program survey respondents did find data discrepancies in every EPA database). While not perfect, the national data were ultimately collected for these reasons. While the reports on data quality are disheartening, problems with the national EPA data are similar to those in the Uniform Crime Report (UCR), which criminologists commonly use.[xxviii]

Media Type

Ideally we would have preferred to collect data on multiple media (environments subject to regulation), as facilities are likely to be regulated across media types (i.e., have water and air permits). However, each medium is contained in an independent data system and each system identifies facilities in a different manner. While the EPA has made strides to provide a single identifier across all media programs (see details of the EPA's Facility Registration System (FRS) below), the task is still significant (National Academy of Public Administration, 2001). Given the scope of the task, the data were collected for one media. Identifiers for other data systems were also collected so this information could be linked to the current sample at a later date.

We selected the water media for both practical and substantive reasons. Practically speaking, the water pollution data are important because they contain monthly self-reports of pollution from facilities. Most studies of environmental crime suffer selection bias problems because violations can only be detected if the facility is inspected. Thus, observation of the dependent variable is based on an independent variable. With exogenous reports of violation in the water data, this problem is circumvented. Water pollution is also important because of the potential harm it can do to wildlife, the environment, and human beings. Reducing the level of oxygen in the water or changing the temperature dramatically kills aquatic organisms and disrupts the food chain. Toxic chemicals released into waterways can cause birth defects and death if ingested.

Time Period

Finally, the time period of 1995 to 2000 was selected for data collection. It was necessary to gather data on enough years/time points to get an accurate picture of compliance and enforcement and to allow for the use of more sophisticated (and dynamic) panel analysis to improve over cross-sectional designs. In addition, the study design involved conducting a vignette survey of the same set of companies that are in the secondary data set. The survey needed to be conducted shortly after the end of the secondary data time period. (The grant was awarded in 2001). Thus, it made sense to gather data from 1995 through 2000.

Sampling Decisions

In addition to decisions regarding the data collected, decisions were also made regarding the sampling frame. Although the national picture of environmental noncompliance is of interest, the scope of the study had to be limited to make its completion practical. Specifically, the sample had to be limited to certain types of companies (public) and certain industries (pulp and paper, steel, oil refining).

Ownership Structure

Although public, private, and international companies are of interest in the environmental arena, it was not possible to gather data on private or international companies. Publicly available information about U.S. companies was used to construct the sample of firms, match them to owned facilities, and gather information about the companies (e.g., profits, size, etc) using sources such as the Securities and Exchange Commission (SEC) annual reports and Standard and Poor's Industrial Compustat. If a company was operating independently in 1995 (beginning of sample period) and was later purchased or merged with an international company, it was followed until it was purchased. If a company was fully owned by international parent at the beginning of the sample period, the company was moved to the international database. If a company has a long history of business in the United States and later went to international business, it remains in the sample as a US public company. Although complete data is not available (because of information constraints), a list of international and privately-held companies operating in the same SIC codes was maintained.

Industries

Because the data collection effort was arduous, we narrowed the industry focus to four basic manufacturing industries known for their "potential" sources of water pollution. In addition, there is overlap across these industries in the pollutants that result from the manufacturing processes. Yet, because the technology and some pollution problems in each industry are unique, it is possible to study industry specific effects.

After selecting the industries of interest (pulp and paper, steel, oil refining), began to gather, verify, and clean the data. Our sample effectively began as a "universe" of all U.S. based, publicly traded companies operating primarily in one of four Standard Industrial

Classifications (SIC) (Pulp Mills; Paper Mills; Petroleum Refining; Steel Works, Blast Furnaces, and Rolling) in 1995 linked to facilities (the EPA tracks compliance at the facility level) that are regulated by the EPA. Facilities were limited to those operating in the same SIC codes in order to ensure a similar culture between parent company and facility. Companies were retained for the study if they owned at least one facility operating in the same SIC code in 1995 that is categorized as a major discharger in the National Pollutant Discharge Elimination System (NPDES).[xxix] Firms/facilities were tracked for years 1995-2000. Therefore, any changes in either the company (mergers, bankruptcy, etc) or the facility (closings, changes in ownership, etc) were recorded through the year 2000. The final sample contains 67 companies as of 1995 (30 Pulp & Paper; 18 Steel; 19 Oil) and drops to 55 (24 Pulp & Paper; 15 Steel; 16 Oil) by 2000 (mainly due to mergers).

Creating the Sample

Universe of Firms

Most researchers have examined plant-level environmental performance. Thus, the samples have been constructed at the plant-level and then (sometimes) parent company characteristics are attached to the sample of plants. In those studies, the samples may contain multiple plants owned by the same firm, but the data sets do not necessarily have information on all plants owned by the same firm. In this data set, we are adding a new level of analysis to the environmental crime literature—the firm. Thus, we began creating our sample at the company-level.[xxx]

Using Ward's Business Directory, Standard and Poor's Industrial Compustat, and Mergent Online we created a list of public (U.S. based), private, and international companies that had their *primary business* (as defined by the source) in pulp and paper, steel, or oil.[xxxi] The

goal was to follow companies that were operating in 1995 through the year 2000 (even those that merged, closed, or filed bankruptcy during that time period). Some sources of information (e.g., Ward's Business Directory) were available on a yearly basis. Thus, we were able to compare the 1995 company list with the 2000 company list to determine and track which companies experienced some sort of change. For example, if a company that appeared in the 1995 Business Directory was no longer listed in 2000, we investigated and coded how/why the company changed. Because some sources of information (e.g., Compustat and Mergent's Online) were available only in the current version (as of 2002), we had to work backward to verify that the company was operating in 1995.[xxxii] We used qualitative company histories (from Mergent's Online and the Business and Company Resource website), company websites, and annual 10K reports to complete these checks. We also used these sources to investigate contradictions across data source regarding primary industry,[xxxiii] company status (i.e., private, international, US public), and company name (e.g., multiple entries with similar names).[xxxiv] Final coding reflects the majority consensus across sources.

Although our preference was to restrict the sample to firms that operate primarily in one line of business to maintain cultural similarity between the various relevant units, in some cases this rule was violated. Some firms listed as parent companies in our data sources were actually subsidiaries of holding companies or conglomerates. Holding companies are a type of parent company that exists primarily to exercise financial control over other firms; the control is exercised through ownership of a majority of the controlled firm's shares. These cases were included in the sample because it is unlikely that a holding company would have the same effect on firm culture as other structural arrangements. It is merely a financial "figurehead."[xxxv] A conglomerate is made up of a number of different companies that operate in diversified fields

rather than having a single primary industry. Two companies with a conglomerate parent company were included in the sample because we were able to obtain independent economic data on the lower-level companies, a fact that suggested each operated somewhat independently.[xxxvi]

In other cases we discovered that firms were actually subsidiaries (companies controlled by another company) of other companies operating in our industries of interest. In these cases, we wanted to determine whether the ultimate parent or the subsidiary was responsible for environmental operations and if so, whether it was operating independently. In one case we listed the subsidiary as the parent company. We were able to obtain unique economic data for the subsidiary and the ultimate parent annual report described it an independent operation.[xxxvii] If the subsidiary did not have independent economic data and did not appear to operate independently according to our business sources, we kept the ultimate parent in our sample and used its' economic data. We created dummy variables to reflect whether the company had a holding company, a conglomerate, or another company as its' ultimate parent to determine if there are any substantive differences in the results with and without these companies in the analysis.

Changes in Companies over Time

Because we were following our companies from 1995 through 2000, it was necessary to track changes in the company over time (mergers, bankruptcy, etc). We gathered information on bankruptcies and mergers from qualitative company histories (Mergent's Online and the Business and Company Resource Center) and firm annual (10K) reports; when possible the type of bankruptcy was noted. Companies were followed through bankruptcy if the company was not dissolved. Companies were also followed through mergers if the new entity continued to operate

in the industry of interest. Although we planned to follow the original companies separately if they operated as subsidiaries of the newly merged entity, this rarely occurred. Although many of the original companies were listed as subsidiaries on Mergent's Online, when calling the new company to solicit them for vignette participation we were almost always told that the original company was no longer operating independently and had no separate contact (it was completely absorbed). Although newly merged companies often retain the brand names of the original companies, the original companies generally do not continue on as independent operations. Consistent with our U.S. based rule, companies that merged with or were acquired by international companies were not tracked post-merger.

. Some companies and their facilities were tracked despite unusual ownership changes. In one instance we continued to follow one company even though it was acquired by a company operating in a different industry because our research suggested that it did continue to operate as an independent entity in the industry of interest. The original company had unique economic data embedded in the new parent company's annual (10K) report; it was also listed on the new parent company website as an independent subsidiary. Finally, some companies that reorganized facility ownership into joint ventures with other companies (not in the sample) were also followed.[xxxviii] In these cases, we only tracked the facilities that were originally owned by a company in our sample/industries as long as we were able to obtain some independent economic data on the joint venture.

Economic Data

Gathering the economic data required several steps. As a first pass, we utilized existing sources that had already compiled the company information (i.e., Compustat and FIS Online).

These databases had some limitations that required us to search for additional information in other places (e.g., 10K reports).

One small problem was differences in data item names across source. Although in most cases the data items had identical names across source, we would occasionally find items that had slightly different names in FIS Online. For example, "pretax income" is a standard measures available in Compustat. While FIS Online often did not have an item names "pretax income," it did include "income from continuing operations before income tax." We entered data items with different names when we thought it was reasonable to do so. When possible we identified companies for which economic data was available in both data sources and compared the data items with different names to make sure they contained identical information for that company (before using it for a company that was not in both sources). When this was not possible, we verified the categories utilizing local faculty experts at the University of Maryland to ensure that the sources were capturing the same piece of information.

We encountered several problems when tracking economic data for two companies that merged. First, the sources often retrospectively applied economic data for one of the original companies to the newly formed merger for years before it was formed. We used 10K reports to determine which of the original companies to whom the economic data belonged. Second, economic data was often missing for the year prior to mergers. Generally we were unable to supplement this information from other sources and it continues to be a source of missing data.

Some missing data problems were resolved using firm 10K reports. Most of the main sources did not contain economic data for joint ventures and subsidiaries and in some cases these entities do not have separate economic data from the parent company. However, in other cases we were able to find unique economic data for the smaller entity embedded in the parent

company 10K reports. In addition, sometimes the original data sources were missing certain years of parent company economic data for no apparent reason. We were often able to gather the data directly from firm 10K reports.

Finally, the original data source occasionally contained economic data for a parent company and a subsidiary with similar names. We used the 10K reports to authenticate the appropriate entity.

Linking Companies to Facilities

Because pollution actually occurs at the facility-level (e.g., plant, mill, refinery, etc), it was necessary to identify all facilities owned by our universe of firms. Although there may be variation due to the plant age and technology, the corporate crime literature provides compelling reasons to believe that firm structure and culture may produce similar environmental performance across plants. Therefore, aggregating plant-level performance to the firm-level provides a new method for examining and learning about environmental performance. In order to create a sample of facilities to aggregate to the firm-level, we included only those facilities that were operating in the same industry as the parent company. We assumed that facilities operating in the same industry as the parent company would maintain a culture that is more similar to the parent company than those operating in a different industry.[xxxix]

The linking process was completed only for publicly-held companies. We used three sources to create a list of owned facilities: The Directory of Corporate Affiliations; Environmental Protection Agency's (EPA) Toxic Release Inventory (TRI); and EPA's Permit Compliance System (PCS).[xl] Some sources are published by company (e.g., the Directory of Corporate Affiliations) and others are compiled at the facility-level but include some ownership information. For example, the Environmental Protection Agency's (EPA) Toxic Release

Inventory (TRI) requires *facilities* to report air, land, and water releases to the EPA if the levels are above specified amounts.

We began with the Directory of Corporate Affiliations because it seemed to be the most complete source of information by company. For companies published in the directory, we created a list of all facilities owned by our sample the company that operated in the same industry (as the company) as of 1995. We next generated a list of all facilities in our SIC codes of interest that submitted TRI reports in 1995. Although TRI reports are done by facilities, they do report ownership information. Unfortunately, the ownership information was often clearly incorrect (e.g., a company was listed as owner before it existed; one facility was listed twice with two different parent companies). Thus, all ownership information gathered from TRI was cross-checked with other sources (annual 10K reports, etc). We added facilities to the master facility file if a parent company in our sample was listed as the owner but the facility was not already entered from the Directory of Corporate Affiliations. In cases where a facility was listed in both sources, we added the TRI number to the Directory entry (for future matching purposes). We did encounter companies listed as owners in TRI that we had not run across in our other sources; however, we often found that the company was privately owned, international, or not in our industries of interest. Very few companies were added to the sample based solely on TRI information (without being listed in Mergent's or Ward's) and all were verified with other sources (annual 10K reports, company histories, etc) before doing so.

Finally, we added facilities from our water pollution data itself—the Permit Compliance System (PCS). The ownership field in PCS is not a required field and it was only populated approximately 60 percent of the time. However, we did use the information that was available. Facilities were added to the master list if a company in the sample was listed in the ownership

field. In addition, facility names often match parent company names. Thus, we also added facilities to the master list if the *facility name* in PCS indicated a particular company. If the facility name matched a parent company name, we assumed it was owned by that company even if ownership was not explicit in PCS. Because the ownership information in PCS is not always updated and the historical ownership is not retained, all PCS ownership information was also verified with the aforementioned sources.

Linking Facilities to the Environmental Data

The goal of the study is to examine compliance with the Clean Water Act, thus, we also limited the sample of facilities to those with EPA water permits. Facilities found in sources other than PCS then had to be matched to PCS. For example, the Directory is not published in conjunction with EPA; it is an independent source of information. Thus, none of the facilities listed in this source had any EPA identifier linked to them. We first attempted to match using name and address, but that approach on a large scale was extremely difficult. In searching for a more efficient method, we learned about the EPA's Facility Registry System (FRS). The FRS is designed to allow matches across EPA data bases. It provides a single identifier (FRS number) that is linked to identifiers in all media programs (e.g., PCS, TRI, etc) at the state and federal level (National Academy of Public Administration, 2001). FRS also contains the facility name, address, a list of all ownership information drawn from every source, and all previous names of the facility.

To reduce coding errors, we wanted to use official EPA identifiers to match our list of facilities to the permit data whenever possible. At the time, we had TRI number for some facilities, but the FRS system can only be queried with facility name or FRS number. We did not have FRS number matched to our facilities and many facilities have similar names—sorting

through them by address can be arduous. Instead, we obtained and utilized the Sector Facility Indexing Project (SFIP) linkages from ABT Associates. SFIP targeted five industries (i.e., automobile assembly, pulp manufacturing, petroleum refining, iron and steel production, and the primary smelting and refining of nonferrous metals) and compiled data across EPA programs (i.e., Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Toxics Release Inventory, and Emergency Response Notification System). Thus, this source allowed us to look up facility FRS numbers using the TRI numbers (for the facilities we gathered from TRI) and PCS numbers (for the facilities listed in PCS) that had already been documented.[xli] [xlii] The FRS numbers were used to enter the FRS system. The FRS system contained additional helpful ownership information (described below).

We did run into cases where the information differed between the two sources. For example, at times the same FRS number was matched to different PCS permit numbers in each data source. In other cases we had permit numbers from SFIP that were not in FRS. Finally, we sometimes found additional permit numbers in FRS that were not in SFIP. Often the additional permit numbers were not in our PCS data file, thus the discrepancy was not a significant problem. Ultimately, the FRS website was used as the ultimate source and contradictions between the two files were noted.

We had some additional problems with this process. Some facilities in our master list with EPA identifiers were not in the SFIP file. In addition, facilities added to our master list from the Directory of Corporate Affiliations did not have any EPA identifiers associated with them (either PCS or TRI). In both of these cases we had to search for these facilities in the FRS system by name and address. We accepted facilities as a match if the address information in each source was identical.[xliii] Within these address matches, we sometimes found that the

facility name differed between sources. In these cases, we examined the list of previous facility names to verify the match (facilities change hands and the names in our 1995 PCS data were sometimes outdated).

Verifying Ownership and Tracking Changes over Time

We began creating our universe of companies and facilities with 1995 matches. Although we now had permit numbers (and other identifiers for later use), there were often ownership contradictions within (i.e., TRI often had the same record twice with different ownership information) and between sources (i.e., two sources had the same facility listed with different owners). For all contradictions, we checked annual 10K reports and the Business and Company Resource Center company history and industry news reports to determine the correct owner in 1995 and over time.[xliv] We began by investigating all facilities owned by companies that merged during the sample period; we could see that many of the facilities with multiple entries had one entry citing pre-merger company as the owners and a second entry listing the post-merger company as the owner. We next investigated all facilities where fields within PCS indicated a contradictory parent company names (e.g., one company was listed in one of the address fields and another company name was embedded in the facility name). Finally, we investigated all facilities with a remaining contradiction in ownership. We often discovered that contradictions across sources and within TRI we often the result of sales; one entry listed the original owner and the second the company that subsequently purchased the facility. For all of these ownership issues, we also tracked ownership over time (procedure outlined below).

After establishing ownership in 1995, changes in ownership were tracked over time to determine whether the facility was still listed with the same company in 2000. If not, the same sources were used to investigate whether the facility changed hands, what company purchased it,

and/or if it closed. In most instances firm annual reports were most useful to find this information. The Business and Company Resource Center and Mergent Online company histories, industry news reports, and the FRS system also were utilized.[xlv]

The FRS system contains a list of previous facility names and ownership information from every EPA database (for which the facility has a permit), but does not state when a facility was sold/purchased. Often the list of company names and the list of old facility names which pointed us to annual reports to check. In a few cases we could not find this information with the annual 10K reports of either the seller or the purchaser (usually we later discovered that the purchaser was international and did not have to file 10K reports). The Business and Company Resource Center company histories and news information was often useful in these cases; industry news reports often documented changes in facility ownership.

Only six ownership changes were left unresolved after these methods were exhausted. In four cases the facilities were actually closed and thus we did not have multiple 10K reports from which to draw information. In two cases the 10K reports provided a year in which the facility closed but not a specific month. In these two cases, the facility DMR reports to the EPA stopped during the year the facility operations stopped and we were able to use the last month with a report as the last month the facility was operational [AR0000558 and OR0000221]. In another two cases the firm 10K contained a closing year but not a closing month but the DMR reports continued. It is likely that the EPA was monitoring the facility as it went through the process of shutting down. Because these two facilities still had the opportunity to offend we kept them in the sample company as long as they were sending DMR reports to the EPA [GA0002798 and WA0000124]. Finally, in two cases the original parent company 10K provided a year but not a month of sale. The 10K of the new parent company could not be examined because these

facilities were purchased by international companies. We were able to locate the specific transaction date on company websites [TX0001643 and TX0053023].

In all cases, we coded the transaction month as the first month of new owner control unless the source specifically said the transaction occurred at the end of the month. Finally, we examined the company histories reported on Mergent's Online to check for any ownership changes we may have missed.

At the end of this coding process, the data base consisted of a universe of pulp and paper, steel, and oil companies that were operating a major pulp and paper, steel, or oil water (permitted) facility in 1995 followed through 2000. The original universe of companies in these industries was winnowed considerably by the sample criteria. Therefore, it is important to understand how the "new" and more restricted sample of firms compares to the industry as a whole. If the sample represents only one portion of the industry (e.g., only large companies or only small companies) then caution should be used in generalizing the results to all firms in the industry.

The Market Share Reporter (compiled by Gale Research Inc) contains annual market share data on companies. The EPA Sector Notebook Project uses these data to create a list of the top U.S. Companies in selected industries. The top ten pulp and paper producers in 1995 (ranked by 1993 sales) are all in our universe of companies (United States Environmental Protection Agency 1995c). The Sector Notebook provided only the top eight iron and steel producers in the 1995 volume; all are in our universe of companies (United States Environmental Protection Agency 1995a). Similarly, 7 of the top 10 petroleum refining companies are also in our sample (one being a subsidiary of a company in our sample). The remaining three were excluded only because the ultimate parent is an international company (United States Environmental Protection

Agency 1995b). While our universe of companies contains some of the largest operators in each industry, it also includes some relatively small firms (e.g., those that own only one plant). Thus, we believe that our companies represent a substantial portion of the market but also provide a reasonable picture of the entire industry, including smaller firms.

The focus on publicly traded companies and specific industries in this study also narrows the number of EPA permitted facilities examined. Again, it is useful to compare the sample for this study with EPA permitted facilities more generally. Using NPDES data for all facilities operating in the industries of interest, we can see that there were 659 unique permits across industries. In some cases facilities have multiple permits; therefore, the actual number of facilities may be slightly lower than the number of permits. These facilities had a total of 14,998 over the entire six year period. Four hundred and eleven permits were for major facilities and these facilities had 11,477 violations over the six year period. Our data consist of 214 unique major permits (52 percent of the majors); our sample has a total of 5,341 violations (47 percent of the violations for majors).[xlvi] Our sample contains 59 percent of the major pulp and paper facilities; 55 percent of the major steel facilities; and 41 percent of the major oil facilities. Our sample of facilities is responsible for 49 percent of the violations for major pulp and paper facilities; 56 percent for major steel facilities; and 36 percent for major oil facilities. Overall then, the sample for this study captures approximately half of the major facilities in each industry and half of the violations, with somewhat smaller numbers for the oil industry. After the firm and facility data was created, it was time to tackle the NPDES data itself.

EPA Data Process

The EPA retains data in the PCS system for two years. After this period has passed, the data are archived. Thus, EPA employees had to pull archived data because the sample period

began in 1995. We requested data on all major facilities operating in 1995 in the industries of interest. Facilities are defined as majors by the Regional Administrator or the State Director (if the state has been approved to run the program). Major industrial facilities are distinguished from minor dischargers by the facility's potential for discharging toxic wastes, the volume and type of wastewater, and whether the receiving water is used for drinking (Yeager 1993).

Major ratings of facilities are not maintained historically, thus data on facilities operating in 1995 that were currently ranked as majors were provided. However, if a facility was not rated a "major" in 1995, the EPA would not have enforcement data on the facility as states are not required to submit monitoring data on minors to EPA headquarters. Thus, this strategy only excludes facilities that were majors in 1995 and became minors by the year we collected the data.

Permitting Process

The goal of NPDES permits is to ensure that discharges in waters are kept at levels that protect human health and the environment. Permits establish discharge limits, monitoring and reporting requirements, and may also require facilities to take measures to reduce or even eliminate particular discharges (Wastewater Primer).

The permit specifies limits on the discharge of pollutants into waterways. Pollutants are defined broadly as any type of waste discharged into the water. Pollutants have been grouped into three categories in the NPDES permit program: conventional, toxic, and non-conventional (Water Permitting 101). Conventional pollutants are well understood by scientists and will break down naturally on their own if left in the water. Toxic pollutants will not break down. These pollutants can cause illness, birth defects, and death if ingested (U.S. EPA, 2003). Pollutants can enter the water from point sources or non-point sources. Point sources include discharges from a

publicly owned treatment works (POTWs) and industrial facilities. Non-point sources include run-off from agricultural facilities. Pollutants may be discharged into the water directly or indirectly. Direct sources discharge directly into the water while indirect sources discharge wastewater to a POTW, which in turn discharges into the water. NPDES permits are issued to direct, point-source dischargers (Water Permitting 101). Thus, the data covers pollutants discharged by industrial facilities themselves and does not include any indirect discharges through POTWs.

The permit provides two types of limits on pollutants: technology-based limits and water quality-based limits. Technology limits are based on the ability of dischargers in the same industry to treat wastewater. For example, the first round of permits (issued from 1973 to 1976) required facilities to meet two technology-based standards: Best Practicable Control Technology Currently Available (BPT) and Best Available Technology Economically Achievable (BAT). BPT is defined as the average of the best existing plant performance. Facilities had to reach BPT standards by 1977. BAT is a more stringent set of standards. These standards are developed based on *the best* control and treatment measures that are capable of being achieved. Facilities had to reach these standards by 1983. However, because a national uniform effluent limit was not ready when the first set of permits were developed, approximately 75 percent of the original permits allowed permit writers to use their Best Professional Judgment (BPJ) to establish limits. Thus, rather than relying on professional assessments to set national limits by industry, permit writers were allowed to develop individualized discharge limits based on knowledge of the industry and the specific discharge. Currently conventional pollutants are controlled by Best Conventional Pollutant Control Technology (BCT) (replacing BAT as the highest standard). BAT remains in effect for toxic pollutants. As of 1984, water quality-based limits are also

included in the permit if technology-based limits are insufficient to protect the waterway. In fact, both technology-based and water-quality based limits are created by the permit writer. The two sets of limits are compared and the more stringent is applied in the permit. One permit may contain both types of limits if one is more stringent for pollutant A and the other is more stringent for pollutant B (Water Permitting 101).

In addition to pollution limits, the permit also specifies the monitoring and reporting requirements. For instance, it includes how often the permittee must collect samples; what type of samples must be taken; where the sample must be taken; and what laboratory procedures must be used to analyze the samples. Permits must be renewed every five years (Water Permitting 101).

There are two types of NPDES permits: individual and general permits. Individual permits are tailed to an individual facility while general permits cover multiple facilities that have common elements. For instance, general permits may cover facilities that involve the same (or similar) types of operations; facilities that discharge the same types of wastes; or facilities that require the same limits. General permits may only be issued to dischargers with in a specific (narrow) geographical area. General permits reduce the costs of issuing specific permits to facilities that have similar requirements and ensure consistency of permit conditions across similar facilities (Water Permitting 101).

Determining Compliance

EPA determines compliance using two methods: inspections and evaluations/assessments. EPA uses a variety of inspection types and they vary by media (ECOS, 2001). Essentially, inspections involve some sort of site visit. EPA inspections can include reviewing DMR reports; interviewing knowledgeable facility personnel; inspecting the processes

that generate and treat wastewater; sampling wastewater discharges; and reviewing how samples are collected and analyzed by the laboratory. Inspections that involve sampling and reviewing laboratory procedures are not regularly scheduled. They are targeted at facilities that show evidence of permit violations or unusual trends/patterns in DMRs or labs that show evidence of poor performance (ECOS, 2001).

The primary assessment tool under the Clean Water Act is the Discharge Monitoring Report (DMR). Facilities are required to report the results of water sampling, usually monthly, to either state or federal EPA. The pollution level is then compared to the permitted level to determine whether a violation has occurred. DMRs are sometimes called "self-assessments" because EPA is not directly involved in the sampling/testing (ECOS, 2001).

Violation Types

Measurement and Reporting Violations

The measurement violation file contains the monthly DMR reports. Thus, it provides information on two kinds of violations: 1) discharges that exceed permitted levels and 2) reporting violations (late or incomplete DMR reports). For each of these violation types, there are multiple data elements that provide information on the violation (see codebook). Permittees must maintain records of DMR reports and supporting documentation on sampling for 3 years (ECOS, 2001).

Compliance Schedule Violations

A compliance schedule is a negotiated agreement between a pollution source and a government agency that specifies dates and procedures by which a source will reduce emissions and, thereby, comply with a regulation. If a facility does not reach the agreed upon goal by the specified date they will be cited for a compliance schedule violation.

Single Event Violations

Single event violations are violations that cannot be otherwise classified (as compliance schedule or effluent violations). For example, a facility might receive a single event violation for an unexplained fish kill.

Enforcement Process[xlvii]

While one group of people is responsible for maintaining the PCS data, another group is responsible for enforcement actions. In 1994, the EPA combined the enforcement staff previously housed in each media office into the Office of Enforcement and Compliance Assurance (OECA). There is disagreement regarding who has the larger role in enforcement, State or federal EPA. While OECA reports suggest that States make up 69 to 80 percent of enforcement actions each year, the ECOS data suggests that figure is closer to 90 percent.

Enforcement actions are generally taken for more serious violations, called significant non-compliance (SNC) (U.S. EPA, 2003). Typically effluent violations (i.e., releasing pollutants over the permitted levels) are tagged as acts of SNC rather than administrative violations, although SNC can be given for serious administrative violations (e.g., failure to sign DMR reports for several months) (ECOS, 2001).

Possible enforcement actions range in severity from verbal warnings to civil and criminal proceedings. According to ECOS (2001), the warning letter or phone call is used commonly throughout the states. It is often the first step to alerting a regulated entity that it is in violation. Alternatively, states may send a Notice of Violation (NOV). While the name of these letters vary by state, they essentially notify the facility that it is in noncompliance; request corrective action; and may assess or refer to a penalty as a future action if compliance is not achieved

(ECOS reports). According to the ECOS (2001) data, NOV's are the most commonly used enforcement mechanism. The second most common was the warning letter.

If these more informal mechanisms (although NOV's are considered formal by some States) do not result in a return to compliance, EPA may draft a consent order (also known as an agreed order or administrative order by consent). These are the third most commonly used enforcement actions. These documents are legally binding. Like the warning letters they include a statement of the violation but also a compliance schedule. They may include penalties or state what the penalties will be if the facility does not return to compliance according to schedule. ECOS (2001) equates these types of enforcement actions with contracts. Compliance schedules allow the facility to return to compliance over time, for instance, if the facility needs to install new pollution control technology (ECOS, 2001).

Beyond the consent order the most common enforcement action is a non-judicial unilateral order. Unlike the contracts discussed above, under State law these orders can be issued by the agency without consent from the regulated entity (although these still are not issued by the court). The noncompliant facility is ordered to take specific actions by a deadline or face escalation of enforcement and these orders may have monetary penalties attached. If a facility is still not in compliance after a state has used one or more of these techniques, the case will likely be referred to attorney for an administrative or a judicial hearing (ECOS, 2001).[xlviii]

Our research uncovered some data deficiencies in the EPA enforcement process. While we feel the data was helpful to learn more about corporate environmental behavior, it also produced some significant liabilities for our research.

Data Deficiencies

A variety of agencies have issued reports regarding EPA data quality. At the request of the Chairman of the Senate Committee on Governmental Affairs, the United States General Accounting Office (GAO, 1993) conducted a review of the potential for facilities to evade regulation or submit inaccurate or fraudulent data to the EPA under the NPDES program. Congress also commissioned the Environmental Council of the States (ECOS, 2001) to gather state data to assess the discrepancies and the National Academy of Public Administration (2001) conducted a subsequent investigation into EPA enforcement and compliance data.

These reports are important because they outline a number of potential limitations of these data. For example, these reports note the discrepancies between the federal and the State data (as previously discussed). In addition, the NPDES program relies heavily on self-report data. Thus, it is important to acknowledge GAO (1993) findings regarding the potential to misrepresent pollution data. The findings of all of these reports are outlined below.

State and Federal Data Discrepancies: The EOCS (2001) Report

In their examination of State and federal data and via interviews with State officials regarding the data entry process, ECOS (2001) determined that data entry problems and definitional differences accounted for most of the discrepancies between state and federal data.

Data Entry

Of the various data systems reviewed by ECOS (2001), PCS had the second greatest number of comments regarding database flaws. State program officials stated that the system is not user-friendly and difficult to enter information. It is a "blind entry" system, meaning data entry clerks cannot review the data that has been entered for errors. Entry screens do not always work correctly, they are often mis-numbered, and are generally difficult to use. Program officials also have difficulty with the excessive number of codes for similar things. In addition,

states have difficulty transferring the data. Transfers often take multiple attempts, have a several day time lag, and when the upload is unsuccessful data entry clerks cannot always determine what data has been lost.

Data entry clerks have found some ways to trick the "inherently antiquated" mainframe system to accept data. For example, if limits change, the limit is taken out (and the facility placed in noncompliance in the meantime) and then re-entered. However, according to the states, EPA teaches these "tricks" rather than fixing the problems (ECOS, 2001).

Definitional Differences

Data discrepancies may also result from definitional differences, in particular with the compliance and the enforcement data. For example, EPA makes a distinction between formal and informal enforcement activities.[xlix] Formal activities, such as administrative orders that assess penalties and judicial actions are more punishment oriented. Informal activities, such as warnings (oral and written) and notices of violation (require facility to take corrective action without penalties), are more compliance oriented interventions. States consider notices of violation a vital part of securing compliance without having to resort to judicial action (ECOS, 2001). Even though State data suggests that informal actions often return facilities to compliance, the EPA does not require States to submit data on informal enforcement actions (National Academy of Public Administration, 2001). EPA does not include them in enforcement activity counts because they are "non-enforceable," or have no force of law (ECOS, 2001). Thus, the State is left with no method to accurately capture enforcement activity and the data may be missing some information on sanctions.

In addition to the State and federal data discrepancies, the GAO (1993) evaluation points to some data quality issues.

The Veracity of the Data: The GAO (1993) Report

Using a three-pronged approach to evaluate the EPA data, the GAO (1993) interviewed officials at EPA headquarters; examined the practices of two EPA regions (V and VI) that cover approximately 30 percent of the major NPDES facilities; and mailed questionnaires to the 39 States and territories authorized to administer the NPDES program. The response rate was 97 percent. The review was conducted between August 1991 and December 1992. The GAO (1993) concluded that the EPA cannot ensure 1) that all facilities subject to regulation are identified and 2) that sampling results are representative and free from error or falsification.

Identifying Wastewater Dischargers

As a result of the focus on majors and low resources (permit backlog for *identified* facilities), the EPA's NPDES program and most authorized States have made little attempt to identify unpermitted wastewater dischargers. In fact, only 13 programs of the 38 responding states had methods in place (e.g., citizens trained to spot them, cross-checks with other regulatory agencies, etc) to find unpermitted dischargers. Officials argued that any unpermitted dischargers were likely to be minor facilities, as major facilities would likely be discovered. In fact, the bulk of unpermitted dischargers identified in 1991 and 1992 by these states were minor dischargers. Thus, this issue is unlikely to affect these data significantly, as we focus on major dischargers. In addition to a failure to identify all dischargers, the GAO (1993) report points to several other problems as well.

Sampling Requirements

The EPA data quality assurance system calls for statistically representative sampling. Statistically representative sampling is supposed to ensure that sampling results provide a "true picture" of the effluent at regulated facilities. However, the NPDES program does not use

statistical techniques to determine sampling requirements. Instead, it relies on permit writer's judgment to designate sampling requirements. Agency regulations dictate the sampling location (usually the end of the discharge pipe) and the type of sample necessary for specific pollutants, but permit writers determine how frequent samples must be taken to ensure they are representative of facility discharges. Given this approach, the GAO (1993) concludes that "NPDES program officials have no statistical basis for assessing how often samples are likely to indicate that a facility is in compliance, when, in fact, the facility is exceeding its permit levels." The GAO (1993) also concludes that the EPA does an inadequate job of detecting fraud in DMR reports.

Detecting Fraud in DMR Reports

Falsification of data may take place when samples are collected at the facility; when samples are analyzed in the lab; or when results are reported to EPA. Both facilities and labs may have incentive to falsify: facilities may want to avoid enforcement actions that are triggered by discharges above permitted levels while commercial labs may falsify in order to save money or to handle more work.

The EPA has several mechanisms in place to prevent falsification by either entity. For example, EPA and authorized states are supposed to conduct inspections and tests at both facilities and laboratories with enough frequency to ensure data quality. However, the GAO (1993) argued that the EPA does not require enough routine inspections to deter fraud or complete enough inspections to detect it.

First, inspectors may be poorly trained. Although federal inspectors are required to take basic training courses, State inspectors are not. EPA does not require states to train inspectors in key areas and the GAO (1993) survey indicated that States are not doing so on their own. "Of 38

state programs providing information on this question, the majority did not require training in facility/laboratory quality assurance/control procedures for inspectors who would conduct such tests." Although federal training classes are open to State inspectors (and most of the students are State inspectors), officials do not feel that the majority of State inspectors attend this training class. In addition, few States train inspectors in fraud detection techniques.

The GAO (1993) also questioned the quality of the EPA inspections. State officials argued that EPA stresses the number rather than the quality of inspections, although headquarters officials disagreed. Most of the responding States reported reviewing sampling procedures during some types of sampling inspections but not others. However, overall, authorized States indicated that they do take independent samples to test facility reports. Of the 24 States responding, all reported that inspectors very often or occasionally took samples. However, States often do not trace results back to supporting documentation during inspections.

In terms of laboratories, although the EPA and the States do routinely inspect the laboratories that are analyzing effluent samples, it does not conduct them routinely and there is no standard acceptable performance level for these labs. One method of testing labs is to send samples with known quantities to see if labs report the same results as the EPA tests. However, labs are made aware that the samples are from EPA. Further, these tests are targeted at poorly performing labs rather than being routine.

While these criticisms are substantial, we feel that the data can still provide new information and insights into firm-level environmental behavior.

Appendix III

Vignette Dimensions and Levels

Variable Name	Description
SURVID	
Vignette Type	
TECNONCOMP	Technical Noncompliance
SIGNONCOMP	Significant Noncompliance
OVERCOMP	Over Compliance
RESPONSE	Response to Counter-Terrorism
Management Location	
MIDMGR	A middle-level manager
UPPERMGR	An upper-level manager
Locus of Control	
ASKED	Is asked by a higher level manager
ASKS	Asks an employee
Corporate Culture	
COMFIRM	This practice is common in the firm
COMIND	This practice is common in the industry
NOCULTURE	*No information about culture
Firm Competitive Position	
STNGTHCOMP	Strengthen the firm's competitive position
WEAKCOMP	Weaken the firm's competitive position
Firm Ownership	
PUBLICOWN	Publicly owned company
PRIVTOWN	Privately owned company

Firm Environmental Marketing

GREENMKT	Firm that promotes itself as a green company
NOMARKET	*No information about marketing

Facility Ownership

OWNONE	Company owns one facility
OWNSEV	Company owns several facilities

Facility Location

FACSUBURB	Facility located in suburban area near a large city
FACRURAL	Facility located in rural area
FACURBAN	Facility located in large urban center

Facility Condition

FACOLD	Facility is over 20 years old
FACNEW	Facility is new
FACREFURB	Facility has been refurbished

EPA Discharge Classification

MAJOR	Major
MINOR	Minor

Firm Environmental Record

EXCDSTND	Firm has exceeded regulatory compliance standards
METSTND	Firm generally has met EPA compliance standards
VIOLTSTND	Firm routinely has violated EPA compliance standards

Firm EPA Volunteer Status

VOLREDPGM	Volunteered to participate in an EPA sponsored pollution reduction program
REJREDPGM	Was contacted by the EPA to participate in a voluntary pollution reduction program but declined to do so

Firm Economic Status/Subsidiary Economic Status

DECLNREV	Declining sales and revenues
GROWREV	Growing sales and revenues

Environmental Constraints	
FOREIGN	Losing ground to foreign competitors
ECHEALTH	Economically healthy
ECDET	Economically deteriorating
Public Awareness	
PUBINFO	The firm has been mandated to release public information regarding the type and amount of toxic substance released by its facilities
NOPUBINFO	*No information about awareness
Managerial Ethics	
ETHGUIDE	Ethical considerations guide top management hiring decisions, performance evaluations, and promotions
ETHDSTNCT	Ethical considerations are considered important, but distinct, from business decisions
ETHIRRLVT	Ethical considerations are considered mostly irrelevant to business decisions
Subsidiary Status	
SUBSID	Subsidiary of
NOSUBSID	*No information about subsidiary
Internal Compliance Structure	
HOTLINE	A hotline in which violation of compliance can be anonymously reported an ethics code
ETHICS	Mandatory ethics training
AUDITS	Internal random environmental audits in which violations of compliance can be uncovered
SELFREPORT	Mandatory self-reporting to the EPA of monthly release data
Internal Compliance Operation	
NOACTION	But the firm took no action against an employee who was discovered violating environmental regulations
REPRIMND	And the firm severely reprimanded an employee who violated environmental regulations
EMFIRED	And the firm fired an employee who violated environmental regulations

SURVEY

Variable Name	Description	Code
MGRACT	What is the chance that you would act as the manager did under these circumstances?	0-10
SITREAL	Regardless of what you would do, is the situation described in this scenario believable or realistic?	0=Yes, 1=No
CAREER	How much would it advance your career if you did what the manager did under these circumstances?	0-10
THRILL	How exciting or thrilling would it be for you if you did what the manager did under the circumstances?	0-10
MORAL1	What this manager is doing is: Culturally acceptable—Culturally unacceptable	0-7
MORAL2	What this manager is doing is: Fair—Unfair	0-7
MORAL3	What this manager is doing is: Just—Unjust	0-7
MORAL4	What this manager is doing is: Violates an unwritten contract—Does Not Violate an unwritten contract	0-7
MORAL5	What this manager is doing is: Traditionally acceptable—Traditionally unacceptable	0-7
MORAL6	What this manager is doing is: Morally right—Not morally right	0-7
MORAL7	What this manager is doing is: Violates an unspoken promise—Does not violate an unspoken promise	0-7
MORAL8	What this manager is doing is: Acceptable to my family—Not acceptable to my family	0-7
MORAL9	What this manager is doing is: Very unethical—No at all unethical	0-7
LAWADQCY	How adequate is the law governing this behavior? Too Lenient—Too Strict	0-10
DSRBLTY	Please rate this behavior according to its desirability Very Desirable—Not at all desirable	0-10
DNGRLIFE	What is the chance that this behavior would endanger human life?	0-10
DNGRWLIFE	What is the chance that this behavior would endanger aquatic and other wildlife?	0-10
CRIMCH	What is the chance you would be arrested for a criminal offence if you did what the manager did under these circumstance?	0-10
CRIMFMCH	What is the chance the firm would be criminally prosecuted if you did what the manager did under these circumstances?	0-10
CIVILCH	What is the chance that you personally would be sued if	0-10

	you did what the manager did under these circumstances?	
CIVILFCH	What is the chance that the firm would be sued if you did what the manager did under these circumstances?	0-10
REGCH	What is the chance that you personally would be investigated by a regulatory agency if you did what the manager did under these circumstances?	0-10
REGFMCH	What is the chance that the firm would be investigated by a regulatory agency if you did what the manager did under these circumstances?	0-10
GUILT	Assume that you did what the manager did and it did not become known within or outside of the company. Would you feel guilty for acting as the manager did?	0=Yes 1=No
KNOWNINF	Suppose in fact you did what the manager did but neither you nor the firm came to the attention of the authorities. What is the chance that if would somehow become known within the firm that you had done this?	0-10
DISMISS	What is the chance that you would be dismissed from the company?	0-10
FRIEND	What is the chance that you would lose the respect and good opinion of your close friends?	0-10
BUSINESS	What is the chance that you would lose the respect and good opinion of your business associates?	0-10
FAMILY	What is the chance that you would lose the respect and good opinion of your family?	0-10
JOBCERT	What is the chance that you would jeopardize your future job prospects?	0-10
SHAME	Would you feel a sense of guilt or shame if others knew that you had done this?	0=Yes 1=No
FIRMREP	What is the chance that your actions would tarnish the reputation of the firm?	0-10
FIRMREPS	Would you feel a sense of guilt or shame if your action tarnished the reputation of the firm?	0=Yes 1=No
CRIMSEV	Being arrested for doing what the manager did	0-10
CRIMFMSV	Having criminal charges brought against the firm	0-10
CIVILSEV	Personally being sued for doing what the manager did	0-10
CIVILFSV	Having the firm sued for doing what the manager did	0-10
REGFMSEV	Having the firm investigated by a regulatory agency for doing what the manager did	0-10
DISCOST	Being dismissed from your job for doing what the manager did	0-10
FRNDCOST	Losing the respect and good opinion of your close friends for doing what the manager did	0-10
BUSCOST	Losing the respect and good opinion of your business associates for doing what the manager did	0-10
FAMCOST	Losing the respect and good opinion of your relatives for	0-10

	doing what the manager did	
JOBSEV	Jeopardizing your future job prospects for doing what the manager did	0-10
FIRMRPSV	Tarnishing the reputation of the firm for doing what the manager did	0-10
SHAMESEV	Feeling a sense of personal shame and guilt for doing what the manager did	0-10
ENVSTRAT	Do you think the environmental strategy described in this scenario is reasonable for firms to pursue?	0-10
FEELGOOD	Assume that you did what the manager did and it did not become known within or outside of the company. Would you feel good for acting as the manager did?	0=Yes 1=No
PROMO	What is the chance that you would be promoted in the company?	0-10
GAINFRND	What is the chance that you would gain the respect and good opinion of your close friends?	0-10
GAINBUS	What is the chance that you would gain the respect and good opinion of your business associates?	0-10
GAINFAM	What is the chance that you would gain the respect and good opinion of your family?	0-10
JOBADV	What is the chance that you would advance your future job prospects?	0-10
PRIDE	Would you feel a sense of pride if others knew that you had done this?	0=Yes 1=No
FIRMREP2	What is the chance that your actions would enhance the reputation of the firm?	0-10
FIRMREPP	Would you feel a sense of pride if your action enhanced the reputation of the firm?	0=Yes 1=No
BENPROMO	Being promoted for doing what the manager did	0-10
BENFRNDS	Gaining the respect and good opinion of your close friends for doing what the manager did	0-10
BENBUS	Gaining the respect and good opinion of your business associates for doing what the manager did	0-10
BENFAM	Gaining the respect and good opinion of your relatives for doing what the manager did	0-10
BENJOB	Gaining future job prospects for doing what the manager did	0-10
BENFIRM	Enhancing the reputation of the firm for doing what the manager did	0-10
BENPRIDE	Feeling a sense of pride for doing what the manager did	0-10
COMPAGNST	An individual should comply with the law even if it goes against what s/he thinks is right	0-10
COMPNOAG	An individual should comply with the law so long as it does not go against what s/he thinks is right	0-10
INDNOHARM	An individual should not cause harm to human health	0-10

FRMNOHRM	A firm should not cause harm to human health	0-10
INDHRMENV	An individual should not cause harm to the environment	0-10
FRMENV	A firm should not cause harm to the environment	0-10
INDFREEINT	Absent blameworthy activity, an individual should be free from government intervention	0-10
FRMFREEINT	Absent blameworthy activity, a firm should be free from government intervention	0-10
INDTRTARB	An individual should not be treated arbitrarily by regulators or be denied an opportunity to defend his/her behavior	0-10
FRMTRTARB	A firm should not be treated arbitrarily by regulators or be denied an opportunity to defend its behavior	0-10
INDFAITH	An individual should be presumed by regulators to act in good faith until events prove otherwise	0-10
FRMFAITH	A firm should be presumed by regulators to act in good faith until events prove otherwise	0-10
INDRECIP	When an individual is given something, s/he should give something in return	0-10
FRMRECIP	When a firm is given something, it should give something in return	0-10
INDACT	An individual should act as others do	0-10
FRMACT	A firm should act as others do	0-10
GENDER	Respondent gender	0=Male 1=Female
AGE	Respondent age	Specify
NATIONAL	Respondent nationality	Specify
HIGHGR	Highest educational level achieved?	0=Some HS 1=HS Grad 2=Some Col 3=4 Yr Col 4=Some Grad 5=Grad Deg
YRSBEXP	Years of business experience	Specify
MARITAL	Marital status	Specify
EMPLOYER	How many years have you been with your current employer?	
EMPYEARS	How many years do you plan to be in your current position?	
RELIGION	How important is religion in your everyday life?	0=Very Imp 1=Important 2=Somewhat 3=Not Imp
LEVEL	What is your management level?	0=Lower 1=Middle 2=Upper
DEPART	Are you currently working in:	0=Sales/Mktg 1=Finance 2=R&D

		3=Manuf/Prod 4=Security 5=Personnel 6=Safety/Com 7=Legal 8=Other
COINVOLVE	Within your company, how involved are you in environmental decision-making?	0=Not 1=Somewhat 2=Routinely
PERSONEXP	Have you personally experienced or known about situations similar to those described in the scenarios?	0=No 1=Yes 2=Personally 3=know about
PERSEXPY	If yes, did these situations arise in your current employment or elsewhere?	0=Elsewhere 1=Current
ETHICS1	Does your current employer have a code of ethics?	0=No 1=Yes
ETHICS2	Does your current employer have mandatory ethics training?	0=No 1=Yes
ETHICS3	Does your current employer have random ethics audits?	0=No 1=Yes
ETHICS4	Does your current employer have an anonymous hotline to report unethical/illegal conduct?	0=No 1=Yes
ETHICS5	Does your current employer have top management that treats ethics and ethics violations seriously?	0=No 1=Yes
ETHICS6	Does your current employer have Corporate Environmental Management System	0=No 1=Yes
WORKLOC	What is your work location?	0=Corporate 1=Subsidiary
ENVCOMMIT	Describe the environmental commitment of your company	0=Excessive 1=About Rght 2=Use Work 3=Poor

Contact and Support Letters sent to Potential Survey Participants

Contact Letter

December 3, 2004

Dear _____:

Over the past decade, many new approaches have been proposed to protect our nation's waterways and wetlands. Many of these new approaches diverge from a more traditional deterrence-based enforcement model with their emphasis on cooperative company-regulator relations and self-policing strategies. Unfortunately, there is a lack of data regarding which existing programs are successful, which do not work, and which may be unnecessarily cumbersome. Researchers at the University of Maryland and Vanderbilt University hope to provide some answers to these important questions, but your cooperation is vital.

The purpose of this letter is to solicit your company's participation in a federally funded research project that examines how corporate managers responde to a variety of environmental scenarios. Your firm was selected for the study because it (or one of its subsidiaries) operated a major facility in 1995 in one of the following SIC codes (2911, 2611, 2621, or 3312) and was regulated under the Clean Water Act. *All* U.S. based firms who share these characteristics comprise our research sample. Participation in this research project will require that some of your managers fill out a questionnaire expected to take no more than 15-20 minutes. We *will not ask* proprietary information and the surveys *will not* be shared with anyone who is not part of the academic research team.

For your information, we have attached one environmental scenario with related questions to demonstrate the kinds of questions we ask on the questionnaire. Our plan is to administer the surveys to participating companies this winter (2004-2005). We can assure you that the responses of individual managers will be *held strictly confidential.* Once the data are analyzed, it will *not be possible* to link your company to any specific results. The research team can, however, provide you with data showing how your company compares to others (within or across markets) on important environmental issues. Also, we can share with you our interpretations as to which environmental strategies, under what kinds of conditions, potentially minimize (or maximize) environmental risks. These data may help you coordinate and streamline efficiencies in the safety, compliance, and security areas. We hope this benchmarking information will be of value to you and help justify the minimal time commitment we are asking of you.

Please consider our request. As you can see from the attached letters of support, this research is considered timely and critical. Results from the survey will inform policy debates in the environmental and national security areas—potentially moving discussions from the narrow deterrence versus cooperation debate toward more practical and efficient governmental enforcement and firm governance policies that achieve the best environmental performance at

the lowest cost. *Evidence-based* environmental regulation literally depends on the willingness of companies like yours to participate in research projects like this.

A member of the research team will be contacting you by telephone in the next week to discuss participation. At that time, if you prefer, we can arrange a conference call to explain how the study may benefit your company and to answer any questions you may have. Your company's participation is important. Too little is currently known about how firms and their managers confront, assess, and respond to environmental issues. Thank you for your consideration of our request.

Statement of Support

To Whom It May Concern:

ASIS International is supporting the research effort conducted by Professor Sally Simpson from the University of Maryland, and Professors Mark Cohen and Michael Vandenbergh from Vanderbilt University. We would ask that you give their request for participation careful consideration because the study has potentially important implications for environmental regulation.

This survey is designed to measure the effectiveness of federal regulatory enforcement and compliance as it relates to environmental protection laws. We believe this study will help guide changes in compliance strategies that will be positive to businesses and increase overall ROI. The goal of this research is to develop a better understanding of the determinants of compliance so that government and private industry can design improved policies that are relatively easy to comply with and to administer.

ASIS International has been assured that participation in the study and answers to survey questions will be strictly confidential. Being funded by the U.S. Department of Justice, the study operates under federal privacy regulations (28 CFR Part 22) that prohibit the reporting of information identifiable to the individual. Because all findings of the research will be reported in summary form, there is no chance that individual responses or companies can be identified.

The survey, which should take only 20 minutes to complete, will yield important insights into environmental decision-making. Results will help develop better regulatory schemes in the future. I hope that your company will agree to participate in this important study.

Sincerely,

Hello_____:

Thank you for agreeing to participate in the web-based environmental compliance survey that my colleagues Mark Cohen and Mike Vandenbergh of Vanderbilt University and I have designed.

Survey Administration

The logistics for taking the survey are as follows:

(1) Please send the survey link listed below to managers within your company who represent a range of managerial authority, duties, and experience with environmental management systems. As you know, our ideal goal is to have approximately 100 participants from your company take the survey. However, we understand that this number of participants may be difficult for some companies to achieve. Therefore, we ask that you send the link to as many managers as conceivable for your firm.

(2) Please let me know how many managers received the e-mail with the survey link. This information will allow me to track the survey response rate for your company. You can do this via e-mail (SSimpson@crim.umd.edu)

(3) The survey link for your company is: www.environmentalsurvey.umd.edu/w.aspx?c=?

This link will connect your managers to the survey web-site. On average, it should take respondents between 15 and 20 minutes to complete the survey which is based around 4 hypothetical scenarios.

Confidentiality and Anonymity

There are no identifying marks on the survey so that individual respondents will be anonymous. The data generated from the survey will be stored in company specific files, but only the principal investigator can link data storage codes to specific companies. The "key" which links companies to the data will be destroyed upon completion of the research project. Therefore, each participating company will remain confidential.

Company Reports

Your company will be provided with an empirical assessment of your firm's responses (in the aggregate) and how these responses compare to those of other participating firms sometime in the fall, 2005. The exact time will depend on when the final report to the funding agency (NIJ) is accepted.

Please contact me if you have any questions regarding the survey, logistics, the response rate, or data confidentiality.

Sally Simpson
Professor and Chair
CCJS
University of Maryland
College Park, MD 20742
301, 405-4726

TABLE 1: **Regression of Environmental Norms Questions (Individuals) on Behavioral Intentions**

	Model 1 Logistic Results (Offending, N=135)				Model 2 OLS Results (Pro-Social, N=139)		
	Coef.	S.E.	t-value		Coef.	S.E.	t-value
Compgnst4	-1.40	5557	-2.52*	Compgnst4	.383	.302	1.27
Compnoag4	.167	.127	1.32	Compnoag4	-.030	.114	-0.27
indmact4	-.044	.146	-.030	indmact4	.075	.148	0.51
idhrmenv4	-.463	.241	-1.92+	idhrmenv4	-.109	.243	-0.45
indfaith4	.109	.115	0.94	indfaith4	.097	.144	0.68
Ifreeint4	.273	.088	3.09**	Ifreeint4	-.004	.099	-0.64
idnoharm4	.571	.627	0.95	idnoharm4	.383	.549	0.71
indrecip4	.118	.077	1.54	indrecip4	.126	.116	1.09
idtrtarb4	-.271	.109	-2.49*	idtrtarb4	-.093	.095	-0.98
Constant	5.69			Constant	1.83		

Log Pseudo-Likelihood = -56.88 R^2 =.04

p<.10 +
p<.05 *
p<.01 **
p<.001 ***

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ENDNOTES

[i] Although states are not required to submit informal enforcement data to EPA headquarters, there is incentive to submit the information (U.S. EPA, 2003).

[ii] Estimates of the proportion of State enforcement varies from 70 to 90 percent depending on measures used.

[iii] For more detailed information about Clean Water Act enforcement, Federal-State responsibilities, and role of the inspectors under the statutes, see Appendix II.

[iv] The 67 companies represent a universe of firms that were U.S. based and publicly-owned in 1995 in these industries that were matched to major EPA facilities regulated under the Clean Water Act.

[v] Merged entities are counted as "new" companies (e.g., Exxon-Mobil). In addition, companies that were spun-off of the 1995 sample are counted as "new" companies even though they were not in operation in 1995.

[vi] The limit fields specify a particular numeric value for the facility discharges; however, the fields may also specify monitoring/reporting requirements without a specific limit. For example, the limit field might say "ADDMON." This code indicates that the permit writer added an additional monitoring requirement over and above what is required in the regulations. Similarly, the limit field might say "DELMON," indicating that the facility is not required to report a limit that is required by regulation. In addition, the limit field might specify "OPTMON." In these cases, the facility monitoring is optional. The limit field is also often blank. If the limit has a unit code attached to it, the blank indicates that the facility is required to report its discharges (in the specified units) but it does not have to stay under or reach a particular limit. In all of these cases the facility does not have the opportunity to receive an effluent violation (although it can receive a reporting violation if the limit field says "ADDMON" or if a blank limit has a unit code); the EPA is monitoring the facility discharges without limiting them. If the limit field is blank and does not have a unit code, then federal regulations do not require the facility to monitor or report the limit. Again, the facility has no opportunity to receive an effluent violation. In constructing our violation rate, we only use the DMR reports in which the facility had the opportunity to be cited for a violation. In a few instances the PCS system calculated a violation for a report that was supposed to simply be monitored (no specific limit was set); we do not include these violations in our counts or in our rates because they are system errors. We discuss the number of required reports (with a particular limit) that are missing in the missing data section.

[vii] Of these enforceable limits, 285,480 (75%) had DMR reports of actual pollution levels. The data file contained an explanation for the missing data in 98.5 percent of these cases (95,966 out of 97,422); thus, less than one percent (0.4) of the required DMRs were missing without explanation. The data was most often missing because there was no discharge (61 percent). Additional explanations included "other" reasons (19 percent), conditional monitoring (the report was not required for that particular monitoring period, 11 percent), the pollutant was below the detectable limit (5 percent), and production based limits (the limit did not apply during this particular production period, 1 percent). Most of the remaining explanations were used less than one percent of the time and indicated that the facility was likely in compliance (e.g., not quantifiable, not tracked in PCS for this period, operations shutdown). However, a few (used less than one percent of the time) were somewhat ambiguous regarding compliance status. For example, in a few instances a facility reported conducting an invalid test, a lost sample, or that analysis was not conducted. While this may indicate malfeasance on the part of the facility, it may also result from an error by the lab responsible for testing samples.

[viii] It is important to note that although this measure does not capture the actual volume of opportunity, it is similar to a rate measure proposed by state EPA officials. For instance, a recent survey of state EPA officials shows that some officials would prefer to calculate a compliance "rate." One suggestion for calculating the rate was the "total discharge monitoring reports (DMR) reporting periods without violations/Total DMR Reporting periods" (Environmental Council of the States 2001, p. 41). Thus, our measure is consistent with some EPA reporting preferences.

[ix] The total number of reports appears to increase dramatically in 1997. We do not believe this is the result of any change in reporting requirements; we believe this simply reflects a change in data entry procedures. Most of the cases that are missing the DMR received date occurred in 1995 and 1996; we believe the "date received" field became a required field in 1997.

[x] It is also likely that the PCS enforcement file undercounts enforcement actions to some degree, as states are not required to report informal actions to EPA headquarters when data are submitted. We believe the degree of

undercounting is small for several reasons: 1) absent reporting, the facility will show up in the data as noncompliant and 2) if informal enforcement actions are not entered it would appear that the state did nothing to fix the problem.

[xi] Although included in the correlation matrix, the nitrogen violation rate was not regressed on the firm-level predictors because of the small sample size.

[xii] An attempt was made to examine the relationship between these firm characteristics and violation rates with number of employees in the model, but the concern about the correlation between it and other predictors proved justified. The direction and size of the coefficients change depending on the specification if the model. Thus, we cannot explore the effect of employees in the multivariate models.

[xiii] Violation rates are also generally unrelated to sanctions in the bivariate regression models (data not shown).

[xiv] Although generally positive, the association between civil and criminal cases and violations counts are not significant probably because the data contain few of these types of cases.

[xv] The association between formal sanctions and number of violations is not significant when a dichotomous measure of sanctions is used, suggesting that it is due to an outlier.

[xvi] The firm characteristics that were significantly associated with violations in the previous models are no significant in the sanction models with the lagged violation measure. One might conclude that firm characteristics are not associated with violations. We do not reach this conclusion. Although necessary for the sanction models, including the lagged violation measure in the model creates a very conservative test of the association between the other factors and the dependent variable. Past behavior is always a robust predictor of future behavior. However, past behavior may be explained by firm profits and structure. Although panel data is useful to sort out these types of temporal ordering problems, it is not possible because of data limitations (sample size and variability).

[xvii] Consistent with the Dillman follow-up strategy (1975), follow-up telephone calls were made to the company contacts of the nonparticipating firms. Unfortunately, although many calls were made, none were returned nor did we receive any further explanation (via e-mail or letter) for the lack of participation.

[xviii] In the process of cutting and pasting the e-mail message, the company contact inadvertently sent the wrong web-link to potential respondents. After correcting this problem, a large number of respondents logged into the survey at the same time causing the system to freeze and time-out some respondents. The two technological problems were frustrating and time consuming for potential respondents. Consequently, the company President requested to withdraw from the survey and asked us to destroy any data collected from respondents.

[xix] Not all participants who began the survey completed it, accounting for the uneven number of vignette respondents.

[xx] When the two noncompliance vignettes are combined, the offending likelihood is zero in 60% of the scenarios. Among those respondents who indicate a nonzero probability of offending, the average likelihood falls in the 10-20% probability range (almost 17%).

[xxi] It is unclear why this would be the case; however, one answer may lie in an e-mail comment we received from one respondent. This respondent could not accept a situation where his supervisor would continue on the path of noncompliance once informed that the behavior was wrong. He reported, "I believe that I would convince my manager that it was wrong." Thus, he did not find the situation realistic under the experimental conditions. For anonymity reasons, we did not conduct post-survey interviews. Thus, it is not clear whether his sentiment was shared by other participants.

[xxii] We did not ask respondents to estimate the severity of individual level regulatory sanctions because regulatory sanctions are directed at the firm, not the individual.

[xxiii] Informal sanctions= Discovery risk* (dismissal certainty*severity) + (friends respect certainty*severity) + (business associate certainty*severity) + (family certainty*severity) + (future jobs certainty*severity).

[xxiv] Results from the business ethics literature indicate that the individual items factor should load on three separate dimensions (Reidenbach and Robin, 1990; Smith and Cooper-Martin, 1997). In our analyses, three distinct factors emerged for the antisocial but not for the pro-social behaviors (where all items loaded on a single dimension). Because our purposes are exploratory and the scale originally was created to evaluate unethical behavior (not pro-social conduct), we analyze the scale items separately for both behavior sets.

[xxv] One variable is marginally significant ($p<.08$). Managers who believe more strongly that when a firm is given something it should give something in return report higher intentions than those who show less support for this question.

[xxvi] Several variables are dropped from our reported models due to collinearity (e.g., age and years of business experience are correlated, .93.), missing data (nationality, for example, had more than 10% missing cases), or lack of

variation (almost all respondents reported feeling guilty if their act tarnished the reputation of the firm, only 4% of reporting respondents were currently unmarried).

[xxvii] In the late 1990s, an internal EPA report conducted by the Office of Enforcement and Compliance Assurance (OECA) and a report by a public interest group suggested that state enforcement activity was declining and that EPA regional offices were not adequately overseeing the states. Inside EPA (a newsletter on federal policymaking published by Inside Washington Publishers) obtained the evaluations of the states and based on the data concluded that state enforcement had dropped. Each report evaluated a limited number of states/regions.

[xxviii] To be fair to the data, criticisms of the data do not exclusively refer to the quality of the information. A number of the criticisms of the data stem from the type of information on which the EPA chooses to focus. The National Academy of Public Administration argues that both national EPA and the states need to focus less on "bean counting" of enforcement actions (e.g., number of inspections, number of administrative cases, etc) and more on environmental impacts and outcomes. While information on actual impacts is certainly a direction to move, we feel that any data on corporate environmental behavior is useful at this point because so little is known about corporate offending, especially environmental violations.

[xxix] Major industrial facilities are distinguished from minor dischargers by the facility's potential for discharging toxic wastes, the volume and type of wastewater, and whether the receiving water is used for drinking (Yeager 1993). Although minor facilities are also required to have permits and report discharges, national EPA does not require that states submit compliance and enforcement data on minors. Thus, in this study we track only major facilities.

[xxx] We originally intended to use the EPA data itself to construct our sample because it contains both plant (compliance is tracked at the plant-level) and parent company information. However, discussions with EPA employees revealed that parent company/ownership is not a required field (40 percent missing in our data) and it is not tracked historically—when facilities change hands the current owner information is recorded over the previous ownership details. Thus, other sources were necessary to create the sample of companies.

[xxxi] The list of private companies was compiled from Ward's Business Directory, 1995. The list of public companies was created using Ward's Business Directory, 1995; Standard and Poor's Industrial Compustat (as of 2002); and Mergent's Online (as of 2002). Finally, we gathered our list of international companies from Standard and Poor's Industrial Compustat and Mergent's Online (international database). We considered companies gathered from Computst to be "international" if they were located in a foreign country; Compustat does not have separate databases for U.S. and international companies. Mergent Online does have a separate database for international companies; we added companies that were not listed in Compustat and verified that companies listed with foreign addresses in Compustat were international companies.

[xxxii] We included companies listed as currently inactive in Compustat and Mergent's if they were operating at the beginning of our sample period, even if they closed during our time period. Although our focus is on companies already operating in 1995, we also included companies that had not yet begun operating in 1995 if they were spun-off of companies already in the sample in that year (e.g., Schweitzer-Mauduit was spun-off of Kimberly Clark in August 1995; Crown Paper was spun-off of James River in August 1995). Several companies restructured or changed names during the sample period but seem to be the same operating entity (Frontier changed name to Wainoco; Valero Energy Corporation restructured but continued operating independently; The Sun Company Inc changed its name to Sunoco; Clark Refinings changed name to Premcor.

[xxxiii] Primary industry was particularly problematic. For example, some companies were added to the master list based on ownership and industry information from the Toxic Release Inventory (TRI). However, the TRI ownership information proved to be less valid than other sources (discussed below) and we were hesitant to rely on it exclusively for industry information. Thus, if we added a company based on TRI information but the SEC and Mergent's online both reported that the company was not in our industry, we removed the company from the sample. In addition, the Securities and Exchange Commission's (SEC) annual 10K reports sometimes had a different primary industry codes than other sources. If the SEC industry code was close to the one reported in Mergent's Online (ex: 2631 and 2621) then the company remained in the sample. If the SEC industry code was totally different (ex: 35__) we examined other sources. If the company was listed only in the SEC reports and

Mergent's Online but each contained a completely different industry code, we left the company in the sample. In nearly all cases we coded the industry according to the majority of sources.

[xxxiv] It would be tempting to assume that entries with similar names were the same company, yet this often was not the case and it was actually quite important (and quite complex) to sort these out. For instance, in many cases our company list contained both "X Steel Company" and "X Company." Without investigation we would have assumed that these were duplicate listings for one company. However, as we often found, one name actually reflected the parent company and the other a large subsidiary. These distinctions became quite important in determining 1) which entity was responsible for environmental operations and 2) which financial data to use (when both were available).

[xxxv] Facilities sometimes had both the holding company and the operational subsidiary listed as owners in various sources. In all of these cases the only economic data available was that of the holding company. Thus, we listed the holding company as the owner and used its' economic data.

[xxxvi] We did collect the economic data for the conglomerate parent as well and can determine whether substantive results change depending on which economic data is used.

[xxxvii] We did collect the economic data for the ultimate parent as well and can determine whether substantive results change depending on which economic data is used.

[xxxviii] Texaco reorganized in 1998 and began to operate its oil refineries through a joint venture with Shell Oil Company called Equilon Enterprises. Although Shell is not in our sample, we continued to follow the facilities originally owned by Texaco after ownership was transferred to the joint venture. Similarly, we continued to track facilities owned by Marathon Oil and Ashland Oil after they reorganized ownership in 1998 to a joint venture called Marathon Ashland Petroleum.

[xxxix] Future studies may find that facilities operating in different industries still maintain a culture that is similar to the parent company, indicating the powerful influence of firm culture. However, if this is not the case, it may suggest a boundary for examining environmental performance at the firm-level. The reach of the parent company may stop at industry lines.

[xl] The Permit Compliance System (PCS) contains the EPA data on facilities permitted to discharge pollutants into U.S. waterways. We had access to the PCS data on all facilities in our industries for 1995 through 2000. EPA staff was very generous with their assistance.

[xli] The SFIP data also contained docket (administrative and civil court case) numbers. At the time, the FRS system docket numbers had already been converted to the new court case system (ICIS) and we could not match those new numbers to our older docket data. Thus, the SFIP data provided the initial links between our permit numbers and court cases.

[xlii] We wanted to have all identification numbers associated with the facility for current and future matching purposes. When searched the SFIP file with any (TRI or PCS) identifiers we had already obtained, we also added identifiers from other systems (e.g., if we used the PCS permit number to look the facility up in the SFIP file we documented the TRI number in addition to the FRS number).

[xliii] However, the address match may have been pulled from the list of alternate addresses because a facility may have a PO Box and a street address.

[xliv] When examining firm 10K reports, we sometimes noticed facilities that seemed to have environmental permits but that were not uncovered in our other sources. In these cases we checked any facility listed in the PCS system that was located in the same city and state as the one listed in the annual report to see if it was a match. If it was clearly the correct facility (i.e., it had part of the company name in its name, the company was listed somewhere in the line of data for that facility, or it had a unique name that was also listed in the 10K) then we added the facility to the sample.

[xlv] During this process, we sometimes noticed facilities that seemed to have environmental permits but that were not uncovered in our other sources. If additional facilities were listed in the 10K report but were not in our database, we checked any facility in the same city and state in PCS to see if it was a match. If it was clearly the correct facility (i.e., it had part of the company name in its name, the company was listed somewhere in the line of data for that facility, or it had a unique name that was also listed in the 10K) then we added the facility to the sample.

[xlvi] These estimates have not been "cleaned" according to the rules below. They are total counts of the number of violations per EPA estimations.

[xlvii] The information cited from the ECOS report refers to EPA enforcement practices in general.

[xlviii] Although the agency often uses a step-by-step process, moving from informal to more formal enforcement actions, it is not always the case. The enforcement tools might be used in a different order or some are skipped if the situation warrants such action (ECOS report).

[xlix] States and the EPA also differ in terms of what constitutes a "major" source. In addition, the two sources may disagree on when a facility in terms of defining reportable non-compliance (significant noncompliance). Enforcement actions for facilities with general permits are not entered in PCS. However, this is not an issue in these data as there are no facilities operating under a general permit in the sample. Regions also reported that states often don't use the national systems and therefore, do not pay attention to the quality of the data they submit to headquarters. In terms of compliance, violation dates may differ between states and federal EPA, as they receive the case at different times.