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Voluntary Environmental Programs: An Examination of Program Performance and the Role of Institutional Design

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Voluntary Environmental Programs: An Examination of Program Performance and the Role of Institutional Design

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Dedication

This thesis is dedicated to my Aunt Juanita, who taught me to embrace education and is my deepest inspiration. It is also dedicated to my husband Donnie, whose love is unwavering and remains committed to my happiness.

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Abstract

Many studies exist on whether Voluntary Environmental Programs (VEPs) improve firms' environmental performance. Furthermore, the literature on VEPs theorizes that specific features contribute to program performance. This study examines the ability of Voluntary Environmental Programs to reduce emissions and the role of institutional design on their performance. Specifically, this study aimed to identify if specific features influence performance more than others do. The indicator of performance focuses on the overall emission reductions of firms across years 2007-2009. To analyze performance and features, the study examines the emission data and design features of each program. The results reveal the ability of the VEPs to reduce emissions and a combination of features that may have a greater influence on performance. This suggests that the success of VEPs rely on their ability to institute these features.

Environmental policies, Voluntary Environmental Programs, VEP

Introduction

Over the last three decades, Voluntary Environmental Programs (VEPs) gained support from many industries as an alternative to government regulation to address environmental concerns. However, the efficacy of VEPs to reduce pollution remains an open question for environmental activists and scholars. Further, many question whether existing VEPs employ appropriate design features to ensure efficacy. This study addresses these questions with the examination of four VEPs and their firms' performance in reducing hazardous air emissions.

The federal government began regulating environmental policies in the late 1960s, followed by the creation of the EPA in 1970 (EPA 2011). Catastrophic events, such as Love Canal and Three Mile Island increased public concern about environmental pollution and changed how the U.S. government addressed environmental problems. The passage of significant environmental legislation, including the Clean Air Act, Resource Conservation and Recovery Act, and the Clean Water Act, addressed environmental policy through government regulation (EPA 2011). By the 1980s, command and control regulation mandated environmental policies. Command and control regulation refers to government regulation wherein agency administrators create legally binding standards, such as emission limits, and the use of specific production technologies (Potoski and Prakash 2005). These regulations control the emissions of environmental pollutants through mandates (e.g., emissions taxes) and penalties (Dawson and Segerson 2008).

Though initially successful, command and control regulations eventually garnered criticisms from scholars and businesses alike as being inflexible and costly (Darnall and Sides 2008; Dawson and Segerson 2008). Furthermore, the EPA struggled to fulfill regulatory

mandates to ensure compliance due in part to limited funding of necessary oversight activities (e.g., inspections) (Darnall and Carmin 2005). As a result, alternative instruments to environmental policy became attractive to governments, businesses and stakeholders.

One such alternative was Voluntary Environmental Programs (VEPs). VEPs are programs that firms join voluntarily in order to pursue environmental stewardship beyond government compliance. Subsequently, VEPs became major instruments for implementing environmental policies in many arenas including government and industries.

The demand for a cost-benefit approach to environmental regulation spurred support of VEPs as an alternative regulatory instrument (Koehler 2007). The nature of VEPs allows firms to avoid costly legislation, monitoring and enforcement (Arora and Cason 1996). The expectations of VEPs are to improved environmental conditions without the cost and inefficiencies of government regulation (Dawson and Segerson 2008). However, VEPs do not replace existing regulations. Instead, they should move firms beyond regulations and address issues overlooked by government regulations (Koehler 2007). The high expectations of VEPs are evident by their extensive involvement in governments, industries and nongovernmental organizations.

Still, VEPs are not without their own critics. At the center of the VEP debate are questions about their efficacy. Given the voluntary nature of VEPs, it is unclear whether these programs actually provide environmental protection and improve human health (Daley 2007). Many consider VEPs to be "greenwashes," a term that refers to a superficial display of environmental concern by an organization in order to undermine unfriendly environmental practices (Cambridge Dictionary Online 2011). VEPs function as greenwashes because

participating firms can simply signal environmental commitment without actually improving their environmental performance. By law, government regulators cannot enforce a voluntary program (Arora and Cason 1996). Thus, to consumers and stakeholders, VEP membership can signal environmental concern without providing evidence of actual environmental performance.

The criticisms of VEPs led many scholars to examine their ability to reduce pollution. The analysis of VEPs performance also fostered the examination of their institutional designs. This study has two goals: to test the ability of VEPs to reduce emissions and to compare the efficacy of various design features of the VEPs. To reach these objectives this research examines four VEPs. The study focuses on the performance of the firms in each VEP and the specific design features of each VEP. The indicator of performance is their overall emission data. The comparison of their design features examines the similarities and differences of each VEP.

The high expectations, criticisms, and multiple design features of VEPs fueled the decision to study their program efficacy. Yet, their known program failures (e.g., free riding) motivate the examination of their institutional design. If VEPs performed properly, the expected benefits would affect not only firms but also the public, governments, and stakeholders. VEPs represent ideal public-private partnerships between businesses and governments to fulfill public policy. The study is vital because it takes into account a combination of features that may influence program performance. Furthermore, VEPs are unique in the sense that government regulation purses compliance through voluntary measures. Since, governments seek to pursue vital public policy with voluntary measures, ensuring that VEPs succeed requires a critical assessment of what influences performance.

Literature Review

Voluntary Environmental Programs are an approach to fostering environmental protection without command and control regulation. Though these programs are popular, their effectiveness in improving environmental compliance and performance is unclear. Current literature on VEPs provides a foundation for understanding their popularity, purpose, firms' participation and effectiveness.

There are three types of VEPs: industry-led (e.g., the automobile industry), government (i.e., a government-led program with private participants), and industry-government (i.e., a program jointly created by government and a specific industry for that industry i.e., Aluminum industry). Each type of program may have different institutional designs, overall performance and public perception; however, they are fundamentally the same.

Governments, industries and regulatory agencies adopt voluntary environmental programs for various reasons. VEPs are popular when the threat of regulation is high (Koehler 2007). The threat of regulation under mandatory environment protocol motivates firms to seek membership in voluntary programs (Khanna and Damon 1999). Firms will seek VEP membership if the anticipated costs are less than the anticipated costs to comply with government orders (e.g., eco-taxes). VEPs, especially industry programs, allow firms to preempt regulation by committing to environmental goals (Koehler 2007). For example, government agrees not to impose a regulation on the firms if the environmental target is achieved voluntarily (Alberini and Segerson 2002). In general, firms participate in VEPs largely because they perceive a benefit that outweighs the cost of participation or at least no net loss from participation (Alberini and Segerson 2002).

VEPs provide direct benefits to firms such as public recognition through newsletters, press releases and awards. Firms also receive technical assistance that provides innovative ways to reduce pollution, which lowers the cost of learning about best practices (Khanna and Damon 1999). Member firms receive benefits, such as a positive "brand name," that exclude nonparticipating firms (Potoski and Prakash 2005). The utility of these benefits may depend on the individual firms. For example, firms closer to consumers (e.g., firms controlling the final product) benefit more from VEP membership because they assume consumers are willing to pay a higher cost for a product that reduces environmental impact (Arora and Cason 1996). This implies that firms that do not directly sell to consumers benefit less from "green branding"; instead, they benefit more from publicity from stakeholders (e.g., customers, sponsors).

The publicity from joining a VEP signals to consumers that firms are environmentally conscious (Arora and Cason 1996). This signaling of environmental stewardship contributes to the criticisms that VEPs are simply "greenwashes." The type of VEP chosen (e.g., industry versus government) also depends on the perception of the firms. Firms seek membership in specific types of VEPs depending on the benefits. For example, if a firm seeks to reduce the cost of environmental regulation they would likely join a government-sponsored program. However, if they seek to enhance their environmental reputation within the industry, they would likely join an industry program (Darnall et al 2009). Thus, firms chose VEPs that convey their level of desired environmental stewardship. Hence, firms select a VEP strategically based on the expected level of publicity and benefit.

Despite the benefits of membership, joining a VEP can impose significant costs on firms. The costs are investments made to improve environmental performance (e.g., equipment, technology, materials, employee training) (Khanna et al 2007). Most VEPs require firms to

make substantial investments in pollution prevention activities. Some also require the implementation of a costly environmental management system (EMS) (Darnall et al 2009) that provides firms with strategies to reduce environmental impact. It also helps firms develop an environmental policy, which states their commitment to prevent pollution, plans for continual improvement and compliance with environmental regulation. (BSI 2011). For example, certification to International Standardization Organization (ISO) 14001 ranges from $25,000 to over $100,000 per facility (Potoski and Prakash 2005). Furthermore, the costs associated with joining a VEP varies for each firm. For example, larger firms face higher adoption costs because they have to collect and apply more information, train more people and implement new technologies on a wider scale (Khanna et al 2007). Firms also face increased operation costs, and they risk the loss of customers and investors from a damaged reputation if performance is not improved (BSI 2011).

VEP Performance

Despite the costs associated with a VEP, they remain attractive to many firms. However, their popularity does not hinge upon their environmental performance and does not necessarily mean they are effective. While some are arguably successes (e.g., EPA's Green Light Program), scholars have identified many that were failures (e.g., EPA's Performance Track) (Moon 2008; Kohler 2007).

Scholarly literature identifies free riding and shirking as the main problems that plague VEPs, and conceivably lead to their failure. Free riding is the tendency of firms to underperform but still benefit (e.g., receive recognition from stakeholders and consumers) from the overall success of the VEP (Potoski and Prakash 2007). Shirking is the intentional avoidance of program obligations and standards by member firms (Potoski and Prakash 2005). Firms have

strong incentives to free ride and shirk. For example, Koehler (2007) argues that underperforming firms avoid making the financial investments necessary to reduce pollution, but still benefit from the VEP success. Furthermore, participating in a VEP still signals environmental compliance and performance to consumers and stakeholders. Since VEPs, by definition, are voluntary, they attract free riding and shirking firms. This is further aggravated because most VEPs lack penalty for underperformance. With the lack of penalty enforcements, some firms may intentionally fail. The incentives to free ride and shirk contributes to the loss of efficiency in overall program performance (Dawson and Segerson 2008).

Design Features

The literature identifies multiple design features associated with VEP performance. The features extensively discussed include oversight and enforcement features such as sanctioning, auditing, reporting, and certification. Scholars argue theses features may address the concerns about free riding and shirking. The literature also discusses the role of other features such as positive, tangible incentives and performance targets on program performance. Theoretically, institutional design is the "parts" that share a significant relationship to the effectiveness or "whole" of the VEP. If free riding and shirking cripples the "whole" program, then the "parts" must be ineffective. Thus, program design features should abate these program failures.

Oversight and Enforcement

Oversight and enforcement features sanction, monitor and audit member firms for undesirable participation and outcomes. Potoski and Prakash (2007) argue that monitoring and sanctioning mechanisms can force members to comply with standards, which can control free riding and shirking. In order for these mechanisms to work, Potoski and Prakash (2007) argue that VEPs need three components: third-party monitoring, public disclosure of audit finding and

sanctioning by program sponsors. They define these elements of the sanctioning mechanisms as "swords"; strong sword programs have audits, disclosure and sanctioning mechanisms. Medium sword programs require third-party audits and public disclosure but no sanctioning mechanisms and weak sword programs only require third-party audits (Potoski and Prakash 2007). However, the majority of VEPs do not have these combinations of features.

Sanctioning and auditing

VEPs adopt sanctioning mechanisms to reprimand program participants for underperformance. Auditing mechanisms monitors if firms are complying with standards. Literature highlights the desirable effects oversight and enforcement has on improving VEPs performance (Rivera, Deleon, & Koerber 2006). For example, King and Lenox (2000) found that the chemical industry's Responsible Care program had informal punishments such as publicly denouncing underperforming firms. However, in the absence of formal sanctions, they did not improve members' performance in pollution abatement. Furthermore, they found that participating firms reduced emissions slower than nonparticipants did. For VEPs, sanctioning mechanism must pose a low cost to implement but a high cost for firms. For firms, the costs are not necessarily fines, but instead negative publicity. If firms gain more publicity from participation, which ultimately affects their profitability, then firms should pay a high cost for failed performance, which is the loss of that publicity. Sanctioning can publicly denounce a firm's performance, which may result in a negative image that undermines their profits.

Auditing is another oversight feature found in VEPs. Government sponsored VEPs generally are self-monitoring programs, in which they self-evaluate their adherence to program requirements and report to a program manager. However, VEPS rarely verify their. Even if a firm fails to meet the goals, there is often no instrument to sanction failing participants (Darnall

and Sides 2008). Industry-sponsored programs also lack third party monitoring and sanctions for poor environmental performance (King and Lenox 2000).

Sachs (2002) demonstrated in a study of the ski industry's Sustainable Slopes Program, that the lack of sanctioning and third party oversight contributes to their criticisms as a "greenwash". The International Standardization Organization's (ISO) 14001 program also receives significant criticism despite requiring third party auditing. ISO 14001 lacks sanctioning and public disclosure of audit findings, which would help ensure that firms improve environmental performance (Darnall and Sides 2008). Darnall and Sides (2008) did find however, that participation in ISO 14001 would produce greater environmental performance over a self-monitored VEP, but this comparison is weak since self-monitored programs perform so poorly. Whereas, Potoski and Prakash (2005) argue that stronger VEPs (e.g., 33/50) had better requirements such as public disclosure of audit findings, which contributed to their stronger performance.

Reporting

Reporting is another oversight feature that relates to auditing. Reporting is not a design feature extensively covered in literature, but recognized as an approach that may influence program performance. Reporting is the annual submission of program performance progress (e.g., attaining the stated goals). Firms submit reports annually to the VEPs through online or mail-in forms. However, firms easily avoid reporting because no sanctioning mechanisms exist to make firms comply with this requirement. Furthermore, lax sanctions on reporting breed free riding and shirking of program obligations due to the diminished view of the requirement (Delmas and Kreller 2005). Delmas and Kreller (2005) found that Waste Wise, which makes reporting central to the program had low reporting rates due to the lack of sanctions associated

with non-reporting. Interestingly, they also concluded that even programs with extensive emergency management systems are not likely to report.

Certification

Certification is another oversight mechanism found in some VEPs. Firms seek certification to signal that they have met the standards of the program. Certification signals that participating firms have committed to their standards of environmental compliance (International Organization for Standardization 2011). Certification is either voluntary or mandatory, and obtained from different sources. An authorized certifying entity such as American Systems Registrar and ABS Quality Evaluations offers third party certification. However, self-certification allows firms to declare themselves compliant with program standards. (International Organization for Standardization 2011). Considerable research has been conducted on the ISO 14001 program. Much like Responsible Care, ISO's 14001 requires firms to adopt an environmental management system (EMS), which then requires firms to obtain certification (International Organization for Standardization 2011). Mixed evidence of efficacy exists on whether certification to ISO 14001 leads to improved environmental performance. Andrews, Hutson, and Edwards (2006), found in their comparative study of 3,189 certified ISO EMS and noncertified ISO manufacturing facilities that participating firms made moderate reductions in other mediums, such as energy use, hazardous waste, spills and leaks, but not in air and water pollution. However, Matthews (2001) found in his analysis of automobile assembly facilities that there was no difference in environmental performance between facilities with and without ISO certified EMSs.

Incentives

Incentives are another feature with the potential to increase program performance. These incentives refer to a tangible reward given to firms for continued or improved environmental

performance. Tangible incentives are lacking in most VEPs, and literature offers little on the efficacy of incentives on program performance. The current incentives for performance in VEPs are similar to the incentives to join a VEP (e.g., publicity). Some VEPs especially those found in public entities do not offer financial incentives or more incentives than traditional regulatory mechanisms. As a result, VEPs fail to improve environmental behavior (Lyon and Maxwell 2007).

The long-term feasibility of VEPs depends on their impact on a firm's profitability, yet they lack positive incentives (Khanna and Damon 1999). King and Lenox (2000), suggest that positive, financial incentives may increase a firm's environmental performance and abate free riding and shirking. However, public recognition will likely only have a small impact on a firm's bottom line and will not encourage large investments in pollution reduction (Lyon and Maxwell 2007). Public recognition will not necessarily guarantee a profit, but positive incentives can effectively guarantee firms can gain a monetary benefit (Alberini and Segerson 2002). The anticipated return from a firm's participation lies in the level of abatement obligation and the extent of the financial incentives provided (Alberini and Segerson 2002). Thus, if incentives can increase environmental performance and effectiveness, then VEPs should offer greater incentives.

Despite the arguments for positive incentives, they may not have the ability to improve environmental performance. In her research of the EPA's Performance Track program, Koehler (2007) finds that changes in environmental performance was minimal because the program did not sufficiently recognize and provide incentives for performing members. She found that legally allowable incentives (e.g., tax breaks) do not offer adequate financial rewards to encourage firms to make the investments required to improved environmental performance.

Thus, the incentive constraint directly influences the performance of Performance Track and other VEPs (Koehler 2007). This implies an incompatible relationship between policy and intent. If VEPs expect firms to make costly investments in pollution abatement, then they need to offer sufficient incentives in order to encourage and continue a firm's environmental performance. Appropriate incentives for participation should depend on the firms' characteristics. This implies that the design of VEPs needs to attract targeted groups of firms. As a result, VEPs have to offer different financial incentives depending on the firms' abatement levels. (Alberini and Segerson 2002).

Performance Targets

Setting performance targets is also a feature found in some VEPs. The targets are typically general in nature and set by the firms themselves. Performance targets often reveal the areas of environmental stewardship that firms seek to improve or prioritize. One study, in an analysis of 33/50, Climate Wise and Climate Challenge, found that this requirement did not encourage significantly higher pollution reduction above the status-quo because participating firms set very low performance targets (Darnall and Sides 2008). Generally, VEPs require participants to establish and meet self-determined environmental targets but weak goals contribute to the underperformance of program participants. Thus, if VEPs allow weaker goals than those required by regulation, then participating firms will be less likely to improve environmental performance than nonmembers will (Darnall and Sides 2008). This suggests that the strength of the goals is problematic not necessarily the requirement of goal setting. Current literature does not offer much evidence about the performance of VEPs that strongly encourage firms to set explicit reduction goals. Explicit reduction goals are those with aggressive reduction targets. In the case of ISO 14001 and Responsible Care, the programs focus on enhancing

management strategies to establish a systematic approach to setting objectives (International Organization for Standardization 2011; Responsible Care 2011). The ISO 14001 does not require firms to specify levels of environmental performance (International Organization for Standardization 2011).

Government Investments

Whether these programs are successful or not, governments make significant investments in VEPs. The federal government via the EPA offers program participants technical assistance, financial and environmental analysis tools, training, seminars, toolkits, and environmental performance benchmarking strategies. Participants have access to not only the EPA's resources but also the resources of other organizations including laboratories and consultants (Benefits of Becoming a Partner 2011). Furthermore, the salaries of program administrators to implement the approximately 60 different VEPs housed under the EPA, is also a government investment. Governments expect firms to return their investments by reducing environmental pollution and damage.

Most literature finds little evidence of the benefits of VEPs, but in theory, these programs can be effective with correct institutional design. Ideally, if firms improve their environmental performance through voluntary efforts, it would reduce governmental pressures and regulations. This ensures a "win-win" situation for firms. Literature explains both the success and failures of VEP, but it does reveal a consensus amongst scholars about the potential effects of design features on effectiveness. Nevertheless, literature does not provide much empirical evidence about the effectiveness of specific design features.

Thus, this study argues that the success or effectiveness of VEPs lies in their design features. Programs with sanctioning mechanisms and programs with explicit reduction targets

should perform better. According to literature, lax regulatory mechanisms contribute to the program failures prevalent amongst VEPs. This implies if VEPs had sanctioning institutions they would improve their performance. This study accepts this argument because sanctioning mechanisms create a sense of consequence, which would motivate firms to improve performance to avoid the negative publicity generated from sanctioning.

Literature also found that goal setting is largely ineffective if the goals are too weak. This argument is persuasive because the stated goals of firms in VEPs are often general which can result in immeasurable goals. Explicit reduction targets, in contrast, are specific and provide measurable goals that have direct influence on improving environmental impact. While the other features may contribute to VEPs' performance, they may be less important than sanctioning and reduction targets. The study analyzes sanctioning and reduction targets for two reasons. Literature offers extensive coverage on the influence of sanctioning mechanisms but offers limited coverage on explicit reduction targets; thus, this research seeks to analyze the influence, if any, these features have on performance. If sanctioning mechanisms and explicit reduction goals positively impact VEP performance, we may conclude that they are features that are more important then incentives and certification. The question this research seeks to answer is whether sanctioning and reduction targets affect effectiveness. This leads to the following hypotheses:

Hypothesis 1: Programs with sanctioning mechanism will perform better than programs with no sanctioning mechanisms.

Hypothesis 2: Programs with reduction targets will perform better than programs with no reduction targets.

Methodology

This is primarily a comparative study using secondary data. The data were obtained from the EPA's Toxic Release Inventory (TRI) and Greenhouse Gases Inventory (GHG). The Emergency Planning and Community Right-to-Know Act (EPCRA) require the EPA and States to collect data annually on the transfer and releases of specific toxic chemicals from industrial facilities. The facilities submit the data through a report form, which is made public through the TRI database. The purpose of the TRI is to inform communities about toxic release chemicals and waste management activities (EPA 2011). Facilities annually submit greenhouse gases data through a report to the EPA, which then becomes public through the GHG Inventory.

The EPA's databases were selected because they provided a single source of data instead of multiple, independent sources. The study uses descriptive statistics (e.g., histograms) and inferential statistics (e.g., test of statistical significance) to analyze the independent variables (design features) and the dependent variables (program effectiveness) to analysis the data.

To test the hypotheses, I examined four VEPs. The VEPs sampled in the research are Responsible Care, Climate Leaders, ISO 14001 and Louisiana's Environmental Leadership Program (ELP). I selected these VEPs because they represent different types of programs and all report emissions data, which meets the research's criteria. Furthermore, these emissions reports are publicly available data. The study compares the Hazardous Air Pollutants (HAPS) and Greenhouse Gas emission data from the four VEPs and their design features. This research examines the performance of each VEP by analyzing their ability to reduce emissions. Therefore, while HAPs and Greenhouse Gases are different types of emissions, it does not affect the comparison of program performance. Table 1 illuminates the background of the four programs.

Table 1 Voluntary Environmental Programs Studied

Program	VEP Size[1]	Founded	Program Type	Type of Firms[2]	Type of Emission[3]	Stated Objective
ISO 14001	1000+	1996	International Organization	Manufacturing, Chemical Paper, Wood, Petroleum, Plastics/Rubber, Metals, Transportation, Textiles	Chemical	Reduce harmful environmental effects and to improve environmental performance
Responsible Care	100-500	1984	Chemical	Chemical	Chemical	Encourage the chemical industry to constantly improve its health, safety and environmental performance
Climate Leaders	200-300	2002	Federal Government	Manufacturing, Chemical, Paper, Wood, Petroleum, Plastics/Rubber, Metals, Transportation, Textiles	Greenhouse Gases	Assist firms in developing strategies to reduce their impact on the global environment
ELP	Up to 100	1995	State Government (Louisiana)	Chemical, Manufacturing, Paper, Petroleum, Plastics and Rubber, Metals	Chemical	Promote a cleaner Louisiana through voluntary pollution prevention, and other environmental efforts

The International Standardization Organization offers an environmental management standard known as ISO 14001. ISO 14001 provides facilities with environmental management strategies, which requires them to adopt an Environmental Management System (EMS). An

[1] Size of Program refers to the number of participating firms within the United States.
[2] Type of firms refers to the firms included in each program. This list is not inclusive of all types of participating facilities. The firms included in this research are US firms only.
[3] Type of emission refers to the primary emission focus of the study.

EMS requires firms to develop an environmental policy that states a commitment to prevent pollution and plans for continual environmental performance. Next, it requires firms to produce objectives (e.g., targets for environmental improvement and a management program to achieve it). Firms must train proper personnel usually starting from top management on down. It then requires firms to undergo assessment and implementation reviews. A certifying entity will perform both a document review and site visit. Last, firms must certify their EMS. They must meet these standards and obtain certification through self-certification or third party certification (BSI 2011). Thus, the voluntary program is the adoption of the 14001 standard and EMS. The 14001 standard is at the facility level. Each individual facility of a company must meet the requirements of the above standards independently. Any organization in any sector can pursue ISO 14001 certification. ISO 14001's program design features include mandatory auditing with no public disclosure of audit findings, mandatory certification through either self-certification or third-party certification, no formal sanctioning mechanism, no reporting requirements and no requirement of explicit reduction targets. Based on these features, ISO 14001 is considered a "weak" program as defined by Potoski and Prakash (2007).

Responsible Care is the chemical industry's VEP, which also requires participants to adopt an EMS. Like ISO 14001 standards, the EMS provides environmental management strategies to assist companies in improving environmental performance, safety, and health. Thus, the voluntary program is the adoption of the EMS. Unlike, ISO 14001, Responsible Care is at the company level. All facilities belonging to a participating company adopt the EMS. Responsible Care only admits chemical companies for membership. Responsible Care's design features include mandatory auditing with no public disclosure of audit findings, mandatory certification through third-party certification only, no formal sanctioning mechanism, mandatory

reporting, and no requirement of explicit reduction targets. Responsible Care is a "weak" program based on their features as defined by Potoski and Prakash (2007).

Climate Leaders is an industry-government voluntary program that works with companies to set environmental management strategies. The program requires members to maintain a greenhouse gas inventory based on a quality management system. Unlike Responsible Care and Climate Leaders, Climate Leaders encourage organizations to set aggressive reduction targets. Any organization in any sector can join Climate Leaders. Climate Leaders' design features include no auditing requirements and no mandatory certification but if desired firms could self-certify or obtain third party certification. Their primary sanctioning policy is removal or expulsion after continued failed performance; and they encourage setting reduction targets. Despite these features, Climate Leaders is a "weak" program as defined by Potoski and Prakash (2007).

Louisiana's Environmental Leadership Program (ELP) is a state run program that requires organizations to improve environmental performance by adopting an internal management system and encouraging pollution and waste reduction targets. ELP is also at the facility level. Any organization of individual in Louisiana can join ELP. ELP's design features include no mandatory auditing, certification, or sanctioning mechanism, but they encourage explicit reduction targets. ELP is a "weak" program based on their features as defined by Potoski and Prakash (2007).

The VEPs' respective websites provide participating companies. The American Chemistry website provides a list of participating companies in Responsible Care. The EPA's website provides a list of participating companies in Climate Leaders. ISO does not publicly list

participating firms. However, a list of about 200 ISO 14001 participants can be accessed from the Environmental, Health and Safety Online website. The roster list of certifying entities such as ABS Quality Evaluations, Advantage International Registrar, and Eagle Registrations provided the remaining participants for ISO 14001. These certifying entities also confirmed the participants accessed from The Environmental, Health and Safety Online website. Current literature, the programs' respective websites and Memorandum of Understandings (MOUs) identified the design features of each VEP. Table 2 below displays the program design features of each VEP.

Literature provided the features significant to VEPs. The features examined include auditing, certification, sanctioning, reporting and explicit reduction targets. This research uses guiding definitions of the program design features. Auditing is the monitoring of program participants to ensure compliance with program standards. Public disclosure is the public release of audit findings. Certification is the accreditation of program participants to signal compliance to program standards. Depending on the VEP, certification is either mandatory or voluntary and obtained through self or third party certification. Sanctioning is the mechanisms taken by the program to reprimand participants for underperformance. Expulsion is the dismissal of participants from the program. Reporting is the submission of participants' program performance progress. Reporting is usually done annually and allow the VEPs to track participates' progress towards goals. Reduction targets are goals with an explicit abatement level of pollutants.

Table 2 Program Design Features

Program Name	Auditing	Certification	Sanctioning	Reporting	Reduction Targets
Responsible Care	Mandatory-Yes Public Disclosure-No	Mandatory-Yes Third Party-Yes Self-No	Formal-No Expulsion-No	Yes	No
Climate Leaders	Mandatory-No Public Disclosure-No	Mandatory-No Third Party-Yes Self-Yes	Formal-Yes Expulsion-Yes	Yes	Yes
ISO 14001	Mandatory-Yes Public Disclosure-No	Mandatory-No Third Party-Yes Self-Yes	Formal-No Expulsion-No	No	No
ELP	Mandatory-No Public Disclosure-No	Mandatory-No Third Party-No Self-No	Formal-No Expulsion-No	Yes	Yes

The study compares the emission data across the years 2007-2009. The emissions data for ISO 14001, Responsible Care and ELP measure total Hazardous Air Pollutants (HAPs). The data for Climate Leaders measure total Greenhouse Gases (GHG). The EPA identifies 188 air toxics as HAPs pollutants. HAPS have hostile environmental effects and cause cancers, reproductive problems, and birth defects. HAPs affect individuals through breathing the toxics and consuming contaminated food products. HAPs are largely human-made toxics derived from mobile sources (e.g., automobiles), stationary sources (e.g., power plants), indoor sources (e.g., cleaning products). They also come from natural sources (e.g., forest fires) (About Air Toxics 2010). Greenhouse gases affect both people and the environment, but the primary damage occurs to the climate. Greenhouse gases cause adverse environmental effects by trapping heat in the atmosphere. Natural (e.g., carbon dioxide) and human-made sources (e.g., sulfur hexafluoride for industrial processes) create greenhouse gases. GHGs cause climate change, which subsequently affects people. The EPA identifies many prevalent diseases, reduced farm

productivity, severe floods and droughts, rising sea levels, and loss of habitat amongst others the result of climate change (Greenhouse Gas Emissions 2011). HAPs and GHG are pollutants of synthetic or natural sources that affect both the environment and humans. The difference in type of pollutant is not significant since the analysis focuses on the overall percentage change in emissions of firms.

The EPA's Toxic Release Inventory (TRI) database provided the data for Responsible Care, ISO 14001 and Environmental Leadership Program. The American Chemistry website identifies 100 participating companies in Responsible Care. The population sampled for Responsible Care is all participating firms with HAPs data reported in the TRI database for years 2007, 2008, 2009. The sample for Responsible Care consists of eighty-two different firms that met this criterion. The population sampled for ISO 14001 is all participating facilities with ISO 14001 certification and/or in place by year 2007 and with HAPs data reported in the TRI database for years 2007, 2008, 2009. The sample for ISO 14001 consists of eighty-eight different firms that met this criterion. Louisiana Department of Environmental Quality identified 88 companies on their Environmental Leadership Program website. Unlike the other VEPs, ELP has a very diverse roster of companies. For example, a significant number of members consist of universities, towns, convenience stores, nonprofit organizations, etc. Therefore, the study examines only those members in similar industries to the other VEPs. The reduction resulted in a population of 46 firms in similar industries, which makes it the smallest VEP studied. The population sampled for ELP is all firms with HAPs data reported in the TRI database for years 2007, 2008, 2009. The sample for ELP consists of fifteen different firms that met this criterion. The EPA's GHG Inventory form provided the data gathered for Climate Leaders. The Environmental Protection Agency website identified 274 participating companies in their

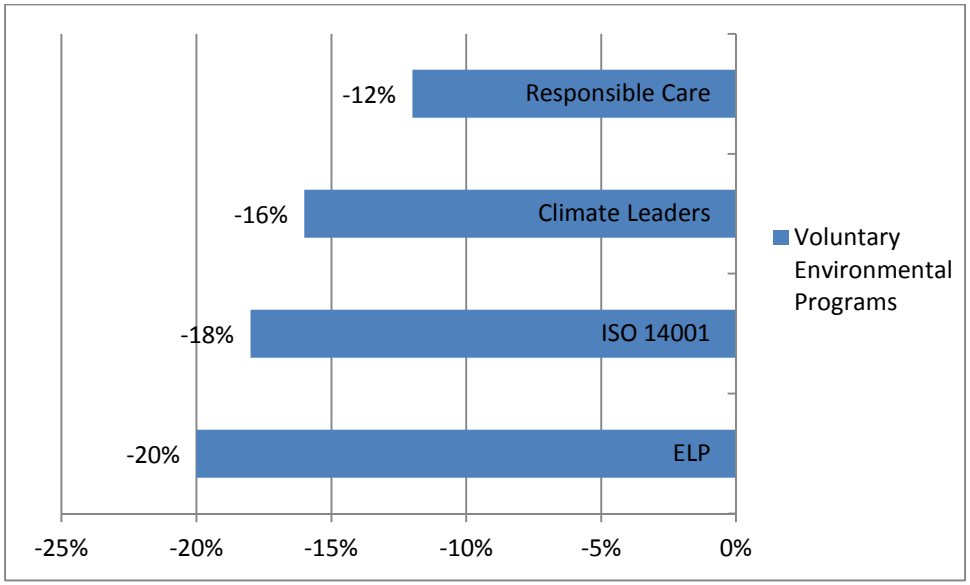
Climate Leaders VEP. The sample for Climate Leaders was all companies with greenhouse gases emission data reported in the Greenhouse Gases Inventory for years 2007, 2008, 2009. Fifty-one firms representing separate companies met this criterion.

This analysis employs a comparative approach to test the hypotheses. The study utilizes the percent change formula to analyze the emission data for the years 2007-2009. For statistical significance, Difference of means and proportion tests exam the statistical significance between the VEPs' data.

Results

Again, the change in emissions from 2007-2009 is the primary indicator of performance. Figure 1 shows the average percentage change in emissions for each VEP. First, each VEP has a net negative reduction in emissions. This suggests that all the programs on average produce some reduction in emissions. However, it is still unclear how these reductions compare to non-participating firms.

Figure 1 Average Emission Reduction of VEPs



Second, there is a clear leader amongst the three VEPs in emission reductions. The chart shows that ELP had the highest reduction in emissions, followed by ISO 14001, Climate Leaders and Responsible Care. Figure 1 shows that ELP has a -20% average reduction from years 2007-2009. ISO 14001 follows ELP with a -18% reduction, Climate Leaders with a -16% reduction and Responsible Care with a -12%. The results show that the average emission reduction varies little amongst all VEPs.

While this examination of average change in emission is helpful in comparing programs it does not fully describe the difference between VEPs. The average percent change overlooks other variation in the distribution of change within the programs. This information can revel if firms are free riding or shirking in their environmental performance. Histograms of each program shed some light on this aspect of VEP performance by showing the varying levels of emission change across facilities. Figures 2-5 below illustrate the frequency of percentage change amongst the individual firms in each VEP.

Figure 2 Responsible Care Histogram

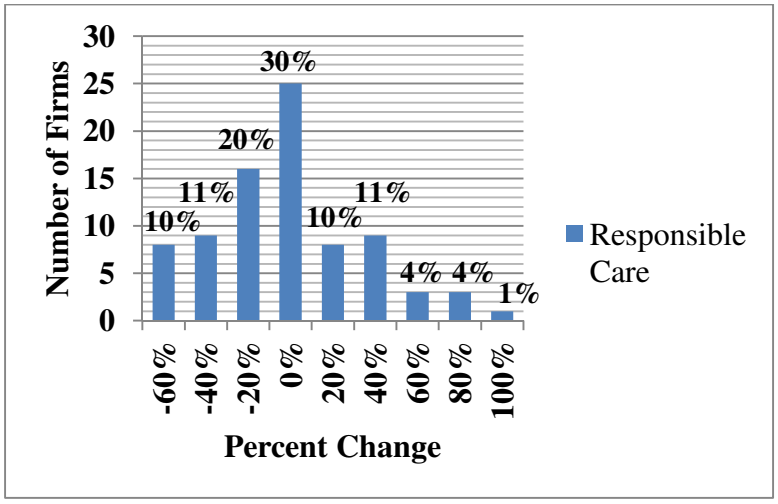


Figure 3 ISO 14001 Histogram

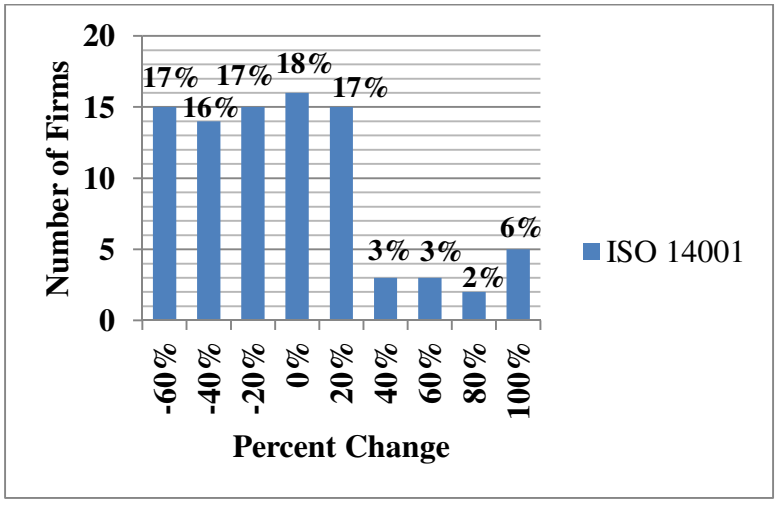


Figure 4 ELP Histogram

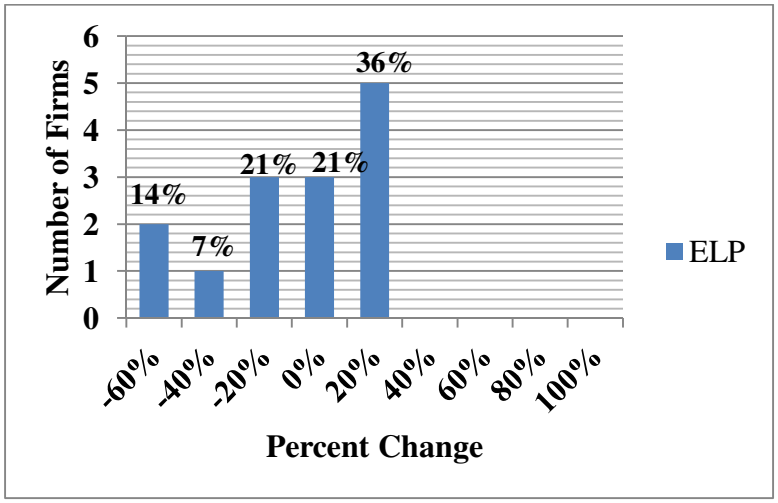
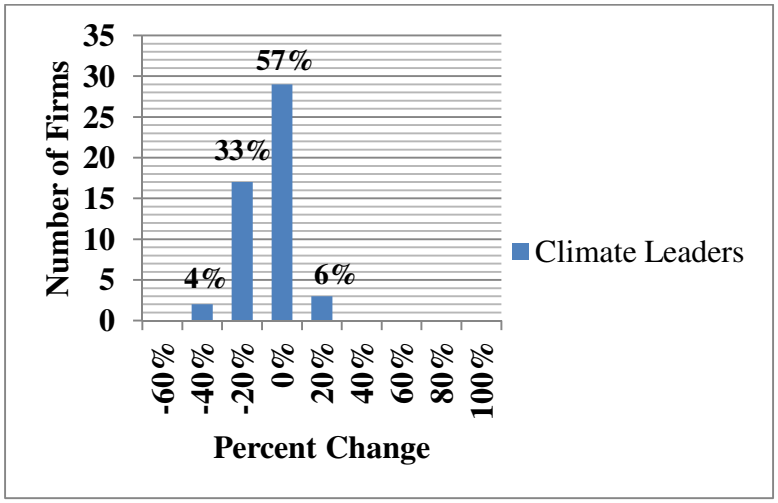


Figure 5 Climate Leaders Histogram



The histograms show a precise comparison between the performances of the individual firms in each VEPs. Negative percent changes represent a reduction in emissions and positive percent changes reflect an increase in emissions. Figure 1 shows that Responsible Care has eight firms, which represent 10% of the total sampled population, with emission reductions equal to or greater than -60%, whereas ISO 14001 in Figure 3 has fifteen firms with emission reductions equal to or greater than -60%. ELP in Figure 4 has two firms with emission reductions equal to or greater than -60%, whereas Climate Leaders has zero firms with emission reductions equal to

or greater than -60%. Comparing emission increases reveal significant differences. For example, Figure 1 shows that Responsible Care has 8 firms with emission increases between 1% and 20%, whereas ISO 14001 has 15 firms with increases between 1% and 20%. However, ELP and Climate Leaders have no emission increases greater than 20%.

Figure 2 illustrates that most of the firms in Responsible Care (70%) make an emission reduction. It also appears that a moderate number of firms made substantial emission increases. ISO 14001's histogram in Figure 3 displays both negative and positive percent changes. Like Responsible Care, a large majority of participating firms made emission reductions (68%), and a moderate number of firms made substantial emission increases (32%). ELP's histogram in Figure 4 reveals that a comparable 64% of firms made emission reductions and 36% made emission increases. Unlike Responsible Care, ELP and ISO 14001, Climate Leaders' histogram illustrates a relatively trivial number of firms with percent increase (6%). It appears that the majority of the firms (94%) have emission reductions. The number of firms with emission increases in ISO 14001 and Responsible Care suggest little consistency amongst firms in making reductions. However, the small number of increases in Climate Leaders suggests a greater consistency amongst firms in making reductions. Table 3 displays the percentage of firms with emission increases and decreases in each VEP.

Table 3 Percentages of Firms with Increases and Decreases in Emissions, 2007-2009

	Responsible Care	ISO 14001	Environmental Leadership Program	Climate Leaders
Decrease	70% (52)	68% (60)	64% (10)	94% (48)
Increase	30% (25)	32% (28)	36% (5)	6% (3)

The preceding descriptive data analysis results offer significant information about the performance of each VEP. It appears that ELP reduces emissions the most, but Climate Leaders was more consistent in reducing emissions. This analysis shows the performance of the VEPs; relative to one another, but it does not assess the efficacy of the design features covered in the Literature Review. The specific hypotheses concerning these design features are as follows:

1.) H_1: Sanctioning programs will reduce emissions more than non-sanctioning programs

H_0: There will be no difference in emission reductions between sanctioning programs and non-sanctioning programs

2.) H_1: Programs with reduction targets will reduce emissions more than programs without reduction targets

$H_{0:}$ There will be no difference in emission reductions between programs with reduction targets and programs without reduction targets.

The results of the preceding descriptive analysis offer evidence that some programs outperform the others in reducing emissions. However, the data spread in each VEP suggest that further analysis of the differences in means is necessary. Differences of means tests examine the differences across VEPs. To test the effects of sanctioning and reduction targets on program performance the study employs a difference of means test on the combined means of programs with sanctioning (Climate Leaders) and those without and programs with reduction targets (Climate Leaders and ELP) to those without. Tables A-1 through A-6 in Appendix A present the results of the difference of means test for all VEPs.

The statistics of most interest are the one-tail p values for each comparison. All the p-values are greater than the alpha level .05. Therefore, the tests show no statistical significance

between the means of the programs. Furthermore, the results in Tables A-1, A-2, A-3 can answer hypothesis 1 because Climate Leaders is the only VEP with sanctioning. However, the t-test results mean we cannot reject the null hypothesis in hypothesis 2. Thus, there is no statistical significance between the difference in means of programs with sanctioning and those without. The results show there is no significant differences in the performances of these VEPs, despite the variation in their design features.

To more directly test the effects of sanctioning and reduction targets, a difference in means test examines on the combined means of the programs without sanctioning in comparison to the one program with sanctioning (Climate Leaders) and the combined means of programs without reduction targets in comparison to those with explicit targets (Climate Leaders and ELP). Tables A-7 and A-8 present the differences in combined means test.

The tables show a p-value greater than the alpha level .05. The results show that there is no statistical significance between the differences in combined means of programs without sanctioning to Climate Leaders; and there is no statistical significance between the differences in combined means of programs without explicit reduction targets and Climate Leaders and ELP. Therefore, I cannot reject the null hypothesis in each hypothesis.

The results of the t-tests provide a vital analysis of the relationship between the means of the programs. However, the tests do not address the differences in the distribution of emissions changes across the four VEPs. To test whether some VEPs and program design features are more effective in reducing emissions, I examine the proportion of firms in each program that had a negative percent change in emissions. Tests of proportions can then determine whether the differences in rates, found in Table 3, are statistically significant; and compare differences in proportions across design features.

Table 4 Climate Leaders and Responsible Care Test of Proportion

```
Two-sample test of proportion                 1: Number of obs =       51
                                              2: Number of obs =       82
------------------------------------------------------------------------------
   Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------------
          1 |   .9411765   .0329478                      .8766    1.005753
          2 |   .7439024   .0482007                     .6494307    .8383742
------------------------------------------------------------------------------
       diff |    .197274   .0583855                      .0828405    .3117075
            |  under Ho:   .0685806     2.88   0.004
------------------------------------------------------------------------------
       diff = prop(1) - prop(2)                                  z =   2.8765
   Ho: diff = 0

   Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.9980         Pr(|Z| < |z|) = 0.0040         Pr(Z > z) = 0.0020
```

Table 5 Climate Leaders and ISO 14001 Test of Proportion

```
Two-sample test of proportion                 1: Number of obs =       51
                                              3: Number of obs =       88
------------------------------------------------------------------------------
   Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------------
          1 |   .9411765   .0329478                      .8766    1.005753
          3 |   .7272727   .0474757                     .634222    .8203234
------------------------------------------------------------------------------
       diff |   .2139037   .0577884                     .1006406    .3271669
            |  under Ho:   .0696237     3.07   0.002
------------------------------------------------------------------------------
       diff = prop(1) - prop(3)                                  z =   3.0723
   Ho: diff = 0

   Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.9989         Pr(|Z| < |z|) = 0.0021         Pr(Z > z) = 0.0011
```

Table 6 Climate Leaders and ELP Test of Proportion

```
Two-sample test of proportion                 1: Number of obs =       51
                                              4: Number of obs =       14
------------------------------------------------------------------------------
   Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------------
          1 |   .9411765   .0329478                      .8766    1.005753
          4 |   .7142857   .1207363                     .4776469  .9509246
------------------------------------------------------------------------------
       diff |   .2268908   .1251512                     -.018401    .4721825
            |  under Ho:   .0935314     2.43   0.015
------------------------------------------------------------------------------
       diff = prop(1) - prop(4)                                  z =   2.4258
   Ho: diff = 0

   Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.9924         Pr(|Z| < |z|) = 0.0153          Pr(Z > z) = 0.0076
```

The results of Tables 4-6 show z values greater than 1.96. 1.96 is the Z score found on the z table for an alpha level of .05. The results can provide some support for hypothesis 1 because Climate Leaders is the only program with sanctioning. The results show that there is a statistical significance between the differences in proportions of Climate Leaders and Responsible Care, ISO 14001 and ELP. Thus, I can reject the null hypothesis in hypothesis 1. Whereas, the results of Tables A-9, A-10, and A-11 in Appendix A, show z values less than 1.96. Therefore, there is no statistical significance between ISO 14001 and Responsible Care, ELP and Responsible Care and ISO 14001 and ELP.

Again, to more directly test the hypotheses regarding design features, difference of proportions test examine the proportions of the participating firms without sanctioning to firms with sanctioning (Climate Leaders). Furthermore, difference of proportions tests examines the proportion of participating firms with reduction targets to firms without reduction targets

(Climate Leaders and ELP). Tables 7 and 8 present the results of the difference in combined proportions.

The tables show z values less than -1.96. -1.96 is the Z score on the z table for an alpha level of .05. Table 7 shows that there is a statistical significance in the differences of proportions in the combined programs without sanctioning and Climate Leaders. The results mean I can reject the null hypothesis in hypothesis 1. Table 8 shows that there is a statistical significance in the differences of proportions in the combined programs without reduction targets and Climate Leaders and ELP. The results suggest that having these design features may have an impact on the proportion of firms that can effectively reduce emissions.

Table 7 Sanctions Test of Proportion

```
Two-sample test of proportion                 0: Number of obs =      184
                                              1: Number of obs =       51
------------------------------------------------------------------------------
   Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------------
          0 |   .7336957   .0325865                      .6698272    .7975641
          1 |   .9411765   .0329478                        .8766    1.005753
------------------------------------------------------------------------------
       diff |  -.2074808   .0463405                     -.2983064   -.1166552
            |  under Ho:     .06569    -3.16   0.002
------------------------------------------------------------------------------
       diff = prop(0) - prop(1)                                  z =  -3.1585
   Ho: diff = 0

   Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.0008         Pr(|Z| < |z|) = 0.0016          Pr(Z > z) = 0.9992
```

Table 84 Reduction Targets Test of Proportion

Two-sample test of proportion 0: Number of obs = 170
1: Number of obs = 65

Variable	Mean	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0	.7352941	.0338367			.6689754	.8016128
1	.8923077	.0384497			.8169477	.9676677
diff	-.1570136	.0512182			-.2573993	-.0566278
	under Ho:	.0605358	-2.59	0.009		

diff = prop(0) - prop(1) z = -2.5937
Ho: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(Z < z) = 0.0047 Pr(|Z| < |z|) = 0.0095 Pr(Z > z) = 0.9953

The preceding results reveal the differences amongst the VEPs' data. Table 9 shows the results of comparing the design features of each VEP. Table 9 illustrates the similarities and differences between the program design features and program performance.

Table 9 Program Design Features and Program Performance

Program	Auditing	Certification	Sanctioning	Reporting	Reduction Targets	% Change	% of Firms with Reduc.
Responsible Care	Mandatory-Yes Public Disclosure-No	Mandatory-Yes Third Party-Yes Self-No	Formal-No Expulsion-No	Yes	No	-12%	70%
Climate Leaders	Mandatory-No Public Disclosure-No	Mandatory-No Third Party-Yes Self-Yes	Formal-No Expulsion-Yes	Yes	Yes	-16%	94%
ISO 14001	Mandatory-Yes Public Disclosure-No	Mandatory-Yes Third Party-Yes Self-Yes	Formal-No Expulsion-No	No	No	-18%	68%
ELP	Mandatory-No Public Disclosure-No	Mandatory-No Third Party-No Self-No	Formal-No Expulsion-No	Yes	Yes	-20%	64%

The table shows multiple similarities and differences between the VEPs. Responsible Care and ISO 14001 require auditing but no public disclosure of audit findings, whereas, Climate Leaders and ELP does not require auditing. Responsible Care and ISO 14001 require certification, but only ISO 14001 and Climate Leaders allow self-certification. Climate Leaders is the only VEP with some form of sanctioning, which is expulsion for underperformance. ISO 14001 is the only VEP that does not require reporting. Climate Leaders and ELP differs from Responsible Care and ISO 14001 by encouraging firms to set explicit reduction goals.

The program design features and the data results of each VEP provide greater insight into each program's performance. For example, Climate Leaders was the only VEP with consistent emission reductions and the only VEP to have some form of sanctioning. Considering the consistency in reductions, Climate Leaders' data results theoretically supports arguments that sanctioning controls free riding and shirking and contributes to positive environmental performance (Rivera, Deleon, & Koerber 2006; Prakash and Potoski 2007). Climate Leaders does not have mandatory certification, which also supports the argument that certification is not necessarily a prerequisite for positive performance (Andrews, Hutson, and Edwards 2006; Matthews, 2001).

The data results offer support and alternatives to many arguments about ISO 14001 and Responsible Care. The striking evidence is the notion of extensive "free-riding" and "shirking" within ISO 14001 and Responsible Care. The significant number of firms with substantial emission increases illustrates this. Furthermore, since each VEP reduced total emissions, this is evidence that underperforming firms actually benefit from the VEP's overall performance. The results support that weak programs, as classified by Prakash and Potoski (2007), are still successful but without sanctioning mechanisms, "free riding" and "shirking" will be more prevalent. Moreover, Responsible Care and ISO 14001 are the only VEPs that require mandatory auditing and certification, yet they are still plagued with substantial "free riding" and "shirking." This suggests that the arguments that those elements may not be as important as sanctioning to curb free riding are valid. Responsible Care, which exhibits the free riding dilemma, requires reporting but lacks any sanctioning mechanisms. Climate Leaders, which exhibits little "free riding", also requires reporting but has some form of sanctioning. This is consistent with existing work (Delmas and Kreller 2005) that shows that despite an EMS system

requiring reporting (found in Responsible Care) the lack of sanctioning mechanisms does not eliminate free riding.

The analyses of the design features show that Climate Leaders and ELP are the only VEPs that encourage firms to set reduction targets. ELP is relatively successful but also has a moderate number of firms with emission increases. This suggests that explicit reduction targets alone may not curb "free riding" or "shirking". Though both, ELP and Climate Leaders have explicit reduction targets, only Climate Leaders has little free riding. This suggests that the combination of sanctioning mechanisms and reduction targets may influence effectiveness. This offers an alternative to recent literature, which contends that requiring programs to set performance target goals results in underperformance (Darnall and Sides 2008).

Discussion

This study had two objectives: identifying the ability of VEPs to reduce emissions and analyzing the effects that various design features have on environmental performance. The findings of this research both support and offer alternatives to the current literature. First, the findings reveal that the studied VEPs have the ability to reduce emissions. Second, the findings show statistical significance between the differences in proportions of programs with sanctioning and explicit targets to programs without. Third, the study reveals the similarities and differences of the design features of each VEP. Furthermore, the study offers insights into the effective combination of features found in effective programs.

This study is not without limitations. There are multiple reasons that may account for the VEP's data. Substantial emission increases and decreases outside of the VEPs influence are possible (e.g., production of new products at the facility, increase in current productions, and/or use of new equipment). Furthermore, many explanations could account for Climate Leaders' consistency in emission reductions. Last, the difference in contaminants may explain the difference in VEP performance.

While the research cannot answer the question of which features determine success, it does illuminate the design features of effective VEPs. Additional research such as the examination and comparison of more VEPs, the analysis of program implementation, the surveying of participants and more features beyond expulsion and reduction targets would expand this research and offers for future areas for research. Despite future empirical research, many critics will remain skeptical of VEPs ability to reduce emissions. While literature identifies varies factors that contribute to the success of VEPs it does suggest that program

design influences their performance. Continued research and improvement in the institutional design of VEPs are necessary for them to be a viable instrument over command and control policies. Despite the criticisms, VEPs are most likely here to stay.

The central implication offered from this research is that the viability of VEPs, as a policy instrument, depends on their institutional design. A strategic design is necessary to foster pollution reduction and control underperformers through enforcement mechanisms. The results of this study suggest a combination of sanctioning and explicit reduction targets may influence program performance and control underperformers. The study offers implications for the future of VEPs, government and environmental policies. Although, arguments are valid about the influence of sanctioning critics and scholars cannot expect VEPs to do it independently. Instead, governments must bridge the gap between voluntary efforts and existing government policies. VEPs should not continue to function outside of enforcement features. Mandating these features through government is necessary to ensure program performance. Despite the voluntary nature of the programs, firms receive significant benefits such as tax breaks and lax regulation for their participation. Thus, if governments legally allow these benefits then they should legally enforce these features. Despite the mandates, VEPs will remain voluntary because government regulation does not require VEP membership as a requirement of environmental compliance. Furthermore, the mandates will help control free riding and shirking firms by deterring them from joining.

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Appendices

Appendix A

Table A-1 Climate Leaders and Responsible Care T-Test

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       1 |      51    -15.2623    1.529606    10.92357   -18.3346   -12.18999
       2 |      82   -14.35514    3.529356    31.95968   -21.37745  -7.332828
---------+--------------------------------------------------------------------
combined |     133     -14.703    2.2481     25.92635   -19.14996   -10.25603
---------+--------------------------------------------------------------------
    diff |          -.9071587    4.640483               -10.08714    8.272824
------------------------------------------------------------------------------
    diff = mean(1) - mean(2)                                      t =  -0.1955
Ho: diff = 0                     degrees of freedom =      131

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.4227         Pr(|T| > |t|) = 0.8453          Pr(T > t) = 0.5773
```

Table A-2 Climate Leaders and ISO 14001 T-Test

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       1 |      51    -15.2623    1.529606    10.92357   -18.3346   -12.18999
       3 |      88   -19.51113    4.394515     41.2242   -28.24571   -10.77656
---------+--------------------------------------------------------------------
combined |     139   -17.95221    2.837113    33.44907   -23.56204   -12.34238
---------+--------------------------------------------------------------------
    diff |           4.248836    5.896888               -7.411855    15.90953
------------------------------------------------------------------------------
    diff = mean(1) - mean(3)                                      t =   0.7205
Ho: diff = 0                     degrees of freedom =      137

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.7638         Pr(|T| > |t|) = 0.4724          Pr(T > t) = 0.2362
```

Table A-3 Climate Leaders and ELP T-Test

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       1 |      51    -15.2623    1.529606    10.92357   -18.3346   -12.18999
       4 |      14    -18.6758    6.477139    24.23524   -32.66881    -4.68279
---------+--------------------------------------------------------------------
combined |      65    -15.99751    1.816704    14.64674   -19.6268   -12.36823
---------+--------------------------------------------------------------------
    diff |            3.4135    4.433373               -5.44589    12.27289
------------------------------------------------------------------------------
    diff = mean(1) - mean(4)                                      t =   0.7700
Ho: diff = 0                     degrees of freedom =       63

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.7779         Pr(|T| > |t|) = 0.4442          Pr(T > t) = 0.2221
```

Table A-4 Responsible Care and ISO 14001 T-Tests

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       2 |      82    -14.35514    3.529356    31.95968   -21.37745   -7.332828
       3 |      88    -19.51113    4.394515     41.2242   -28.24571   -10.7765
---------+--------------------------------------------------------------------
combined |     170    -17.02412    2.839937    37.02824   -22.63044   -11.4178
---------+--------------------------------------------------------------------
    diff |            5.155995    5.686407               -6.070026    16.38202
------------------------------------------------------------------------------
    diff = mean(2) - mean(3)                                      t =   0.9067
Ho: diff = 0                     degrees of freedom =      168

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.8171         Pr(|T| > |t|) = 0.3659          Pr(T > t) = 0.1829
```

Table A-5 Responsible Care and ELP T-Test

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       2 |      82   -14.35514    3.529356    31.95968   -21.37745   -
7.332828
       4 |      14    -18.6758    6.477139    24.23524   -32.66881    -4.68279
---------+--------------------------------------------------------------------
Combined |      96   -14.98524    3.151751    30.88073   -21.24225   -
8.728218
---------+--------------------------------------------------------------------
    diff |            4.320659    8.966323               -13.48218     22.1235
------------------------------------------------------------------------------
    diff = mean(2) - mean(4)                                      t =   0.4819
Ho: diff = 0                     degrees of freedom =       94

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.6845         Pr(|T| > |t|) = 0.6310          Pr(T > t) = 0.3155
```

Table A-6 ISO 14001 and ELP T-Test

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       3 |      88   -19.51113    4.394515     41.2242   -28.24571   -10.77656
       4 |      14    -18.6758    6.477139    24.23524   -32.66881    -4.68279
---------+--------------------------------------------------------------------
combined |     102   -19.39648    3.885054    39.23713   -27.10338   -11.68958
---------+--------------------------------------------------------------------
    diff |           -.8353359    11.34595               -23.34538     21.6747
------------------------------------------------------------------------------
    diff = mean(3) - mean(4)                                      t =  -0.0736
Ho: diff = 0                     degrees of freedom =      100

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.4707         Pr(|T| > |t|) = 0.9415          Pr(T > t) = 0.5293
```

Table A-7 Responsible Care and ISO 14001 Test of Proportion

```
Two-sample test of proportion                 2: Number of obs =       82
                                              3: Number of obs =       88
------------------------------------------------------------------------------
   Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------------
          2 |   .7439024   .0482007                      .6494307    .8383742
          3 |   .7272727   .0474757                       .634222    .8203234
------------------------------------------------------------------------------
       diff |   .0166297   .0676554                     -.1159725    .1492319
            |  under Ho:   .0677156     0.25   0.806
------------------------------------------------------------------------------
       diff = prop(2) - prop(3)                                  z =   0.2456
   Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.5970         Pr(|Z| < |z|) = 0.8060          Pr(Z > z) = 0.4030
```

Table A-8 Responsible Care and ELP Test of Proportion

```
Two-sample test of proportion                 2: Number of obs =       82
                                              4: Number of obs =       14
------------------------------------------------------------------------------
   Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------------
          2 |   .7439024   .0482007                      .6494307    .8383742
          4 |   .7142857   .1207363                      .4776469    .9509246
------------------------------------------------------------------------------
       diff |   .0296167   .1300022                     -.2251829    .2844164
            |  under Ho:   .1269091     0.23   0.815
------------------------------------------------------------------------------
       diff = prop(2) - prop(4)                                  z =   0.2334
   Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.5923         Pr(|Z| < |z|) = 0.8155          Pr(Z > z) = 0.4077
```

Table 5 ISO 14001 and ELP Test of Proportion

```
Two-sample test of proportion                3: Number of obs =       88
                                             4: Number of obs =       14
------------------------------------------------------------------------------
    Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           3 |   .7272727   .0474757                      .634222    .8203234
           4 |   .7142857   .1207363                     .4776469    .9509246
-------------+----------------------------------------------------------------
        diff |    .012987   .1297351                    -.2412892    .2672632
             |  under Ho:   .1284072     0.10   0.919
------------------------------------------------------------------------------
        diff = prop(3) - prop(4)                      z =   0.1011
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
  Pr(Z < z) = 0.5403         Pr(|Z| < |z|) = 0.9194          Pr(Z > z) = 0.4597
```

Table A-10 Sanctions T-Test

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |     184    -17.1498    2.666331    36.16788   -22.4105   -11.88909
       1 |      51    -15.2623    1.529606    10.92357   -18.3346   -12.18999
---------+--------------------------------------------------------------------
combined|     235   -16.74017   2.112897    32.39009  -20.9029  -12.57744
---------+--------------------------------------------------------------------
    diff |           -1.887498    5.135186               -12.00483    8.229834
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                  t =  -0.3676
Ho: diff = 0                     degrees of freedom =      233

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.3568         Pr(|T| > |t|) = 0.7135          Pr(T > t) = 0.6432
```

Table A-11 Reduction Targets T-Test

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	170	-17.02412	2.839937	37.02824	-22.63044	-11.4178
1	65	-15.99751	1.816704	14.64674	-19.6268	-12.36823
combined	235	-16.74017	2.112897	32.39009	-20.9029	-12.57744
diff		-1.026611	4.733159		-10.35187	8.298647

diff = mean(0) - mean(1) t = -0.2169

Ho: diff = 0 degrees of freedom = 233

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.4142 Pr(|T| > |t|) = 0.8285 Pr(T > t) = 0.5858

Vita

The author was born in New Orleans, Louisiana. She obtained her Bachelor's degree in political science from Dillard University in 2009. She joined the political science graduate program at the University of New Orleans to pursue a Master of Public Administration.