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Examining the Effectiveness of EPA's Compliance Assistance Program

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Do Environmental Audits Improve Long-term Compliance? Evidence from Manufacturing Facilities in Michigan

Abstract

The role of compliance assistance in the U.S. EPA's overall enforcement strategy has been quite variable over the past decade and a half, increasing in prominence under the Bush administration and now slated for significantly reduced funding under the Obama administration. While many theoretical models and anecdotal evidence suggest that compliance assistance should play some role in a comprehensive enforcement strategy, to date there has been relatively little empirical evidence on the actual effectiveness of existing compliance assistance programs. To help inform the debate over the appropriate use of compliance assistance, this paper uses data on hazardous waste generators nationwide to assess the effect of federal compliance assistance programs in improving compliance with hazardous waste regulations. The paper also conducts a direct empirical analysis of the relationship between traditional enforcement tools and compliance assistance. The results show that federal compliance assistance efforts do increase compliance, but the evidence does not suggest any specific relationship between traditional enforcement and compliance assistance. Also, while states do not appear to substitute federal compliance assistance for traditional enforcement, state compliance assistance programs do appear to decrease the likelihood of inspections among the smallest hazardous waste generators.

Keywords: Environmental Regulation, Enforcement, Compliance Assistance

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1. Introduction

Between 1998 and 2008, the U.S. Environmental Protection Agency's (EPA) enforcement budget fell from over $590 million to less than $560 million in real dollars and staffing in its Office of Enforcement and Compliance Assurance fell from around 3,900 full-time equivalent employees to 3,400.[1] During this same time, compliance assistance began to play a more significant role in EPA's overall enforcement and compliance strategy, particular once the Bush Administration came into power. For example, in EPA's 1997 Strategic Plan compliance assistance was mentioned only in passing.[2] By 2000 compliance assistance was more prominently featured in EPA's Strategic Plan, but was clearly presented as a supplement to a strong traditional enforcement regime.[3] However in 2003, EPA's Strategic Plan identified compliance assistance as the first method through which EPA intended to increase compliance, followed by compliance incentives and finally enforcement.[4] Thus under the Bush Administration, compliance assistance increasingly became to be seen as a viable substitute for more traditional enforcement measures. In contrast, President Obama's 2012 proposed budget for the Environmental Protection Agency eliminates all separate funding for compliance assistance and transfers those funds to traditional compliance monitoring and civil and criminal

[1] See Gray and Shimshack (2011), Figure 1.
[2] U.S. EPA (1997), p. 57.
[3] "While EPA will maintain a strong presence in enforcement, we will also bring a mix of innovative compliance tools…to bear on environmental programs," U.S. EPA (2000), p. 6.
[4] U.S. EPA (2003), pp. 111-113. The 2006 Strategic Plan contained similar language to the 2003 Strategic Plan, U.S. EPA (2006), pp. 128-133.

enforcement.[5]

Interestingly, neither the increased role of compliance assistance in the Bush EPA nor the proposed decreased role of compliance assistance in the Obama EPA appear to be based on any evaluation of the effectiveness of compliance assistance programs either in general or relative to traditional enforcement methods. While theoretical models and anecdotal evidence suggest that compliance assistance should play some role in a comprehensive enforcement and compliance strategy, to date there has been relatively little empirical evidence on the actual effectiveness of existing compliance assistance programs. The purpose of this paper is to provide some evidence on this issue, specifically to determine whether compliance assistance does increase environmental compliance using hazardous waste regulations as a case study. In addition, the study examines the relationship between compliance assistance and traditional deterrence in increasing overall compliance.

The next section provides a description of EPA's approach to compliance assistance. Section 3 then presents a theoretical framework for the analysis and discusses the related literatures. Section 4 explains the empirical approach and describes the data used in the analysis and Section 5 presents the results of the analysis. Finally, Section 6 discusses the policy implications of these results and Section 7 summarizes the results and suggests avenues for future research.

2. EPA's Approach to Compliance Assistance

EPA uses the term "compliance assistance" to describe activities and technical assistance

[5]"FY 12: EPA Budget in Brief," p. 80 available at http://www.epa.gov/planandbudget/annualplan/FY_2012_Budget_In_Brief.pdf, last accessed February 16, 2011.

efforts that help regulated entities understand and meet their environmental compliance obligations or voluntarily adopt environmentally beneficial practices that go beyond compliance. Compliance assistance includes facility visits and counseling, online and hardcopy resources such as fact sheets and guides, and training programs and workshops. Compliance assistance is related to, but distinct from, compliance incentives. Compliance incentives are voluntary programs that offer direct rewards to firms to encourage increased compliance such as providing regulatory relief or flexibility in how certain firms comply with a regulation or decreasing penalties for facilities that self-police.[6]

EPA began offering formal compliance assistance after its enforcement functions were reorganized in 1994 to create a single Office of Enforcement and Compliance Assurance.[7] One of EPA's first actions was to open four industry-specific compliance assistance centers targeted to small businesses (U.S. EPA, 1997). In 1999 EPA further refined its compliance assistance strategy by adopting a "wholesaler" approach to compliance assistance.[8] Under this approach EPA focuses on developing compliance assistance tools and materials and working with states, localities and private providers to deliver additional assistance to the regulated community. However EPA continues to provide targeted compliance assistance directly to regulated entities.

Today EPA provides compliance assistance materials and funds sector-specific compliance assistance centers for regulated entities across the U.S. In addition, EPA's ten regional offices provide additional compliance assistance tools and workshops for regulated entities in each region and conduct on-site compliance assistance visits. Many state environmental protection agencies and departments of environmental quality also provide

[6] Potoski and Prakash (2004) provide a more detailed discussion of regulatory relief programs. Stafford (2007) discusses EPA's self-policing program.
[7] U.S. EPA (1996), p.5-19.
[8] U.S. EPA, (1999), p.4.

compliance assistance including on-site visits, compliance assistance hotlines, workshops, etc. Finally, regulated entities can seek compliance assistance from the private sector including trade-associations, non-profit organizations, and for-profit consultants. Of course, private sector compliance assistance is paid for by regulated entities, not through government funding.

Although the role of compliance assistance in EPA's overall enforcement strategy may have changed over the years, EPA consistently acknowledges that "[c]ompliance assistance is most effective when used in an integrated strategy combining compliance monitoring (inspections), compliance incentives and auditing (self-disclosure policies) and enforcement."[9] The goal of compliance assistance is to help regulated entities understand their obligations under various environmental statutes and reduce the information costs associated with understanding environmental regulations. However, EPA stated early in the development of its compliance assistance program that compliance assistance does not absolve regulated entities of the responsibility to learn and comply with regulations and it cannot be successful without an accompanying threat of formal enforcement.[10]

3. Theoretical Framework for the Analysis and Related Literature

The appropriate role for compliance assistance in an enforcement and compliance strategy depends on the underlying reasons that regulated entities do or do not comply with regulations. The theoretical literature on regulatory compliance can be roughly divided into three camps, with each focusing on different motivations for compliance and solutions to

[9] EPA compliance assistance website, http://www.epa.gov/compliance/assistance/index.html, last accessed February 21, 2011.
[10] U.S. EPA (1998), p. 5.

noncompliance.[11] The first camp assumes that regulated entities make compliance decisions based on an assessment of the cost of compliance relative to the expected cost of noncompliance; thus the decision to comply or not is a rational one and violations can be deterred by increasing the cost of noncompliance. The second camp assumes that regulated entities generally want to comply with regulations because it is a social norm, but may be unable to do so when the regulations are complex and entities do not fully understand them. To increase compliance, regulators need to help regulated entities and their employees understand the regulations and how to comply. The third camp is somewhat of a hybrid of the first two: it assumes that regulated entities are rational and want to minimize regulatory costs but it focuses on cooperative strategies to increase compliance rather than deterrence-based strategies. While these three camps have been called by various names in the literature, for the purposes of this article I will refer to them as the deterrence, complexity, and cooperative literatures.[12]

The seminal article for the deterrence-based models is Becker's (1968) paper on the economics of crime. Becker assumes potential criminals are rational and will commit a crime whenever the expected value of the crime is greater than the expected cost of the crime. To deter criminals, one must increase the expected cost of the crime either by increasing the likelihood that the crime is detected or the punishment associated with the crime. Becker's model spawned a large literature on the economics of crime and enforcement that starts with the same basic assumption that potential criminals make decisions based on a rational comparison of costs (see Polinsky and Shavell 2000 for a survey of this literature). Russell, Harrington, and Vaughn

[11] Of course, there are many papers in the regulatory compliance literature that do not easily fall into one of these three camps.

[12] The deterrence and cooperative designations are consistent with Scholz's (1984) terminology, although others such as Reiss (1984) and Ayers and Brathwaite (1992) use the term compliance instead of cooperative. The complexity designation is taken from Spence (2001).

(1986) took these general models and explicitly applied them to environmental regulation. Since then numerous additional models of environmental compliance and enforcement have been built on the rational polluter framework (see Cohen, 1999 and Heyes, 2000 for surveys of this literature). These models allow for complexities such as imperfect information, self-reporting, principal-agent relationships, and dynamic settings and while the optimal enforcement regime in such models may include a combination of civil and criminal penalties, targeted enforcement, or escalating penalties for repeated noncompliance, ultimately such regimes are designed to deter violations by increasing the expected cost of noncompliance as efficiently as possible.

In the complexity literature regulated entities intend to comply with environmental regulations, but may be noncompliant because they do not fully understand the regulatory requirements, do not fully know their facility's operations, have poor internal environmental management systems, or do not have the ability to comply (see, for example Spence, 2001 and Environmental Law Institute, 2003). This literature often does not use formal models, relying instead on anecdotal or qualitative evidence to develop a theory of compliance. For example, an analysis by the Colorado Department of Public Health and the Environment found that a number of facilities were frequently violating hazardous waste storage requirements because they were unaware of their regulatory status. Similarly, a study by the New Hampshire Department of Environmental Services attributes the fact that less than half of the hazardous waste generators in the state are in compliance with training requirements to the common misconception that federally required OSHA training qualifies as hazardous waste management training.[13] In complexity-based theories noncompliance is not intentional and thus deterrence-based approaches to enforcement are generally ineffective. Instead, outreach and compliance assistance

[13] Shewmake (2004).

are the primary means for improving environmental performance. For example, Colorado's Air Program found that compliance improved after facilities received on-site compliance assistance consultations.

Like the deterrence literature, the cooperative enforcement literature also assumes (either explicitly or implicitly) that regulated entities are motivated by a desire to minimize costs. However, the cooperative literature is generally more expansive in its definition of the costs of noncompliance and often includes social costs of noncompliance in addition to formal enforcement costs as one of the factors that drive regulated entities to comply. Cooperative enforcement also frequently adopts a more flexible definition of compliance, taking a performance-based approach to compliance rather than a standards-based approach. A number of different authors have developed qualitative descriptions of this approach (see, for example Bardach and Kagan, 1982 and Reiss, 1984), but Scholz (1984) provides the first formal model.[14] Using a game theoretic framework Scholz suggests a "tit-for-tat" strategy in which regulators agree to cooperate with regulated entities and take a flexible approach to evaluating compliance as long as the entities themselves are also cooperative. However, if the regulated entities take advantage of the regulator's cooperation to evade the spirit of the regulation, the regulator will respond with traditional punishments. Scholz shows that in a dynamic game such a strategy can establish a mutually beneficial cooperative equilibrium where deterrence is used primarily as a threat. In this model, the optimal solution to noncompliance is to offer both compliance assistance and incentives as "carrots," and also have a deterrence-based enforcement regime that works as a "stick" when necessary. Related models such as the responsive regulation model of Ayers and Brathwaite (1992) also call for a mix of premonitory actions such as assistance and

[14] Winter and May (2001) provide a good overview of the cooperative literature.

incentives and postmonitory actions such as compliance inspections and penalties.[15]

Numerous papers in the empirical literature on environmental enforcement have shown that deterrence-based tools such as compliance inspections and penalties for detected violations do increase overall compliance (see Gray and Shimshack, 2011 for a recent survey of this literature). There has been less formal empirical analysis of the effectiveness of compliance assistance and incentives tools in increasing compliance, although qualitative analyses and anecdotal evidence suggests it can be effective and Stafford (2006) shows that some state-level compliance assistance programs have appear to have a positive effect on compliance with hazardous waste regulations.[16] There are a few empirical studies that explicitly acknowledge the different motivations behind compliance and attempt to determine the extent to which different theories can explain compliance. For example, Burby and Patterson (1993) examine enforcement in North Carolina's sedimentation control program and find that in addition to traditional deterrence mechanisms, the clarity of regulations also has a significant positive effect on compliance, particularly in cases where the regulatory standard is performance-based. Brehm and Hamilton (1996) investigate compliance with the Toxics Release Inventory (TRI) reporting requirements by facilities in Minnesota and find that noncompliance is better explained by variables associated with the likelihood that a firm is ignorant of those reporting requirements than by variables associated with deliberate evasion. Stafford (2006) examines compliance with hazardous waste regulations using a wide variety of explanatory variables to measure the level of

[15] Reiss (1984) uses the terms premonitory and postmonitory to distinguish programs that focus on preventing noncompliance before it occurs from programs that focusing on detecting or punishing acts of noncompliance that have already occurred.

[16] For example, Colorado's Air Program found that compliance improved after facilities received on-site compliance assistance consultations (Shewmake 2004). There have also been a number of analyses comparing the effectiveness of regulatory styles – most often an "adversarial" style versus a more "cooperative" style (see, for example, Scholz, 1991; Harrison, 1995; and Sharma, 2001) – but these studies do not examine the effectiveness of particular compliance tools.

complexity and costs associated with facility compliance as well as deterrence-based enforcement and state compliance assistance and incentive programs. Her results suggest that both the deterrence and complexity models have some explanatory power and that ignoring either type of noncompliance would be problematic.

As discussed above, the three strands of the regulatory compliance literature provide different predictions as to the ultimate effectiveness of compliance assistance. If deterrence-based models provide an accurate picture of regulatory compliance, compliance assistance should be generally ineffective at increasing compliance. Conversely, if complexity-based models are more consistent with regulated entities' actual compliance decisions, compliance assistance should be effective. Finally, if cooperative models provide the best fit then compliance assistance and deterrence should have a complementary relationship – that is compliance assistance should be effective, but its effectiveness should be enhanced by deterrence. This paper will examine both the overall effectiveness of compliance assistance in increasing environmental compliance and determine the extent to which there is a complementary relationship between compliance assistance.

4. Empirical Approach and Data Used in the Analysis

To determine the effectiveness of compliance assistance econometrically, there must be variation in the level of compliance assistance provided to regulated entities. Much of the federal compliance assistance is developed and delivered by EPA's ten regional offices. These offices also have significant discretion over the form and level of compliance assistance offered to regulated entities. Thus there is regional variation in the level of compliance assistance. Additionally, compliance assistance efforts are often targeted to particular types of regulated

entities. For example, according to EPA the majority of compliance assistance efforts are directed at small and medium sized businesses and a number of industry sectors receive more focused compliance assistance (Metzenbaum, 2007). Finally, states may offer additional compliance assistance above what is offered by the federal EPA.

To test for a complementary relationship between compliance assistance and deterrence there also needs to be variation in the level of deterrence at regulated entities. The level of deterrence depends on both the likelihood that an entity is subject to a compliance inspection or evaluation and the severity of sanctions associated with violations. In the U.S. the general level of deterrence varies across regulated entities because states implement most environmental programs and have a significant level of discretion over how to enforce those regulations. As a result, overall inspection rates and the level of sanctions can vary significantly across states. Additionally, specific deterrence – that is, the level of deterrence a particular facility faces – also varies across facilities because many regulatory agencies appear to engage in targeting – that is, focusing enforcement resources on those entities most likely to violate and/or those which have the potential to cause significant environmental harm. Thus the level of specific deterrence in a given state could vary significantly across types of regulated entities.

To take advantage of the differences in both enforcement efforts and compliance assistance efforts, this paper examines a national universe of regulated entities. However, because EPA regulates media programs separately and each program employs its own enforcement regime, it would be difficult to develop a reasonable measure of enforcement or deterrence for a given entity if I considered all regulated entities in the U.S. Additionally, each program collects different information about the facilities that it regulates and it would be quite challenging to collect a consistent set of explanatory variables for all regulated entities. Thus I

chose to focus on firms subject to hazardous waste regulations. I chose the hazardous waste program over other media programs because it is a large federal program that covers a wide variety of entities and thus there is substantial variation across facility types in both enforcement effort and compliance assistance. Additionally, the hazardous waste program is enforced primarily through compliance inspections so that it is easy to measure deterrence levels in this program. Finally, this sector has been the focus of a number of other compliance analyses, and I can easily compare the results to those of other studies.

The universe for the analysis includes almost 350,000 regulated hazardous generators in the continental U.S. that were identified using EPA's RCRAInfo database.[17] Hazardous waste generators can be grouped into three basic categories: Large Quantity Generators (LQGs), Small Quantity Generators (SQGs), and Conditionally Exempt Generators (CEGs). LQGs generate over 1,000 kilograms of hazardous waste a month, while SQGs generate between 100 and 1,000 kilograms a month and CEGs generate less than 100 kilograms a month. LQGc are subject to more stringent regulations that SQGs, and CEGs are subject to less stringent regulations than SQGs. Additionally, LQGs generally face higher levels of enforcement than SQGs and CEGs, as will be shown in more detail below.

Compliance assistance may immediately effect a facility's compliance with environmental regulation. However, it may also take time for a facility to absorb the assistance provided and use it to increase environmental performance. Thus for this analysis, I use lagged compliance assistance efforts. Additionally, I use lagged deterrence measures rather than

[17]I do not include facilities that are subject to hazardous waste regulations but do not generate hazardous waste such as hazardous waste transporters. I also do not include facilities in Alaska and Hawaii because one of the state-level variables (the index of state pollution abatement costs) is not available for those two states. However, the results do not change qualitatively if facilities in these two states are included (and the incomplete state abatement cost variable is not used).

contemporaneous deterrence measures because facilities are likely to base their estimation of current deterrence on recently observed levels of deterrence. The use of lagged measures also minimizes any concerns about the potential endogeneity of such measures.

EPA began collecting data on the type and level of compliance assistance provided by its regional offices in 2005. According to EPA staff, the first year of its compliance assistance data collection suffered from some inconsistencies across regions in reporting data, so I have chosen to use the data from 2006 to conduct the analysis.[18] Table 1 presents three different compliance assistance measures provided by EPA: entities reached by compliance assistance, facility compliance assistance visits, and compliance assistance tools developed, all normalized by the total number of regulated facilities in the region. Note that there is reasonable variation in all three variables across the regions. The number of entities assisted includes facilities that receive on-site visits, facilities that participate in workshops, as well as facilities that receive compliance assistance materials. Compliance assistance tools include compliance workshops, web-based assistance and training programs, guidance documents etc. Since the activities measured by these two variables could be very different across regions, these two variables are likely to be more noisy than the number of compliance visits.

Given the need to lag the compliance assistance data, I use 2007 compliance data as the dependent variable in the analysis. Violations of RCRA regulations can range from minor paperwork violations to major violations that pose an immediate threat to human health and the environment. However, the RCRAInfo database contains very limited information on the nature of violations found at facilities and thus it would be very difficult to develop a continuous measure of the level of noncompliance at a given facility. Thus I model compliance as a binary

[18]September 4, 2009 phone conversation with Karen Koslow, Acting Director of the Compliance Assistance and Sector Program Division of EPA's Office of Compliance.

variable: facilities with any detected violations are considered to be in noncompliance and facilities with no detected violations are considered to be in compliance.

Because the dependent variable is binary, I use a probit model to analyze the facilities' compliance behavior. However, data on compliance is only available if a facility is inspected, and thus any valid empirical method must control for this censoring. Additionally, it is likely that compliance and inspections are jointly determined, that is, a regulator's decision to inspect a particular facility depends in part on the likelihood that the facility will be noncompliant and the facility's decision to comply depends in part on the likelihood of inspection. To control for both the censoring and the probability that the compliance and inspection equation may have correlated errors, I use a censored bivariate probit model.

As discussed in more detail in Greene (1992), the censored bivariate probit uses maximum likelihood to estimate a probit model with sample selection where the selection equation and the underlying equation of interest may have correlated errors. More specifically, both the probability of a violation and the probability of an inspection are modeled as latent variables, $V_i^* = x_{1i}\beta_1 + \varepsilon_{1i}$ and $I_i^* = x_{2i}\beta_2 + \varepsilon_{2i}$, respectively. Let V_i and I_i be the observable binary variables associated with these two latent variables. Since regulators target facilities that are likely to be in violation for inspection, the error terms ε_{1i} and ε_{2i} should be positively correlated. Therefore, the likelihood of observing a detected violation (V_i=I_i=1) can be written as:

$$L_{V_i=1,I_i=1} = \sum_{V_i=1,I_i=1} \log \Phi_2 \left[x_1\beta_1, x_2\beta_2, \rho \right]$$

where Φ_2 is the bivariate normal cumulative distribution function and ρ is the covariance between ε_{1i} and ε_{2i}. Similarly, the likelihood of inspecting a non-violator (V_i = 0, I_i = 1) is:

$$L_{V_i=0,I_i=1} = \sum_{V_i=0,I_i=1} \log \Phi_2 \left[-x_1\beta_1, x_2\beta_2, -\rho \right].$$

Finally, if a facility is not inspected, whether the facility is in violation is unknown. Thus the maximum likelihood function can be expressed as:

$$L = L_{V_i=0,I_i=1} + L_{V_i=1,I_i=1} + L_{I_i=0} = \sum_{V_i=1,I_i=1} \log \Phi_2 \left[x_1\beta_1, x_2\beta_2, \rho \right] + \sum_{V_i=0,I_i=1} \log \Phi_2 \left[-x_1\beta_1, x_2\beta_2, -\rho \right] \sum_{I_i=0} \log\left(1 - \Phi\left[x_2\beta_2\right]\right)$$

To identify the model, there must be at least one explanatory variable that affects whether the facility will be inspected but does not affect whether the facility violates the regulations. I address the identification strategy later in this section.

Table 2 lists the variables used in the analysis and presents summary statistics for each of the three categories of generators, LQGs, SQGs, and CEGs. All of the facility-level variables are extracted from EPA's RCRAInfo database which includes data each facility's location, regulatory status, compliance history, enforcement history, and whether the facility is regulated by another media program. Note that there is significant variation in the means of the facility-level variables across the three groups.

The two dependent variables are $Inspected_{07}$ and $Violated_{07}$. $Inspected_{07}$ is equal to 1 if any state or regional official inspects the facility in 2007, regardless of the purpose of the inspection. As shown, LQGs face a 30 percent chance of being inspected in a given year while SQGs and CEGs face a much smaller likelihood. $Violated_{07}$ is equal to 1 if there is any detected hazardous waste violation at the facility in 2007, regardless of the type or severity of the

violation. Of course, violations cannot be detected if the facility is not inspected, so the higher percentage of LQGs that violated is due, at least in part, to the higher probability of being detected. The empirical method described above will allow me to determine whether LQGs are more likely to violate even after controlling for the different probability of being inspected.

The first set of explanatory variables measures the level of deterrence at each facility in the analysis. *State Inspections*$_{06}$ measures the total number of RCRA inspections conducted in the state in 2006 normalized by the total number of RCRA regulated facilities (not just generators) and is a proxy for the level of general deterrence each facility faces. While generators are unlikely to know the values of this variable explicitly, recent enforcement levels are likely to provide the best estimate a facility has of current enforcement efforts and thus this variable is likely to be highly correlated with the level of deterrence a facility experiences. *Change in State Inspections*$_{06\text{-}07}$ measures the change in the total number of RCRA inspections conducted in the state in between 2006 and 2007. To identify the model I do exclude *Change in State Inspections*$_{06\text{-}07}$ from the Violation equation. From a theoretical standpoint I believe this exclusion is valid as an increase in the total number of inspections in a state will increase the probability regulators will inspect a facility, but such a change is unlikely to be common knowledge to facilities, and thus it should not affect the facility's violation decision.[19] *State Average Penalty*$_{06}$ measures the average penalty per violation in the state in 2006 and is a second measure of general deterrence at facilities in the analysis. Specific deterrence at a facility is captured by two variables, *Facility Inspections*$_{06}$ which indicates the number of inspections at the facility in 2006 and *Facility Inspection History*$_{02\text{-}06}$ which is a count of the number of inspections between 2002 and 2006. Both of these variables do vary significantly across generator types.

[19] From an econometric standpoint, when this variable is included in the Violation equation, the coefficient on *Change in State Inspections*$_{06\text{-}07}$ is not significant.

In the analysis federal compliance assistance is measured by the variable *Regional CA Visits*$_{06}$ which counts the number of facilities that receive a compliance assistance visit in the region, normalized by the total number of regulated facilities in the region. As shown in Table 1, the number of entities visited in the sample ranges from a high of 1,465 per 100,000 facilities in Region 8 to a low of 6 per 100,000 facilities in Region 5.[20] While this is the only measure of regional compliance assistance used in the final regression reported in this paper, I did consider the two alternate measures of regional compliance assistance presented in Table 1 as well. However, as discussed above, these other two variables (Entities Reached and Tools Developed) are likely to be more noisy than the number of compliance visits. Additionally, when included in the analysis, neither of the coefficients for these two variables were statistically significant.

The analysis also includes a variable that measures whether the state has a current compliance assistance program, *State CA Program*. Ideally, I would like a variable that measures whether the state had a compliance assistance program in 2006, but unfortunately historic data on compliance assistance programs is not available.[21] I also considered a series of dummies capturing the different aspects of states' current compliance assistance programs, such as whether the state environmental agency has a separate compliance assistance division, provides on-site consultations to assist facilities with compliance, or has a compliance assistance hotline, but due to the binary nature of these variables and high correlations across them, including them in the analysis caused conversion problems in the regression. Note that both the regional and

[20] The high number of visits in Region 8 is due to over 1,500 visits to auto service centers. However the results are robust even if these visits are excluded from the Region 8 count.
[21] There are data on state compliance assistance programs in 2000 that were compiled from a survey conducted by the Environmental Council of the States (ECOS). However, fifteen states did not respond to the ECOS survey and the data are older than would be ideal. Thus I collected data on current state compliance assistance programs by searching the websites of all state environmental agencies in June 2010.

state compliance assistance variables are also interacted with the general deterrence proxy *State Average Penalty*$_{06}$.[22]

In addition to the deterrence and compliance assistance measures, I include a number of facility and state-level characteristics in the analysis. *Waste Generated*$_{07}$ is the natural log of the tons of waste generated by the facility in 2007 and *Waste Managed*$_{07}$ measures the log of the tons of waste managed at the facility in 2007.[23] *Transporter* indicates whether the facility is also licensed to transport hazardous waste and *Multimedia* indicates whether the facility is regulated under an environmental program other than the hazardous waste program. Both of these variables measure the level of regulatory complexity a facility would face, and while there is not a lot of variation across types with respect to the *Transporter* variable, LQGs are significantly more likely to be regulated under other media programs than SQGs or CEGs. *Facility Violations*$_{06}$ indicates the number of violations detected at the facility in 2006 while *Facility Violation History*$_{02\text{-}06}$ is a count of the number of detected violations at the facility between 2002 and 2006. Here too there are significant differences across facility types.

State Violations$_{06}$ measures the total number of RCRA violations detected in the state in 2006 normalized by the total number of RCRA regulated facilities in the state. As with most of the state-level variables, there are some minor differences in mean and standard deviations across

[22] As shown in the results section, *State Average Penalty*$_{06}$ has the most consistently significant effect on the likelihood of violation as thus chosen as the best measure proxy for general deterrence.

[23] Because quantity of waste generated and managed both have a skewed distribution (e.g., the mean quantity generated is over 2,400 tons although about 90 percent of facilities generate less than 500 tons), the log of tons generated performs significantly better than tons. Any facility listed in RCRAInfo as a LQG that did not generate hazardous waste in 2007 was dropped from the analysis as all LQGs are required to report their waste generation quantities. However, depending on state requirements SQGs and CEGs may not have to report waste quantities. For SQGs and CEGs that did not report, I assumed generation equal to the maximum quantity for that generator type.

the generator types, but these differences are much less significant than the differences in facility-level variables. *State* $PAOC_{05}$ is a variable that measures the pollution abatement operating costs in each state and is thus a proxy for a state's regulatory stringency. These data were constructed by Rutqvist (2009) and are based on data collected in the U.S. Census Bureau's 2005 Pollution Abatement Costs and Expenditures (PACE) Survey.[24] The final variable *State Environmental Group Revenues*$_{06}$ measures the total revenues (in thousands) collected by non-profit environmental groups in the state in 2006 normalized by the number of regulated entities, is included to control for non-governmental deterrence that could affect a facility's compliance decision.[25]

5. Results

Table 3 presents the results of the censored bivariate probit regressions. Because the explanatory variables include a number of state-level variables, I cluster the standard errors by state. As shown in the table I ran four separate models: one which combines all types of generators together with dummy variables for generator types, and one for each type of generator separately.

Focus first on the results for the deterrence variables in the Violation equation. General deterrence is measured by two variables, *State Inspections*$_{06}$ and *State Average Penalty*$_{06}$. The coefficient on *State Inspections*$_{06}$ is negative in all four regressions and significant in two while the coefficient on *State Average Penalty*$_{06}$ is negative and significant in three of the four regressions, indicating as expected that higher levels of general deterrence result in a lower

[24] Rutqvist constructs this variable following Levinson's (2001) methodology which takes into account state differences in industrial composition.
[25] I collected the data on environmental group revenues from the National Center for Charitable Statistics' Guidestar Database.

probability of a violation. Specific deterrence is captured by both *Facility Inspections*$_{06}$ and *Facility Inspection History*$_{02\text{-}06}$. Interestingly *Facility Inspections*$_{06}$, does have the expected negative and significant coefficient in three of the four regressions, while *5 Year Inspection History* has a positive and significant coefficient in two of those three regressions. The positive coefficient may be due to the fact that some facilities are more likely to violate due to their underlying characteristics and that regulators target those facilities. Having controlled for the general level of targeting with the history variable, a higher rate of inspections in 2006 also appears to have a deterrent effect on 2007 behavior. The fact that neither of these variables is significant for conditionally exempt generators is likely to stem from the fact that those facilities have an extremely low probability of inspection (less than 2%).

Next consider the regional compliance assistance variable, *Regional CA Visits*$_{06}$. It has a negative and significant coefficient in two of the regressions – the overall regression and the SQG regression. Thus there is reasonable evidence that compliance assistance does decrease noncompliance. However, interpreting the results on the interaction between *Regional CA Visits*$_{06}$ x *State Average Penalty*$_{06}$ is more difficult. The coefficient on this interaction is positive and significant in the regression for all generators and the regression for LQG suggesting that in states with higher levels of deterrence, regional compliance assistance is less effective, but it is negative and significant in the CEG regression. The fact that compliance assistance does have a negative effect on violations in the SQG and CEG regressions but does not in the LQG regression is consistent with the fact that compliance assistance is more often focused on small businesses. While small businesses are not necessarily SQGs or CEGs because the small business designation is based on number of employees while the generator categorization is

based on the quantity of hazardous waste generated – the percentage of SQGs and CEGs that are small businesses is likely to be much higher than percentage of LQGs.

Interestingly, in contrast to the results in Stafford (2006) the existence of some sort of a state compliance assistance program does not have a significant effect on compliance: while the coefficients on *State CA Program*$_{06}$ are consistently negative in all four regressions, they are never significant and none of the coefficients on the interaction with the deterrence proxy are significant either. This result does not imply that all state compliance assistance programs are ineffective, but is more likely to be due to the fact that there is significant variation across state programs.

The remaining variables in the Violation equation are generally consistent across the four regressions and furthermore are consistent with expectations and the results of other studies of hazardous waste compliance. Similarly, most of the variables in the Inspection equation are consistent with expectations and the findings of previous studies. There are however, a couple of interesting new results. First, note that coefficient on *Regional CA Visits*$_{06}$ is never significant, indicating that in general regional compliance assistance does not decrease the probability of an inspection – thus regional compliance assistance does not appear to be substituting for more traditional enforcement. However, this finding does not hold universally for state compliance assistance efforts. For CEGs, state compliance efforts appear to be a substitute for inspections while for SQGs they appear to complement state inspections. Since most inspections are conducted by state regulators, one might expect there to be more explicit tradeoffs between inspections and compliance assistance efforts at the state level.

To provide a sense of the magnitude of the effects of the explanatory variables, Table 4 presents the change in the predicted probability (in percentage points) that a "representative"

facility violates in 2007 for various changes in the explanatory variables. The representative facility has the mean values for all continuous explanatory variables and the median values for discrete explanatory variables. The representative facility varies across the four regressions, as do the coefficients on each variable. Thus in the regression that includes all facilities the predicted baseline violation probability is around 8 percent, while it is almost 35 percent for LQGs, 20 percent for SQGs, and eight percent for CEGs.

While this table does provide some general understanding of the size of the relative effects each variable has on the violation probability, the estimates need to be interpreted with care. For example, increasing the number of state inspections per RCRA-regulated facility by one standard deviation results in a 1.46 percentage point decrease in violation probability at the representative facility according to the "All" facility regression. Because the standard deviation of *State Inspections*$_{06}$ is 0.018, this change requires an additional 18 inspections of every 1,000 RCRA-regulated facilities in the state. All RCRA-regulated facilities in the state will also have decreased probability of violation, although the magnitude of each facility's decrease will depend on the facility's characteristics and thus could be higher or lower than the representative facility. In comparison, increasing the number of regional compliance assistance variables per EPA-regulated facility by one standard deviation results in a 0.7 percentage point decrease in violation probability at the representative facility according to the "All" facility regression. Because the standard deviation of *Regional CA Visits*$_{06}$ is 0.002, this change requires 2 additional visits for every 1,000 EPA-regulated facilities in the region. All RCRA-regulated facilities in the region will then have decreased probability of violation, with the magnitude depending on each facility's characteristics. While the change in state inspections at first might seem to have a large per facility effect, it definitely affects a smaller number of facilities (state-wide rather than

region-wide effects) and may also requires a larger number of inspections. What is clear from these estimates is that the change induced by increase state inspections and compliance assistance visits are in the same general ballpark. In contrast, the interaction between compliance assistance and penalties has a very small effect on the estimated probability of violation.

6. Policy Implications

This study provides evidence that federal compliance assistance is effective at increasing compliance among some types of hazardous waste generators, particularly those facilities that generate relatively small quantities of hazardous waste. However, the study does not find any increase in compliance associated with federal compliance assistance at large quantity generators. These results suggest that federal compliance assistance is not an effective tool for increasing compliance at large generators, either because assistance is not needed or perhaps because compliance assistance as it is currently provided is not useful for such facilities. Thus any suggestion that the compliance rates of larger hazardous waste generators can be increased through increased compliance assistance should be reviewed carefully. Without a significant change in the type of compliance assistance offered, such efforts are unlikely to be effective.

On the other hand, since the results show that compliance assistance does increase compliance among smaller facilities, any significant defunding of compliance assistance efforts is likely to decrease overall compliance, ceteris paribus. If the funds currently used for compliance assistance were to be redirected to traditional deterrence efforts, it is unclear what the net effect might be. Given that the current rate of enforcement for smaller generators is quite low, if the redirected funds were to be targeted toward smaller facilities, the net effect could be

positive. However, if funds were redirected towards larger generators, the net effect might be negative. Thus it is not clear how redirecting funds from compliance assistance to traditional enforcement would effect overall compliance with hazardous waste regulations. Any such change should therefore be studied carefully to determine the appropriate mix of compliance assistance and traditional enforcement efforts.

7. Summary

The purpose of this study is to examine the effectiveness of compliance assistance as well to explore the relationship between the "carrot" of compliance assistance programs and the "stick" of traditional deterrence efforts. I use data on hazardous waste generators nationwide to assess the effect of federal regional compliance assistance programs in improving compliance with hazardous waste regulations. The results of this study show that federal compliance assistance efforts administered by EPA's regional offices do increase compliance. The analysis finds no evidence that the presence of a state compliance assistance program decreases violations, although that may be because there is no differentiation between types of levels of effort for such programs. With respect to the relationship between deterrence efforts and compliance assistance, there is no consistent relationship: for CEGs increased deterrence enhances the effectiveness of compliance assistance, but for all facilities the opposite is true. The results also show that regional compliance efforts are not being used as a substitute for more traditional enforcement. However, there is some evidence that at the state level compliance assistance is being used in place of more traditional enforcement, at least for the very smallest generators.

Since both deterrence and compliance assistance efforts decrease facility violations, these results suggest that for at least some facilities deterrence-based models provide an accurate picture of regulatory compliance and for others complexity-based models may be more consistent with regulated entities' actual compliance decisions. However, given that there is no clear complementary relationship between compliance assistance and deterrence, this analysis does not provide much support for cooperative models.

One limitation of this study is that it examines a cross-section of facilities at one point in time and only considers the immediate effectiveness of compliance assistance. It may be the case the effectiveness of compliance assistance is not immediate. One could argue compliance assistance should have a persistent effect on facility behavior so that facilities that receive compliance assistance change their behavior for a number of years, not just the year following the assistance. Additionally, the effect of compliance assistance may be cumulative – it may take several years of receiving assistance for facilities to change their behavior. Additional examination of the effect of compliance assistance taking a longer time frame into consideration would help to shed additional light on its effectiveness, although using a longer time frame in the analysis will increase endogeneity concerns.

Table1: Regional Compliance Assistance Measures Per 100,000 Regulated Entities

Region	States	Entities Reached	Entities Visited	Tools Developed
1	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	33,189	26	1
2	New Jersey, New York	131,254	10	24
3	Delaware, Maryland, Pennsylvania, Virginia, West Virginia, the District of Columbia	6,270	25	0
4	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee	6,615	31	7
5	Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin	25,920	6	4
6	Arkansas, Louisiana, New Mexico, Oklahoma, Texas	2,355	10	0
7	Iowa, Kansas, Missouri, Nebraska	12,867	183	4
8	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming	6,718	1,466	1
9	Arizona, California, Hawaii, Nevada	6,388	256	1
10	Alaska, Idaho, Oregon, Washington	76,571	37	6

Table 2: Summary Statistics for the Variables in Analysis, by Generator Type: Variable Mean (Standard Deviation)

	All Generators	LQGs	SQGs	CEGs
Number of Observations	348,838	10,313	171,590	166,935
Dependent Variables				
$Inspected_{07}$	0.038	0.383	0.036	0.020
	(0.192)	(0.486)	(0.186)	(0.139)
$Violated_{07}$	0.014	0.183	0.012	0.005
	(0.117)	(0.386)	(0.110)	(0.069)
Deterrence Measures				
State $Inspections_{06}$	0.022	0.025	0.022	0.020
	(0.018)	(0.020)	(0.017)	(0.020)
Change in State $Inspections_{06\text{-}07}$	0.032	0.033	0.0002	0.064
	(0.549)	(0.543)	(0.531)	(0.564)
State Average $Penalty_{06}$	3.588	3.500	3.852	3.322
	(5.606)	(5.467)	(5.921)	(5.258)
Facility $Inspections_{06}$	0.051	0.672	0.041	0.023
	(0.394)	(1.778)	(0.261)	(0.183)
Facility Inspection $History_{02\text{-}06}$	0.241	3.081	0.171	0.138
	(1.401)	(6.59)	(0.756)	(0.562)
Compliance Assistance Measures				
Regional CA $Visits_{06}$	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.003)
State CA Program	0.608	0.624	0.484	0.734
	(0.488)	(0.484)	(0.500)	(0.442)
Deterrence and Compliance Assistance Interactions				
Regional CA $Visits_{06}$	0.007	0.006	0.007	0.006
x State Average $Penalty_{06}$	(0.064)	(0.065)	(0.068)	(0.059)
State CA Program	2.381	2.365	2.437	2.324
x State Average $Penalty_{06}$	(5.751)	(5.599)	(6.182)	(5.280)

Table 2, Continued	**All Generators**	**LQGs**	**SQGs**	**CEGs**
Facility Characteristics				
Waste Generated$_{07}$	-0.871	3.962	0.122	-2.191
	(1.489)	(2.066)	(0.294)	(0.279)
Waste Managed$_{07}$	-18.324	-15.343	-18.411	-18.418
	(1.516)	(8.004)	(0.456)	(0.258)
Transporter	0.015	0.045	0.011	0.017
	(0.122)	(0.208)	(0.106)	(0.131)
Multimedia	0.202	0.864	0.202	0.160
	(0.401)	(0.342)	(0.402)	(0.367)
Facility Violations$_{06}$	0.104	1.680	0.083	0.028
	(2.261)	(9.733)	(1.856)	(1.063)
Facility Violation History$_{02-06}$	0.484	7.137	0.382	0.179
	(6.192)	(24.887)	(5.367)	(3.068)
State Characteristics				
State Violations$_{06}$	0.043	0.048	0.044	0.042
	(0.039)	(0.041)	(0.042)	(0.036)
State PAOC$_{05}$	0.978	0.977	0.941	1.016
	(0.309)	(0.295)	(0.26)	(0.348)
State Environmental Group Revenues$_{06}$	1.123	1.137	1.074	1.174
	(2.392)	(2.499)	(1.632)	(2.971)

Table 3: Results of the Censored Bivariate Probit, by Generator Type: Coefficient (Standard Error)

	All Generators	LQGs	SQGs	CEGs
Violation Equation				
State Inspections$_{06}$	-5.884**	-3.931	-3.999	-12.496**
	(2.574)	(2.694)	(3.078)	(4.076)
State Average Penalty$_{06}$	-0.048**	0.004	-0.079**	-0.058*
	(0.019)	(0.030)	(0.036)	(0.032)
Facility Inspections$_{06}$	-0.044*	-0.043*	-0.16**	0.058
	(0.023)	(0.023)	(0.052)	(0.068)
Facility Inspection History$_{02-06}$	0.018**	0.017**	0.036	0.035
	(0.008)	(0.008)	(0.026)	(0.04)
Regional CA Visits$_{06}$	-20.003*	4.499	-30.649*	42.931
	(11.902)	(17.797)	(16.12)	(36.374)
State CA Program	-0.149	0.106	-0.258	-0.367
	(0.122)	(0.181)	(0.254)	(0.232)
Regional CA Visits$_{06}$	1.757*	2.247**	1.35	-35.143*
X State Average Penalty$_{06}$	(0.914)	(0.862)	(1.069)	(18.083)
State CA Program	0.004	-0.043	0.035	0.045
X State Average Penalty$_{06}$	(0.023)	(0.032)	(0.039)	(0.045)
LQG	0.496**			
	(0.12)			
SQG	0.193**			
	(0.066)			
Waste Generated$_{07}$	0.066**	0.036**	0.229**	0.102**
	(0.01)	(0.01)	(0.035)	(0.042)
Waste Managed$_{07}$	-0.004	0.002	0.013	0.007
	(0.003)	(0.004)	(0.014)	(0.021)
Transporter	0.023	0.037	-0.047	0.003
	(0.069)	(0.078)	(0.13)	(0.207)
Multimedia	0.261**	0.088*	0.287**	0.161*
	(0.055)	(0.048)	(0.072)	(0.095)
Facility Violations$_{06}$	0.006	0.004	0.008	0.013
	(0.004)	(0.004)	(0.008)	(0.009)
Facility Violation History$_{02-06}$	0.006**	0.005**	0.007*	0.007*
	(0.003)	(0.002)	(0.004)	(0.004)
State Violations$_{06}$	4.269**	2.812**	4.448**	6.694**
	(1.418)	(0.974)	(2.19)	(1.807)
State PAOC$_{05}$	0.108	0.093	0.045	0.122
	(0.141)	(0.162)	(0.221)	(0.147)
State Environmental Group	-0.034**	-0.024**	-0.035**	-0.052**
Revenues$_{06}$	(0.011)	(0.001)	(0.001)	(0.002)
Constant	-1.425**	-0.899**	-0.779	-0.853
	(0.345)	(0.364)	(0.798)	(0.754)

**Significant at the 5% level; *Significant at the 10% level.

Table 3, Continued	All Generators	LQGs	SQGs	CEGs
Inspection Equation				
State Inspections$_{06}$	10.765**	12.237**	11.464**	10.308**
	(2.905)	(2.882)	(3.457)	(3.118)
Change in State Inspections$_{06-07}$	30.602**	23.859*	32.854**	27.272**
	(12.111)	(12.845)	(16.43)	(10.901)
State Average Penalty$_{06}$	0.014	-0.003	0.038	-0.045*
	(0.044)	(0.025)	(0.054)	(0.024)
Facility Inspections$_{06}$	0.025	-0.08**	-0.006	0.286**
	(0.042)	(0.04)	(0.084)	(0.067)
Facility Inspection History$_{02-06}$	0.190**	0.134**	0.215**	0.251**
	(0.017)	(0.014)	(0.028)	(0.04)
Regional CA Visits$_{06}$	-17.906	2.991	-27.152	-10.646
	(18.629)	(13.298)	(28.967)	(13.94)
State CA Program	0.299	0.059	0.545*	-0.215*
	(0.245)	(0.119)	(0.303)	(0.125)
Regional CA Visits$_{06}$	1.075	-1.492**	1.585	1.711*
X State Average Penalty$_{06}$	(0.828)	(0.637)	(1.025)	(0.895)
State CA Program	-0.041	0.008	-0.071	0.006
X State Average Penalty$_{06}$	(0.044)	(0.024)	(0.054)	(0.026)
LQG	0.712**			
	(0.08)			
SQG	0.151**			
	(0.068)			
Waste Generated$_{07}$	0.076**	0.025**	0.227**	0.16**
	(0.007)	(0.008)	(0.018)	(0.016)
Waste Managed$_{07}$	0.004	0.012**	0.007	0.029*
	(0.003)	(0.003)	(0.007)	(0.015)
Transporter	0.208**	0.175*	0.204**	0.224*
	(0.076)	(0.098)	(0.092)	(0.115)
Multimedia	0.31**	0.087*	0.292**	0.269**
	(0.038)	(0.046)	(0.041)	(0.056)
Facility Violations$_{06}$	0.016**	0.015**	0.021**	0.005
	(0.003)	(0.003)	(0.005)	(0.008)
Facility Violation History$_{02-06}$	-0.003**	-0.004**	-0.003	-0.001
	(0.001)	(0.001)	(0.002)	(0.004)
State Violations$_{06}$	-1.043	-0.921	-1.55	-0.125
	(1.367)	(0.699)	(1.885)	(1.15)
State PAOC$_{05}$	-0.109	0.069	-0.07	-0.195
	(0.217)	(0.114)	(0.275)	(0.187)
State Environmental Group	0.009	0.01	0.014	-0.009
Revenues$_{06}$	(0.015)	(0.006)	(0.023)	(0.011)
Constant	-2.306**	-0.99**	-2.341**	-1.154**
	(0.351)	(0.17)	(0.508)	(0.333)

**Significant at the 5% level; *Significant at the 10% level.

Table 4: Marginal Effects (in Percentage Points) for a Representative Facility

	All	LQG	SQG	CEG
Predicted Probability of Inspection for Representative Facility	7.80%	34.75%	18.96%	8.09%
Change in the predicted probability of a violation if:				
Increase State Inspections$_{06}$ by one sd	**-1.46%**	-2.86%	-1.79%	**-3.08%**
Increase State Average Penalty$_{06}$ by one sd	**< -0.01%**	<0.01%	**-0.01%**	**-0.01%**
Increase Facility Inspections$_{06}$ by one sd	**-0.25%**	**-2.78%**	**-1.11%**	+0.16%
Increase Facility Inspection History$_{02-06}$ by one sd	**+0.37%**	**+4.27%**	+0.74%	+0.30%
Increase Regional CA Visits$_{06}$ by one sd	**-0.70%**	+0.35%	**-1.69%**	+1.98%
No State CA Program	+2.40%	-3.84%	-6.20%†	+7.02%
Increase Regional CA Visits$_{06}$ x State Average Penalty$_{06}$ by one sd	**< +0.01%**	**+0.01%**	< +0.01%	**-0.03%**
Increase State CA Program x State Average Penalty$_{06}$ by one sd	< +0.01%	-0.01%	+0.01%	< +0.01%
LQG	**+10.00%**			
SQG	**+3.22%**			
Increase Waste Generated$_{07}$ by one sd	**+1.53%**	**+2.75%**	**+1.88%**	**+0.44%**
Increase Waste Managed$_{07}$ by one sd	-0.08%	+0.50%	+0.17%	+0.03%
Transporter	+0.34%	+1.38%	-1.24%	+0.05%
Multimedia	**+4.54%**	**-3.19%**††	**+8.72%**	**+2.69%**
Increase Facility Violations$_{06}$ by one sd	+0.19%	+1.60%	+0.41%	+0.20%
Increase Facility Violation History$_{02-06}$ by one sd	**+0.55%**	**+4.52%**	**+1.05%**	**+0.31%**
Increase State Violations$_{06}$ by one sd	**+2.76%**	**+4.36%**	**+5.51%**	**+4.27%**
Increase State PAOC$_{05}$ by one sd	+0.50%	+1.02%	+0.32%	+0.66%
Increase State Environmental Group Revenues$_{06}$ by one sd	**< -0.01%**	**< -0.01%**	**< -0.01%**	**< -0.01%**

Significant effects in bold.

†For the SQG run, the representative facility is in a state with no State CA Program and thus the change is to having a State CA program.

†† For the LQG run, the representative facility is a Multimedia facility and thus the change is to not being a Multimedia facility.

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