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Evaluation of Three Environmental Results Programs (ERPs)

Final Report

Promoting Environmental Results

Through Evaluation

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ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

BACKGROUND

The auto body sector includes between 35,000 and 80,000 facilities across the country that are in the business of repairing and refinishing vehicles, primarily cars. Auto body shops present a wide array of environmental concerns, from use and emissions of hazardous materials such as methylene chloride, to discharges of polluted water into water systems, and worker exposure to toxic solvents and particulate matter. The auto body sector has recently received regulatory attention under the National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources. The rule requires, among other things, that all spray painting must be done in a spray booth, painters must use spray guns and techniques that reduce overspray (such as high volume, low pressure, or HVLP, spray guns), all painters must receive training, and paint spray gun cleaning cannot release any mist of cleaning solvent to the air. Although new auto body shops (those that started operations after September, 2007) are required to comply with these requirements by January, 2008 or upon startup of operations, existing auto body shops must comply with these requirements by January, 2011 (with the exception of an initial notification date in 2010). States are considering how they may implement these regulations, and some states are considering adopting Environmental Results Programs (ERP) as a means to implement them. As the compliance date approaches, this evaluation of ERPs in the auto body sector is intended to inform states and EPA regions considering approaches to improve the environmental performance of the auto body sector.

ENVIRONMENTAL RESULTS PROGRAMS (ERP)

ERP is an innovative approach to improving facilities' management practices within small business sectors. ERP is an integrated system of:

- Plain language compliance assistance that promotes pollution prevention;
- Facility self-assessment and self-certification;
- Agency inspections;
- Statistically-based performance measurement; and
- Where necessary, comprehensive facility investigations and targeted enforcement actions.

These elements are intended to work together to achieve the goals of ERP, which are to improve compliance and reduce environmental impacts of the target sector, while deploying government resources strategically and efficiently.

ERP components are combined into a cyclical process. Generally speaking, after identifying facilities in the target sector, states conduct inspections at a random sample of facilities at the outset of the program (i.e., at baseline). States then offer compliance assistance to all facilities, and then encourage (or in some cases, require) them to conduct a self-assessment and submit self-certification forms. This self-certification period is followed in turn by another set of inspections at a random sample of facilities to measure group performance compared to the baseline. Compliance assistance specifies how facilities should assess their operations and certify compliance, while agency inspectors document progress against specific performance indicators, which are also tracked in self-certification checklists. Performance data, in turn, can inform and improve the next round of compliance assistance.

EVALUATION DESIGN

This evaluation reviews the experience of three states, Delaware, Maine, and Rhode Island, which established ERPs for the auto body sector. Each of these ERPs incorporates voluntary self-certification and encompasses cross-media environmental and/or health concerns. While these states are similar in the types of programs they have implemented, they differ in terms of several circumstances in the state that could affect ERP implementation, participation of auto body shops, and outcomes. Therefore, our primary intent is to describe each state's experience, rather than to directly compare their outcomes, costs, or cost-effectiveness. The primary purpose of this evaluation is to inform states and EPA regions who are currently considering developing programs to encourage auto body shops to adopt best practices and improve compliance with environmental regulations.

The evaluation is designed to answer the following questions related to three categories: environmental outcomes, program costs/cost-effectiveness, and implementation experiences:

- To what extent have the ERPs in Delaware, Rhode Island, and Maine, led to actual and/or expected adoption of selected best practices that reduce the environmental footprint of auto body shops?
- What environmental and health outcomes are estimated to result from auto body shops implementing these best practices?
- What are the cost implications of each program for regulators and auto body shops initially and over time?
- What is the cost-effectiveness of each program?
- Overall, what are the advantages and disadvantages of each of the three ERPs in terms of reaching auto body shops, generating environmental and worker health outcomes, and achieving cost-effective results?
- What factors influenced the outcomes of each program (e.g., existing or impending regulations, regulatory/assistance offices involved in conducting the program, and extent of coordination with industry representatives)?

- What do our findings suggest regarding the circumstances under which ERPs are likely to produce cost-effective results?
- What is the current status of each program?
- What are the primary implementation challenges states faced in developing and implementing their programs?
- What factors influenced the states' decisions to continue, not continue, or modify their program after initial pilots?
- How does the state and/or EPA Region involved in implementing each program view the program's results, and why?

EVALUATION METHODOLOGY

We use existing data reported by each program included in this study to summarize the changes in auto body shop behaviors that affect environmental and health concerns. As noted earlier, ERP involves selecting a random sample of shops prior to ERP to assess baseline performance, and then selecting a second, independent random sample of shops to assess performance after ERP implementation. We compare the percentage of shops using certain best practices during baseline inspections to the percentage of shops using these same practices after ERP implementation (i.e., during post-certification inspections). The indicators are organized in five categories of environmental concern: air emissions, water discharges, waste management, pollution prevented, and worker health & safety. We calculate the observed percentage point change over the ERP cycle (i.e., the difference between the baseline percentage and the post-certification inspection percentage). We then use the data from these independent random samples to make inferences about changes in the proportion of shops in the entire population of facilities subject to ERP using specific practices. Since the samples are drawn from the entire population of eligible facilities (not just those that self-certify), changes in implementation of best practices reflect the sector as a whole, not just those shops that elected to participate in the voluntary ERP self-certification.

Once we analyze changes in practices following each program intervention, we translate these behaviors into environmental outcomes, where possible. For other categories of environmental concern, we qualitatively discuss the benefits we would expect facilities would observe as a result of adopting these behaviors.

Overall, we cannot be certain of the extent to which the states' ERP caused or contributed to observed changes in performance, in comparison to other factors (e.g., regulations or permit requirements) happening concurrently with ERP. In addition, while we have extensive, statistically-based data on behavior changes associated with ERP, states did not collect quantitative data on long-term outcomes (e.g., emissions reductions), and therefore, we were limited to estimating this information where we could.

To assess the remaining evaluation questions, we rely on interviews with state program staff, EPA staff involved in supporting ERP, representatives of the States' ERP Consortium, and operators of selected auto body shops. For example, these interviews

provided insights on program status, costs, factors that influenced outcomes, as well as implementation experiences.

KEY FINDINGS

The experiences of the three ERPs reviewed in the course of this evaluation suggest that ERP is associated with improved business practices in the auto body sector and is regarded as successful by both state and industry representatives. Quantifying environmental outcomes associated with ERP is difficult, and those outcomes that we were able to quantify were relatively small. In addition, sustaining the program has proven to be difficult given resource constraints and overall regulatory priorities.

Each state included in this analysis selected between 19 and 24 indicators of environmental performance, and measured the percentage of shops meeting these criteria at baseline and post-certification. States observed improved performance between the samples of facilities measured for the vast majority of indicators (observed performance improved for 54 out of 65 indicators (83 percent) between baseline and post-certification). Of these 54 indicators, 29 (54 percent of the indicators where observed performance improved, and 45 percent of all indicators) were found to have statistically significant changes in performance. For the measures where there were statistically significant improvements, we can infer[1] that there was an increase in the proportion of the entire population of auto body shops eligible to participate in ERP following best practices. In other words, for nearly half of the measured indicators, we believe that the auto body sector as a whole is shifting to increased use of best practices, not just those shops that were included in the samples measured. Note that there were no statistically significant declines in performance.

For the 55 percent of indicators (36 of 65 indicators) where we did not detect a statistically significant change in performance, we cannot be certain at the specified confidence level (90 percent in Delaware and Maine, 95 percent in Rhode Island) that there was a change in the proportion of the entire population of auto body shops following the best practices.

The greatest percentage of the total number of indicators with statistically significant improvements were observed in the air emissions and worker health and safety categories. In both of these categories, half of the total set of indicators measured (not solely those improving, but of the total number of indicators) showed statistically significant improvements. A small number of indicators showed worsening performance, but none of these observations were statistically significant.

With regard to air emissions, we were able to estimate reductions in emissions of VOCs from auto body shops in Maine and Delaware associated with improving spray gun cleaning methods. In both states, we estimate that VOC emissions reductions associated with the behavior changes related to low-VOC/waterbased solvent usage measured by

[1] We make this inference with 90 percent confidence for indicators measured by Maine and Delaware, and 95 percent for indicators measured by Rhode Island.

ERP could be as much as 1.7 tons per year for all auto body shops in each state (although the actual amount may be less). Based on calculations presented in the final Surface Coating Rule, we estimate that this is equivalent to approximately a 1 percent reduction in reduction in total VOC emissions per shop associated with the use of low-VOC/waterbased solvent.

Regarding hazardous waste management, in one state we were able to develop a first order approximation of the change in the amount of hazardous wastes subject to proper hazardous waste determination, which can serve as proxy for proper waste management. We estimate that there was a potential increase of as much as 22,440 pounds per month of hazardous waste being properly identified at all auto body shops in Delaware (although the actual amount is likely to be less). This amount is equivalent to the minimum waste generated by 10 large quantity generators per month.

We were not able to quantify reductions in water discharges associated with ERP, but two of the three states did find statistically significant improvements in behaviors that are expected to reduce water discharges. For example, both Delaware and Rhode Island observed significant improvement in the percentage of shops that post signs prohibiting the discharge of industrial chemicals to non-industrial drainage outlets.

We were also not able to quantify the improvements associated with worker health and safety, but in Rhode Island, three of the six indicators measured showed statistically significant improvement, specifically, the indicators related to whether the shop has established a Personal Protective Equipment Program, whether the shop has a Lockout/Tagout Program, and whether the employer has posted the Job Safety & Health Protection poster. All of these improvements are expected to reduce worker risks.

We were able to estimate materials reductions associated with increased usage of automatic spray gun cleaning methods in Delaware. We estimate that the material usage associated with auto body shop spray gun cleaning operations declined by between 0.6 and 2.0 tons per year for all shops in Delaware.

Note that while the overall trend in improving performance measured by states is consistent with the hypothesis that ERP leads to adoption of selected best practices, we cannot be sure that the observed changes can be fully attributed to the presence of ERP. For example, in Delaware, the fact that ERP was developed in tandem with a source category permit may have made the program more successful. In Rhode Island, the fact that the state had passed regulations specifically addressing the auto body sector, and had conducted outreach related to this rule, meant that for some indicators, baseline performance was relatively high. Also in Rhode Island, ERP was implemented in tandem with the auto body license renewal process, which may have given the program more visibility and clout with auto body shops. Note that the presence of the federal Surface Coating Rule may now be affecting shops' behavior regarding air emissions, but the vast majority of data analyzed in this report (with the exception of the Rhode Island's second ERP cycle) was gathered prior to the promulgation of the federal rule, and therefore we do not expect that the rule had a substantial impact on shop behavior reported in these ERPs.

The three states included in the evaluation spent a range of resources developing and implementing their ERPs. We estimate government costs (including state resources and an EPA State Innovation Grant) of $800 to $2,000 per auto body shop in the population for states conducting a single cycle of ERP (Delaware and Maine). We note that these costs are *not* inclusive of all of the resources spent by the state for staff time throughout the program. Therefore, our per shop estimates are underestimating the total costs of the program to the states. For Rhode Island, costs range from $400 to $700 per shop for two cycles of ERP (in other words, cost per shop for each cycle of ERP would be half as much). States also spent a range of staff resources, which are partially, but not completely captured in these cost estimates. Delaware dedicated an average of roughly half of a Full Time Equivalent (FTE) for 2.5 years (330 days of staff time over this period). A total of 23 staff members were involved to various extents over this period. For Maine, the design and development phase required two FTEs for the period of six months, the initial implementation phase also required two FTEs for six months, and program follow-up/ongoing support required one and a half FTEs for two years. In Rhode Island's first round, the design and development phase required one to two FTEs, the initial implementation phase also required one to two FTEs, and program follow-up/ongoing support required less than one FTE.

The best assessment of the cost effectiveness of ERP would take into account alternative approaches to regulating (or not-regulating) the target sector. For the states included in this evaluation, the alternatives to ERP considered by the states were to: 1) follow-up on complaints or other information about violations, but otherwise not focus on the auto body sector, 2) continue inspecting less than five percent of auto body shops for air, water and hazardous waste compliance each year, or 3) implement a source category permit, but without the focused compliance assistance efforts associated with ERP.

Compared to the likely outcomes of these less resource-intensive alternatives, states perceive that ERP resulted in greater improvements in performance. For the first two alternatives (following up on complaints or conducting infrequent inspections) states predicted that low levels of compliance would persist, and that ERP provided an avenue for the states to improve performance. It is more difficult to tease out the relative benefits of ERP and a source category permit, but the state's feedback suggests that ERP led to more shops getting a source category permit than would have done so otherwise, which presumably led to improved performance/compliance. Moreover, in addition to resulting in better performance than the alternatives considered by these three states, ERP provides far more data about the results achieved than any of the alternatives.

These benefits of ERP typically come at a higher initial cost, however, compared to these three less resource-intensive alternatives. Two of the three states in this evaluation have not found sustainable funding models, and have had to discontinue ERP for the auto body sector. If states conducted successive rounds of ERP, it's likely that per facility costs would be reduced, since initial program design and development costs would be reduced or eliminated in successive rounds. Rhode Island has found that subsequent rounds of its ERP have required substantially less resources than the initial phases.

A key factor related to cost effectiveness is the number of facilities targeted by ERP. Specifically, ERP can be more cost effective for larger populations of facilities, so long as the population is relatively homogenous, with a common set of regulatory requirements and best practices.

Another factor related to the likelihood of a state achieving cost-effective results through ERP is the degree to which state staff can build partnerships within and outside agency walls. ERP staff within all of the ERPs described in this evaluation forged partnerships within and outside of their agencies to implement the ERP. Outside partners may provide support in the form of technical expertise and/or funding. For example, Rhode Island received both technical and financial support for its ERP from the University of Rhode Island.

Successful design and implementation of ERPs that deal with multiple environmental media require the cooperation among and buy-in from the various offices that are affected. For example, in both Delaware and Rhode Island, regulators found that the high level of input and collaboration with the various media offices made the process much more successful, primarily because the workbook they developed accurately covered all of the various regulations involved. While this cooperation is integral to the success of an ERP that deals with multiple environmental media, it can also be a challenge to coordinate and facilitate the involvement of so many offices.

Baseline performance and the likely extent of improvement (i.e., to what extent are facilities likely to be able or willing to change their behavior) both have a direct effect on the extent to which statistically significant changes may be observed. It may be advisable for states to undertake a limited assessment before committing resources to conducting a full ERP. For example, states may find it useful to conduct a relatively small, targeted survey to assess baseline performance on key indicators and to ask facilities about what would enable or motivate them to change their behavior.

As noted above, of the three ERP programs, only one of them is currently ongoing: the ERP in Rhode Island. Both ERPs in Delaware and Maine were operational for a specific period of time, with a specific amount of funding with which to implement the program, and have not continued. Delaware and Maine each received EPA State Innovation Grants (SIG) to design and conduct their ERPs. These grants were intended to support the development and implementation of an ERP in each state, and were not intended to support an ongoing ERP effort. Rhode Island is the only state to continue its ERP. Its ERP was developed without the direct assistance of EPA SIG funding. Instead, DEM conducted its own studies prior to the development of its ERP that revealed significant pollution and health concerns arising from auto body operations. In addition, its traditional inspections reached less than five percent of shops in the state. Therefore the department saw a benefit of an ERP as a way to address the significant occupational health, safety, and environmental issues in the auto body sector, because of the program's potential to reach more shops. Rhode Island recently completed its second cycle of ERP, and intends to continue implementing the program. Moving forward, however, the state plans on spending minimal additional resources in outreach efforts.

If states see ERP as a one-time trial program, and not as an alternative or complement to their traditional permitting and inspection process, they may not see the benefit of continuing to support the program once grant funding has expired. This was the case in both Delaware and Maine: program managers used SIG funding to conduct an ERP as a pilot, with the possibility of continuing the program. However, once the funding ended, the states were unable to commit the necessary resources to continue their programs. If, on the other hand, regulators see ERP as a new way to approach to permitting and compliance, the state may choose to commit the resources necessary to continue the program. This was the case in Rhode Island: the state saw the long-term benefit of ERP as an effective tool to reach more shops and achieve a higher rate of compliance than with its traditional permitting process, so the state provided the support necessary to maintain the program. This "buy-in" and support, either from EPA or state agencies, is integral to the program moving beyond a one-time effort.

In addition to sustainable funding, we found that key factors leading to success of an ERP include the regulatory context in which the program was implemented, effective coordination and communication among involved offices, upper management buy-in, and continuing program support.

RECOMMENDATIONS

Based on our findings from this evaluation, we offer several recommendations for consideration:

1. **Combine forces.** ERP offers economies of scale, but until recently states have been working independently. The Region 5 effort to conduct a multi-state ERP offers great potential to streamline the investment in ERP (e.g., developing materials and conducting inspections); this should allow for more cost effective results.
2. **Decide on a set of common indicators.** Much work on this has already been done as part of the Common Measures project. It would be helpful to be able to compare and aggregate ERP data for the same sector across programs.
3. **Collect quantitative data on facility practices, not just information on the proportions of shops utilizing specific practices, for a small number of indicators.** Measuring a few key indicators (e.g., quantity of methylene chloride used, quantity and type of paint used, amount of hazardous waste generated) could help quantify environmental outcomes.
4. **Develop a tool to help states estimate environmental outcomes.** Transforming the DfE calculator into something states could easily use themselves could encourage more states to make the effort to collect key inputs to the tool so that they can generate outcome data.
5. **Un-package ERP.** While ERP as a package offers value, it requires more resources and effort than some states can provide on an ongoing basis. We suggest that states consider different ways to apply the measurement component

of ERP (e.g., for initial assessment and longer-term monitoring) alone as well as in combination with compliance assistance and self-certification.

6. **Consider implementing ERP primarily where larger populations of facilities are present.** This approach has the potential to reduce per facility expenditures and increase the cost-effectiveness of the program on a per facility basis.

7. **Develop a clearer agreement between EPA and states whether ERP can be used to address traditional regulatory programs**. In circumstances where this is suitable, develop appropriate guidance and a sustainable funding mechanism.

CHAPTER 1 | INTRODUCTION

I. INTRODUCTION AND BACKGROUND

This report summarizes an evaluation of three state Environmental Results Programs (ERPs) designed to encourage auto body shops to comply with environmental regulations, adopt best practices, reduce worker health and safety risks, and prevent pollution. The auto body sector includes between 35,000 and 80,000 facilities across the country that are in the business of repairing and refinishing vehicles, particularly cars.[2] Auto body shops present a wide array of environmental concerns, from use and emissions of hazardous materials such as methylene chloride, to discharges of polluted water into water systems, and worker exposure to toxic solvents and particulate matter.

The auto body sector has recently received regulatory attention under the National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources, hereafter, the Surface Coating Rule.[3] States are considering how they may implement these regulations, and some states are considering adopting ERP as a means to implement the federal rule. Exhibit 1-1 summarizes the rule requirements that will affect auto body shops. Although new auto body shops (those that started operations after September, 2007) are required to comply with these requirements by January, 2008 or upon startup of operations, existing auto body shops must comply with these requirements by January, 2011 (with the exception of an initial notification date in 2010). As this compliance date approaches, this evaluation of ERPs in the auto body sector is intended to inform states and EPA regions considering approaches to improve the environmental performance of the auto body sector.

The next section in this chapter describes the purpose and scope of the evaluation in more detail. The chapter then provides an introduction to ERP, including a logic model that illustrates the basic structure and design of this type of program. The following section presents the specific questions the evaluation is designed to answer and the relationship

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[2] Estimates of the number of auto body shops in the nation vary widely, from roughly 35,000 to 80,000. A study conducted for EPA in support of rule development found that the estimated number of auto body shops nationwide ranged from approximately 35,200 reported by the U.S. Census in 2002, to over 70,000 shops found in an online "yellow pages" listing. (Source: Eastern Research Group, Memorandum to EPA, "Estimating the number of automotive refinishing shops and the projected number of new shops," dated February 22, 2006, included as part of the Technical Support Document for Proposed Rule: National Emission Standards for Hazardous Air Pollutants Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources, Docket ID EPA-HQ-OAR-2006-0306, Document ID EPA-HQ-OAR-2006-0306-0041.3. Available online at http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&o=09000064804808ea. (Last viewed September 24, 2008.) EPA staff familiar with the auto body Surface Coating Rule, estimated that there are approximately 80,000 auto body shops nation-wide. (Source: Discussion at States ERP Consortium All Members Meeting August 26th - 28th, 2007)

[3] Environmental Protection Agency, FR Vol. 73, No. 6, Wednesday, January 9, 2008. 40 CFR Part 63: National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources. Final Rule. http://www.epa.gov/ttn/atw/area/fr09ja08.pdf. (Last viewed: July 22, 2009).

between the evaluation questions and key components of the logic model. The chapter concludes by orienting readers to the structure of the evaluation report.

EXHIBIT 1-1 SUMMARY OF REQUIREMENT FOR AUTO BODY SHOPS

1) All spray painting must be done in a spray booth
   - Full cars must be painted in a spray booth with four walls, a roof and a ventilation system. (Filters in the booth have to remove at least 98% of the particulates.)
   - Parts of cars must be painted in a booth with at least three walls or flaps, a roof and a ventilation system that pulls air into the spray booth.
   - Spot repairs must be done in an enclosure which prevents any mist from getting out of the enclosure.
2) Painters must use spray guns and techniques which reduce overspray (such as high volume, low pressure, or HVLP, spray guns).
3) All painters must receive training. Owners must keep records of the training of each painter. (Specific training requirements are specified in the rule.)
4) Paint spray gun cleaning cannot create any mist of cleaning solvent to the air. Workers may spray solvent through the gun for cleaning purposes using an enclosed gun cleaner, or they may clean the gun manually.
5) All shops must also send a notification to EPA with some general information by January 2010:
   - Location of facility
   - Description of spray painting equipment
   - Confirmation that shop has necessary equipment and training.
6) Exemptions to the rule are facility maintenance activities, which include the application of coatings to stationary structures or their appurtenances at the site of installation, to portable buildings at the site of installation, and to pavements and curbs.

Source: Brief Summary New EPA regulations for Autobody Refinishing Shops, 40 CFR Part 63 Subpart HHHHHH, August 2008, online at http://www.epa.gov/ttn/atw/area/autobodybs.doc. (Last viewed: September 24, 2008)

II. PURPOSE AND SCOPE OF THE EVALUATION

This evaluation is intended to inform states and EPA regions who are currently considering developing programs to encourage auto body shops to adopt best practices[4] and improve compliance with environmental regulations. This evaluation considers the experience of three states in implementing ERP in this sector. Given the significant differences in the contexts and circumstances in which the programs were implemented, the intention of this evaluation is to describe each state's experience, rather than to directly compare their outcomes, costs, or cost-effectiveness.

One purpose of the evaluation is to characterize environmental outcomes associated with changes in facilities' management practices and compliance at auto body shops resulting from the ERP program. To assess these outcomes, we analyze and report data collected by the ERP states on the proportion of auto body shops in each state following specific best practices before and after the ERP. We then discuss how changes in auto body shops behavior (e.g., extent of adoption pollution prevention techniques) may translate into long-term environmental outcomes (e.g., reductions in air emissions) using available emissions factors.

In addition, this evaluation presents information on the costs required to develop, implement, and participate in the program, including the staff time and resources invested by the states, EPA, and participating auto body shops.

We also explore the implementation experience of each state to understand some of the challenges and opportunities states experienced in implementing ERP programs. We discuss how these programs unfolded in each state, their current status, and any lessons or insights that may suggest how states can bolster program sustainability over time.

III. OVERVIEW OF ENVIRONMENTAL RESULTS PROGRAMS

ERP is an innovative approach to improving facilities' management practices within small business sectors (e.g., dry cleaners, gas stations, and auto body shops).[5] ERP is an integrated system of:

- Plain language compliance assistance that promotes pollution prevention;
- Facility self-assessment and self-certification;
- Agency inspections;
- Statistically based performance measurement; and
- Where necessary, comprehensive facility investigations and targeted enforcement actions.

These elements are intended to work together to achieve the goals of ERP, which are to improve compliance and reduce environmental impacts of the target sector, while

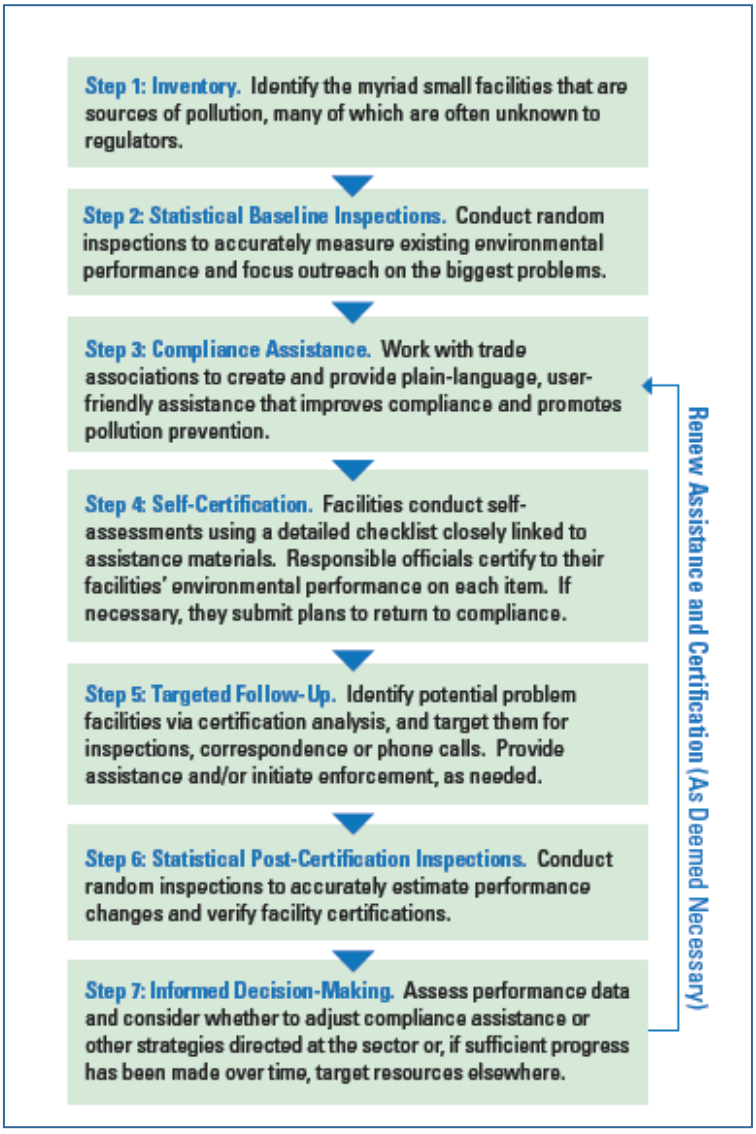
[4] The term "best practices" is used to refer to certain environmentally-preferred business practices, such as use of specific types of efficient spray-painting equipment. We do not seek to distinguish between practices that are voluntary and those that may be required, now or in the future, by state or federal regulations.

[5] The term "sector" is used to refer to groups of facilities that ERP targets. In many cases these are business sectors, but in other cases ERP targets other groups of regulated entities that are found in multiple business sectors (e.g., small quantity generators of hazardous waste).

deploying government resources strategically and efficiently. States believe that ERP's mix of tools drives facilities to hold themselves more accountable and gives them the capability and incentive to improve performance.

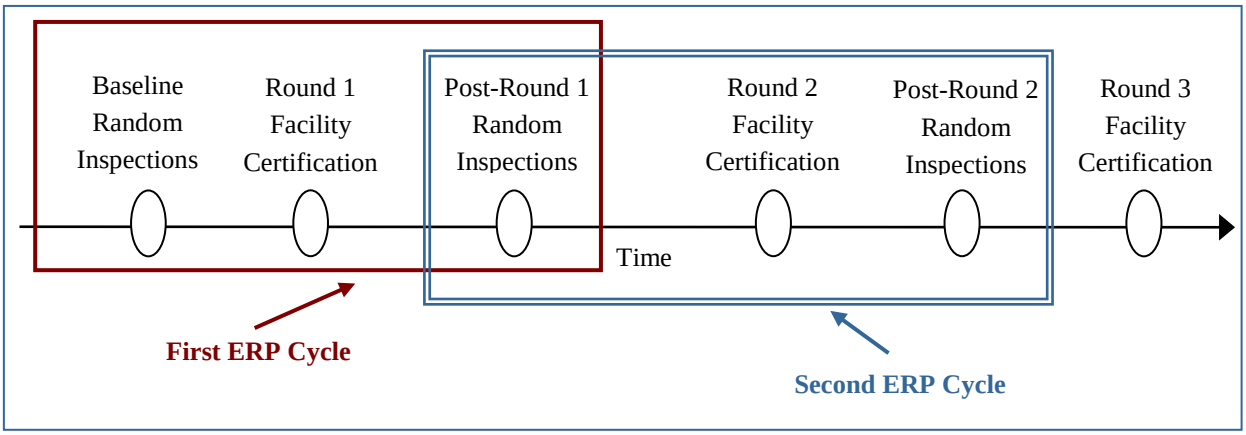
Exhibit 1-2 shows how the components of ERP are combined in a cyclical process. Generally speaking, after identifying facilities in the target sector, states conduct inspections at a random sample of facilities at the outset of the program (i.e., at baseline). States then offer compliance assistance to all facilities, and then encourage (or in some cases, require) them to conduct a self-assessment and submit self-certification forms. This self-certification period is followed in turn by another set of inspections at a random sample of facilities to measure group performance compared to the baseline. Compliance assistance specifies how facilities should assess their operations and certify compliance, while agency inspectors document progress against specific performance indicators, which are also tracked in self-certification checklists. Performance data, in turn, can inform and improve the next round of compliance assistance. Note that no two ERPs are exactly alike, because states have adapted this approach for a wide variety of circumstances.

EXHIBIT 1-2 A TYPICAL ERP CYCLE



In this document, the term "cycle" refers to this process of random inspections, followed by facility certification and then follow-up random inspections. The term "round" is used to designate each new self-certification period. Exhibit 1-3 illustrates the first two cycles in an ERP over time. In the first ERP cycle, Baseline Random Inspections are followed by Round 1 Facility Certification, which is in turn followed by another set of random inspections. These "Post-Round 1 Random Inspections" also serve as the beginning of the second ERP cycle, when followed by Round 2 Facility Certification and a set of Post-Round 2 Random Inspections.[6]

EXHIBIT 1-3 TERMINOLOGY FOR ERP MILESTONES OVER TIME



ERPs are typically cross-media focused, meaning that they address multiple types of pollution (i.e., air emissions, water discharges, or waste management). While individual facilities within these sectors may release small amounts of pollution, their aggregate impact can be significant.

The Massachusetts Department of Environmental Protection first developed ERP over 10 years ago as an alternative to traditional site-specific state permits for sectors characterized by large numbers of small, relatively similar facilities. The ERP approach has been picked up and adapted by other states, and now 18 states have developed or are implementing at least one ERP to address environmental issues in one of 11 sectors. To date, six of those states have applied ERP in the auto body sector.

This evaluation reviews the experience of three states, Delaware, Maine, and Rhode Island, which established ERPs for the auto body sector. Each of these ERPs incorporates voluntary self-certification[7] and encompasses cross-media environmental and/or health concerns. While these states are similar in the types of programs they have implemented, they differ in terms of several circumstances in the state that could affect ERP implementation, participation of auto body shops, and outcomes. For example, Rhode Island had been focusing on improving facilities' management practices at auto body shops for several years before implementing an ERP, and in fact the state had

[6] This text is drawn from The States ERP Consortium Guide to Reporting ERP Results, May 2009. The Guide is intended to help ensure transparency, consistency, and credibility in ERP results reporting.

[7] Whether or not facilities opt to participate in the self-certification component of ERP, all facilities are expected to comply with applicable regulatory requirements.

promulgated regulations specifically requiring auto body shops to adopt practices to reduce their air emissions nearly 10 years before the start of the ERP. Rhode Island is also unique in that it has completed two full cycles of ERP, while Delaware and Maine have completed only one full cycle, although Delaware also conducted a Round 2 Facility Certification. Delaware developed a source category permit for the auto body sector to make the permitting process easier for auto body shops, and the Delaware ERP featured incentives to encourage facilities to participate in ERP by voluntarily self-certifying. The Maine ERP was geographically focused on, and limited to, three counties in the southern part of the state that had historically been classified as non-attainment areas (i.e., the counties had not met ground-level ozone federal national ambient air quality standards).

To illustrate the different components of ERP as applied in the three states under review, the evaluation team developed a logic model, i.e., a graphical representation of the relationships between program inputs, outputs, and intended outcomes (see Exhibit 1-4). Key components of ERP are listed below. Note that the logic model and components of ERP described below focus on common aspects of ERP shared across all three programs included in this evaluation. Important distinctions between the programs are noted in the text.

- **Resources** are the basic inputs of funds, staffing, and knowledge dedicated to the program. For example, the ERPs in question have been led by staff from pollution prevention/compliance assistance offices, who have worked in coordination with regulatory and enforcement staff. Their efforts have typically been complemented by outside resources such as EPA and contractor support. We believe that some of the resources listed in Exhibit 1-4 may not have been utilized in all the ERPs in question. Specifically, not all states included in this evaluation had access to existing data systems for housing ERP data; delegated resources redirected to the project; EPA training/feedback on project work plan and measurement/quality approach; EPA ERP tools and guidance documents for data management and analysis; or partner agencies.
- **Activities/Outputs** are the specific actions taken to achieve program goals and the immediate products that result. For example, in ERPs, we typically find 10 categories of activities/outputs: external stakeholder involvement; internal stakeholder involvement; facility inventory; statistically-based baseline inspections; compliance assistance; self-certification; targeted follow-up; statistically-based post-certification inspections; data management and analysis; and formal reporting. Note that the word “inspection” is used for convenience in this logic model to refer to all manner of site visits. ERPs typically involve some combination of formal regulatory inspections and non-regulatory visits (the latter for assistance and/or measurement). External stakeholder involvement is generally limited to activities/outputs related to identifying facilities, and participating in compliance assistance and self-certification. However, some ERP states may involve external stakeholders in other activities. For example, Rhode Island Department of Environmental Management (DEM) worked closely with the industry in developing the self-certification checklist, with the understanding that the checklist would also

serve as an inspection checklist. Some states also sought feedback from a small number of auto body shops regarding the design of their programs.

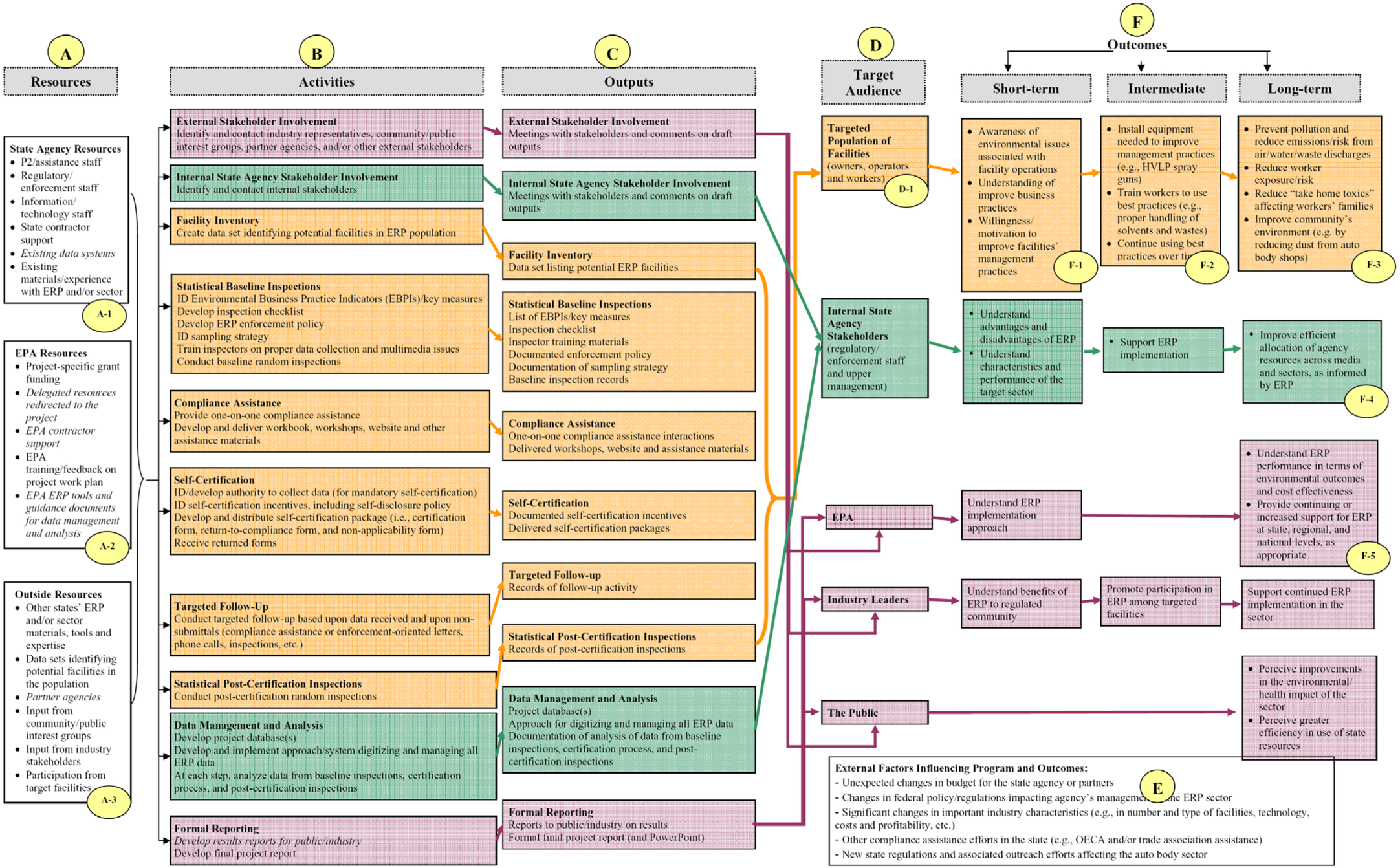
- **Target Audience** represents the groups that will use or be influenced by the project activities and outputs provided. The principal target audience for ERP is the population of regulated facilities, in this case auto body shops, whose changes in attitude and behavior are expected to directly lead to changes in environmental conditions. Other audiences include internal state agency stakeholders, EPA, industry leaders, and the public.
- **Short-Term Outcomes** are intended changes in awareness, attitudes, understanding, knowledge, and skills resulting from program outputs. For example, states implementing ERP expect that the program will increase facility owner/operators/workers' awareness of environmental issues associated with facility operations and business practices that can reduce environmental and health risks. ERP is also designed to change facility owner/operators/workers' attitudes, so that they are willing and motivated to improve their performance. Note that most ERPs focus on cross-media environmental issues (i.e., air emissions, water discharges, and waste management), and incorporate both compliance and voluntary best management practices. Rhode Island's ERP also devotes considerable attention to addressing worker health and safety issues.
- **Intermediate Outcomes** involve changes in behaviors resulting from short-term outcomes such as changes in awareness and understanding. For example, the targeted population is expected to adopt specific improved best practices as a result of short-term increases in knowledge, awareness, and willingness to act.
- **Long-Term Outcomes** parallel the overarching goals of the program and include minimizing environmental/health impacts of facility operations (such as by reducing pollution and waste, minimizing health risk, and improving water/air quality).
- **Contextual/External Factors** are factors, not directly controlled by the program or its entities, which may affect program performance. For example, past ERPs have been forced to adapt substantially when confronted with new budgetary constraints and/or unexpected changes in federal requirements for the targeted population.

Note: In the logic model for ERP shown in Exhibit 1-4, the activities and outputs are generally organized in a rough chronological order (e.g., the stakeholder involvement and facility inventory precede baseline inspections, which in turn precede compliance assistance and self-certification.) In contrast, the target audience and outcomes are arranged roughly in order of importance to achieving the goals of the program. For example, while all target audiences are important to establishing a successful ERP, influencing the population of auto body facilities is crucial to achieving improved compliance and reduced environmental impacts, and internal state agency stakeholders are central in deploying agency resources strategically and effectively. To make it easier to track connections between related activities, outputs, target audiences, and outcomes

across the logic model, we have used color coding. Activities and outputs designed for, and outcomes produced by, the target population of facilities are highlighted in light orange. Activities and outputs that gather input from and inform internal state agency stakeholders, along with their outcomes, are highlighted in green. Activities and outputs designed to communicate with external audiences (including EPA, industry leaders, and the public), along with their outcomes, are highlighted in purple.

Also note that the letter and number codes shown in the logic model in Exhibit 1-4 are used to show the connection between components of the logic model and the evaluation questions. These relationships are shown later, in Exhibit 1-6.

EXHIBIT 1-4 LOGIC MODEL FOR ERP



Italics indicate an item that is not believed to be applicable for one or more of the auto body ERPs being evaluated

IV. EVALUATION QUESTIONS

Based on the logic model shown in Exhibit 1-4, the evaluation team developed and refined the specific questions to be addressed in this evaluation. The evaluation is designed to answer the following questions related to three categories, as described in Exhibit 1-5.

EXHIBIT 1-5 EVALUATION QUESTIONS

Environmental Outcomes

1. To what extent have the ERPs in Delaware, Rhode Island, and Maine, led to actual and/or expected adoption of selected best practices that reduce the environmental footprint of auto body shops?
2. What environmental and health outcomes are estimated to result from auto body shops implementing these best practices?

Program Costs/Cost-Effectiveness

3. What are the cost implications of each program for regulators and auto body shops initially and over time? For example:
    a. What resources did states use to develop and implement each program?
    b. What resources did auto body shops invest initially, and on an ongoing basis, to participate in each program?
4. What is the cost-effectiveness of each program?
5. Overall, what are the advantages and disadvantages of each of the three ERPs in terms of reaching auto body shops, generating environmental and worker health outcomes, and achieving cost-effective results? [(a)]

Implementation Experiences

6. What factors influenced the outcomes of each program (e.g., existing or impending regulations, regulatory/assistance offices involved in conducting the program, and extent of coordination with industry representatives)? [(a)]
7. What do our findings suggest regarding the circumstances under which ERPs are likely to produce cost-effective results?
8. What is the current status of each program?
9. What are the primary implementation challenges states faced in developing and implementing their programs?
10. What factors influenced the states' decisions to continue, not continue, or modify their programs after initial pilots?
11. How does the state and/or EPA Region involved in implementing each program view the program's results, and why?

Notes:

(a) This question relates to environmental outcomes as well as cost effectiveness, but for simplicity of presentation it is included in the category shown.

Exhibit 1-6 below shows the relationship between the components of the program's logic model and the evaluation questions. While not every specific component of the logic model is addressed in the evaluation questions, the questions address the most essential elements needed to understand the programs' costs and outcomes. Note that evaluation question 8 (current status of each program) is difficult to show in a logic model format, since it relates to the evolution of the programs over time; therefore we have not attempted to link question 8 to a specific component of the logic model.

EXHIBIT 1-6 RELATIONSHIP BETWEEN EVALUATION QUESTIONS AND ERP LOGIC MODEL

EVALUATION QUESTION	KEY COMPONENTS OF ERP LOGIC MODEL
1.) To what extent have the ERPs in Delaware, Rhode Island, and Maine, led to actual and/or expected adoption of selected business practices that reduce the environmental footprint of auto body shops?	F-2
2.) What environmental and health outcomes are estimated to result from auto body shops implementing these best practices?	F-3
3.) What are the cost implications of each program for regulators and auto body shops initially and over time?	
a. What resources did states use to develop and implement each program?	A-1, A-2, A-3
b. What resources did auto body shops invest initially, and on an ongoing basis, to participate in each program? (exclusive of resources spent to comply with regulatory requirements)?	A-3
4.) What is the cost-effectiveness of each program?	A, F-4 , F-5
5.) Overall, what are the advantages and disadvantages of each of the programs in terms of:	
a. Reaching auto body shops	D-1, F-1
b. Generating environmental and worker health outcomes	F-2, F-3
c. Achieving cost-effective results	A, F-3
6.) What factors influenced the outcomes of each program?	A, B, C, E
7.) What do our findings suggest regarding the circumstances under which ERPs are likely to produce cost-effective results?	A, B, C, E, F-5
8.) What is the current status of each program?	Not shown on logic model
9.) What are the primary implementation challenges states faced in developing and implementing their program?	A, B, C, E
10.) What factors influenced the states' decision to continue, not continue, or modify their programs after initial pilots?	A, F, E
11.) How does the state and/or EPA Region involved in implementing each program view the program's results, and why?	F

V. STRUCTURE OF THE REPORT

The remainder of this report describes the approach and findings of the evaluation:

- **Chapter 2** presents the methodology used in conducting the evaluation, including the evaluation design, analytic approach, indicators for changes in behaviors, outcomes, costs and program experiences, and key analytical limitations.
- **Chapter 3** present findings for the intermediate and long-term outcomes of the three programs, including changes in behavior and resulting changes in environmental conditions.
- **Chapter 4** present conclusions and recommendations, including an overarching summary of findings and suggestions for going forward.

CHAPTER 2: EVALUATION METHODOLOGY

This chapter summarizes the key aspects of the methodology used to evaluate the three ERP programs. It begins with a description of the evaluation design, followed by the analytical approach and the indicators of changes in behaviors, outcomes, costs, and program experiences. It concludes by discussing the key limitations of the analysis.

I. EVALUATION DESIGN

As described in Chapter 1, the evaluation includes an analysis of three aspects of the ERP programs:

- Environmental outcomes;
- Program costs/cost-effectiveness; and
- Program implementation experience.

Approaches for addressing each component of this analysis are described below.

II. ANALYTICAL APPROACH

We use existing data reported by each program included in this study to summarize the change in auto body shop behaviors that affect environmental and health concerns. The evaluation uses a non-experimental design known as "one group pretest/posttest," which involves measurement or observation of a group of subjects (auto body shops) prior to and after the application of an intervention (the ERP). As noted earlier, ERP involves selecting a random sample of shops prior to ERP to assess baseline performance, and then selecting a second, independent random sample of shops after ERP implementation. We compare the percentage of shops using certain best practices during baseline inspections to the percentage of shops using these same practices after ERP implementation (i.e., during post-certification inspections). The basis for these comparisons is data collected on-site by state inspectors or data collectors at a randomly selected sample of facilities.[8] We calculate the observed percentage point change over the ERP cycle (i.e., the difference between the baseline percentage and the post-certification inspection percentage). We then use the data from these independent random samples to make inferences about changes in the proportion of shops in the entire population of facilities subject to ERP using specific practices. Changes in implementation of best practices reflect the sector as a whole, not just those shops that elected to participate in the voluntary ERP self-certification.

[8] We do not rely on data reported by facilities on self-certification forms for our summary of intermediate outcomes (behavior changes).

We are not able to quantitatively assess what portion of observed changes in behavior are a result of the ERP, however, since no control or comparison groups were used that were *not* subject to the states' ERP. We note substantial external factors (e.g., other concurrent outreach and education initiatives) that may have contributed to observed outcomes.

Note that we present the percentage of the sample following each indicator before and after program deployment, as well as the change in the percentage points. We feel it is important to show baseline levels of performance in order to provide the complete picture. For example, if 100 percent of facilities were conducting a certain behavior (e.g., using HVLP spray guns) before the ERP, and all facilities continued this behavior after the ERP self-certification period, the percentage point change in performance for that behavior would be zero. Reported on its own, it would appear that the program was not effective for this indicator, when in reality there was no room for improvement to occur.

We also note that we include all data in our analysis, whether or not it is statistically significant. We clearly label which results are statistically significant, and which are not. For results that are statistically significant, we can infer the proportion of facilities in the entire population (statewide in DE and RI; three counties in ME) using certain practices changed with a specified degree of confidence. For results that are not statistically significant, we cannot make this inference; we can only report the observed changes in the proportion of shops using certain practices for the samples of facilities visited.

III. INDICATORS FOR CHANGES IN BEHAVIORS, OUTCOMES, COSTS, AND PROGRAM EXPERIENCES

A summary list of the types indicators related to changed behavior tracked by states is provided in Exhibit 2-1 (Note, the specific wording of each indicator varies by state, and not all states track each indicator. Exact wording of each indicator tracked by each state is included in our findings in Chapter 3). This list includes only Environmental Business Practice Indicators (EBPIs) selected by the state programs, which they prioritized as the best indicators of compliance and adoption of best management practices for the auto body sector.

The indicators are organized in five categories of environmental concern: air emissions, water discharges, waste management, pollution prevented, and worker health & safety. These categories of concern were selected based on their inclusion in Part IV of EPA's Comparison Matrix for Element 13 Proposals.[9]

For each indicator, we summarize the change in percentage of shops that conducted specific practices (e.g., use low VOC/HAP paints and coatings) for each state that included that practice as an EBPI. We also summarize the outcomes for each of the five categories to provide an overarching picture of the states and environmental areas of concern (air, water, waste, etc.) where the greatest changes have been observed.

[9] Included as part of a draft EPA document, "Instructions for Using Comparison Matrix for Element 13 Proposals," May 9, 2007. Personal communication with John Heffelfinger on May 2, 2008. Note that the Comparison Matrix also identifies additional categories of environmental outcomes for which we do not have existing data: changes in ecological conditions, population impacts (e.g., impacts on local communities), and energy/water consumption. Given resource constraints, we do not propose to address these indicators in this evaluation.

EXHIBIT 2-1 INDICATORS OF CHANGES IN BEHAVIOR

CATEGORIES OF ENVIRONMENTAL CONCERN	SUMMARY DESCRIPTION OF INDICATORS OF CHANGES IN BEHAVIOR (INTERMEDIATE OUTCOMES)
Air Emissions	*Related to Types of Paint Usage*, change in the percentage of shops that:
	Use low VOC/HAP paints and coatings (lower than the federal standard), and percentage of the shop's painting/coating is done with low VOC/HAP materials
	Use compliant surface coatings
	Related to Spray Gun Usage, change in the percentage of shops that:
	Use HVLP spray equipment and/or other preferred painting application techniques
	Related to Training, change in the percentage of shops that:
	Employ a training program in the proper use and handling of coatings, solvents and/or waste products to minimize air emissions
	Related to Spray Booth Usage, change in the percentage of shops that:
	Carry out all painting and coating in a spray booth to contain paint emissions and over-spray
	Related to Storage, change in the percentage of shops that:
	Store absorbent paint applicators (e.g., shop rags/towels) in closed containers.
	Store solvents, thinners, or other VOC and HAP containing materials in closed containers when not in use.
	Related to Practices to Control Dust, change in the percentage of shops that:
	Use vacuum sanders or other equipment to control fugitive dust emissions
	Have no dust exhausted to the outside, or do not release any airborne emissions from painting and coating off site
	Related to Cleaning/Stripping, change in the percentage of shops that:
	Minimize/do not use methylene chloride
	Use low VOC/HAP solvents
	Utilize an enclosed spray gun cleaner, solvent recycler, or other spray gun cleaning methods to reduce VOC emissions
	Use detergents, high-pressure water, or other non-VOC cleaning options to clean coating lines and containers when practical
Waste Management	*Related to Hazardous Waste*, change in the percentage of shops that:
	Label containers properly
	Properly containerize and dispose of rags and other absorbent materials contaminated with a listed hazardous waste or flammable waste
	Have an EPA ID number
	Have a contingency plan
	Conduct container inspections
	Have a personnel training program
	Track waste through a manifest
	Track hazardous waste totals

CATEGORIES OF ENVIRONMENTAL CONCERN	SUMMARY DESCRIPTION OF INDICATORS OF CHANGES IN BEHAVIOR (INTERMEDIATE OUTCOMES)
Waste Management cont'd.	Conduct complete/accurate hazardous waste determination
	Use permitted hazardous waste facilities
	Related to Universal Waste, change in the percentage of shops that:
	Are aware of universal waste handling requirements
	Properly dispose of fluorescent light bulbs
	Related to Used Oil, change in the percentage of shops that:
	Burn waste oil in a waste oil furnace
	Burn waste oil contaminated with hazardous wastes
	Undertake any reclamation activities, such as with refrigerants
Water Discharges	Change in the percentage of shops that:
	Have proper closure/permitting/registering of floor drains
	Do not conduct vehicle maintenance and repair in areas with unsealed floor drains
	Do not store oil or hazardous materials in areas with unsealed floor drains
	Manage wash water properly
	Post signs prohibiting industrial discharge
Pollution Prevention[10]	Have secondary containment
	Store chemicals/materials securely away from stormwater
	Dry cleaning/sweeping methods employed
	Utilize an enclosed spray gun cleaner, solvent recycler, or other spray gun cleaning methods to reduce or eliminate VOC emissions
	Use HVLP spray equipment and/or other preferred painting application techniques
	Painting carried out in a spray booth
Worker Health and Safety[11]	Change in the percentage of shops that:
	Have a personal protective equipment (PPE) program
	Have a respiratory protection program
	Conduct hazard communication training
	Post safety/health poster
	Have a lockout/tag out program
	Provide employee medical exams specific to respirator use
	Avoid use of methylene chloride-based paint stripper
	Control dust emissions
	Properly store solvents in closed containers
	Carry out painting in a spray booth
	Use low VOC/HAP solvents and coatings
	Use an enclosed spray gun cleaner

[10] These indicators are a subset of indicators in the air, water, and waste categories.

[11] Six of these indicators are unique to this category; the remainder a subset of indicators in the air, water, and waste categories.

Once we analyze changes in practices following each program intervention, we translate these behaviors into environmental outcomes, where possible. Specifically, for air emissions, we use an emissions calculator developed by EPA's Design for the Environment (DfE) program to estimate VOC and PM emissions reductions associated with adoption of best practices for shops influenced by ERP.[12] To use the calculator, we need to make a number of assumptions and use a number of default values embedded in the calculator (these values are based on industry research conducted by the DfE program). We present the emissions reductions associated with two behavior changes: switching to automatic spray gun cleaning in Delaware, and use of low VOC/water-based solvents in Delaware and Maine. The DfE calculator also allows us to estimate materials use reductions associated with automatic spray gun cleaning operations in Delaware. In addition, we present the potential increase in hazardous waste that is properly being managed in Delaware following its ERP. (See Exhibit 2-2)

EXHIBIT 2-2 INDICATORS OF CHANGES IN OUTCOMES

CATEGORIES OF ENVIRONMENTAL CONCERN	INDICATORS OF ENVIRONMENTAL OUTCOMES (LONG-TERM OUTCOMES)
Air Emissions	**Volatile Organic Compounds (VOC)/ Hazardous Air Pollutants (HAPs)** reduced through spray gun cleaning methods and types of solvents used.
Hazardous Waste	Amounts of **hazardous waste** that are properly controlled or managed
Pollution Prevented	Reductions in **material usage of solvents**

For other categories of environmental concern, we qualitatively discuss the benefits we would expect facilities would observe as a result of adopting these behaviors. For example, in the area of worker health and safety, we would expect that having a respiratory protection program would limit worker exposure to heavy metals, solvents, and other contaminants in auto repair facilities. We qualitatively discuss the types of health and safety benefits that would be associated with reducing worker exposure to these contaminants. Likewise, in the area of behaviors related to hazardous waste management, we expect that increased adoption of practices such as labeling containers properly, conducting container inspections, and having a contingency plan would result in fewer hazardous waste leaks and associated emissions to the atmosphere, fewer facility emergencies, and more appropriate responses in the event an accident does occur. In our analysis, we qualitatively describe these expected outcomes associated with the changes in behavior observed following implementation of ERP.

[12] The DfE emissions calculator focuses on emissions reductions associated with best practices for painting, with a specific focus on VOC and PM emissions. The tool is intended to estimate emissions reductions associated with certain best practices for a single shop; however data collected in the three states represent changes for multiple facilities. Therefore, we needed to make a series of assumptions in using the calculator, which we document in our analysis.

Evaluating Program Effectiveness and Cost Implications

In addition to evaluating environmental outcomes, we conducted an assessment of program costs spent in developing and implementing the three ERPs. To develop these cost estimates, we reviewed project summary reports submitted to the State Innovation Grants program for Delaware and Maine, and for all three states we interviewed program staff representing to assess the amount of staff time (e.g., full-time equivalents, FTEs) invested over a given period, the dollar value of contractor services, and other direct costs such as the costs for printing and mailing outreach materials.

We also explored the level of resources expended by auto body shops to participate in the program. We interviewed five auto body shop owners/operators representing seven auto body shops that participated in the ERPs. These auto body shops were suggested by the ERP states, as shops that were representative of typical participants in ERP. A few of the shops had provided input to the state on the development of ERP, and thus had a broader perspective on the program (as well as a greater investment in it). In assessing costs of participation, we asked shops to describe, for example, time and resources facilities invested in participating in compliance assistance workshops and completing self-certification forms and return to compliance plans. We do not include the costs to the facility of purchasing new equipment or changing business practices in order to come into compliance, since we assume these costs would be constant regardless of the policy tool used to motivate facilities to comply with the law.

Evaluating Program Implementation Experiences

An important subset of our evaluation questions relates to the implementation experience of the programs, specifically:

- What factors influenced the outcomes of each program?
- What do our findings suggest regarding the circumstances under which ERPs are likely to produce cost-effective results?
- What is the current status of each program?
- What are the primary implementation challenges states faced in developing and implementing their program?
- What factors influenced the states' decision to continue, not continue, or modify their programs after initial pilots?
- How does the state and/or EPA Region involved in implementing each program view the program's results, and why?

This evaluation does not have sufficient data to answer these questions quantitatively, through methods such as correlation analysis. Instead, we answer these questions qualitatively, by exploring program implementation experiences in interviews with state regulators, EPA staff involved in supporting ERP, representatives of the States' ERP Consortium, and a small number of facility representatives.

IV. LIMITATIONS OF THE ANALYSIS

A key challenge we faced in conducting the evaluation was that we cannot be certain of the extent to which the states' ERP caused or contributed to observed changes in performance, in comparison to other factors (e.g., regulations or permit requirements) happening concurrently with ERP. We did seek to qualitatively assess other external factors that may have influenced observed outcomes; however, we did not gather extensive data on this point.

While we have extensive, statistically-based data on behavior changes associated with ERP, states did not collect quantitative data on long-term outcomes (e.g., emissions reductions), and therefore we were limited to estimating this information where we could, which required a number of assumptions which are described in detail in Appendix A.

Regarding evaluation questions 3 – 11, our primary data source was interviews with state representatives directly involved in designing and implementing ERP programs, as well as EPA staff involved in supporting ERP. While these individuals were best positioned to have information to respond to the questions, by the nature of their involvement in ERP, they may have had a biased perspective, and may in some cases have an interest in advocating ERP. On the other hand, several of these individuals are no longer involved in implementing ERP, and we heard critiques of ERP as well as praise. Overall, we feel that our interviews provided a candid assessment of the program from the point of view of states that have implemented it.

Another challenge in our analysis is that the ERP states included in this evaluation have not all used the same indicators of changes in behavior (intermediate outcomes). Therefore, results are not entirely comparable across states. However, this limitation does not represent a significant concern, since it is not our aim to directly compare the results across the state ERPs.

In addition, we are limited by the fact that the ERP states have not collected extensive data on environmental outcomes (e.g., emissions reductions) or costs involved in implementing the program. We were limited by our ability to extrapolate from available data, as well as the ability of state representatives to accurately recall or estimate the time and effort spent in developing their programs.

CHAPTER 3: FINDINGS

INTRODUCTION

This chapter documents the findings from our review of three state Environmental Results Programs (ERPs) designed to improve compliance and environmental performance of the auto body sector. These findings are based on a review of ERP performance measures collected and analyzed by three states (Delaware, Maine, and Rhode Island), as well as limited additional research on environmental impacts of the sector and projected long-term environmental outcomes (i.e., emissions reductions) associated with changes in the kinds of behaviors tracked by ERP. These findings also reflect the perspectives of 12 interviewees:

- Four individuals representing three states involved in developing and implementing the ERPs under review;
- Five auto body shop owners/operators representing seven auto body shops that participated in the ERPs;
- Two EPA staff involved in supporting ERPs at the state level; and
- Two representatives of the States' ERP Consortium, a collection of 18 states and three supporting organizations that collaborate in promoting the use of ERP approaches for effective and efficient environmental protection and improvement.

This chapter is organized as follows:

- **Section I** provides a description of each state's program and its current status.
- **Section II** includes an overview of the behavioral changes and related environmental outcomes from the three ERPs reviewed.
- **Section III** provides a qualitative review of each program's effectiveness, and a summary of its costs.
- **Section IV** discusses the implementation experience of each program, including program advantages/disadvantages, factors influencing program outcomes, implementation challenges, and program sustainability/transferability.
- **Section V** includes broader reflections on challenges in ERP implementation and sustainability (not limited to the three state programs that are the focus on this evaluation) based on interviews with EPA staff and representatives of the States' ERP Consortium.
- **Section VI** describes characteristics of a successful ERP, and the future direction of the program overall, drawn from interviews with EPA staff and representatives of the States' ERP Consortium.

I. DESCRIPTION AND STATUS FOR EACH ERP

This section describes the state ERPs developed for the auto body sector in Delaware, Maine, and Rhode Island. Each of these three ERPs integrates the standard components of ERP:

- Plain language compliance assistance that promotes pollution prevention;
- Facility self-assessment and self-certification;
- Agency inspections; and
- Statistically-based performance measurement. The states measured performance through baseline and post-certification on-site surveys at a random sample of facilities, and analyzed this data to make statistical inferences about changes at facilities across the entire population of shops subject to ERP.

Where necessary, regulators also conducted a comprehensive facility inventory and targeted enforcement actions. These elements are intended to work together to achieve the goals of ERP, which are to improve compliance and reduce environmental impacts of the target sector, while simultaneously deploying government resources strategically and efficiently.

The three ERP programs reviewed here all commenced in 2003 and 2004.[13] Each of the reviewed states structured their ERPs to encourage, but not require, participation in the outreach offered and in self-certification.[14] Each program encompasses several environmental issues and/or health concerns (i.e., each ERP addresses multiple environmental media).

While these states are similar in the types of programs they have implemented, they differ in terms of several circumstances that could affect ERP implementation, participation of auto body shops, and outcomes. One difference was the population of auto body shops that each state was seeking to address: Maine and Delaware were targeting relatively small populations (104 and 152 shops at baseline, respectively), while Rhode Island was targeting a larger population of 367 shops.[15] Rhode Island was also unique in that the state had been focusing on improving facilities' management practices at auto body shops for several years before implementing an ERP, and it had promulgated regulations specifically requiring auto body shops to adopt practices to reduce their air emissions nearly 10 years before the start of its ERP. A notable feature of the Delaware ERP was that the state had developed an air source category permit for the auto body sector to make the permitting process easier for auto body shops. The Maine ERP was unique in that it addressed only part of the state: the program was limited to three counties that had

[13] For Delaware and Maine, these dates reflect the start of the State Innovation Grants that provided a significant share of the funding for the ERP. For Rhode Island, this date reflects the launch of the program, which was initiated after more than two years of industry research and stakeholder meetings.

[14] Whether or not facilities opt to participate in the self-certification component of ERP, all facilities are expected to comply with applicable regulatory requirements.

[15] While the population of shops in Rhode Island is about 3.5 times larger than the population in Maine, and more than twice as large as the population in Delaware, all three states have relatively small populations of auto body shops, compared to a large state such as Texas, which is estimated to have 5,000 auto body shops. (Information on the number of auto body shops is based on an interview with representatives of the Texas Commission on Environmental Quality in June 2008.)

historically been classified as non-attainment areas (i.e., the counties had not met ground-level ozone federal national ambient air quality standards). The Rhode Island ERP is ongoing, while the programs in Delaware and Maine have concluded.

The following sections describe each state's program development, structure, and status in more detail.

DELAWARE[16]

The Delaware Department of Natural Resources and Environmental Control (DNREC) received an EPA State Innovation Pilot Grant (SIG) to design and conduct its Auto Body Self-Certification Program. The ERP commenced in March 2003, and was designed to complement an air source category permit, which DNREC developed for the auto body sector at the same time as it was developing the ERP. The source category permit was intended to make it easier for the 152 regulated shops in the state to file for permit coverage; moreover, DNREC permit staff conducted the emissions calculations required for the permit, so that auto body shops would not have to determine their own emissions.

Delaware's ERP was not intended to replace permitting, but work in conjunction with the permitting process. Delaware[17] thought that a self-certification program with a strong outreach and education component would help enhance the regulatory programs within DNREC and would help move the auto body sector closer to their goal of 100 percent compliance.

Without the ERP the Air Quality Management Program at DNREC would simply have implemented the source category permit on its own. Beyond supporting the new permit and improving compliance, DNREC also sought to use ERP to promote beyond-compliance best management practices and pollution prevention.

DNREC addressed all environmental regulations pertaining to the auto body sector, across several environmental media. DNREC offered typical components of ERP outreach (i.e., workshops, workbook, and self-certification package) for auto body shops in the state.[18] The four ERP workshops explained the program and the broad range of environmental regulations that applied to this sector; the workbook included a concise, easy to understand summary of information about environmental requirements and beyond-compliance practices; and the self-certification package allowed shops to conduct a self-audit of their environmental performance through a series of yes/no questions. If, in this audit, shops discovered they were out of compliance in a given area, they were required to submit a return-to-compliance plan for that area.

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[16] These findings, as well as those discussed in Section III and IV, are primarily based on an interview with the Delaware Department of Natural Resources and Environmental Control (DNREC) on February 12, 2009. In addition to the interview, these findings incorporate supplemental information provided DNREC, information provided in the Final State Innovation Grant Report for the Delaware Auto Body Self-Certification Program, which is posted on EPA's website (see http://www.epa.gov/innovation/stategrants/PDFs/DEautobodyfinalreport.pdf, last accessed May 6, 2009), and interviews with representatives from two auto body shops that participated in the ERP.

[17] Here, and throughout the report, we use the name of the state as shorthand to refer to statements made by the representatives of the state that we interviewed.

[18] Eligible shops include those that have either a) operations or student training in at least one of the following areas: collision repair, vehicle painting, paint stripping or sanding, body work, antique restoration; or b) painting operations, as part of a dealership or general auto repair shop.

The ERP provided incentives to encourage shops to participate, including:

- **Waived permit fee:** DNREC waived the $165 advertising fee associated with permit applications.
- **Amnesty period:** DNREC gave shops time to come into compliance without being penalized, provided they met the provisions of the Penalty Mitigation Policy.
- **Technical assistance and audits:** DNREC offered free technical assistance, and conducted pollution prevention audits when requested.
- **Electronic reporting**: DNREC established web-based reporting so that shops could submit their self-certification forms electronically.

After Delaware's SIG funding ended in September 2005, the state did not continue full implementation its ERP. The state encouraged program participants to renew their self-certifications in July 2007, but no further inspections to measure sector performance occurred after the grant period. Delaware notes that the ERP was a pilot program, and DNREC does not currently have the sufficient funding or manpower to continue it. Delaware is incorporating requirements of the federal Surface Coating Rule for auto body shops[19] into its auto body permitting program, which will include an outreach component. It is also conducting a self-certification component for the dry cleaning sector, but the state says it cannot afford to conduct a complete ERP for that sector.

MAINE[20]

The Maine Department of Environmental Protection's (DEP) Office of Innovation received an EPA State Innovation Pilot Grant in 2004 to conduct its Auto Body ERP pilot project. The auto body industry in Maine is subject to federal and state air, water, and solid and hazardous waste regulations; however, there was limited awareness of and compliance with these regulations in the sector. The DEP sought to address this situation by implementing an ERP that covered regulations across all environmental media. The DEP believed that auto body shops were posing a particular concern for air compliance issues. Beyond increasing compliance and awareness, DEP sought to use ERP to promote beyond-compliance best management practices and pollution prevention. The program's manager also wanted to present ERP as a model for the Department that could potentially be applied to other sectors where small businesses were not receiving adequate regulatory attention.

Maine's ERP applied to the 100 auto body shops[21] in the state's three southernmost counties, which were classified as a non-attainment area for ozone. DEP offered

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[19] Environmental Protection Agency, FR Vol. 73, No. 6, Wednesday, January 9, 2008. 40 CFR Part 63: National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources. Final Rule. http://www.epa.gov/ttn/atw/area/fr09ja08.pdf

[20] These findings, as well as those discussed in Section III and IV, are primarily based on an interview with the Maine Department of Environmental Protection on April 8, 2009. In addition to this interview, these findings incorporate information provided in the Final State Innovation Grant Report for the Maine Auto Body Environmental Results Program, which is posted on EPA's website (see http://www.epa.gov/innovation/stategrants/PDFs/maineerpfinalreport.pdf, last accessed May 10, 2009) and an interview on April 29, 2009 with an owner of three auto body shops that participated in the program.

compliance assistance workshops and provided shops with a plain language workbook that covered regulations, best management practices, and pollution prevention. DEP also provided shops with a voluntary self-certification checklist that corresponded to the workbook and allowed shops to self-identify where they were out of compliance through simple yes/no questions. The ERP provided incentives to encourage shops to participate, including:

- **Environmental Leadership recognition:** shops who participated in the ERP were recognized as Environmental Leaders, received a decal to display on-site, and were listed on the DEP's ERP webpage. Additionally, LaserPaint devices were awarded to those participants that implemented the most pollution prevention practices.
- **Use of incentives policy:** The DEP's Small Business Compliance Incentives Policy (SBCIP) allowed small businesses the opportunity to work with technical assistance staff from the Department to solve environmental violations while avoiding the threat of enforcement action, provided certain requirements were met.
- **Free technical assistance.**
- **Enforcement action avoidance:** self-certification allowed shops to find and fix violations that could lead to enforcement actions if they were inspected.

Maine's SIG funding ended in March 2007. The state's auto body ERP is no longer active due to lack of sufficient funding and a hiring freeze that prevents bringing on a new staff person to coordinate the program. Currently, the DEP is engaged in another ERP, a pilot program that seeks to reduce the stormwater impacts of drive-through commercial establishments (e.g., quick service/fast food restaurants). This stormwater ERP is funded by a separate SIG from EPA.

RHODE ISLAND[22]

Prior to developing its ERP for the auto body sector, the Rhode Island Department of Environmental Management (DEM) had been involved in efforts to prevent pollution from the auto body sector dating back to the early 1990s. With support from EPA Region 1 grants, and in partnership with the University of Rhode Island, local vocational schools, the state Department of Health, and the auto body industry, Rhode Island DEM conducted detailed surveys on pollution prevention, environmental controls, and occupational health and safety practices at auto body shops in the state. These efforts confirmed significant pollution and health concerns arising from auto body operations.

In 1994, the DEM implemented specific regulations pertaining to air emissions from auto body shops. However, due to a lack of resources, less than five percent of shops were

[21] The population of shops was 104 at the outset of the program; it had dropped to 100 at the time of post-certification inspections.

[22] These findings, as well as those discussed in Section III and IV, are primarily based on two interviews with the Rhode Island Department of Environmental Management (DEM), one on May 14, 2008 and the other on February 12, 2009 In addition to the interviews, these findings incorporate supplemental information provided by Rhode Island DEM and interviews with representatives from two auto body shops that participated in the ERP.

being inspected each year prior to the start of the ERP. When the DEM learned about ERP and its statistical sampling method from ERP proponents in Massachusetts, it seemed like the ideal approach to increase compliance and address pollution prevention, and in the process provide data on the sector's performance over time.

The DEM considered implementing a traditional permitting program instead of ERP. However, without ERP, the state likely would have simply continued with the existing low inspection levels, due to the high level of resources a permitting program would have required.

The state's earlier research had indicated that there were significant occupational health issues such as lead and methylene chloride exposure occurring in the auto body sector. Consequently, the ERP was designed to address occupational health issues, as well as more traditional ERP topics of compliance with air, water, and waste requirements, and pollution prevention.

DEM started outreach and self-certification in 2003. Unlike the other states discussed in this report, Rhode Island funded the auto body ERP on its own, without a SIG.[23] The program applied to all auto body shops in the state[24], and included standard components of ERP (technical/compliance assistance, self-certification, and statistically-based performance measurement). If in the process of self-certification shops discovered they were out of compliance in a given area, they were required to submit a return to compliance plan for that area.

DEM developed incentives to encourage shops to participate in the ERP by taking advantage of compliance assistance and filling out a self-certification form. The incentives for those firms that self-certified included reduced inspection priority, the ability to correct violations without gravity-based penalties, and technical and compliance assistance.

To date, Rhode Island has conducted two cycles of ERP and intends to continue implementing the program, albeit with minimal additional resources invested in outreach. (For a description of what constitutes an ERP cycle, see Exhibit 1-3 in the Introduction to this report.) DEM is adapting the program to be consistent with the federal Surface Coating Rule for auto body shops,[25] and plans to extend it to a third and maybe even a fourth cycle. Additionally, DEM is currently using ERP in additional sectors, including auto salvage, underground storage tanks, MS4 Construction Site Runoff Control, and reduction of fats/oils/grease discharges from food processing facilities.

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[23] Rhode Island has received State Innovation Grant funding for its other ERP initiatives, including a 2004 grant for an auto salvage ERP, a 2006 grant for an underground storage tank (UST) ERP, a 2007 grant for a small municipal separate storm sewer system (MS4) construction site runoff control ERP, and a 2008 grant focused on sustainable energy management practices for wastewater treatment, which includes an ERP component for food processing businesses to encourage use of collected grease as a renewable energy source. For more information, see the State Innovation Grant website at http://www.epa.gov/NCEI/stategrants/rhodeisland.htm.

[24] All facilities that were licensed by the RI Department of Business Regulation as an auto body or collision repair facility were eligible to participate.

[25] Environmental Protection Agency, FR Vol. 73, No. 6, Wednesday, January 9, 2008. 40 CFR Part 63: National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources. Final Rule. http://www.epa.gov/ttn/atw/area/fr09ja08.pdf

II. OVERVIEW OF ERP ENVIRONMENTAL OUTCOMES

This section addresses ERP outcomes related to five categories of environmental concerns associated with auto body shops: three environmental media (air emissions, hazardous waste generation and handling, and water discharges), as well as two cross-cutting issues (worker health and safety, and pollution prevention).

The section begins with an explanation of how ERP measurement works, and then provides an overview of results across the categories of indicators. For each category of concern, this section includes a summary of the problem, i.e., how auto body shops contribute to an environmental or health concern and an overview of relevant behavior changes that could reduce auto body shops' impacts. Each category summary also provides a description of ERP outcomes, including observed intermediate outcomes, i.e., estimates of the extent to which auto body shops subject to the three state ERPs changed their behaviors over the course of the three ERPs and anticipated long-term outcomes that can be expected based on the observed behavior changes. For the most part, these long-term outcomes are presented in qualitative terms, with the exception of those related to air emissions, for which we were able to model emissions and materials reductions using EPA's Design for Environment (DfE) emissions calculator for the auto body sector and hazardous waste properly managed in Delaware.

This section primarily focuses on outcomes from a single cycle of ERP, since in two states only a single cycle of the program was completed. However, Rhode Island has completed two rounds of facility certification and associated measurement. Therefore, at the end of this section there is a separate discussion of Rhode Island's data from post-Round 2 random inspections, and how these data compare to baseline and post-Round 1 random inspection data.

EXPLANATION OF ERP MEASUREMENT

As noted earlier, a key component of the standard ERP design is statistically-based performance measurement. In this design, states measure facility performance at baseline (i.e., before conducting any compliance assistance or outreach that will be part of the ERP). To do so, a state selects a representative (random) sample of the facilities eligible for the ERP, and conducts site visits at each of the facilities in the sample. During the site visits, state staff (e.g., inspectors, program staff) assess performance by filling out a detailed checklist that indicates whether or not the facility is following certain compliance and pollution prevention practices.[26] For example, in the auto body sector, a state might check whether or not each facility in the sample conducts its painting operations within a spray booth. The state then calculates the percentage of shops in the sample following this practice. We call this percentage of shops in the sample following a certain practice the *observed proportion of shops*.

Next, the state conducts the outreach component of ERP, e.g., by holding compliance assistance workshops, providing compliance assistance materials such as plain language

[26] In some cases, inspectors may also collect other types of performance information, e.g., quantities of specific materials used or hazardous wastes generated, however this type of measurement is less frequently part of ERP, and was not analyzed by any of the states included in this evaluation.

workbooks, and encouraging[27] facilities to fill out self-certification forms. States often also provide on-site outreach and assistance as part of the ERP. After ERP outreach, facilities are given time following the certification deadline to implement their return to compliance plans. Then the state measures performance again by conducting inspections at a second, independently selected representative (random) sample of the facilities eligible for ERP (i.e., from the entire population of facilities, not just facilities that participated in the ERP). This is called the "post-certification" measurement. As in the baseline, post-certification performance is measured by the percentage of facilities in the sample (i.e., the observed proportion of shops) that are following key compliance assistance and pollution prevention practices. The state then looks to see whether the percentage of shops following each practice changed relative to baseline, for example, whether the percentage of shops conducting painting operations within a spray booth increased.

Importantly, the random sampling approach allows states to use information from the sampled facilities to draw inferences about *all* facilities being eligible for ERP (i.e., the population) – not just those facilities visited by inspectors. Thus, by using statistics, states can use the observed proportion of shops in the sample following each practice to estimate, within a certain range, the proportion of all shops in the *population* (all facilities eligible to participate in ERP) following that practice (this range is often called a *confidence interval*[28]). Moreover, the state can compare estimates of the population's baseline performance to estimates of its post-certification performance to assess whether the overall percentage of the facilities in the entire population following specific practices changed, and if so, by how much.

When reporting results from their ERPs, states distinguish between changes in performance that are *statistically significant* vs. those that are not. A statistically significant change in performance is one where states can be confident that a change in performance occurred in the population of all shops eligible for ERP, not just in the samples of facilities visited. In other words, if a statistically significant change occurred, a state can be confident that the percentage of *all* shops in the eligible population following a certain practice is different at baseline and post-certification. The degree of confidence in this conclusion is expressed as the *confidence level*. In our analysis, we test for statistical significance using a 90 percent confidence level (95 percent in Rhode Island).[29] At a 90 percent confidence level, there is at most a 10 percent chance of being

[27] Some ERPs require participating facilities to fill out self-certification forms, however the ERPs included in this evaluation allowed voluntary self-certification.

[28] A confidence interval represents the entire range of possible proportions for the population, whereas the margin of error is the distance from the observed estimate to each end of the confidence interval range. For example, if the observed proportion is 10 percent, and the margin of error is 5 percent, then the confidence interval is 5 percent to 15 percent.

[29] For Delaware and Maine, we tested for statistical significance using a 90 percent confidence level, calculated using a two-sided hypothesis test, which accounts for the possibility that the true change in the population could have been either positive or negative. Rhode Island tested for statistical significance using a 95 percent confidence level, calculated using a one-sided hypothesis test, which only tests for the possibility that the true change in the population was greater than zero. The confidence associated with a two sided hypothesis test at the 90 percent confidence level is equivalent to a one-sided hypothesis test at the 95 percent confidence level.

mistaken in saying that there was a change in performance for the group as a whole (i.e., the entire population of auto body shops eligible for ERP).

Saying that a change is statistically significant does not, however, indicate the degree of change that occurred. Rather, to understand how much performance changed, we need to consider the *difference* between the baseline and post-certification measurements, as well as the *confidence interval for the difference*. This confidence interval expresses the range within which we estimate the true difference in population proportions between baseline and post-certification is expected to fall. Our confidence in this interval is 90 percent for Delaware and Maine, 95 percent for Rhode Island. Exhibit 3-1 provides an example to illustrate how this works in practice.

EXHIBIT 3-1 EXAMPLE OF MEASURING CHANGE IN PERFORMANCE

As part of its ERP, Delaware measured the percentage of auto body shops that had conducted a complete and accurate hazardous waste determination at baseline and at post-certification. At baseline, Delaware observed that 17 out of 47 randomly selected shops met this criterion (36 percent). At post-certification, 43 out of 47 randomly selected shops met this criterion (91 percent). (Note, these measurements reflect two independent samples, therefore the set of shops included in the first sample is *not* the same set of shops included in the second sample, although some shops may be included in both random samples).

The difference in the observed proportion of shops conducting a complete and accurate hazardous waste determination between baseline and post-certification is 55 percentage points (91 percent minus 36 percent). Using statistics, we can calculate that this change is statistically significant at the 90 percent confidence level. In other words, we can be 90 percent confident that the percentage of *all* auto body shops in the state that were conducting a complete and accurate hazardous waste determination increased from baseline to post-certification. Again, using statistics, we can also calculate the confidence interval for the difference in proportions, to estimate the degree of change in performance from baseline to post-certification. In this case, we can be 90 percent confident that the increase in the percentage of all shops in the state meeting this criterion was between 44 and 67 percentage points.

Note, if a change in performance is not statistically significant at a particular confidence level, it could still be true that the entire eligible population proportion changed between baseline and post-certification, however we cannot be as certain that this occurred. Therefore, while real changes in performance can be observed in the facilities included in the random sample, the lack of statistical significance prevents us from drawing conclusions about the likely change in performance of the statewide population of auto

body shops. Lack of statistically significant results may occur, even when a change in the population has actually occurred, for any of several reasons, including samples sizes being too small to detect a difference, performance changes being too small to detect, and simply by chance. Note that small increases in performance may occur when the vast majority of shops are meeting a given criteria and at baseline. For example, if 98 percent of shops were meeting a certain indicator at baseline, only a 1 or 2 percentage point increase in performance would be possible. It would be very difficult to detect this small amount of change unless sample sizes were quite large.

SUMMARY OF OUTCOMES

Each state included in this analysis selected between 19 and 24 indicators of environmental performance, and measured the percentage of shops meeting these criteria at baseline and post-certification (see Exhibit 3-2 below). States observed improved performance between the samples of facilities measured for the vast majority of indicators (observed performance improved for 54 out of 65 indicators (83 percent) between baseline and post-certification). Of these 54 indicators, 29 (54 percent of the indicators where observed performance improved, and 45 percent of all indicators) were found to have statistically significant changes in performance.

Delaware measured statistically significant improvements in a substantial majority of indicators (15 out of a total of 19 indicators, or 79 percent, show statistically significant improvements between baseline and post-certification); in Maine and Rhode Island, less than half of the improvements observed were statistically significant. Each state observed a small number of indicators with declining performance, but none of these declines was statistically significant. For a few indicators, all of the shops in the sample were already following the best practice being measured, and therefore no improvements were possible (the count of these indicators is shown in the "# No Change (100%)" column in Exhibit 3-2 below).

Note, in this section, and throughout the report, to the extent possible the evaluation team used the raw data[30] provided by the states to calculate observed proportions, percent changes, and which changes are statistically significant. We took this approach to allow for consistency of analysis. However, in Rhode Island, we did not take this approach, since that state relied on a more complex, stratified sample, which is also statistically valid and based on random sampling. Rather than trying to replicate analysis of this data, we simply report the interpretation of the data provided by the state.

EXHIBIT 3-2 SUMMARY OF INDICATORS BY STATE

STATE	# OF INDICATORS	# IMPROVING (# SIGNIFICANT[a])	# WORSENING (# SIGNIFICANT)	# NO CHANGE (100%)
Delaware	19	17 (15)	1 (0)	1

[30] Raw data provided by the state included the number of facilities meeting each indicator at both baseline and post-Round 1 inspections. This did not include facility-specific data; we relied on the states' summary for each indicator.

Maine	22	18 (7)	4 (0)	0
Rhode Island	24	19 (7)	3 (0)	2
Overall	**65**	**54 (29)**	**8 (0)**	**3**

Note:

a) Significance measured at a 90 percent confidence level in Delaware and Maine, and 95 percent in Rhode Island.

Exhibit 3-3 below shows a summary of indicators broken out by environmental medium. The greatest number of indicators measured was in the air emissions category, followed by waste management and water discharges. Relatively few indicators were measured related to worker health and safety. Note that indicators for pollution prevention are not included in this chart, since these indicators are a subset of the indicators in the other environmental media categories. The greatest percentage of the total number of indicators that made statistically significant improvements were observed in the air emissions and worker health and safety categories; in both of these categories, half of the total set of indicators measured (not of those improving, but of the total number of indicators) showed statistically significant improvements. A small number of indicators showed worsening performance, but none of these observations were statistically significant.

EXHIBIT 3-3 SUMMARY OF INDICATORS BY ENVIRONMENTAL MEDIUM

ENVIRONMENTAL MEDIUM	# OF INDICATORS	# IMPROVING (# SIGNIFICANT[a])	# WORSENING (# SIGNIFICANT)	# NO CHANGE (100%)
Air Emissions	26	19 (13)	5 (0)	2
Waste Management	21	18 (9)	3 (0)	0
Water Discharge	12	11 (4)	0 (0)	1
Worker Health and Safety[(b)]	6	6 (3)	0 (0)	0
Overall	**65**	**54 (29)**	**8 (0)**	**3**

Notes:

(a) Significance measured at a 90 percent confidence level in Delaware and Maine, and 95 percent in Rhode Island.

(b) This row only counts indicators that are exclusively related to worker health and safety. There are several additional indicators discussed later in this section which relate to both worker health and safety *and* air emissions or waste management. These cross-cutting indicators are only counted once in the table above.

The following sections describe each environmental medium in more detail, including observed changes in behavior and estimated environmental outcomes.

AIR EMISSIONS

Summary of the Problem

The paints, coatings, and solvents used in auto body shops contain several materials that contribute to air pollution when emitted. In particular, auto body shops contribute to the following types of air pollutants:

- *Volatile Organic Compounds (VOCs)* – Auto body paints used for coating operations and solvents used during sanding and cleaning operations contain volatile organic compounds (VOCs). When paints and solvents are exposed to the air, the VOCs evaporate and are released into the atmosphere, reacting with nitrogen oxides in sunlight to form ground-level ozone.[31] According to the U.S. EPA, paints used in auto body shops contain higher concentrations of more reactive VOCs than do other types of paints. In 2008, the EPA estimated that 120,400 tons of VOCs per year were released from surface coating operations, which are primarily made up of auto body shops.[32]
- *Hazardous Air Pollutants (HAPs)* – Many components of paints used in auto body shops produce significant quantities of HAPs.[33] HAPs are toxic air pollutants that are known or suspected to cause serious health effects, such as cancer and reproductive effects, and adverse environmental effects such soil or surface waster deposition.[34] Methylene chloride is the primary HAP emitted by auto body shops, where it evaporates from paint stripping solvents.
- *Particulate Matter (PM)* – Dust from paint pigments and atomized paint from spray applications are released during shop operations as PM. PM also includes sanding dust, which can contain toxic metals such as lead and chromium. PM is made up of acids, organic chemicals, metals, soil, and/or dust particles. The smaller the particles, the higher the potential for causing health problems, as they can get deep into the lungs and potentially enter the bloodstream. Potential health problems from PM inhalation include irritation of the airways, decreased lung function, aggravated asthma, irregular heartbeat, development of chronic bronchitis, and nonfatal heart attacks. Environmental effects include: reduced visibility, lake and stream acidity (caused by PM settling), altered nutrient balance in coastal water and large river basins, depletion of nutrients in soil, damage to forests and farm crops, and damage to stone and other building materials.[35]

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[31] Kansas Small Business Assistance Program – Pollution Prevention Institute at Kansas State University. "Autobody Shops: A Primer on Environmental Regulation and Pollution Prevention." http://www.sbeap.org/publications/autobody.pdf

[32] 40 CFR part 63: National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources; Final Rule. Wednesday, January 9, 2008.

[33] Kansas Small Business Assistance Program – Pollution Prevention Institute at Kansas State University. "Autobody Shops: A Primer on Environmental Regulation and Pollution Prevention." http://www.sbeap.org/publications/autobody.pdf

[34] U.S. EPA Air Toxics Web Site: About Air Toxics. http://www.epa.gov/ttn/atw/allabout.html

[35] U.S. EPA Air & Radiation Website: Particulate Matter – Health and Environment. http://www.epa.gov/air/particlepollution/health.html

Overview of Relevant Behavior Changes

There are several steps that shops can take to reduce their air emissions. Specifically, shops can:

- Use spray paint booths to reduce paint overspray and fugitive paint emissions;[36]
- Increase paint transfer efficiency by using high transfer efficiency spray equipment, such as high volume low pressure (HVLP) spray guns;[37]
- Store solvent rags in closed containers;
- Manage sanding dust by using a ventilated or wet sander, or by installing room ventilators and filtration equipment that remove airborne dust;[38]
- Properly train employees in the use of equipment and materials;
- Use low-VOC paints, such as waterborne paints. Standard solvent-based paints contain 4.5 to 5.5 pounds of VOC per gallon, while waterborne paints only contain 1.9 pounds per gallon;[39]
- Reduce or eliminate the use of methylene chloride-based paint strippers;
- Clean spray guns with an enclosed spray gun cleaner, one that recirculates cleaning solvent during the cleaning process and is vapor tight;[40]
- Use less toxic solvents, install a gun washer, or adopt distillation/recycling practices;[41]
- Minimize the use of paint additives such as chemical hardeners, flex additives, and retarders.[42]
- Use waterborne cleaners, and use mechanical cleaning when possible.[43]

Summary of ERP Outcomes

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[36] Missouri Department of Natural Resources, Division of Environmental Quality. "Preventing Pollution in Collision Repair". May, 2007.

[37] Illinois Sustainable Technology Center at the University of Illinois at Urbana-Champaign. "Metal Painting and Coating Operations: Overview of Pollution Prevention in Coating Application Processes." http://www.istc.illinois.edu/info/library_docs/manuals/coatings/overvp2.htm

[38] Pollution Prevention in Auto Body Shops and Paint Shops, "Sanding Waste Management", CA Department of Toxic Substances Control, September 2006. Available at: http://www.dtsc.ca.gov/PollutionPrevention/ABP/upload/TD_FS_SandingWaste.pdf

[39] Edwards, Joseph D., Local Hazardous Waste Management Program in King County, Technical Assistance and Pollution Prevention Team. "Waterborne Coatings and the Autobody Shop: A Status Report. Publication Number SQG-ABODY-3(10/94) rev 9/00, October, 1994.

[40] Rhode Island Department of Environmental Management – Office of Technical & Customer Assistance, Small Business Assistance Program. "Air Pollution Control in Autobody Shops. http://www.dem.ri.gov/programs/benviron/assist/pdf/airconab.pdf

[41] Illinois Sustainable Technology Center at the University of Illinois at Urbana-Champaign. "Metal Painting and Coating Operations: Overview of Pollution Prevention in Coating Application Processes." http://www.istc.illinois.edu/info/library_docs/manuals/coatings/overvp2.htm

[42] Kansas Small Business Assistance Program – Pollution Prevention Institute at Kansas State University. "Autobody Shops: A Primer on Environmental Regulation and Pollution Prevention." http://www.sbeap.org/publications/autobody.pdf

[43] Kansas Small Business Assistance Program – Pollution Prevention Institute at Kansas State University. "Autobody Shops: A Primer on Environmental Regulation and Pollution Prevention." http://www.sbeap.org/publications/autobody.pdf

In this section of the evaluation we are interested in the extent to which the ERPs led to adoption of selected best practices that reduce air emissions from auto body shops, as well as the environmental and health outcomes estimated to result from the implementation of these best practices. We classify adoption of best practices as intermediate outcomes (as noted in the ERP logic model). We consider environmental and health outcomes (e.g., emissions reductions associated with adopting these best practices) as long-term outcomes. We consider intermediate and long-term outcomes of ERP related to air emissions in turn in the sections that follow.

Intermediate Outcomes

The ERP states included in this evaluation tracked several indicators of performance relevant to air emissions, including behaviors related to:

- Painting techniques, equipment, and materials;
- Cleaning techniques, equipment, and materials;
- Methylene chloride-based paint stripper usage;
- Sanding equipment;
- Emissions control equipment;
- Materials storage; and
- Employee training.

Exhibit 4 shows the specific indicators tracked, along with the observed percentage of facilities in the sample following each practice sampled at baseline and post-certification, and the difference in percentages between these two measurements (i.e., the observed percentage point change). The exhibit then shows whether each observed change in behavior is statistically significant. Findings are listed by state, and ordered from the greatest observed change to the smallest observed change. Those changes that are statistically significant are shown in bold. Note, in cases where indicators measured a change in a negative condition (e.g., when airborne emissions from painting and coating leave the business premises), we transformed the data so that increases in observed percentages represent an improvement.

EXHIBIT 3-4 SUMMARY OF AIR EMISSIONS INDICATORS[44]

INDICATOR	BASELINE %[(a)]	POST-CERTIFICATION INSPECTIONS %[(b)]	OBSERVED PERCENTAGE POINT CHANGE[(c)]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
DELAWARE					
Does the shop employ a training program in the proper use and handling of coatings, solvents and waste products to minimize air emissions?	**47%**	**91%**	**45**	**yes**	**(33 - 56)**
Does the shop store absorbent paint applicators (e.g., shop rags/towels) in closed containers?	**53%**	**96%**	**43**	**yes**	**(32 - 53)**
Does the shop use detergents, high-pressure water, or other non-VOC cleaning options to clean coating lines and containers when practical?	**11%**	**35%**	**24**	**yes**	**(13 - 36)**
Does the shop clean the spray guns using only methods that comply with Delaware Regulations?	**89%**	**100%**	**11**	**yes**	**(5 - 17)**
Does any airborne sanding or painting dust (i.e. fugitive dust) leave the business premises and create a condition of air pollution? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**89%**	**98%**	**9**	**yes**	**(2 - 15)**

[44] For Delaware and Maine, these calculations are based on raw data provided by the states (i.e., the total number of facilities sampled at baseline and post-certification, the number of facilities sampled at each time period for which the answer to the question was "yes," and the total number of facilities in the population). Raw data was drawn from the State Innovation Grant final reports for these two states, available online at http://www.epa.gov/NCEI/stategrants/PDFs/DEautobodyfinalreport.pdf and http://www.epa.gov/NCEI/stategrants/PDFs/Maine2004Final%20Report.pdf. We then used this information to calculate the observed proportion of shops at baseline and post-certification, the observed percentage point change, whether or not this change is significant, and the confidence interval for the difference. We used the ERP Results Analyzer tool to conduct these calculations The Results Analyzer calculates confidence intervals for the difference between proportions observed in two different rounds of inspections. A version of the Results Analyzer can be accessed at: http://www.epa.gov/erp (however, the authors used an updated version of the results analyzer that had not been posted on line as of the time of writing this report; for the most up-to-date version of the Results Analyzer, contact Scott Bowles, bowles.scott@epa.gov). Calculations for the confidence intervals are based on the following source: Kish, Leslie, 1965. *Survey Sampling*. John Wiley & Sons, Inc. New York, NY. p.41. We use a 90 percent, two-sided significance test and a 90 percent confidence interval in our calculations. In both Maine and Delaware, the number of facilities in both samples was relatively small (59 and 47 facilities, respectively). Smaller sample sizes typically only show significant results when observed changes are fairly large. We believe that 90 percent significance and confidence levels are acceptable in this case. We use the raw data, rather than observed percentages, statistical significance, or confidence intervals reported by the states to ensure consistency in the analytic approach. In some cases, rounding leads to an observed percentage point change that is slightly different than the difference between the reported baseline and post-certification inspection percentages.

For Rhode Island, we could not use the ERP Results Analyzer because the state had a stratified random sampling approach (this approach is also statistically valid, but requires more complex analytical techniques). Therefore, for Rhode Island we simply report the values given by the state in the article summarizing their results (Enander et al., "Environmental Health Practice: Statistically Based Performance Measurement," *American Journal of Public Health.)* Note that RI reports a 95 percent confidence interval and a one-sided significance test.

INDICATOR	BASELINE %[a]	POST-CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE[c]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
Do the painters and technicians use only painting techniques that comply with Delaware Regulations?	**89%**	**98%**	**9**	**yes**	**(2 - 15)**
Is all painting carried out in a spray booth to contain paint emissions and over-spray?	81%	87%	6	no	N/A
Does the facility avoid any use of methylene chloride-based paint strippers?	43%	35%	-9%	no	N/A
MAINE					
Does the shop utilize low VOC/HAP solvents?	**49%**	**97%**	**47**	**yes**	**(40 - 55)**
Does the shop utilize low VOC/HAP paints and coatings? (lower than the federal standard)	**59%**	**93%**	**34**	**yes**	**(26 - 42)**
Does the shop utilize a dust control system to control dust generated from the sanding process?	**34%**	**47%**	**14**	**yes**	**(4 - 23)**
Do any airborne emissions from painting and coating leave the business premises? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**71%**	**85%**	**14**	**yes**	**(5 - 22)**
Does the shop exhaust air from process areas to the outside? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**27%**	**37%**	**10**	**yes**	**(1 - 19)**
Does painting and coating take place in areas outside of a spray booth? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops answering "no" to the question.)	**75%**	**85%**	**10**	**yes**	**(2 - 18)**
Does the shop carry out painting and coating in a spray booth to contain paint emissions and over spray?	80%	86%	7	no	N/A
Does the shop utilize an enclosed spray gun cleaner, solvent recycler, or other spray gun cleaning methods to reduce or eliminate VOC emissions?	54%	61%	7	no	N/A
Are solvents, thinners, or other VOC and HAP containing materials stored in closed containers when not in use?	93%	90%	-3	no	N/A

INDICATOR	BASELINE %[a]	POST-CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE[c]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
Does the shop train all employees in the proper use and handling of paints and coatings according to the manufacturers' recommendations to minimize air pollution?	100%	97%	-3	no	N/A
Does the shop employ a training program in the proper use and handling of solvents and waste products to minimize air emissions?	100%	97%	-3	no	N/A
RHODE ISLAND					
Does your facility use a methylene chloride-based paint stripper? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**67%**	**95%**	**28**	**yes**	**(12 - 44)**
Do you control dust emissions from your facility using a specific device?	33%	48%	15	no	N/A
Do you store solvents, waste paint, sludge, and shop rags/towels saturated with solvent in closed containers?	81%	88%	7	no	N/A
Is your cleaning device totally enclosed during cleaning, rinsing, and draining operations?	83%	88%	5	no	N/A
Do you use coatings that comply with the emission limitations listed in Rhode Island Air Pollution Control Regulation No. 30, Control of Volatile Organic Compounds from Automobile Refinishing Operations?	100%	100%	0	not tested	N/A
Do your painters and technicians use spray guns that have a transfer efficiency of at least 65% such as High Volume Low Pressure (HVLP) spray equipment?	100%	100%	0	not tested	N/A
Does your shop use a ventilated sander (dustless vacuum) system?	31%	30%	-1	not tested	N/A

INDICATOR	BASELINE %[a]	POST-CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE[c]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS

Notes:

(a) Unless otherwise indicated in the table, this column represents the observed proportion of shops in the baseline sample for which the answer to the indicator question is "Yes," which indicates positive environmental performance.

(b) Unless otherwise indicated in the table, this column represents the observed proportion of shops in the post-certification sample for which the answer to the indicator question is "Yes," which indicates positive environmental performance.

(c) All changes are listed as percentage point changes. These changes are calculated by subtracting the observed percentage of shops in the sample following the behavior at baseline prior to ERP from the observed percentage of shops in the sample following the behavior at post-certification. We use percentage point changes, rather than percent changes, to more clearly show the magnitude of change. For example, suppose the observed proportion of shops following a behavior increased from 6 percent at baseline to 12 percent at post certification: this change could be expressed as a 100 percent improvement, or a 6 percentage point improvement. We believe the latter approach is a clearer, more accurate description of changes in performance.

The ERPs addressed in this evaluation included more indicators related to air pollution than any other category. States observed improvements in the majority of the air emissions indicators tracked (i.e., 19 out of 26 indicators, or 73 percent shown in Exhibit 3-4). Thirteen of these improvements were statistically significant, meaning that we can infer that the total universe of shops eligible for the ERPs showed improvements for these indicators. Among the statistically significant improvements, the average observed change was 23 percentage points. Performance on five of the indicators declined; however, none of those declines were statistically significant.

Since each state selected a different set of indicators, the types of observed improvements varied among states. However it is notable that two states measured statistically significant improvements related to sanding dust. Specifically, Maine detected a 14 percentage point improvement in shops using a dust control system, while Delaware found a nine percentage point improvement in shops preventing fugitive dust from leaving the building premises. Rhode Island also observed a 15 percentage point improvement in shops controlling dust emissions; however this change was not statistically significant.

Another area where multiple states measured statistically significant improvements related to the types of solvents used at the shops. Specifically, Maine observed a 47 percentage point increase in shops using low VOC/HAP solvents. Rhode Island observed a 28 percentage point reduction in the percentage of shops using methylene chloride-based paint strippers.[45] On the other hand, Delaware also measured the percentage of shops using methylene chloride-based paint strippers, and found that more shops were using this solvent at post-certification than at baseline, which represents a worsening of environmental performance (although the decline in performance was not statistically significant).

Notably, indicators for which the greatest improvements were observed in some states showed minimal improvements or declines in performance in other states. For example, one of the largest observed improvements in this category was in Delaware, where the state observed a 45 percentage point improvement related to employee training for use and handling of coatings, solvents and wastes. However, for a very similar indicator (employee training in the proper use and handing of paints and coatings according to manufacturers recommendations), Maine found a three percentage point decline in performance. (This decline was not statistically significant.)

Aside from changes in performance, the ERP data reveal interesting patterns in the overall level of performance at post-certification. The indicators where one or more states observed at least 95 percent of shops sampled following preferred behaviors include:

- Use of spray guns cleaning methods that comply with state regulations
- Use of coatings that comply with emissions limits

[45] Note, this finding applies to Rhode Island's first cycle of ERP. For further results on Rhode Island's findings for this indicator in its second cycle of ERP, see the section "Discussion of Results from a Second Cycle of ERP" later in this report.

- Use of HVLP spray guns
- Prevention of fugitive dust from leaving the business premises
- Use of painting techniques that comply with state regulations
- Use of low VOC/HAP solvents
- Employee training related to proper use and handling of paints and coatings
- Employee training related to proper use and handling of solvents and waste products
- Proper storage of absorbent paint applicators
- Avoiding use of methylene chloride-based paint stripper

Conversely, the behaviors where at least one state observed relatively poor performance (less than 40 percent of shops following preferred behavior) include:

- Allowing air from process areas to exhaust to the outside
- Use of methylene chloride-based paint strippers
- Use of non-VOC options to clean coating lines and containers when practical
- Use of a ventilated sander system

Notably, there are some indicators (e.g., fugitive dust/air from process areas exhausted to the outside and use of methylene chloride-based paint strippers) that were observed at a high level of performance in one state, but a low level of performance in another state. These variations in performance may well be due external factors, e.g., the history of each state in terms of prior outreach to auto body shops, rather than the influence of the ERP itself in affecting shop behavior. These variations could also be the result of differences in ERP implementation between the states.

Long-term Outcomes

The Emissions Reduction Calculator from the U.S. EPA's Design for the Environment (DfE) Program[46] was developed to provide rough estimates for reductions of VOCs, PM, and materials used through implementation of certain best practices in auto body shops. The calculator estimates that there are five primary best practices that small shops can adopt to reduce their emissions and materials used: (1) waterborne paint usage, (2) HVLP spray gun usage, (3) training in spray gun usage, (4) spray booth usage, and (5) equipment cleaning improvements. The tool is intended to estimate emissions reductions associated with these practices for a single shop; however, the data available to the evaluators represent changes in the percentage of a group of facilities following these key practices. Therefore, a number of assumptions are required to use the emissions calculator to estimate emissions reductions associated with ERP, as described below and in Appendix A.

This analysis considers observed behavior changes that are statistically significant and are modeled in the DfE tool to extrapolate emissions reductions from facilities in the sample

[46] A copy of the Emissions Reduction Calculator is available at: http://www.epa.gov/dfe/pubs/projects/auto/

to facilities across the state. There are two behavior changes that meet these criteria: switching to automatic spray gun cleaning in Delaware, and use of low-VOC/water-based solvents in Delaware and Maine. Specifically, for each of these best practices we use the emissions factors built into the tool to estimate a range of annual emissions reductions that could be expected. The results of this analysis are summarized below, and details on the assumptions and methodology for conducting the analysis are included in Appendix A.

- **Emissions reductions associated with increased use of automatic cleaning methods at shops in Delaware**.[47] We are 90 percent confident that the percentage point increase in the percent of shops cleaning spray guns only with methods that comply with Delaware regulations is between 5 and 17 percentage points. We expect that the VOCs reductions from this increase in the percent of auto body shop improving their spray gun cleaning operations in the entire population of auto body shops in Delaware would lead to a decline of between 296 and 962 lbs/year, relative to baseline.[48]
- **Emissions reductions associated with increase in shops in Delaware that use non-VOC cleaning methods when possible.**[49] We are 90 percent confident that the percentage point increase in the percent of shops that use non-VOC cleaning methods when possible is between 13 and 36 percentage points. We expect that the VOCs reductions from this increase in auto body shops improving their cleaning operations in the entire population of auto body shops in Delaware would lead to a decline of *up to* 3,355 lbs/year, relative to baseline. We include only the maximum of this range because it is difficult to estimate the minimum emissions reductions, since some shops likely began using non-VOC cleaning methods when possible, but did not completely switch over to low-VOC/water-based solvents. If many of the shops that Delaware counted as having switched to using non-VOC cleaning methods when possible were only using these non-VOC materials for a small percentage of their cleaning operations, the emissions reductions would be much lower.
- **Emissions reductions associated with increase in shops in Maine that use low VOC/HAP solvents.**[50] We are 90 percent confident that the percentage point increase in the percent of shops that use low VOC/HAP solvents is between 40 and 55 percentage points. We expect that the VOCs reductions from this increase in auto body shops improving their cleaning operations at shops across the state

[47] To calculate this emissions decrease we assume adoption of automatic cleaning methods (the variable tracked in the DfE calculator) is equivalent to the indicator tracked by Delaware: use of cleaning methods that comply with Delaware regulations (specifically, enclosed spray gun cleaning systems that are kept closed when not in use, unatomized discharge of solvent into a paint waste container that is kept closed when not in use, disassembly of the spray gun and cleaning in a vat that is kept closed when not in use, or atomized spray into a paint waste container that is fitted with a device designed to capture atomized solvent emissions).

[48] The percentage point increases reported in this section represent the increase in the percentage of shops adopting a certain best practice over the course of the ERP. The emissions reductions reported reflect the *annual* emissions reductions that are estimated from the increase in shops adopting that behavior.

[49] To calculate this emissions decrease we assume adoption of low VOC-water-based cleaners is equivalent to shops that use non-VOC cleaning methods when possible.

[50] To calculate this emissions decrease we assume adoption of low VOC-water-based cleaners is equivalent to shops that use non-VOC cleaning methods when possible.

would lead to a decline of *up to* 3,416 lbs/year, relative to baseline. As in Delaware, we include only the maximum of this range because it is difficult to estimate the minimum emissions reductions, since some shops likely began using low VOC /HAP solvents, but did not completely switch over to these alternative solvents. If many of the shops that Maine counted as having switched to low VOC/HAP solvents were only using low VOC or water-based solvents for a small percentage of their cleaning operations, the emissions reductions would be much lower.

Note that each practice is considered individually, but in reality the practices influence on another (e.g., type of spray gun used and training for spray gun use are interrelated, and there is overlap in the potential emissions reductions between these two indicators). Therefore, the results are not additive, i.e., the total potential emissions reductions associated with adopting all practices is less than the sum of potential emissions reductions for each practice. In other words, the DfE calculator combines emissions reductions associated with using automatic cleaning methods and low VOC/water-based solvents into one estimate. However, to use the ERP data, we have broken out these behaviors into separate estimates. If we used the DfE calculator to estimate the emissions associated with a single shop that used automatic cleaning methods *and* low VOC/water-based solvents, the emissions reductions would be *less* than if we used the DfE calculator to estimate the emissions reductions associated with each of these behaviors separately, and then added them together.

Appendix B presents default values embedded in the DfE calculator which are used in our analysis. Appendix C presents *potential* emissions estimates that could be expected for each typical small auto body shop that adopts certain best practices tracked in the DfE tool.

Based on estimates from the Surface Coating Rule of the VOC emissions from small auto body shops before improvements[51], the declines in Delaware and Maine in VOC emissions represent the following percentage VOC emissions reductions per shop:

- Automatic cleaning methods: 0.6 percent reduction in total VOC emissions per shop.
- Low-VOC or water-based cleaning methods: 0.9 percent reduction in total VOC emissions per shop.

While these percent reductions are small, they only represent the percent reductions from the change associated with a single behavior change. For comparison, the final Surface

[51] The final Surface Coating Rule (40 CFR part 63: National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources; Final Rule. Wednesday, January 9, 2008) estimates that there are 36,000 surface coating operations in the United States, and 35,000 of these are auto body shops involved in motor vehicle and mobile equipment. Further, the rule estimates that VOC emissions for surface coating operations is 120,400 tons per year. The rule does not directly estimate emissions associated with auto body shops, excluding other surface coating operations. However, if, we assume that per shop emissions of auto body shops are equivalent to emissions from other surface coating operations, then 1/36 of the 120,400 tons per year total estimate (or 3,344 tons per year) can be attributed to other surface coating operations, and the remainder (117,056 tons per year) can be attributed to auto body shops. Further, to calculate average VOC emissions per shop, we divide 117,056 tons by 35,000 shops to estimate total average emissions per shop of 3.34 tons per year.

Coating Rule estimates achieving full compliance will the rule will results in a 17.4 percent reduction in total VOC emissions per shop.

HAZARDOUS WASTE

Summary of the Problem

Auto body shops generate many materials that are regulated as hazardous wastes. For example, waste solvent and coatings, contaminated rags, wipes and absorbents, empty containers, used oil, waste antifreeze, sanding or grinding dusts, and contaminated wash waters.[52] These wastes can generally be classified as hazardous because they are ignitable, corrosive, reactive, and/or toxic.[53] They can be in liquid, solid, contained gas, or sludge form and are considered dangerous or potentially harmful to human health or the environment.[54] Used solvent combined with paint waste is often the largest waste stream in auto body shops.[55] If not properly managed, the wastes generated by shops have the potential to be accidentally released into the environment.

State and federal regulations dictate procedures for the proper handling, management, and storage of hazardous wastes. Hazardous waste generators are divided into categories based on the amount of waste they produce each month, and different regulations apply to each generator category. In general, there are three categories of hazardous waste generators, as described in Exhibit 3-5.

In addition, shops must handle universal wastes, which are not considered "hazardous" but are collected and managed with hazardous wastes, because they have at least one of the four characteristics of hazardous waste. [56,57] For auto body shops, this includes wastes such as fluorescent light bulbs and car batteries. In the shop, these wastes must be handled as hazardous.

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[52] Pollution Prevention in Auto Body Shops and Paint Shops, "Hazardous Waste Management", CA Department of Toxic Substances Control, September 2006. Available at: http://www.dtsc.ca.gov/PollutionPrevention/ABP/upload/TD_FS_Hazwaste.pdf

[53] U.S. EPA, Hazardous Waste Information Pages. Available at: http://www.epa.gov/ebtpages/wasthazardouswaste.html, or

http://www.epa.gov/osw/hazard/wastetypes/characteristic.htm

[54] U.S. EPA Hazardous Waste Home Page. Available at: http://www.epa.gov/waste/hazard/index.htm

[55] Pollution Prevention in Auto Body Shops and Paint Shops, "Solvent Recycling", CA Department of Toxic Substances Control, September 2006. Available at: http://www.dtsc.ca.gov/PollutionPrevention/ABP/upload/TD_FS_SolventRecycling.pdf

[56] Rhode Island Department of Environmental Management, Office of Technical and Customer Assistance. "Rhode Island Universal Waste Rule Fact Sheet." January 2003. Available at: http://www.dem.ri.gov/programs/benviron/assist/pdf/univrule.pdf

[57] U.S. EPA "Universal Wastes". Available at: http://www.epa.gov/osw/hazard/wastetypes/universal/index.htm

EXHIBIT 3-5 HAZARDOUS WASTE GENERATOR CATEGORIES

	DELAWARE[1]	MAINE[2]	RHODE ISLAND[3]
Large Quantity Generators	Generates more than 2,200 pounds or 300 gallons (1,000 kilograms) of hazardous waste in any calendar month.	Generates more than 220 pounds (about 27 gallons) of hazardous waste per month or accumulates more than 1,320 pounds of hazardous waste on site at any one time.	Generates more than 1,000 kilograms per month of hazardous waste, more than 1 kilogram per month of acutely hazardous waste, or more than 100 kilograms per month of acute spill residue or soil.
Small Quantity Generators (called "Small Quantity Generator Plus" in Maine)	Generates more than 220 and less than 2,200 pounds or about 25 to under 300 gallons (between 100 kilograms and less than 1,000 kilograms) of hazardous waste in any calendar month.	Generates less than 220 pounds (about 27 gallons) of hazardous waste per month and accumulates one to three drums, but no more than 1,320 pounds of hazardous waste on site at any one time.	Generates more than 100 kilograms, but less than 1,000 kilograms, of hazardous waste per month.
Conditionally Exempt Small Quantity Generators (called "Small Quantity Generators" in Maine)	Generates no more than 220 pounds or 25 gallons (100 kilograms) of hazardous waste in any calendar month	Generates less than 220 pounds (about 27 gallons) of hazardous waste per month and accumulates a total of no more than 55 gallons (1 drum) of hazardous waste on site at any one time.	Generates 100 kilograms or less per month of hazardous waste, or 1 kilogram or less per month of acutely hazardous waste, or less than 100 kilograms per month of acute spill residue or soil.

Sources:

1. Delaware Department of Natural Resources and Environmental Control. "Delaware's Hazardous Waste Regulations and You." January 1995.
2. Maine Department of Environmental Protection. "Auto Body Environmental Results Program: Workbook". February 2006.
3. Rhode Island Department of Environmental Management. "Rules and Regulations for Hazardous Waste Management." February 9, 2007, Section 5.02 D. and U.S. Code of Federal Regulations §261.5 (a) and (e), §262.34 (d) and §262.

Overview of Relevant Behavior Changes

There are several steps that an auto body shop can take to reduce the amount of hazardous waste that it generates and to properly manage the waste that it does generate. State compliance regulations for the auto body sector differ to some degree; however, in general, to properly manage their waste, shops must:

- Properly determine what waste qualifies as hazardous;
- Obtain a hazardous waste identification number;
- Properly label hazardous waste containers;
- Maintain accurate recordkeeping;
- Develop emergency procedures; and

- Ship waste to a permitted facility and/or store waste on-site in a storage area that meets criteria for secondary containment.

In addition, shops can reduce the amount of hazardous waste they generate for example, by:

- **Using enclosed spray gun cleaners** – These systems reduce waste solvent by recirculating the cleaning solvent until it can no longer be reused.[58]
- **Mixing paint efficiently** – There are several steps shop workers can take to reduce wasted paint that must be managed as hazardous, including:
  - *Managing inventory:* Limit the amount of paint that must be thrown away as a result of overstocking or old paint becoming unusable (i.e., from separation).
  - *Matching colors:* Better color matching and/or using small test panels reduce the need to re-spray if the color is mixed incorrectly.
  - *Measuring paint:* Mix only the amount of paint needed.
  - *Minimizing paint transfers:* When paint is transferred from one container to another, some paint sticks to the original container and is wasted. Shops can use disposable spray gun cup liners to reduce this transfer waste, because paint can be mixed and sprayed in the same cup.[59]
- **Improving painting efficiency** – Improving the efficiency of the painting process reduces the amount of paint that is wasted and must be managed as hazardous waste. Shops can:
  - Plan primer and clear coat work on multiple cars back-to-back;
  - Use tintable primer systems to improve color matches and get complete coverage with fewer coats;
  - Remove parts and perform like jobs together;
  - Improve training of employees on proper painting techniques;
  - Use high volume low pressure (HVLP) spray guns;
  - Use laser-based spray paint technology;
  - Maintain equipment; and
  - Use waterborne paints.[60]
- **Recycling solvent** – Recycling solvent reduces the amount of used solvent hazardous waste shipped off-site.[61]

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[58] Enander, Richard T., Gute, David M., and Missaghian, Richard. "Survey of Risk Reduction and Pollution Prevention Practices in Rhode Island Automotive Refinishing Industry." *American Industrial Hygiene Association Journal.* Vol. 59, 1998, pp. 478-489.

[59] Pollution Prevention in Auto Body Shops and Paint Shops, "Minimizing Paint Waste", CA Department of Toxic Substances Control, September 2006. Available at:

http://www.dtsc.ca.gov/PollutionPrevention/ABP/upload/TD_FS_PaintWasteMin.pdf

[60] *Ibid*

Summary of ERP Outcomes

Taking steps to reduce or recycle potentially hazardous wastes should result in less waste that needs be managed as hazardous in the environment. Proper management of the hazardous wastes that *are* generated reduces the likelihood of accidental releases or other associated hazards to the environment or human health.

Intermediate Outcomes

Exhibit 3-6 shows the specific indicators tracked, along with the observed percentage of facilities in the sample following each practice at baseline and post-certification, and the difference in percentages between these two measurements (i.e., the observed percentage point change). The exhibit then shows whether each observed change in behavior is statistically significant at a 90 percent confidence level. For each change that is statistically significant, it presents the confidence interval for the difference (i.e., range within which we can be 90 percent confident the true percentage point change for the entire population of facilities will fall). Findings are listed by state, and ordered from the greatest observed change to the smallest observed change. Those changes that are statistically significant are shown in bold. Note, in cases where indicators measured a change in a negative condition (e.g., when shops add hazardous wastes such as waste gasoline, solvents, or paint thinner into the waste oil), we transformed the data so that increases in observed percentages represent an improvement.

In total, across all three ERP states, this category of indicators improved substantially. Of the 21 indicators in this category, 18 (86 percent) improved, and nine of those improvements were statistically significant, meaning that we can infer with 90 percent confidence that the total universe of shops eligible for the ERPs showed improvements for these indicators. Among the statistically significant improvements, the average observed change was 36 percentage points. The performance for three indicators declined, but none of those changes were statistically significant.

[61] Pollution Prevention in Auto Body Shops and Paint Shops, "Solvent Recycling", CA Department of Toxic Substances Control, September 2006. Available at: http://www.dtsc.ca.gov/PollutionPrevention/ABP/upload/TD_FS_SolventRecycling.pdf

EXHIBIT 3-6: SUMMARY OF HAZARDOUS WASTE INDICATORS[62]

INDICATOR	BASELINE %[(a)]	POST-CERTIFICATION INSPECTIONS %[(b)]	OBSERVED PERCENTAGE POINT CHANGE[(c)]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
DELAWARE					
Has the shop conducted a complete, accurate hazardous waste determination for each waste it generates?	**36%**	**91%**	**55**	**yes**	**(44 - 67)**
Does the shop have a program that trains employees who handle hazardous waste in proper waste management procedures?	**34%**	**89%**	**55**	**yes**	**(44 - 67)**
Are shop employees aware that batteries, mercury thermostats, and mercury containing fluorescent light bulbs need to be handled according to Delaware requirements for universal waste?	**44%**	**91%**	**47**	**yes**	**(35 - 59)**
Are all hazardous waste containers properly labeled?	**45%**	**91%**	**47**	**yes**	**(35 - 58)**
Does the shop track hazardous waste accumulation totals?	**53%**	**85%**	**32**	**yes**	**(20 - 44)**
Does the shop send all hazardous wastes to a permitted hazardous waste treatment storage, or disposal facility or a state authorized facility?	**66%**	**91%**	**26**	**yes**	**(14 - 37)**

[62] For Delaware and Maine, these calculations are based on raw data provided by the states (i.e., the total number of facilities sampled at baseline and post-certification, the number of facilities sampled at each time period for which the answer to the question was "yes," and the total number of facilities in the population). Raw data was drawn from the State Innovation Grant final reports for these two states, available online at http://www.epa.gov/NCEI/stategrants/PDFs/DEautobodyfinalreport.pdf and http://www.epa.gov/NCEI/stategrants/PDFs/Maine2004Final%20Report.pdf. We then used this information to calculate the observed proportion of shops at baseline and post-certification, the observed percentage point change, whether or not this change is significant, and the confidence interval for the difference. We used the ERP Results Analyzer tool to conduct these calculations. The Results Analyzer calculates confidence intervals for the difference between proportions observed in two different rounds of inspections. A version of the Results Analyzer can be accessed at: http://www.epa.gov/erp (however, the authors used an updated version of the results analyzer that had not been posted on line as of the time of writing this report; for the most up-to-date version of the Results Analyzer, contact Scott Bowles, bowles.scott@epa.gov). Calculations for the confidence intervals are based on the following source: Kish, Leslie, 1965. *Survey Sampling*. John Wiley & Sons, Inc. New York, NY. p.41 We use a 90 percent, two-sided significance test and a 90 percent confidence interval in our calculations. In both Maine and Delaware, the number of facilities in both samples was relatively small (59 and 47 facilities, respectively). Smaller sample sizes typically only show significant results when observed changes are fairly large. We believe that 90 percent significance and confidence levels are acceptable in this case. We use the raw data, rather than observed percentages, statistical significance, or confidence intervals reported by the states to ensure consistency in the analytic approach. In some cases, rounding leads to an observed percentage point change that is slightly different than the difference between the reported baseline and post-certification inspection percentages.

For Rhode Island, we could not use the ERP Results Analyzer because the state had a stratified random sampling approach (this approach is also statistically valid, but requires more complex analytical techniques). Therefore, for Rhode Island we simply report the values given by the state in the article summarizing their results (Enander et al., "Environmental Health Practice: Statistically Based Performance Measurement," *American Journal of Public Health.)* Note that RI reports a 95 percent confidence interval and a one-sided significance test.

INDICATOR	BASELINE %[a]	POST-CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE[c]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
Is the shop undertaking any reclamation activities?	**47%**	**70%**	**23**	**yes**	**(10 - 37)**
MAINE					
Does the shop properly dispose of (recycle) fluorescent light bulbs?	**29%**	**85%**	**56**	**yes**	**(48 - 64)**
Has anyone ever filled out or signed a hazardous waste manifest?	71%	78%	7	no	N/A
Does the shop burn oil in a waste oil furnace?	28%	32%	4	no	N/A
Does the shop properly label containers of hazardous waste?	68%	71%	3	no	N/A
Does the shop containerize rags and other absorbent materials contaminated with a listed hazardous waste or flammable waste and dispose of it as hazardous waste?	27%	29%	2	no	N/A
Does the shop ever add hazardous wastes such as waste gasoline, solvents, or paint thinner into the waste oil? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	100%	96%	-4	no	N/A
RHODE ISLAND					
Do you have appropriate documentation which shows where hazardous waste is being shipped?	**56%**	**89%**	**33**	**yes**	**(15 - 51)**
Is the area (satellite accumulation area) clearly marked and the containers labeled with: (1) the words "Hazardous Waste", (2) Name of the waste and its waste code?, (3) the hazard classification?, and (4) the date that they were placed in the storage area?	21%	39%	18	no	N/A
Has your shop submitted to DEM a list of authorized agents that are allowed to sign the manifest (hazardous waste manifest)?	28%	44%	16	no	N/A
Does your shop have a written contingency plan designed to help your shop reduce hazards associated with the possibility of an explosion, fire, or unplanned/accidental release of hazardous materials?	6%	22%	16	no	N/A
Is the area (hazardous waste storage area) inspected weekly for signs of spills or container deterioration?	6%	22%	16	no	N/A

INDICATOR	BASELINE %[a]	POST-CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE[c]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
Does your shop have an employee training program that teaches them proper hazardous waste management procedures, including how to implement the contingency plan?	6%	22%	16	no	N/A
Do you use coatings that comply with the emission limitations listed in Rhode Island Air Pollution Control Regulation No. 30, Control of Volatile Organic Compounds from Automobile Refinishing Operations?	100%	100%	0%	not tested	N/A
What is your facility's hazardous waste identification number?	88%	86%	-2	not tested	N/A
Does your hazardous waste storage area meet the criteria for secondary containment (i.e. spill/leak containment capability)?	63%	56%	-7	not tested	N/A

Notes:

(a) Unless otherwise indicated in the table, this column represents the observed proportion of shops in the baseline sample for which the answer to the indicator question is "Yes," which indicates positive environmental performance.

(b) Unless otherwise indicated in the table, this column represents the observed proportion of shops in the post-certification sample for which the answer to the indicator question is "Yes," which indicates positive environmental performance.

(c) All changes are listed as percentage point changes. These changes are calculated by subtracting the observed percentage of shops in the sample following the behavior at baseline prior to ERP from the observed percentage of shops in the sample following the behavior at post-certification. We use percentage point changes, rather than percent changes, to more clearly show the magnitude of change. For example, suppose the observed proportion of shops following a behavior increased from 6 percent at baseline to 12 percent at post certification: this change could be expressed as a 100 percent improvement, or a 6 percentage point improvement. We believe the latter approach is a clearer, more accurate description of changes in performance.

Delaware by far saw the greatest improvements in this category, as all seven of their indicators significantly improved. In addition, the average performance increase for these indicators was 41 percentage points. Delaware's improvements were primarily related to the proper management of hazardous waste. For example, the observed proportion of shops properly identifying their hazardous waste and training their employees in proper management procedures increased by 55 percentage points over the course of the ERP, while the observed proportion of shops tracking hazardous waste accumulation totals increased by 32 percentage points and the proportion of shops shipping their waste to permitted or state authorized facilities increased by 26 percentage points.

Maine and Rhode Island observed more modest improvements in the management of hazardous waste. Both of these states detected one statistically significant improvement in performance related to hazardous waste management. Specifically, Rhode Island found a 33 percentage point increase in the percent of shops with appropriate documentation showing where hazardous waste is being shipped, while Maine found a 56 percentage point increase in shops properly disposing of fluorescent light bulbs.

In addition to changes in performance, the ERP data also track overall levels of performance at post-certification. In contrast to the air emissions category, where for 10 indicators at least 95 percent of shops sampled at post-certification were following preferred behaviors; in the waste management category, only one indicator showed this level of performance. Specifically, Maine observed that 96 percent of shops at post certification did not ever add hazardous wastes such as waste gasoline, solvents, or paint thinner into their waste oil. (Note that this performance represented a decline from baseline, when 100 percent of shops met this criterion.) Other waste management indicators with relatively high levels of performance (at least 90 percent compliance with the indicator at post-certification) in at least one state include:

- Hazardous waste determination
- Awareness of requirements for universal waste
- Labeling of hazardous waste containers
- Sending hazardous wastes to a permitted/state authorized facility

Conversely, the behaviors where at least one state observed relatively poor performance (less than 40 percent of shops following preferred behavior) include:

- Labeling of hazardous waste containers
- Burning oil in a waste oil furnace
- Proper handling of rags and other absorbent materials contaminated with hazardous waste
- Having a written contingency plan
- Inspection of hazardous waste storage areas
- Employee training for proper hazardous waste management procedures

Notably, one of these indicators (labeling of hazardous waste containers), is an area of relatively high performance in one state and poor performance in another. As in the air

emissions category, these variations in performance across states may be due to external factors, e.g., the history of each state in terms of prior outreach to auto body shops, rather than differences in the influence of the ERP itself in affecting shop behavior.

Long-term Outcomes

In general, we expect that changes in the kinds of behaviors observed by the three states should result in better management of hazardous waste and fewer potential accidental releases to the environment. While these states did not track the amounts of waste generated by each shop, which would allow us to quantify the amount of hazardous waste managed, we can develop a first order approximation of the potential increase in the amount of hazardous waste controlled in one state due to improved waste management procedures.

Specifically, Delaware found that nearly all shops inspected were Conditionally Exempt Small Quantity Generators (CESQGs) (45 out of 47 shops in the baseline inspections met this criterion). According to regulatory requirements, CESQGs are not allowed to generate more than 220 pounds or 25 gallons of hazardous waste in any calendar month. (While these shops may generate less than 220 pounds of waste a month, that quantity represents the *potential* amount of waste to be controlled.) In developing this estimate, we assume that all shops in the state are CESQGs. In addition, since we cannot estimate the actual hazardous waste generated by each shop every month, we assume that each shop is generating the maximum allowed by their regulatory status (as CESQGs). In reality, these shops could (and most likely are) generating less than 220 pounds of waste per month. To estimate the total potential amount of waste generated by the shops in the state, we multiply the 152 shops in the state by 220 pounds of waste for each shop, which equals 33,440 pounds of hazardous waste per month). This means that the 152 shops in the state have a combined *potential* to generate 33,440 pounds (16.7 tons) of hazardous waste a month, according to the statutory limit.

Moreover, based on input from EPA, we assume that complete and accurate hazardous waste determination for each waste generated is a useful indicator of proper management of hazardous waste. Using the data from Delaware, we know that Delaware observed a maximum 67 percentage point increase in the number of shops that complete hazardous waste determination from baseline to post-Round 1 random inspections. This translates to an increase of 102 shops completing hazardous waste determinations (67 percent of the 152 shops in the state). Again, according to the regulations, each shop can generate a maximum of 220 pounds of waste per month. If the 102 additional shops properly manage their 220 pounds of waste, this means that there is potentially an increase of as much as 22,440 pounds (11.2 tons) per month of hazardous waste properly being identified as hazardous waste in the state (although the actual amount may be far less, and we are not able to estimate bottom of the range). If the increase in waste being properly

identified is equal to 22,440 pounds per month, this would be equivalent to the minimum waste generated by 10 large quantity generators per month.[63]

WATER DISCHARGES

Summary of the Problem

If not controlled properly, wastewater produced by auto body shops has the potential to contribute harmful pollutants into groundwater, storm drains, wastewater systems and soil. Several activities in shops have the potential to release pollutants to surface waters, including: surface preparation, wet and dry sanding, painting, vehicle washing, floor cleaning, and product and waste storage. Water wastes generated during these processes include:

- *Sanding operations* – heavy metals like cadmium, chromium, lead, nickel, and zinc;
- *Vehicle preparation* – oil, grease, and coolant removed from vehicles;
- *Painting process* – toxic chemicals from cleaners, strippers, solvents, and paints in the form of scrubber water, paint sludge, spent solvents, aqueous cleaners, and wastewater.
- *Vehicle washing* – soaps. [64,65,66]

Unused floor drains should be properly sealed, but if they are currently active, shops generally must comply with their state's Underground Injection Control Program's regulations to ensure that wastewater discharges do not have the potential of polluting the soil and groundwater.[67]

Overview of Relevant Behavior Changes

There are two primary categories of behaviors that shops can employ to reduce the likelihood of releasing harmful pollutants into the water systems: spill prevention and drainage control. In other words, shops should manage the wastewater that they create so that it does not pollute. Shops can take the following steps to prevent spills in their shops:

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[63] This is based on the high end of the confidence interval for the difference between baseline and post-Round 1 random inspections, measured in percentage points (67), multiplied by the number of shops in Delaware (152) and the potential amount of waste generated (220 pounds per month). We use only the high end of the confidence interval because we are attempting to quantify the maximum potential amount of waste that is properly characterized as hazardous; in fact CESQGS may generate much less than 220 pounds of hazardous waste per month, and therefore we cannot accurately estimate the minimum amount of waste that shops in Delaware may be properly characterizing. In addition, if hazardous waste determination is not the best indicator of good management practices, then we may not be capturing the true improvement in performance for this indicator.

[64] Illinois Sustainable Technology Center at the University of Illinois at Urbana-Champaign. "Metal Painting and Coating Operations." http://www.istc.illinois.edu/info/library_docs/manuals/coatings/toc.htm

[65] Enander, Richard T., et. al. "The Concordance of Pollution Prevention and Occupational Health and Safety: A Perspective on U.S. Policy. *American Journal of Industrial Medicine*. Vole. 44, 2003, pp. 312-320.

[66] Pollution Prevention in Auto Body Shops and Paint Shops, "Wastewater Management", CA Department of Toxic Substances Control, September 2006. Available at: http://www.dtsc.ca.gov/PollutionPrevention/ABP/upload/TD_FS_WastewaterMgmt.pdf

[67] Rhode Island Department of Environmental Management – Office of Technical & Customer Assistance, Small Business Assistance Program. Factsheet: Water Pollution in the Autbody Shop. http://www.dem.ri.gov/programs/benviron/assist/pdf/h2opcab.pdf

- Keeping containers closed;
- Using secondary containment for hazardous materials storage;
- Inspecting containers for leaks;
- Storing hazardous materials away from sanitary sewer and storm drains;
- Keeping trash containers and dumpsters closed and inspect for leaks; and
- Inspecting vehicles for leaks and use drip pans as needed.[68]

Shops should also control any active drains in their shops by:

- Clearly marking all indoor drains;
- Posting signs prohibiting the discharge of industrial chemicals to non-industrial outlets;
- Properly closing all inactive floor drains;
- Registering all active (and inactive, if required) floor drains as required by state regulations; and
- Having a system in place for recycling or proper disposal of wastewater.

Shops can also use dry cleaning methods to reduce the amount of wastewater they generate during the cleaning process.

Summary of ERP Outcomes

By managing the wastewater they produce, auto body shops can reduce the potential for the harmful pollutants in that wastewater to leak into groundwater. Properly closing inactive floor drains ensures that no wastewater is leaking into sewer systems. Increasing awareness about the importance of not discharging wastewater into non-industrial drainage outlets and not performing maintenance in areas with unsealed floor drains decreases the likelihood of accidental leakages.

Exhibit 3-7 shows the specific indicators tracked, along with the observed percentage of facilities in the sample following each practice at baseline and post-certification, and the difference in percentages between these two measurements (i.e., the observed percentage point change). The exhibit then shows whether each observed change in behavior is statistically significant at a 90 percent confidence level. For each change that is statistically significant, it presents the confidence interval for the difference (i.e., range within which we can be 90 percent confident the true percentage point change for the entire population of facilities will fall). Findings are listed by state, and ordered from the greatest observed change to the smallest observed change. Those changes that are statistically significant are shown in bold. Note, in cases where indicators measured a change in a negative condition (e.g., when shops conduct vehicle maintenance and repair in areas with unsealed floor drains), we transformed the data so that increases in observed percentages represent an improvement.

[68] Pollution Prevention in Auto Body Shops and Paint Shops, "Wastewater Management", CA Department of Toxic Substances Control, September 2006. Available at: http://www.dtsc.ca.gov/PollutionPrevention/ABP/upload/TD_FS_WastewaterMgmt.pdf

EXHIBIT 3-7 SUMMARY OF WASTEWATER INDICATORS[69]

INDICATOR	BASELINE %[(a)]	POST-CERTIFICATION INSPECTIONS %[(b)]	OBSERVED PERCENTAGE POINT CHANGE[(c)]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
DELAWARE					
Does the shop post signs prohibiting the discharge of industrial chemicals and/or wastewater to bathroom/kitchen sinks, toilets, showers, shop wash basins, emergency showers, eyewash stations, or other non-industrial drainage outlets?	**4%**	**81%**	**77**	**yes**	**(68 - 86)**
Does the shop have secondary containment for all chemicals, including paints, thinners, strippers, cleaners and automotive fluids, so as to prevent potential spills from entering open floor drains or other access ways to water sources?	**49%**	**79%**	**30**	**yes**	**(17 - 43)**
Does the shop use dry cleaning methods such as sweeping and vacuuming, when cleaning the shop?	98%	100%	2	no	N/A
Does the shop keep paints, cleaners, and any chemicals or materials that can cause runoff (indoors or otherwise) protected from rainwater?	100%	100%	0	no	N/A

[69] For Delaware and Maine, these calculations are based on raw data provided by the states (i.e., the total number of facilities sampled at baseline and post-certification, the number of facilities sampled at each time period for which the answer to the question was "yes," and the total number of facilities in the population). Raw data was drawn from the State Innovation Grant final reports for these two states, available online at http://www.epa.gov/NCEI/stategrants/PDFs/DEautobodyfinalreport.pdf and http://www.epa.gov/NCEI/stategrants/PDFs/Maine2004Final%20Report.pdf. We then used this information to calculate the observed proportion of shops at baseline and post-certification, the observed percentage point change, whether or not this change is significant, and the confidence interval for the difference. We used the ERP Results Analyzer tool to conduct these calculations. The Results Analyzer calculates confidence intervals for the difference between proportions observed in two different rounds of inspections. A version of the Results Analyzer can be accessed at: http://www.epa.gov/erp (however, the authors used an updated version of the results analyzer that had not been posted on line as of the time of writing this report; for the most up-to-date version of the Results Analyzer, contact Scott Bowles, bowles.scott@epa.gov). Calculations for the confidence intervals are based on the following source: Kish, Leslie, 1965. *Survey Sampling*. John Wiley & Sons, Inc. New York, NY. p.41 We use a 90 percent, two-sided significance test and a 90 percent confidence interval in our calculations. In both Maine and Delaware, the number of facilities in both samples was relatively small (59 and 47 facilities, respectively). Smaller sample sizes typically only show significant results when observed changes are fairly large. We believe that 90 percent significance and confidence levels are acceptable in this case. We use the raw data, rather than observed percentages, statistical significance, or confidence intervals reported by the states to ensure consistency in the analytic approach. In some cases, rounding leads to an observed percentage point change that is slightly different than the difference between the reported baseline and post-certification inspection percentages.

For Rhode Island, we could not use the ERP Results Analyzer because the state had a stratified random sampling approach (this approach is also statistically valid, but requires more complex analytical techniques). Therefore, for Rhode Island we simply report the values given by the state in the article summarizing their results (Enander et al., "Environmental Health Practice: Statistically Based Performance Measurement," *American Journal of Public Health.)* Note that RI reports a 95 percent confidence interval and a one-sided significance test.

INDICATOR	BASELINE %[a]	POST-CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE[c]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
MAINE					
Have inactive floor drains been properly sealed/closed?	75%	87%	12	no	N/A
Does the shop conduct vehicle maintenance and repair in areas (bays) with unsealed floor drains? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	77%	86%	9	no	N/A
Does the shop store oil or hazardous materials in areas that have unsealed floor drains? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	96%	100%	4	no	N/A
Does the shop have any active floor drains? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	31%	33%	3	no	N/A
Are active and inactive floor drains registered with the DEP?	39%	41%	2	no	N/A
RHODE ISLAND					
Does your shop post signs prohibiting the discharge of industrial chemicals and/or wastewater to bathroom/kitchen sinks, toilets, showers, shop wash basins, emergency showers, eyewash stations, or other non-industrial drainage outlets?	**0%**	**48%**	**48**	**yes**	**(33 - 63)**
Does your shop allow process wastewater (i.e., from wet sanding, car washing, work area washing) to run off your site to storm drains or other areas (i.e., water runs down the street, water runs off to soil or sand area, water just puddles up and evaporates)? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**37%**	**74%**	**37**	**yes**	**(17 - 57)**

INDICATOR	BASELINE %[(a)]	POST-CERTIFICATION INSPECTIONS %[(b)]	OBSERVED PERCENTAGE POINT CHANGE[(c)]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
Does your shop contain open floor drains that are not currently in use? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	67%	69%	2	no	N/A

Notes:

(a) Unless otherwise indicated in the table, this column represents the observed proportion of shops in the baseline sample for which the answer to the indicator question is "Yes," which indicates positive environmental performance.

(b) Unless otherwise indicated in the table, this column represents the observed proportion of shops in the post-certification sample for which the answer to the indicator question is "Yes," which indicates positive environmental performance.

(c) All changes are listed as percentage point changes. These changes are calculated by subtracting the observed percentage of shops in the sample following the behavior at baseline prior to ERP from the observed percentage of shops in the sample following the behavior at post-certification. We use percentage point changes, rather than percent changes, to more clearly show the magnitude of change. For example, suppose the observed proportion of shops following a behavior increased from 6 percent at baseline to 12 percent at post certification: this change could be expressed as a 100 percent improvement, or a 6 percentage point improvement. We believe the latter approach is a clearer, more accurate description of changes in performance.

States observed improvements at the sampled facilities in almost all indicators for this category. Of the 12 wastewater indicators, 11 (92 percent) improved, and the one that did not improve had a baseline compliance level of 100%, so had no room for improvement. Four of the improvements were statistically significant, meaning that we can infer with 90 percent confidence that the total universe of shops eligible for the ERPs showed improvements for these indicators. Among the statistically significant improvements, the average observed change was 48 percentage points.

Both Delaware and Rhode Island observed significant improvement in the percentage of shops that post signs prohibiting the discharge of industrial chemicals to non-industrial drainage outlets, with 77 and 48 percentage point improvements respectively.

Delaware found a statistically significant improvement in the percentage of shops that have secondary containment for all chemicals. In addition, all of the shops included in the samples in Delaware were keeping paints, cleaners, and any chemicals that can cause runoff protected from rainwater at both the baseline and post-certification inspections.

Maine saw modest improvements in all of the indicators in this category for the facilities in the sample. None of them were statistically significant, however, meaning that we cannot make inferences with a 90 percent degree of confidence about whether there were changes related to these indicators among the entire population of facilities.

Rhode Island found a 37 percentage point statistically significant improvement in the percent of shops that have a proper system in place for recycling or properly disposing of wastewater, which should substantially reduce the likelihood of that wastewater accidentally leaking into water sources.

In addition to changes in performance, the ERP data also track overall levels of performance at post-certification. For three indicators, at least 95 percent of shops sampled in at least one state showed preferred behaviors:

- Use of dry cleaning methods such as sweeping and vacuuming;
- Keeping chemicals or materials that can cause runoff protected from rainwater; and
- Avoiding storing oil or hazardous materials in areas that have unsealed floor drains.

Conversely, poor performance (less than 40 percent of shops following the preferred behavior) was observed for one indicator at post-certification:

- Avoiding having any active floor drains.

WORKER HEALTH & SAFETY

Summary of the Problem

Operations in auto body shops potentially expose workers to a variety of harmful contaminants. Paint formulations, surface and equipment cleaners, adhesives, and paint strippers contain organic solvents, isocyanates, metal particulates and other airborne contaminants. In addition, metal-bearing fumes, paint pigments, and other fine solid particulates are generated during welding, spray painting, and sanding/ grinding

operations. In general, during these operations, workers are exposed through: (1) inhalation of volatized material, (2) inhalation of particulates, fibers, and gases, (3) dermal absorption of solvents and isocyanate monomers, and (4) incidental ingestion of contaminants resulting from unsanitary work practices such as not washing hands.[70] Specifically:

- *Sanding, grinding, and welding* – These activities release aerosols which may contain lead, cadmium, or chromium.[71] In addition to inhalation, these metals can adhere to workers' hands and can be ingested from food handling and hand-to-mouth contact. Health impacts from exposures to these chemicals include asthma, heart attacks, bronchitis, neurotoxicity, lung cancer, and premature mortality.[72] Sanding dust can also be tracked home on workers' clothes and shoes.[73]
- *Paint stripping* – The chemicals in common paint strippers are intended to loosen paint from the surfaces of cars; however, if not used properly, these chemicals can pose a serious health risk to auto body shop workers. Short-term exposure adversely affects the nervous system and the heart, and can cause skin and eye irritation. Long-term exposure is expected to lead to cancer.[74]
- *Painting* – Painting operations can expose workers to: solvents in the paint, metal-bearing pigments in the paint like lead and zinc chromates, and isocyanates. Chromates and lead can cause skin, eye, and respiratory irritation, nervous system damage, liver and kidney disease, and chromates have been linked to cancer. Isocyanates can cause skin problems as well as allergic and asthmatic reactions.[75] The U.S. Department of Labor, Occupational Safety & Health Administration has found evidence that exposure to auto body paint can lead to cancer, and they have found that painters suffer from allergic and nonallergic contact dermatitis, chronic bronchitis, asthma, and adverse central nervous system effects.[76] While isocyanate inhalation exposure is the most

[70] Enander, Richard T., Hute, David M., and Missaghian, Richard. "Survey of Risk Reduction and Pollution Prevention Practices in the Rhode Island Automotive Refinishing Industry." *American Industrial hygiene Association Journal*. Vol. 59, 1998, pp. 478-489.

[71] U.S. Department of Labor, Occupational Safety & Health Administration. In-Depth Survey Report: Control Technology for Autobody Repair and Painting Shops at Jeff Wyler Autobody Shop, Betavia, Ohio. http://www.osha.gov/SLTC/autobody/docs/ectb179-15a/ectb179-15a.html

[72] U.S. EPA Region 10 Collision Repair Campaign – Auto Body Shops. Health Impacts from Collision Repair Activities. http://yosemite.epa.gov/R10/AIRPAGE.NSF/Collision+Repair+Campaign/crc-auto

[73] Prevention in Auto Body Shops and Paint Shops, "Sanding Waste Management", CA Department of Toxic Substances Control, September 2006. Available at: http://www.dtsc.ca.gov/PollutionPrevention/ABP/upload/TD_FS_SandingWaste.pdf

[74] U.S. EPA, Chemicals in the Environment: Office of Pollution Prevention and Toxics Chemical Fact Sheets – Methylene Chloride, August 1994. http://epa.gov/chemfact/f_dcm.txt

[75] Rhode Island Department of Environmental Management – Office of Technical & Customer Assistance, Small Business Assistance Program. Factsheet: Safety Concerns in the Autobody Shop. http://www.dem.ri.gov/programs/benviron/assist/pdf/safetyab.pdf

[76] U.S. Department of Labor, Occupational Safety & Health Administration. In-Depth Survey Report: Control Technology for Autobody Repair and Painting Shops at Jeff Wyler Autobody Shop, Betavia, Ohio. http://www.osha.gov/SLTC/autobody/docs/ectb179-15a/ectb179-15a.html

common cause of health problems in workers, there has also been a link to skin exposure causing allergic contact dermatitis and skin irritation.[77]

- *Solvent-based cleaning* – Exposure to solvents include irritation, headache, nausea, and liver, kidney and nervous system damage.[78] In addition, VOCs in solvents and paints contribute to ground-level ozone, exposure to which can cause a range of adverse respiratory system effects, including decreased lung function, increased susceptibility to respiratory infection, airway inflammation, and increased lung reactivity.[79]
- *Other shop operations* – Other contaminants generated in the shops include asbestos, glass fibers, styrene, crystalline silica, and carbon monoxide, which may pose additional health hazards.[80]

Overview of Relevant Behavior Changes

There are several things that auto body shops can do to protect their workers from the potential chemical hazards present in the shop. Shops can invest in equipment and materials that help minimize worker exposure to harmful chemicals. Specifically, shops can use:

- *Spray booths,* which help contain the metal-bearing fumes, paint pigments, and organic solvents present in paint.
- *Enclosed spray gun cleaners,* which limit workers' dermal and respiratory exposure to solvents.
- *Dust control equipment,* such as ventilated sanding equipment, which limits worker exposure to the harmful metal particulates and toxins in sanding atmospheric dust concentrations.[81] Controlling sanding dust also limits the amount of dust that is tracked home by workers.
- *Low VOC/HAP paints and solvents,* which *reduce* the amount of VOCs and HAPs that workers are exposed to during painting and cleaning.
- *Personal protective equipment,* such as gloves, masks, respirators, and paint suits, which reduce worker exposure during all shop operations.

Shops can also implement management standards that reduce the risk of worker exposure, such as hazard communication programs, lockout/tagout programs (outlining specific

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[77] Dhimiter, Bello, et al. "Skin Exposure to Aliphatic Polyisocyanates in the Auto Body Repair and Refinishing Industry: II. A Quantitative Assessment." *American Occupational Health.* Vol. 52, No. 2, January 2008, pp. 117-124.

[78] U.S. EPA Region 10 Collision Repair Campaign – Auto Body Shops. Health Impacts from Collision Repair Activities. http://yosemite.epa.gov/R10/AIRPAGE.NSF/Collision+Repair+Campaign/crc-auto

[79] Enander, Richard T., Hute, David M., and Missaghian, Richard. "Survey of Risk Reduction and Pollution Prevention Practices in the Rhode Island Automotive Refinishing Industry." *American Industrial hygiene Association Journal*. Vol. 59, 1998, pp. 478-489.

[80] Enander, Richard T., Hute, David M., and Missaghian, Richard. "Survey of Risk Reduction and Pollution Prevention Practices in the Rhode Island Automotive Refinishing Industry." *American Industrial hygiene Association Journal*. Vol. 59, 1998, pp. 478-489.

[81] Enander, Richard T., Hute, David M., and Missaghian, Richard. "Survey of Risk Reduction and Pollution Prevention Practices in the Rhode Island Automotive Refinishing Industry." *American Industrial hygiene Association Journal*. Vol. 59, 1998, pp. 478-489.

practices and procedures to safeguard employees from unexpected startup of machinery or release of stored energy during operation or maintenance),[82] performing regular spray booth maintenance, and respiratory protection programs.

Summary of ERP Outcomes

While we cannot quantitatively measure the improvements in worker health and safety that would result in shops adopting the practices and equipment described above, it is clear that adopting these practices will reduce the risk of harmful health effects to auto body shop workers. By limiting worker exposure to the harmful chemicals in the materials used in shop operations, shops can also limit the likelihood that workers will experience the negative health effects associated with shop materials and operations.

Note that many indicators related to worker health and safety are also related to air emissions or waste management; indeed, Rhode Island was the only state to specifically track worker health and safety indicators, therefore only six of 20 indicators reviewed here are not also tracked in these other categories (these six indicators are in italics in Exhibit 3-8). The full set of indicators related to worker health and safety are included here to suggest the extent to which behavior changes at shops may influence the working environment. In fact, the people most affected by air emissions and wastes on site at an auto body shop are the workers. For example, changes in a behavior like using methylene chloride-based paint stripper can directly affect worker health, even though this indicator is also tracked as it relates to air emissions.

Exhibit 3-8 shows the specific indicators tracked, along with the observed percentage of facilities in the sample following each practice at baseline and post-certification, and the difference in percentages between these two measurements (i.e., the observed percentage point change). The exhibit then shows whether each observed change in behavior is statistically significant at a 90 percent confidence level. For each change that is statistically significant, it presents the confidence interval for the difference (i.e., range within which we can be 90 percent confident the true percentage point change for the entire population of facilities will fall). Findings are listed by state, and ordered from the greatest observed change to the smallest observed change. Those changes that are statistically significant are shown in bold. Indicators that are unique to this category (i.e., are not also tracked under air emissions or waste management) are shown in italics.

[82] U.S. Department of Labor, Occupational Safety & Health Administration. "Lockout/Tagout Tutorial". Available at http://www.osha.gov/dts/osta/lototraining/tutorial/tu-overvw.html

EXHIBIT 3-8 SUMMARY OF WORKER HEALTH AND SAFETY INDICATORS[83]

INDICATOR	BASELINE %[(a)]	POST-CERTIFICATION INSPECTIONS %[(b)]	OBSERVED PERCENTAGE POINT CHANGE[(c)]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
RHODE ISLAND					
Has the employer established a Personal Protective Equipment Program (PPE)?	***9%***	***63%***	***54***	***yes***	***(36 - 72)***
Has your company developed a Lockout/Tagout Program?	***6%***	***56%***	***50***	***yes***	***(31 - 69)***
Has the employer posted the Job Safety & Health Protection poster?	***42%***	***83%***	***41***	***yes***	***(21 - 61)***
Does your facility use a methylene chloride-based paint stripper? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**67%**	**95%**	**28**	**yes**	**(12 - 44)**
Has the employer established a Respiratory Protection Program?	*33%*	*61%*	*28*	*no*	*N/A*
Has a Hazard Communication (Right-To-Know) Program been established?	*28%*	*46%*	*18*	*no*	*N/A*
Do you control dust emissions from your facility using a specific device?	33%	48%	15	no	N/A
Have all employees who wear respirators had a medical examination specific for respirator use?	*33%*	*46%*	*13*	*no*	*N/A*

[83] For Delaware and Maine, these calculations are based on raw data provided by the states (i.e., the total number of facilities sampled at baseline and post-certification, the number of facilities sampled at each time period for which the answer to the question was "yes," and the total number of facilities in the population). Raw data was drawn from the State Innovation Grant final reports for these two states, available online at http://www.epa.gov/NCEI/stategrants/PDFs/DEautobodyfinalreport.pdf and http://www.epa.gov/NCEI/stategrants/PDFs/Maine2004Final%20Report.pdf. We then used this information to calculate the observed proportion of shops at baseline and post-certification, the observed percentage point change, whether or not this change is significant, and the confidence interval for the difference. We used the ERP Results Analyzer tool to conduct these calculations. The Results Analyzer calculates confidence intervals for the difference between proportions observed in two different rounds of inspections. A version of the Results Analyzer can be accessed at: http://www.epa.gov/erp (however, the authors used an updated version of the results analyzer that had not been posted on line as of the time of writing this report; for the most up-to-date version of the Results Analyzer, contact Scott Bowles, bowles.scott@epa.gov). Calculations for the confidence intervals are based on the following source: Kish, Leslie, 1965. *Survey Sampling*. John Wiley & Sons, Inc. New York, NY. p.41. We use a 90 percent, two-sided significance test and a 90 percent confidence interval in our calculations. In both Maine and Delaware, the number of facilities in both samples was relatively small (59 and 47 facilities, respectively). Smaller sample sizes typically only show significant results when observed changes are fairly large. We believe that 90 percent significance and confidence levels are acceptable in this case. We use the raw data, rather than observed percentages, statistical significance, or confidence intervals reported by the states ensures consistency in the analytic approach. In some cases, rounding leads to an observed percentage point change that is slightly different than the difference between the reported baseline and post-certification inspection percentages.

For Rhode Island, we could not use the ERP Results Analyzer because the state had a stratified random sampling approach (this approach is also statistically valid, but requires more complex analytical techniques). Therefore, for Rhode Island we simply report the values given by the state in the article summarizing their results (Enander et al., "Environmental Health Practice: Statistically Based Performance Measurement," *American Journal of Public Health.)* Note that RI reports a 95 percent confidence interval and a one-sided significance test.

INDICATOR	BASELINE %[a]	POST-CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE[c]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
Do you store solvents, waste paint, sludge, and shop rags/towels saturated with solvent in closed containers?	81%	88%	7	no	N/A
Is your cleaning device totally enclosed during cleaning, rinsing, and draining operations?	83%	88%	5%	no	N/A
Do you use coatings that comply with the emission limitations listed in Rhode Island Air Pollution Control Regulation No. 30, Control of Volatile Organic Compounds from Automobile Refinishing Operations?	100%	100%	0	not tested	N/A
Does your shop use a ventilated sander (dustless vacuum) system?	31%	30%	-1	not tested	N/A
DELAWARE					
Does the shop store absorbent paint applicators (e.g., shop rags/towels) in closed containers?	**53%**	**96%**	**43**	**yes**	**(32 - 53)**
Is all painting carried out in a spray booth to contain paint emissions and over-spray?	81%	87%	6	no	N/A
Does the facility avoid any use of methylene chloride-based paint strippers?	43%	35%	-9	no	N/A
MAINE					
Does the shop utilize low VOC/HAP solvents?	**49%**	**97%**	**47**	**yes**	**(40 - 55)**
Does the shop utilize low VOC/HAP paints and coatings? (lower than the federal standard)	**59%**	**93%**	**34**	**yes**	**(26 - 42)**
Does the shop utilize a dust control system to control dust generated from the sanding process?	**34%**	**47%**	**14**	**yes**	**(4 - 23)**
Does painting and coating take place in areas outside of a spray booth? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**75%**	**85%**	**10**	**yes**	**(2 - 18)**
Does the shop utilize an enclosed spray gun cleaner, solvent recycler, or other spray gun cleaning methods to reduce or eliminate VOC emissions?	54%	61%	7	no	N/A
Does the shop carry out painting and coating in a spray booth to contain paint emissions and over spray?	80%	86%	7	no	N/A
Are solvents, thinners, or other VOC and HAP containing materials stored in closed containers when not in use?	93%	90%	-3%	no	N/A

INDICATOR	BASELINE %[a]	POST-CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE[c]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS

Notes:

(a) Unless otherwise indicated in the table, this column represents the observed proportion of shops in the baseline sample for which the answer to the indicator question is "Yes," which indicates positive environmental performance.

(b) Unless otherwise indicated in the table, this column represents the observed proportion of shops in the post-certification sample for which the answer to the indicator question is "Yes," which indicates positive environmental performance.

(c) All changes are listed as percentage point changes. These changes are calculated by subtracting the observed percentage of shops in the sample following the behavior at baseline prior to ERP from the observed percentage of shops in the sample following the behavior at post-certification. We use percentage point changes, rather than percent changes, to more clearly show the magnitude of change. For example, suppose the observed proportion of shops following a behavior increased from 6 percent at baseline to 12 percent at post certification: this change could be expressed as a 100 percent improvement, or a 6 percentage point improvement. We believe the latter approach is a clearer, more accurate description of changes in performance.

This category of indicators improved substantially overall in the sampled facilities, with the majority of the improvements (and indicators) occurring in Rhode Island and Maine. Of the 22 total indicators in the category, 18 (82 percent) improved; of the six unique indicators (i.e. those that are not also tracked in other categories), all improved. Nine of the total improvements and three of the unique improvements were statistically significant, meaning that we can infer with 90 percent confidence that the entire universe of shops eligible for the ERPs showed improvements for these indicators. Among the statistically significant improvements, the average observed change was 36 percentage points and 48 percentage points for the total indicators and unique indicators respectively. The performance for two indicators declined; however, neither of these declines was statistically significant.

In three areas, multiple states observed improvements to related indicators. Rhode Island and Maine observed improvements related to dust control (statistically significant for Maine and not for Rhode Island); Rhode Island and Delaware observed improvements related to proper storage of solvents, waste paint, sludge, rags/towels, and paint applicators; Delaware and Maine observed improvements related to painting and coating in spray booths. In addition, while Rhode Island observed a 28 percentage point statistically significant improvement in avoiding the use of methylene chloride paint stripper, Delaware observed a nine percentage point increase in paint stripper usage (not statistically significant).

Rhode Island measured changes in shops' management practices and equipment, and observed improvements in both areas. All four of the state's indicators relating to equipment and material changes improved. Of the six indicators relating to management practices that improved, three (50 percent) showed significant improvements. The progress that shops in Rhode Island made in limiting worker exposure in shops may be due, in part, to the fact that Rhode Island DEM partnered with the Rhode Island Department of Health in designing and implementing the program. From DEM's perspective, the fact that the Department of Health performed inspections, led workshops, and was an active participant in the program made a substantial contribution to improved facility performance.

Maine and Delaware did not measure changes in management practices; however, they did measure changes in the percentages of shops using equipment that reduces worker exposure. Delaware observed a 43 percentage point improvement in the percent of shops that store absorbent paint applicators in closed containers, a change that was statistically significant. Maine observed a three percentage point decline in the percent of shops that properly store solvents, thinners, or other VOC containing materials, although this change was not statistically significant. Maine observed improvement in the remaining six indicators regarding safer equipment, and four of these were statistically significant.

Aside from changes in performance, the ERP data demonstrates the overall level of performance at post-certification. The indicators where a state observed at least 95 percent of the shops sampled following preferred behavior include:

- Use of coatings that comply with specific regulatory emission limitations;
- Use of low VOC/HAP solvents;

- Proper storage of absorbent paint applicators; and
- Avoiding use of methylene chloride-based paint strippers.

Conversely, the behaviors where at least one state observed relatively poor performance (less than 40 percent of shops following preferred behavior) include:

- Use of a ventilated sander (dustless vacuum) system
- Avoiding use of methylene chloride-based paint strippers

Notably, one of these indicators (avoiding use of methylene chloride-based paint strippers), is an area of high performance in one state and poor performance in another. As in the air emissions and waste management categories, these variations in performance may be due to external factors, e.g., the history of each state in terms of prior outreach to auto body shops, rather than differences in the influence of the ERP itself in affecting shop behavior.

POLLUTION PREVENTION

Summary of the Problem

This category generally encompasses all of the ways in which auto body shops can reduce the amount of pollution they produce at their shops. Pollution prevention here refers to reducing or eliminating waste at the source of its production by modifying production processes, promoting the use of non-toxic or less-toxic substances, implementing conservation techniques, and re-using materials rather than putting them into a waste stream.[84] Specifically, pollution prevention includes raw material substitution, improved operating practices, process and equipment modifications, and energy and water conservation. Note that the indicators tracked in this section are also presented in the other media categories (e.g., air emissions, water discharges, etc.), however we repeat them here to highlight the extent to which ERPs have measured changes in behavior with prevent pollution at the source, which results in less extraction and use of resources, as well as less waste.

Overview of Relevant Behavior Changes

In auto body shops, pollution prevention practices generally involve product changes, good operating practices, or technology changes.[85]

- *Product Changes* – Material substitution is a way for shops to replace a more harmful product for a safer one. This ensures that the waste generated by those materials is potentially less harmful and that the negative effects of the products are lessened. For example:
  - Replace solvent-based cleaners with water-based or low VOC materials;
  - Use high-solids, low VOC coatings;

[84] U.S. EPA's Pollution Prevention Website – General Information. http://www.epa.gov/p2/

[85] Rhode Island Department of Environmental Management – Office of Technical & Customer Assistance, Small Business Assistance Program. Factsheet: Pollution Prevention in the Autobody Shop. http://www.dem.ri.gov/programs/benviron/assist/pdf/general.pdf

- Eliminate the use of solvents to clean hands and other skin surfaces;
- Use cadmium-free solder and resistant spot welding and/or metal adhesives in place of conventional welding practices;
- Use abrasive blasting techniques in place of methylene-chloride strippers;
- Use disposable masking as an alternative to solvent cleaning; and
- Use paintless dent removal as a replacement for conventional refinishing.[86,87]

- *Good Operating Practices* – Good operating practices focus on containing or controlling the source(s) that produce the pollution. These practices often create cost-saving opportunities for shops as well. For example:
  - Keep solvent containers closed when not in use;
  - Protect raw materials from damage, contamination or exposure to the elements;
  - Supervising and controlling the dispensing of raw materials;
  - Recycle solvents;[88] and
  - Efficiently mix paint to reduce the amount of paint needed for each job and the labor, materials, and disposal costs required.[89]
- *Technology Changes* – While technology changes can require significant investment from auto body shops, they can substantially reduce the amount of pollution generated in the shop. For example:
  - High Volume Low Pressure (HVLP) spray guns result in a 30% or more reduction in coating usage, a reduction in paint overspray resulting in cleanup cost savings and decreased frequency of spray booth filter changes, and improved ability to apply thick or high-solid coatings as compared to conventional high-pressure siphon guns.
  - Enclosed spray gun cleaners reduce solvent losses to the environment by containing solvent vapors. They also recirculate solvent so that less fresh solvent is needed.[90]

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[86] Rhode Island Department of Environmental Management – Office of Technical & Customer Assistance, Small Business Assistance Program. Factsheet: Pollution Prevention in the Autobody Shop. http://www.dem.ri.gov/programs/benviron/assist/pdf/general.pdf

[87] Enander, Richard T., Gute, David M., and Missaghian, Richard. "Survey of Risk Reduction and Pollution Prevention Practices in the Rhode Island Automotive Refinishing Industry." *American Industrial Hygiene Association Journal*. Vol. 59, 1998, pp. 478-489.

[88] Rhode Island Department of Environmental Management – Office of Technical & Customer Assistance, Small Business Assistance Program. Factsheet: Pollution Prevention in the Autobody Shop. http://www.dem.ri.gov/programs/benviron/assist/pdf/general.pdf

[89] Pollution Prevention in Auto Body Shops and Paint Shops, "Minimizing Paint Waste", CA Department of Toxic Substances Control, September 2006. Available at: http://www.dtsc.ca.gov/PollutionPrevention/ABP/upload/TD_FS_PaintWasteMin.pdf

[90] Enander, Richard T., Gute, David M., and Missaghian, Richard. "Survey of Risk Reduction and Pollution Prevention Practices in the Rhode Island Automotive Refinishing Industry." *American Industrial Hygiene Association Journal*. Vol. 59, 1998, pp. 478-489.

- Spray booths reduce the amount of overspray, resulting in less paint needed, which also cuts down on VOC emissions and the amount of solvent needed for cleanup.[91]

Summary of ERP Outcomes

The primary expected long-term outcome of pollution prevention activities in auto body shops is the reduction in material usage of paints and solvents. If shops use alternative materials, practice good housekeeping techniques, and make the shift to better technology, they should use fewer materials and produce less waste.

Exhibit 3-9 shows the specific indicators tracked, along with the observed percentage of facilities in the sample following each practice at baseline and post-certification, and the difference in percentages between these two measurements (i.e., the observed percentage point change). The exhibit then shows whether each observed change in behavior is statistically significant at a 90 percent confidence level. For each change that is statistically significant, it presents the confidence interval for the difference (i.e., range within which we can be 90 percent confident the true percentage point change for the entire population of facilities will fall). Findings are listed by state, and ordered from the greatest observed change to the smallest observed change. Those changes that are statistically significant are shown in bold.

States observed improvements in the sampled facilities in the majority of indicators tracked for this category. Of the 11 pollution prevention indicators, 8 (73 percent) improved, and all three of the indicators that did not improve had a baseline performance level of 100 percent, so had no room for improvement. Four of the improvements were statistically significant, meaning that we can infer with 90 percent confidence that the total universe of shops eligible for the ERPs showed improvements for these indicators. Among the statistically significant improvements, the average observed change was 19 percentage points. Of the three indicators that had a baseline performance level of 100 percent, two declined slightly, but neither of these declines was statistically significant.

[91] Pollution Prevention in Auto Body Shops and Paint Shops, "Minimizing Paint Waste", CA Department of Toxic Substances Control, September 2006. Available at: http://www.dtsc.ca.gov/PollutionPrevention/ABP/upload/TD_FS_PaintWasteMin.pdf

EXHIBIT 3-9 SUMMARY OF POLLUTION PREVENTION INDICATORS[92]

INDICATOR	BASELINE %[(a)]	POST-CERTIFICATION INSPECTIONS %[(b)]	OBSERVED PERCENTAGE POINT CHANGE[(c)]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
DELAWARE					
Does the shop employ a training program in the proper use and handling of coatings, solvents and waste products to minimize air emissions?	**47%**	**91%**	**45**	**yes**	**(33 - 56)**
Does the shop clean the spray guns using only methods that comply with Delaware Regulations?	**89%**	**100%**	**11**	**yes**	**(5 - 17)**
Do the painters and technicians use only painting techniques that comply with Delaware Regulations?	**89%**	**98%**	**9**	**yes**	**(2 - 15)**
Is all painting carried out in a spray booth to contain paint emissions and over-spray?	81%	87%	6	no	N/A
MAINE					
Does painting and coating take place in areas outside of a spray booth? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**75%**	**85%**	**10**	**yes**	**(2 - 18)**
Does the shop carry out painting and coating in a spray booth to contain paint emissions and over spray?	80%	86%	7	no	N/A

[92] For Delaware and Maine, these calculations are based on raw data provided by the states (i.e., the total number of facilities sampled at baseline and post-certification, the number of facilities sampled at each time period for which the answer to the question was "yes," and the total number of facilities in the population). Raw data was drawn from the State Innovation Grant final reports for these two states, available online at http://www.epa.gov/NCEI/stategrants/PDFs/DEautobodyfinalreport.pdf and http://www.epa.gov/NCEI/stategrants/PDFs/Maine2004Final%20Report.pdf. We then used this information to calculate the observed proportion of shops at baseline and post-certification, the observed percentage point change, whether or not this change is significant, and the confidence interval for the difference. We used the ERP Results Analyzer tool to conduct these calculations. The Results Analyzer calculates confidence intervals for the difference between proportions observed in two different rounds of inspections. A version of the Results Analyzer can be accessed at: http://www.epa.gov/erp (however, the authors used an updated version of the results analyzer that had not been posted on line as of the time of writing this report; for the most up-to-date version of the Results Analyzer, contact Scott Bowles, bowles.scott@epa.gov). Calculations for the confidence intervals are based on the following source: Kish, Leslie, 1965. *Survey Sampling*. John Wiley & Sons, Inc. New York, NY. p.41 We use a 90 percent, two-sided significance test and a 90 percent confidence interval in our calculations. In both Maine and Delaware, the number of facilities in both samples was relatively small (59 and 47 facilities, respectively). Smaller sample sizes typically only show significant results when observed changes are fairly large. We believe that 90 percent significance and confidence levels are acceptable in this case. We use the raw data, rather than observed percentages, statistical significance, or confidence intervals reported by the states to ensure consistency in the analytic approach. In some cases, rounding leads to an observed percentage point change that is slightly different than the difference between the reported baseline and post-certification inspection percentages.

For Rhode Island, we could not use the ERP Results Analyzer because the state had a stratified random sampling approach (this approach is also statistically valid, but requires more complex analytical techniques). Therefore, for Rhode Island we simply report the values given by the state in the article summarizing their results (Enander et al., "Environmental Health Practice: Statistically Based Performance Measurement," *American Journal of Public Health.)* Note that RI reports a 95 percent confidence interval and a one-sided significance test.

INDICATOR	BASELINE %[a]	POST-CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE[c]	SIGNIFICANT?	CONFIDENCE INTERVAL FOR THE DIFFERENCE IN PERCENTAGE POINTS
Does the shop utilize an enclosed spray gun cleaner, solvent recycler, or other spray gun cleaning methods to reduce or eliminate VOC emissions?	54%	61%	7	no	N/A
Does the shop train all employees in the proper use and handling of paints and coatings according to the manufacturers' recommendations to minimize air pollution?	100%	97%	-3	no	N/A
Does the shop employ a training program in the proper use and handling of solvents and waste products to minimize air emissions?	100%	97%	-3	no	N/A
RHODE ISLAND					
Is your cleaning device totally enclosed during cleaning, rinsing, and draining operations?	83%	88%	5	no	N/A
Do your painters and technicians use spray guns that have a transfer efficiency of at least 65% such as High Volume Low Pressure (HVLP) spray equipment?	100%	100%	0	not tested	N/A

Notes:

(a) Unless otherwise indicated in the table, this column represents the observed proportion of shops in the baseline sample for which the answer to the indicator question is "Yes," which indicates positive environmental performance.

(b) Unless otherwise indicated in the table, this column represents the observed proportion of shops in the post-certification sample for which the answer to the indicator question is "Yes," which indicates positive environmental performance.

(c) All changes are listed as percentage point changes. These changes are calculated by subtracting the observed percentage of shops in the sample following the behavior at baseline prior to ERP from the observed percentage of shops in the sample following the behavior at post-certification. We use percentage point changes, rather than percent changes, to more clearly show the magnitude of change. For example, suppose the observed proportion of shops following a behavior increased from 6 percent at baseline to 12 percent at post certification: this change could be expressed as a 100 percent improvement, or a 6 percentage point improvement. We believe the latter approach is a clearer, more accurate description of changes in performance.

Most of the related behavior changes in this category relate to technological changes. Specifically,

- *HVLP guns* – Delaware saw a statistically significant 9 percentage point improvement in the proportion of shops that use high transfer efficiency spray guns, such as HVLP guns. Rhode Island's shops all used high transfer efficiency spray guns at both the baseline and post-certification inspections.
- *Enclosed spray gun cleaners* – All three states saw an improvement in the percentage of shops that use enclosed spray gun cleaners. Delaware observed a statistically significant 11 percentage point increase, while Maine and Rhode Island only had 7 and 5 percentage point improvements, respectively, neither of which was statistically significant.
- *Spray booths* – Maine observed a 10 percentage point improvement in the proportion of shops that carry out all painting in spray booths (this was statistically significant), while Delaware observed a 6 percentage point improvement that was not statistically significant.

Using the DfE tool, we are able to consider observed behavior changes that are statistically significant and model them in the DfE tool to extrapolate materials reductions from facilities in the sample to facilities across the state. There is one indicator for which we can use the DfE tool to estimate the reductions in materials use: switching to automatic spray gun cleaning in Delaware. We are 90 percent confident that the percentage point increase in the percent of shops cleaning spray guns only with methods that comply with Delaware regulations is between 5 and 17 percentage points. We expect that material usage associated with auto body shop spray gun cleaning operations declined by between 1,224lbs/year and 3,978 lbs/year for all shops in Delaware. Please see Appendix A for a full description of the calculations used for this estimate.

In addition, Delaware observed a statistically significant 45 percentage point improvement related to employee training in the proper use and handling of coatings, solvents, and waste products. Maine observed 3 percentage point declines for two indicators related to employee training, although both declines were not significant.

Aside from changes in performance, the ERP data shows the overall level of performance at post-certification. The indicators where a state observed at least 95 percent of the shops sampled following preferred behavior include:

- Use of HVLP spray guns
- Use of spray gun cleaning methods that comply with state regulations
- Use of painting techniques that comply with state regulations
- Employee training related to proper use and handling of paints and coatings
- Employee training related to proper use and handling of solvents and waste products

No behaviors existed for pollution prevention where states observed relatively poor performance (less than 40 percent of shops following preferred behavior).

DISCUSSION OF RESULTS FROM A SECOND CYCLE OF ERP

All of the results discussed to this point reflect a single cycle of ERP (i.e., changes in behavior between baseline and post-Round 1 certification inspections, and associated environmental/health benefits). For two of the ERPs addressed in this evaluation (Delaware and Maine), no further data on the results of ERP are available. However, in Rhode Island, the state has continued to implement ERP for a second cycle, and has provided results from post-Round 2 certification inspections. These results provide potential insights into the effects of ERP over time, if the program is continued. Note that the second cycle of ERP in Rhode Island involved much more limited outreach than the first cycle, as discussed in the next section of this chapter (ERP Effectiveness and Costs). Therefore, the second-cycle results of Rhode Island's ERP may be best understood as representing the impacts of an ERP in "maintenance" mode, where the state is not continuing to provide extensive outreach, but is rather using additional rounds of facility certification to remind facilities of their obligations and encourage incremental improvements.

Exhibit 3-10 shows the observed proportion of facilities in the sample meeting each indicator at baseline, post-Round 1 certification inspections, and post-Round 2 certification inspections, as well as the incremental percentage point changes across each cycle. Changes that are statistically significant between baseline and post-Round 1 certification are shown in bold. Indicators are organized within each category by descending order of observed percentage point change (Baseline to Post-Round 1).

Exhibit 3-11 shows the cumulative changes in performance between baseline and post-Round 2 certification inspections. This type of cumulative performance is consistent with how ERP states are expected to report their results over time.[93] Changes that are statistically significant between baseline and post-Round 2 certification are shown in bold. Indicators are organized within each category by descending order of cumulative observed percentage point change (Baseline to Post Round 2).

[93] These expectations are formalized in a document prepared by the States ERP Consortium, with support from EPA, entitled The States ERP Consortium Guide to Reporting ERP Results. For more information on the States ERP Consortium, see www.erpstates.org. Last accessed August 3, 2009.

EXHIBIT 3-10 INCREMENTAL RESULTS FROM FIRST AND SECOND CYCLES OF RHODE ISLAND ERP

INDICATOR	BASELINE %[a]	POST- ROUND 1 CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE (Baseline to Post-Round 1)	POST-ROUND 2 CERTIFICATION INSPECTIONS %[b]	INCREMENTAL OBSERVED PERCENTAGE POINT CHANGE (Post-Round 1 to Post Round 2)
WASTE					
Do you have appropriate documentation which shows where hazardous waste is being shipped?	**56%**	**89%**	**33**	92%	3
Is the area (satellite accumulation area) clearly marked and the containers labeled with: (1) the words "Hazardous Waste", (2) Name of the waste and its waste code?, (3) the hazard classification?, and (4) the date that they were placed in the storage area?	21%	39%	18	87%	48
Is the area (hazardous waste storage area) inspected weekly for signs of spills or container deterioration?	6%	22%	16	DNC	DNC
Does your shop have a written contingency plan designed to help your shop reduce hazards associated with the possibility of an explosion, fire, or unplanned/accidental release of hazardous materials?	6%	22%	16	DNC	DNC
Does your shop have an employee training program that teaches them proper hazardous waste management procedures, including how to implement the contingency plan?	6%	22%	16	DNC	DNC
Has your shop submitted to DEM a list of authorized agents that are allowed to sign the manifest (hazardous waste manifest)?	28%	44%	16	DNC	DNC
What is your facility's hazardous waste identification number?	88%	86%	-2	100%	14
Does your hazardous waste storage area meet the criteria for secondary containment (i.e. spill/leak containment capability)?	63%	56%	-7	DNC	DNC

INDICATOR	BASELINE %[a]	POST- ROUND 1 CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE (Baseline to Post-Round 1)	POST-ROUND 2 CERTIFICATION INSPECTIONS %[b]	INCREMENTAL OBSERVED PERCENTAGE POINT CHANGE (Post-Round 1 to Post Round 2)
AIR					
Does your facility use a methylene chloride-based paint stripper? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**67%**	**95%**	**28**	89%	-6
Do you control dust emissions from your facility using a specific device?	33%	48%	15	84%	36
Do you store solvents, waste paint, sludge, and shop rags/towels saturated with solvent in closed containers?	81%	88%	7	92%	4
Is your cleaning device totally enclosed during cleaning, rinsing, and draining operations?	83%	88%	5	89%	1
Do you use coatings that comply with the emission limitations listed in Rhode Island Air Pollution Control Regulation No. 30, Control of Volatile Organic Compounds from Automobile Refinishing Operations?	100%	100%	0	100%	0
Do your painters and technicians use spray guns that have a transfer efficiency of at least 65% such as High Volume Low Pressure (HVLP) spray equipment?	100%	100%	0	100%	0
Does your shop use a ventilated sander (dustless vacuum) system?	31%	30%	-1	53%	23
WATER					
Does your shop post signs prohibiting the discharge of industrial chemicals and/or wastewater to bathroom/kitchen sinks, toilets, showers, shop wash basins, emergency showers, eyewash stations, or other non-industrial drainage outlets?	**0%**	**48%**	**48**	55%	7

INDICATOR	BASELINE %[a]	POST- ROUND 1 CERTIFICATION INSPECTIONS %[b]	OBSERVED PERCENTAGE POINT CHANGE (Baseline to Post-Round 1)	POST-ROUND 2 CERTIFICATION INSPECTIONS %[b]	INCREMENTAL OBSERVED PERCENTAGE POINT CHANGE (Post-Round 1 to Post Round 2)
Does you shop allow process wastewater (i.e., from wet sanding, car washing, work area washing) to run off your site to storm drains or other areas (i.e., water runs down the street, water runs off to soil or sand area, water just puddles up and evaporates)? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**37%**	**74%**	**37**	84%	10
Does your shop contain open floor drains that are not currently in use? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	67%	69%	2	87%	18
WORKER HEALTH AND SAFETY					
Has the employer established a Personal Protective Equipment Program (PPE)?	**9%**	**63%**	**54**	77%	14
Has your company developed a Lockout/Tagout Program?	**6%**	**56%**	**50**	56%	0
Has the employer posted the Job Safety & Health Protection poster?	**42%**	**83%**	**41**	83%	0
Has the employer established a Respiratory Protection Program?	33%	61%	28	71%	10
Has a Hazard Communication (Right-To-Know) Program been established?	28%	46%	18	77%	31
Have all employees who wear respirators had a medical examination specific for respirator use?	33%	46%	13	44%	-2

INDICATOR	BASELINE %[(a)]	POST- ROUND 1 CERTIFICATION INSPECTIONS %[(b)]	OBSERVED PERCENTAGE POINT CHANGE (Baseline to Post-Round 1)	POST-ROUND 2 CERTIFICATION INSPECTIONS %[(b)]	INCREMENTAL OBSERVED PERCENTAGE POINT CHANGE (Post-Round 1 to Post Round 2)

Notes:

Baseline Total Sample Size = 40

Post-Round 1 Sample Size = 44. Rhode Island randomly inspected 42 facilities in at this time, but included 2 additional facilities in their calculations based on corrective action statements acknowledging regulatory deficiencies that were assumed to be accurate indicators of nonperformance for statistical analysis purposes.

Post-Round 2 = 38

(a) Proportion of sample facilities following indicators at baseline.

(b) Proportion of sample facilities following indicators at post-certification.

"DNC" (Did Not Collect) means post-certification data was not collected for the indicator at the Post-Round 2 sample.

Changes that are statistically significant between baseline and post-Round 1 certification are shown in bold across the row.

EXHIBIT 3-11 CUMULATIVE RESULTS FROM FIRST AND SECOND CYCLES OF RHODE ISLAND ERP

INDICATOR	BASELINE %[a]	POST- ROUND 2 CERTIFICATION INSPECTIONS %[b]	CUMULATIVE OBSERVED PERCENTAGE POINT CHANGE (Baseline to Post Round 2)	SIGNIFICANT?
WASTE				
Is the area (satellite accumulation area) clearly marked and the containers labeled with: (1) the words "Hazardous Waste", (2) Name of the waste and its waste code?, (3) the hazard classification?, and (4) the date that they were placed in the storage area?	**21%**	**87%**	**66**	**yes**
Do you have appropriate documentation which shows where hazardous waste is being shipped?	**56%**	**92%**	**36**	**yes**
Has your shop submitted to DEM a list of authorized agents that are allowed to sign the manifest (hazardous waste manifest)?	28%	DNC	DNC	no
Is the area (hazardous waste storage area) inspected weekly for signs of spills or container deterioration?	6%	DNC	DNC	no
Does your shop have a written contingency plan designed to help your shop reduce hazards associated with the possibility of an explosion, fire, or unplanned/accidental release of hazardous materials?	6%	DNC	DNC	no
Does your shop have an employee training program that teaches them proper hazardous waste management procedures, including how to implement the contingency plan?	6%	DNC	DNC	no
Does your hazardous waste storage area meet the criteria for secondary containment (i.e. spill/leak containment capability)?	63%	DNC	DNC	no
What is your facility's hazardous waste identification number?	88%	100%	12	no

INDICATOR	BASELINE %[a]	POST- ROUND 2 CERTIFICATION INSPECTIONS %[b]	CUMULATIVE OBSERVED PERCENTAGE POINT CHANGE (Baseline to Post Round 2)	SIGNIFICANT?
AIR				
Do you control dust emissions from your facility using a specific device?	**33%**	**84%**	**51**	**yes**
Does your shop use a ventilated sander (dustless vacuum) system?	31%	53%	22	no
Does your facility use a methylene chloride-based paint stripper? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	67%	89%	22	no
Do you store solvents, waste paint, sludge, and shop rags/towels saturated with solvent in closed containers?	81%	92%	11	no
Is your cleaning device totally enclosed during cleaning, rinsing, and draining operations?	83%	89%	6	no
Do you use coatings that comply with the emission limitations listed in Rhode Island Air Pollution Control Regulation No. 30, Control of Volatile Organic Compounds from Automobile Refinishing Operations?	100%	100%	0	not tested
Do your painters and technicians use spray guns that have a transfer efficiency of at least 65% such as High Volume Low Pressure (HVLP) spray equipment?	100%	100%	0	not tested
WATER				
Does your shop post signs prohibiting the discharge of industrial chemicals and/or wastewater to bathroom/kitchen sinks, toilets, showers, shop wash basins, emergency showers, eyewash stations, or other non-industrial drainage outlets?	**0%**	**55%**	**55**	**yes**

INDICATOR	BASELINE %[a]	POST- ROUND 2 CERTIFICATION INSPECTIONS %[b]	CUMULATIVE OBSERVED PERCENTAGE POINT CHANGE (Baseline to Post Round 2)	SIGNIFICANT?
Does your shop allow process wastewater (i.e., from wet sanding, car washing, work area washing) to run off your site to storm drains or other areas (i.e., water runs down the street, water runs off to soil or sand area, water just puddles up and evaporates)? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	**37%**	**84%**	**47**	**yes**
Does your shop contain open floor drains that are not currently in use? (Note, since this indicator measures a condition that the state wants shops to discontinue, the percentages shown here reflect the number of shops not performing this practice.)	67%	87%	20	no
WORKER HEALTH AND SAFETY				
Has the employer established a Personal Protective Equipment Program?	**9%**	**77%**	**68**	**yes**
Has your company developed a Lockout/Tagout Program?	**6%**	**56%**	**50**	**yes**
Has a Hazard Communication Program been established?	**28%**	**77%**	**49**	**yes**
Has the employer posted the Job Safety & Health Protection poster?	**42%**	**83%**	**41**	**yes**
Has the employer established a Respiratory Protection Program?	**33%**	**71%**	**38**	**yes**
Have all employees who wear respirators had a medical examination specific for respirator use?	33%	44%	11	no

Notes:

(a) Proportion of sample facilities following indicators at baseline

(b) Proportion of sample facilities following indicators at post-certification.

"DNC" (Did Not Collect) means post-certification data was not collected for the indicator in Round Two.

Changes that are statistically significant between baseline and post-Round 2 certification are shown in bold across the row.

As shown in Exhibit 3-10, between the baseline and post-Round 1 certification inspections, Rhode Island observed seven statistically significant improvements out of the 24 indicators measured (29 percent): one related to waste, one related to air emissions, two related to water discharges, and three related to worker health and safety. Of these, the greatest percentage point improvements were related to worker health and safety, where for two indicators (establishing a Personal Protective Equipment Program and a Lockout/Tagout program), the observed proportion of shops with these programs in place increased by at least 50 percentage points.

In the second cycle of ERP (comparing post-Round 1 certification inspections to post-Round 2 certification inspections), one large change was observed (the proportion of facilities following container labeling guidelines increased by 48 percentage points), and several smaller but still substantial changes were also observed (for example, the proportion of facilities controlling dust with a specific device increased by 36 percentage points, and the proportion of facilities with a Hazard Communication Program increased by 31 percentage points). Note that in two instances, observed performance declined after the first cycle. For example, in the air emissions category, the observed proportion of shops not using methylene chloride paint stripper increased from 67 to 95 percent over the first cycle of ERP, but then declined to 89 percent after the second cycle of ERP.

Overall, including all results (those that were and were not statistically significant), the initial average observed percentage point change between the baseline and post-Round 1 certification inspections was 19 percentage points. In comparison, the incremental average observed percentage point change between post-Round 1 certification inspections and post-Round 2 certification inspections was 11 percentage points. This would suggest that in Rhode Island, the state observed substantial gains in each cycle of ERP, but that rate of improvements was smaller in the second cycle of ERP compared to the first.

Exhibit 3-11 shows that when the cumulative effect of the two cycles of ERP is measured (by comparing baseline to post-Round 2 certification inspections), the state found 10 of 24 indicators (42 percent) with statistically significant improvements. Five of these were in the worker health and safety category, two each in the waste and water categories, and one in the air category. These include all of the same indicators that showed statistically significant improvements after the first cycle of ERP except one air indicator (methylene chloride usage); plus four additional indicators that are only statistically significant when comparing across the two cycles of ERP.

Note that Rhode Island did not collect data for all indicators across both cycles of ERP; five indicators in the waste category were measured at baseline and after the first cycle of ERP, but not after the second cycle.

III. ERP EFFECTIVENESS AND COSTS

As described in the previous section, each of the three states reviewed achieved quantifiable, statistically significant improvements for some indicators related to intermediate outcomes/behavior changes, and in some cases we can assess the types of likely long-term outcomes associated with these improvements. This section takes a broader view of program effectiveness, as defined by the states themselves and program participants. Key aspects of program effectiveness typically addressed by states include participation in the voluntary self-certification component of ERP, increased awareness of compliance obligations among auto body shops, observed changes in behavior at the shops, improved relationships, and sharing of information between regulators and the auto body sectors.

While each state views its ERP as successful, these results must be balanced with the program's costs. This section provides a description of resources each state invested in developing and implementing the ERP, as well as an indication of the extent of resources that auto body shops spent participating in the ERP.

It is important to note that each state interviewed weighed the costs and benefits of conducting an ERP differently, since each state had its own alternative scenario about what it would have done in the absence of ERP.

DELAWARE

Program Effectiveness

DNREC was able to achieve a 68 percent participation rate in its ERP (i.e., 103 out of 152 eligible auto body shops volunteered to participate in self-certification).[94] The program helped shops gain a better understanding of their regulations, which in turn increased compliance. According to Delaware, the ERP generated more results because shops now took the time to make sure that they understood what they needed to do to be in compliance. Before ERP, shops got their permit applications in the mail and they may not have even read them because they were not familiar with the regulations.

As a result of increased awareness, one of the shops interviewed as part of this evaluation started a recycling program for fluorescent tubes, addressed air permits for spray booths, plugged floor drains, and labeled containers for hazardous rags. It is also currently attempting to transition to waterborne paints. These sorts of improvements can lead to positive environmental outcomes, especially when they occur throughout a sector.

The self-certification program improved the relationship between regulators and shops. The shops interviewed for this evaluation were very complimentary of how the DNREC sought to help them come into compliance and make improvements, as opposed to penalizing them for not being in compliance; the shops saw the regulators as being on their side. Additionally, the shops gained contacts they could go to with questions during and after the ERP. From the regulators' perspective, DNREC achieved improved

[94] Throughout this section, "participation rate" refers to the percentage of facilities that volunteered to participate in the self-certification component of the ERP. It is calculated by taking the number of facilities that completed self-certification forms divided by the total number of eligible auto body shops in the state. It does not include shops that, for example, attended a workshop but did not complete a self-certification form.

relationships and a better understanding of the universe of auto body shops through ERP. Less directly, the permitting staff who wrote the source category permit became more sensitive to the needs of small businesses as a result of collaborating with ERP, and the Department's air office – which did not participate in ERP – gained improved relationships with auto body shops as well.

There were some suggestions for improvement. Specifically, one of the shops interviewed for this evaluation felt the record-keeping aspect of ERP was time-consuming and inefficient. Furthermore, this respondent felt ERP could be improved by offering more workshops and providing even more information, in order to share best practices and cost saving ideas and keep shops abreast of changes and developments in the sector.

Program Costs

The EPA State Innovation Grant for Delaware's ERP totaled $116,500, with DNREC contributing an additional $10,376 in state funding.[95,96] These costs include $95,000 in consultant costs, which covered a range of tasks related to ERP development (e.g., identification of an initial facility universe; and developing the workbook, self-certification forms, return to compliance forms, inspector checklists, and a database). On top of consultant costs and internal staff hours, there was an additional $10,000 spent on things like supplies, printing, postage, workshop materials, and workshop locations.

In addition to the direct costs, DNREC dedicated staff resources. A total of 23 staff members from various offices participated in the program at different times, investing approximately 330 days overall over 2.5 years, which is approximately equivalent to one half of an FTE working over this period.[97,98] A total of 75 staff days were spent on the Design and Development phase; 220 staff days were spent on the Initial Implementation phase; 32 staff days were spent on Program Follow-Up/Ongoing Support (see Appendix D for a detailed breakdown of DNREC's investment of staff time). The $10,376 contributed by the state covered a portion of these staff costs, not the entire amount.[99]

Delaware was surprised by the amount of time required to support auto body shops participating in ERP once the materials had been sent out. Despite the state's best efforts to provide everything the shops needed to understand how to improve their practices, DNREC's outreach still prompted many phone calls, requests for in-person assistance, and interest in pollution prevention assistance. When returning their self-certification forms, if shops did not know an answer to one of the questions, they would often leave it blank, which required follow up from DNREC.

Overall, Delaware found that implementing the self-certification program in tandem with the source category permit required significantly more resources than the permit would

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[95] "Final Report: EPA 2002 State Innovation Pilot Grant Program", Delaware Department of Natural Resources and Environmental Control.
[96] Note that the remaining information in this section is drawn from our interview with Delaware state program staff and additional information sent by the state.
[97] This length of time of the project is based on the duration of the State Innovation Grant, which provided significant funding for the project.
98 The FTE calculation is based on 52 weeks per year, five days per week, which is equal to 650 days. The 330 days divided by 650 days is 51 percent.
[99] The state was unable to give an estimated dollar value these additional staff costs. Therefore, our cost estimates are underestimating the total costs of the program to the state.

have required on its own. However, the permitting process was more efficient and effective because it was implemented in conjunction with ERP.

Auto body shops also had to invest staff resources to participate in the program. The two shops interviewed as part of this evaluation spent time attending compliance assistance workshops (one shop spent two days and the other spent two hours), reading compliance assistance materials (one shop spent one day and the other spent four hours), completing self-certification forms (one shop spent five days and the other spent four hours), and completing return to compliance documents (one shop spent four hours and the other spent two hours). One of the interviewees, a training shop at a vocational high-school, also implemented yearly ERP-related training for ninth graders in their program as a result of their participation.

That said, both shops realized cost savings as a result of changes made during their involvement in ERP. One obtained savings by decreasing waste and becoming generally more efficient, the other through changes in materials and equipment. Both shops felt that the program was designed to be sensitive to their operations and cost structures.

MAINE

Program Effectiveness

DEP was able to achieve a 42 percent participation rate in its ERP (i.e., 42 out of a universe of 100 eligible auto body shops participated in self-certification[100]). Among the shops that self-certified, 81 percent self-identified as being out of compliance with one or more requirements. This sort of increased awareness is an important short-term program outcome that can lead to changed behaviors and ultimately reduced environmental impacts. From the state's perspective, these participation and self-identification rates made the program a success. Maine had a very positive experience with the auto body ERP, and believes that ERP is one of the best programs which has been administered and supported by EPA.

Maine notes that program participants report that the ERP led to compliance improvements in areas such as air quality and hazardous and universal waste. Specific improvements included increased shop-licenses, raised awareness about compact fluorescent light bulbs, increased conscientiousness about covering solvent containers, and many updated air filtration systems. The auto body shop representative interviewed for this evaluation owns three participating shops. This shop owner reports that the major change in his shops occurred in terms of awareness:

> [Participating in ERP] heightened our awareness of what we do. We already had things like state of the art spray booth technology in place; the ERP brought issues like hygiene to the forefront of our thoughts. We now make sure best-

[100] According to the Maine DEP's final State Innovation Grant Report, "The selected universe for this project included 104 auto body facilities within the 3 targeted counties during the baseline surveys. [Four] auto body facilities went out of business prior to the post-certification surveys. [Therefore,] the universe for the post-certification surveys included 100 facilities."

> practices are in place. A lot of these practices were in place to begin with – the ERP made us think about and confirm these things.

In addition, as a result of ERP participation, his shops became involved in an additional program called the Governor's Carbon Challenge.

This shop owner also notes that ERP's influence goes beyond participating shops:

> …whenever you focus on an industry – like the auto body industry – that word spreads. Even the folks who don't participate or attend are making adjustments as well. Nothing but good comes out of an ERP like this, both directly and indirectly.
>
> In this case, a message from the DEP rang out. It basically gave shops a heads up to get in compliance, saying that down the road if you're not in compliance you will be penalized.

The ERP provided an opportunity for regulators as well as auto body shops to learn. Increased communication between the industry and DEP led to a better understanding on the part of regulators as to which requirements were feasible in the field. The shop owner interviewed believes that ERP was sensitive to his shops' operations and cost-structures. In one instance, DEP representatives made a site-visit to one of his facilities and became aware that a program requirement was impractical in the field; in turn, program staff modified what they were asking in this regard.

Lastly, ERP improved the relationship between regulators and the auto body industry. The DEP connected with both trade associations and individual shops. From one shop owner's perspective, the DEP appeared intent on helping and improving compliance, and was not heavy-handed.

Program Costs

Total program costs for the Maine ERP included an expenditure of approximately $200,000. This included an EPA contribution of a $152,000 State Innovation Grant used for a range of program expenses, including $20,100 in contractor support. The DEP contributed an additional $47,000 in matching funds.[101]

The DEP invested substantial internal staff resources in the ERP.[102] The design and development phase required two Full Time Equivalents (FTEs) for the period of six months; the initial implementation phase also required two FTEs for six months; and program follow-up/ongoing support required one and a half FTEs for two years. Most of these staff time resources were supported by the State Innovation Grant mentioned above.

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[101] "Auto Body Environmental Results Program: Final Report". Maine Department of Environmental Protection, Office of Innovation, May 7, 2007.

[102] The majority of the state staff costs were covered by the State Innovation Grant and the DEP contributions. However, some additional staff costs were incurred during the program that are not included in this value. Therefore, our cost estimates are underestimating the total costs of the program to the state.

The auto body ERP was the first such program developed by Maine, and therefore it required more resources to implement than the projected costs for subsequent ERPs. Initial costs for the auto body ERP were high, but they tapered off over time as the staff member working on the program required less assistance and became more independent. EPA financial support – in the form of an SIG – allowed Maine to implement the program.

Maine believes that the ERP required fewer resources than outreach alone would have, while reaching a greater percentage of the population of auto body shops. At the same time, Maine asserts that the ERP generated more environmental/health results than the alternative assistance approach would have. According to the state, a major reason for these improvements is self-accountability; self-certification gives auto body shops more ownership, because they actually have to sign the form and send it off.

The auto body shop representative interviewed for this evaluation indicated that participation requires resources as well. He estimated that attending two compliance assistance workshops required four hours, reading compliance assistance materials required two hours, and completing self-certification forms an additional hour. That said, due to involvement in ERP, he notes that his shops are doing a better job minimizing waste, which has led to savings on purchasing and disposal of materials. Furthermore, these shops will also be switching over to waterborne base coat in the near future as a result of the program, which will bring further savings along with improved environmental outcomes.

RHODE ISLAND

Program Effectiveness

DEM was able to achieve a 47 percent participation rate in its ERP (i.e., 171 out of 367 eligible auto body shops volunteered to participate in self-certification).[103] From the state's perspective, the program was a success, with its most important achievement being statistically significant improvements across multiple regulatory areas. For the shops that were interviewed for this evaluation, ERP was an educational experience for the shops, increasing their awareness of what was required of them. For one of the shops, it showed them what it needed to do and where it could go for more information. As a result of ERP, this shop went above and beyond what was needed in regards to Right-to-Know requirements. This, in turn, had a positive effect on employee morale.

Program participants also report that the ERP affected the awareness and attitude of auto body shops. One auto body shop owner reports:

> [As a result of participating in ERP] the shop has evolved into a cleaner, healthier environment. It has changed from a dirty body shop to something you can walk through that is nice and clean. There's been an attitude change, though it's hard to pinpoint anything specifically.

[103] Source: "Rhode Island ERP auto body results - extracted from region 5 meeting slides"

Both auto body representatives interviewed for this evaluation engaged in substantial dialogue with the DEM and had a very positive experience. From the shops' perspective, the regulators wanted to work with them, were on the same side, and were trying to help.

With this in mind, both shops found the cutback that occurred after the first cycle of ERP to be an impediment to continued progress. According to one shop, the seminars and outreach that were lost were valuable, due to the educational component and, especially, the dialogue they provided:

> …the problem is the communication is no longer there…it's frustrating. This lack of communication is a prescription for making the program go downhill. [ERP] becomes just a form to fill out. Relationships keep participants involved and excited about the program, which is vital.

In its first cycle of ERP, DEM found statistically significant improvements had occurred in seven indicators. The state continued implementing ERP for a second cycle, but due to resource limitations, the state reduced its efforts on outreach in the second cycle. Despite this cutback, the post-Round 2 random inspections conducted in 2008 displayed continued incremental progress: at this time the state observed statistically significant improvements in ten categories (comparing post-Round 2 random inspections to baseline levels of performance).

Additionally, according to Rhode Island, preliminary analysis of data comparing shops that self-certified and those that did not indicated that there was improvement overall, even for facilities that did not self-certify. In other words, Rhode Island believes that the ERP seems to be having the affect of influencing behavior across the auto body sector as a whole in Rhode Island, not just those that formally participated in the program by submitting a self-certification form.

Program Costs

The DEM contracted with staff from the University of Rhode Island's Center for Pollution Prevention to assist with ERP design and implementation. The total amount spent on the program up to this point is estimated at between $150,000 and $250,000 (including state staff time). This includes less than $10,000 spent on the direct costs of printing, postage, and workshops. In addition, the University staff used some of their own EPA grant money (received for pollution prevention research) for their ERP support.

DEM has invested substantial internal staff resources over the course of the first round of the ERP. The design and development phase required one to two FTEs; the initial implementation phase also required one to two FTEs; and program follow-up/ongoing support required less than one FTE. The total amount invested in the program decreased dramatically over time due to factors like reductions in available staffing. DEM's investment in ERP has declined such that resources expended in the second cycle of ERP have been less than half of what was expended in the first cycle. As described earlier, despite this cutback, additional positive outcomes occurred in the second cycle.

Auto body shops have also invested time and resources in participating in ERP. The two shops interviewed as part of this evaluation spent time attending compliance assistance workshops, reading compliance assistance materials, and completing self-certification

forms. One of the shops also spent time assisting the DEM with the creation of the program. Furthermore, as a result of participating, it spent $25,000 on a new vacuum system that was above and beyond ERP requirements.

One of the shops interviewed saw cost savings as a result of changes made during its involvement in the program, while the other shop did not make any direct changes while in the program, and saw no financial benefit. Due to its participation, this first shop implemented a new anti-dust system and generally cleaned up shop operations. This, in turn, increased efficiency and improved product quality and employee morale, all factors that affect the bottom line, even if the cost savings are not easily quantifiable or show up in the short term. As the shop representative notes:

> Overall I have no doubt that the changes we've made have been very good investments. I've spent money that other shop owners haven't, but will receive long run benefits for years and years to come.

Both shops felt that the program was designed to be sensitive to their operations and cost structures.

ERP required more resources than maintaining the status quo of annually inspecting less than five percent of facilities statewide. However, it led to substantial improvements in performance and allowed the DEP to make inferences about the universe of facilities at the same time.

IV. ERP IMPLEMENTATION EXPERIENCE

This section describes the insights of ERP states about what factors influenced their success with ERP, and how the program could be sustained over time, and applied to other sectors and states. Importantly, two of the three programs reviewed have not continued, and one is operating on severely limited resources. ERP proponents suggest that the program can help states use their resources more effectively to monitor compliance and/or improve performance in sectors that states cannot address through more traditional permitting approaches. Thus the question arises as how states view the value of ERP, what its role should be in the future, and how the program can be applied within available resources. This section offers state perspectives on these questions.

DELAWARE

Key Factors Influencing the Program

The ERP was primarily developed to complement the source category permit. The DNREC believed that the ERP would enhance regulatory programs and improve compliance. With this in mind, a portion of the results may be attributable to the permit, rather than the ERP itself. The program's development and results should be understood within this context of supporting the source category permit.

Cooperation among and buy-in by the various DNREC offices was integral to the program. Without it, the comprehensive package addressing multiple environmental media that emerged would have been impossible to develop. The program's success has encouraged DNREC to look for further opportunities for this sort of collaboration.

Sustainability and Transferability

The EPA State Innovation Grant was at the heart of the program's success. Without it, DNREC would not have been able to hire consultants who helped with the program's design and implementation. Similarly, the most significant current limiting factor is cost. With additional funding and resources, the state would be interested in doing the program again. Currently, the DNREC is doing a self-certification program for the dry cleaning sector but they can not afford to engage in measurement (e.g., site inspections).

Involvement in the States' ERP Consortium and obtaining information such as what has been done, and what works and what does not in implementing ERP, is essential for a successful program. So too is EPA technical support and inter-office collaboration within DNREC.

The small number of eligible facilities in Delaware meant that the ERP was not as efficient as it could have been in other contexts. Delaware notes that small states still have to conduct a relatively large number of baseline and post-certification inspections; in other words, the benefit of only having to inspect a random selection of facilities is less when you have a smaller number of facilities in the first place.

MAINE

Key Factors Influencing the Program

Maine cites several internal and external resources that were important to the program's success, as follows:

- **Strong relationships with trade associations:** DEP had an established and positive relationship with the Maine Auto Dealers Association prior to beginning ERP. DEP had a champion at this organization, and leveraged this relationship to help get the ERP started and organize the workshops. This relationship with the trade association also boosted participation in the program.
- **Support from state regulators in Maine:** Internal support at DEP was integral to the program's development. Having the assistance of other regulatory offices was key to working through technical compliance issues.
- **Information and resources from other states:** The States' ERP Consortium was a valuable resource to new states undertaking ERP. Maine notes that there are ERP templates available, resources and tools that can be adapted by states starting a new ERP.

In addition to resources, Maine DEP used several implementation strategies that contributed to the program's success. For example, the DEP found that it was very helpful to conduct a test-run of the survey checklist before full implementation. This type of field testing suggests that arranging the checklist in the order shops carry out their work can make the checklist more efficient. In addition, DEP found that postcard reminders of the upcoming deadline for self-certification were very effective at stimulating participation in this aspect of the program.

One factor that limited Maine's success with the ERP was the short-term nature of the program. As the state describes, it takes time for a sector to understand ERP and for large improvements to take place, particularly in states where there has been limited compliance assistance or outreach in the past. Maine believes substantial improvements can occur over time, with consistent education and workshops. Many shops are reluctant to change shop practices and how they do business; over time, these shops can be encouraged to participate, often by peers who are champions of the program.

Sustainability and Transferability

Funding was the key challenge for Maine's ERP. The program relied on the EPA State Innovation Grant for support, and there was no funding infrastructure available for ongoing support after the grant ended. For ERP to be most effective, Maine believes there should longer-term, consistent funding. One way that Maine suggests for ERP to get dedicated funding is through Performance Partnership Agreements (PPAs) with the EPA. From the state's perspective, pollution prevention and ERPs should be funded through PPAs or another dedicated EPA pool.

If Maine had access to more funding, the program manager would propose to use ERP to address approximately six sectors made up of small sources, rotating focus and budget among them each year. State-dedicated funding to target a different sector each year would be critical to maintaining an ERP program.

The state believes that the resources required to apply for EPA State Innovation Grants are too great, especially given the recent drop in grant funding, which makes winning less likely. From the state's perspective, it would be good if the application process for the grants could be made more efficient, so it is not a deterrent.

RHODE ISLAND

Key Factors Influencing the Program

A key factor that allowed the DEM to develop and implement the ERP as they did was the partnerships that they had established. The Department worked with the University of Rhode Island, a vocational and technical school, the Rhode Island Department of Health, and the Rhode Island Autobody Association to do the research that formed the basis of the program. Part of the funding for the University's ERP work came from their own grants. There were also six shops on the ERP steering committee that looked at materials and workbooks before they were sent out. The ERP developers also had good relationships with other internal offices at DEM. Due to the nature of the program addressing multiple environmental media, support from offices such as RCRA was integral to developing a workbook that accurately covered the various regulations involved.

Results were influenced by regulations addressing air emissions from the auto body sector (specifically HVLP spray guns, VOC compliant coatings, and enclosed spray gun cleaners) that were passed in 1994, well before the ERP was implemented. These Rhode Island regulations, along with the state's previous outreach and education, meant that there were already high levels of compliance in this area, and thus opportunities for improvement were limited. Outcomes for other indicators were influenced by specific

factors like state health inspector on-site assistance (which affected the worker health and safety indicators) and targeted outreach for methylene chloride. In some areas improvements simply resulted from awareness of a previously unknown practice or requirement, or whether or not change was easy to implement, such as by posting a sign.

The ERP's impact was also increased by being connected to the license renewal process. As one shop owner describes:

> Being tied to auto body license renewal gives the ERP extra clout. Everyone has to look at the ERP and fill it out, so at the very least everyone sees where they're [messing] up. Everyone sees their little non-compliances, and may eliminate some serious ones as well.

Sustainability and Transferability

After the first cycle, it was clear to the DEM that ERP was working. DEM judges that it does not have the resources to inspect every facility in the state, and it views ERP as a program that successfully improved compliance without substantial resource expenditure. In fact, growing budget concerns have caused DEM to consider ERP for other sectors where resources are low.

According to Rhode Island, the key hurdle in getting states to see the cost-efficiency of ERP is getting them to understand the statistical aspects of the program. With random sampling, you can inspect a very small number of facilities and in doing so you can potentially characterize compliance for the entire universe. In the state's view, this method is applicable whether or not other states want to run a full ERP and should be applied in many situations where states are conducting inspections. If states want to do specific targeting, a combination of approaches can be used, or the ERP can be modified. For example, Rhode Island is applying ERP to the Underground Storage Tank sector by taking a risk-based approach. In other words, Rhode Island is inspecting all higher risk facilities on a relatively frequent basis. For low and medium risk facilities, Rhode Island is taking a random sample to monitor sector-wide performance (so any individual low or medium risk facility may not be inspected as often).

While the DEM has continued to view ERP positively, the shops we interviewed have been frustrated by the cutback that occurred after the first cycle. One shop, in particular, feels that the benefits the program has brought could be lost. According to the shop representative:

> Rhode Island did a tremendous job at the beginning. It reached out and helped us. However, they're running the risk of letting it all slip through their fingers. They could send us a yearly reminder letter; it wouldn't have to be threatening, just a simple "hello." We totally forget about little things like checklists, and simple reminders – which don't require much time or cost – are very helpful.

Upper management buy-in and early stakeholder involvement – which occurred in Rhode Island through, among other things, a research program and an ERP workgroup – are essential for a successful program.

Lastly, Rhode Island perceives that ERP was a good fit for the auto body shops due to the variety of environmental concerns associated with the sector. However, there are some

circumstances where ERP may not be the best approach. For example, in a sector with a relatively small number of facilities, where there are resources to inspect them all, ERP may not make sense. That said, ERP may still be useful if it allows resources to be reallocated elsewhere.

V. BROADER REFLECTIONS ON ERP CHALLENGES

Two key questions underlying this evaluation include what factors influenced the states' decisions to continue, not continue, or modify their programs after initial pilots (evaluation question 8), and what implementation challenges states face in developing and carrying out their programs (evaluation question 9). Of the three states included in this evaluation, only one state (Rhode Island) has continued its auto body ERP through a full second cycle. In addition, a second state, Delaware, completed a partial second cycle (facility certification only). Both Rhode Island and Maine have used ERP in other sectors, and Delaware has conducted a partial ERP in another sector. However, some observers have wondered why more states have not continued their ERPs over time, and what this means about the effectiveness of ERP.

While we considered these questions as they pertain to Delaware, Maine, and Rhode Island in Section IV of the report, we also interviewed staff at EPA and representatives of the ERP States' Consortium to gain a broader perspective on the sustainability of ERP, as well as challenges in implementing the program.[104] These interviews did not focus primarily on the three states included in this evaluation, but rather drew on the EPA and Consortium perspectives on a broad range of ERPs in different states and sectors.

The interviews suggest that a key challenge related to the sustainability of ERP is that in many cases ERP is perceived as an "extra" program; i.e., one that is innovative and suitable for addressing sectors that have not historically been well covered by regulatory agencies. ERP has often been pioneered by a "lone staffer" or a small group of staff who believe in the potential for ERP, and in some cases have secured a State Innovation Grant (SIG) from EPA to fund the program. In these situations, when budgets are cut or SIG funding ends, the program does not have the support to continue. Without a sustained source of funding, and an overall institutional context in which ERP is viewed as integral to how regulators will meet their goals, the program is likely to continue only as an experimental effort that may demonstrate success but not fully take root. States and EPA staff have different perspectives on this issue, which are discussed in turn below.

PERSPECTIVES FROM EPA

From the viewpoint of EPA staff charged with supporting ERP, one of the biggest challenges in implementing ERP is developing in-state support for the program. The state needs to be willing to commit resources to an ERP. To value an ERP, state management has to perceive the program as directly addressing or otherwise enabling progress on a high priority concern. Meanwhile, staff have to see the program as making their work easier. If ERPs provide efficiencies that free up staff time to take care of other high

[104] These findings are based on four interviews, two with EPA staff members involved in supporting ERP and two with ERP consortium members. We interviewed Scott Bowles (EPA) on February 19, 2009; Beth Termini (EPA) on February 24, 2009; Renee Bashel (ERP Consortium) on April 13, 2009; and Al Innes (ERP Consortium) on April 16, 2009.

priority concerns, then the program adds value and is more likely to be sustained. In some states (e.g., Massachusetts and Rhode Island), ERP is part of a broader state agency shift toward changing the way the state allocates resources to "do more with less." In the current economic climate with severe budget cuts at the state level, some state managers are relying on ERP as a way to get results more efficiently. However many other state managers are inclined to rely on traditional approaches for achieving compliance and focus exclusively on traditional regulatory programs mandated by EPA, rather than investing state resources in ERP.

From the perspective of EPA staff, it is critical to make sure that state staff working on ERP engage other offices and programs, and draw on their knowledge and resources. It is a challenge for a "lone staffer" or a few staffers to convince others to buy-in to ERP. Moreover, it can be difficult for small business assistance programs to work with their peers in environmental regulatory offices, since these groups have different goals and audiences. In most cases, staff implementing ERP need senior management support. In addition to engaging peers within the state regulatory structure, staff implementing ERP do best when they can engage industry and academics. Rhode Island exemplifies the potential for a state to create synergistic relationships with academics and industry; these partnerships have helped the state focus its ERPs effectively and achieve its goals. Local governments (municipalities and counties) also represent a potential resource for ERP. Specific local programs that ERPs could partner with include offices of weights and measures, local departments of health, and business licensing departments.

In addition to committing resources and forging partnerships, the success or failure of an ERP is influenced by the ability of people running ERPs to communicate program outcomes. States need to be able to demonstrate how ERP outcomes can help regulators do their jobs better and more efficiently. From the perspective of EPA staff, states should spend time upfront thinking about how they are going to measure the outcomes of the program, and what matters to potential partners (e.g., program offices within the state or EPA). States need to allocate sufficient resources to analyzing the ERP results, so that they have the data in hand to convince others of the value of the program. States also need to do more to estimate the long-term environmental benefits of ERPs. In the past, states have sometimes hesitated to try to quantify the environmental results of their programs because they cannot demonstrate a causal link between ERP and the results (i.e., they cannot prove that ERP caused the outcomes). However, in EPA's view, while states should be careful not to make unsupported claims, they should still talk about the emissions reductions and other environmental improvements associated with the behavior changes observed as part of ERP.

PERSPECTIVES FROM STATES

The representatives of the States' ERP Consortium interviewed for this evaluation agree with EPA that access to resources is essential to the success of ERP. However, the state views differ somewhat from each other and from EPA's. One interviewee made the case that EPA should be supporting ERP by allowing this approach as a compliance option for traditional regulatory programs. This interviewee suggested that allowing ERP as an approach to implement the recent federal Surface Coating Rule for auto body shops represents a potential starting point. This interviewee also recommends that EPA

frameworks such as Performance Partnership Agreements, and the National Program Managers (NPM) Guidance should include ERP as an acceptable approach for working with sectors that EPA already requires states to address. The ERP Consortium has tried to influence the NPM Guidance in the past and, according to this interviewee, a few years ago the Guidance did provide flexibility that would allow for ERP, but in recent years it has not. Overall, this interviewee suggests that EPA should demonstrate to states that the Agency views ERP as a way to address traditional regulatory programs, and the Agency should also provide sustained funding for ERP.

Another interviewee sees the challenge of transitioning from traditional inspection programs to statistically-based programs like ERP as an internal challenge for the states, rather than an issue for which EPA needs to provide the primary leadership. In this interviewee's opinion, very few states are prepared to devote the resources needed to sustain ERP and maintain a presence in sectors over time, such as Massachusetts has done. Other states are much more likely to use ERP as an overlay on existing programs, which is likely to be discarded when fiscal constraints are severe. One approach in light of this situation would be to "un-package" ERP. The statistically-based inspection component of ERP may be best used as a "one time" tool to assess problems in a sector, rather than as an ongoing program to maintain compliance. From this interviewee's perspective, statistically-based inspection is too resource intensive to do on a routine basis, and the data it produces are not compelling to existing programs that may not demand or value such data. At the same time, the self-certification and plain language compliance assistance components of ERP are powerful tools and can motivate behavior changes among the regulated community in a cost-effective manner.

In addition to these issues of resources, and state demand for statistically-based data on sector performance, the Consortium representatives identified several implementation challenges. These include:

- **Finding an accurate universe for the sector, and selecting the types of facilities to include.** It is easier to capture samples in small states, as sites are closer together and require less travel time and cost to identify.
- **Developing outreach materials.** It takes significant resources to address issues related to all the different environmental media, and states need to find the right balance of providing sufficient detail but not overwhelming the target audience. This relates back to the challenge of identifying the right universe of facilities: a bigger, more heterogeneous universe (with a wide range of applicable requirements) requires more information and materials.
- **Structure of the state regulatory agency, and whether it is conducive to multimedia efforts.** In some states, coordination across media offices is difficult, which makes it more challenging to implement a program like ERP that addresses multiple environmental media.
- **Obtaining buy-in from existing program staff**, who may not see the need for or value of ERP, and may believe that traditional approaches should be continued, even if they cannot measure their results.

- **Partnering with others to implement ERP**, if they do not have the same motivations in pursuing the program. This challenge, which could also be described as trying to implement ERP by "remote control," reflects the fact that states often need to cobble together a collection of staff from different programs and backgrounds to carry out ERP inspections, and these staff may find it difficult to implement the ERP as designed. For example, compliance assistance staff may find it difficult to conduct unbiased assessment, without first trying to help facilities improve their performance.

VI. A VISION OF SUCCESS FOR ERP

Interviews with EPA staff and the States' ERP Consortium representatives paint a picture of the characteristics of a successful ERP, and what such a program can achieve. Specifically, these interviewees suggest that a successful ERP has many attributes, including:

- Regular schedules of self-certification and random inspections. These schedules are facilitated by systems such as reminder postcards to regulated facilities.
- A regular system of reporting results in an easy to understand format. ERP results should explain how the program helps regulatory programs meet their goals, such as fulfilling the requirements of the federal Surface Coating Rules.
- An adaptable program format that can incorporate new requirements over time (e.g. through workbook updates).
- A concise set of indicators that are regularly used to track performance.
- A sustained source of funding and ongoing management support.

Successful ERPs have the potential to generate the following types of tangible results:

- Improved sector performance and compliance with initial ERP implementation. This may include increased knowledge of and compliance with regulatory requirements; increased awareness and application of pollution prevention practices; and improvements in beyond compliance indicators such as energy use, water use, and recycling. Note that over time, states may expect performance of sectors managed with ERP to plateau. ERP can be used to maintain a high level of sector performance and compliance over time.
- Estimates of emissions reductions or other long-term outcomes associated with ERP.
- Overall improvements in worker health and safety.
- Improved understanding of sector performance by regulators.
- Streamlined state operations and more efficient use of state resources.
- Creation of increased capacity and motivation for improved environmental performance of facilities in ERP targeted sectors.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

Conclusions and Recommendations for ERP Evaluation

The experiences of the three ERPs reviewed in the course of this evaluation suggest that ERP is associated with improved business practices in the auto body sector and is regarded as successful by both state and industry representatives. Quantifying environmental outcomes associated with ERP is difficult, and those outcomes that we were able to quantify were relatively small. In addition, sustaining the program has proven to be difficult given resource constraints and overall regulatory priorities. This conclusions section summarizes the evaluation team's response to each of the evaluation questions, while the recommendations section offers the evaluators' suggestions about how state and federal agencies could apply the lessons learned from this evaluation.

I. CONCLUSIONS

QUESTION 1: TO WHAT EXTENT HAVE THE ERPs IN DELAWARE, MAINE, AND RHODE ISLAND LED TO ADOPTION OF SELECTED BEST PRACTICES THAT REDUCE THE ENVIRONMENTAL FOOTPRINT OF AUTO BODY SHOPS?

The findings from this evaluation provide strong evidence that during the three ERP initiatives, auto body shops changed their behavior on many key indicators of business practices that affect air emissions, hazardous waste, discharges to water, worker health and safety, and pollution prevention. Overall, we found statistically significant improvements on nearly half (29 of 65 indicators, or 45 percent) of the indicators of best practices that states measured at samples of shops before and after ERP assistance and self-certification. For the measures where there were statistically significant improvements, we can infer[105] that there was an increase in the proportion of the entire population of auto body shops[106] following best practices. In other words, for nearly half of measured indicators, we believe that the auto body sector as a whole is shifting to increased use of best practices, not just those shops that were included in the samples measured. Furthermore, we found no statistically significant declines in performance.

Despite finding measurable changes in the sample population of facilities, for the 55 percent of indicators (36 of 65 indicators) where we did not detect a statistically

[105] We make this inference with 90 percent confidence for indicators measured by Maine and Delaware, and 95 percent confidence for indicators measured by Rhode Island.

[106] By "entire population" we mean all auto body shops in the state, except in the case of Maine, where the program only covered the southern portion of the state. The entire population of shops included those that opted to participate in ERP (e.g., through voluntarily submitting a self-certification form), as well as shops that did not actively participate in ERP.

significant change in performance, we cannot be certain at the specified confidence level (90 percent in Delaware and Maine, 95 percent in Rhode Island) that there was a change in the proportion of the entire population of auto body shops following the best practices. However, for nearly 70 percent of these indicators, states did observe an increase in the percentage of auto body shops that were following the best practices, as measured by a comparison of a sample of shops measured at baseline and an independent sample of shops measured after ERP assistance and self-certification. This could mean that the percentage of the entire population following best practices for these indicators is in fact increasing, but that the improvement is not large enough to produce a statistically significant change.

There were a number of indicators where multiple states observed statistically significant improvements in performance. For example, in the air emissions category, two states observed statistically significant improvements in the percentage of shops controlling sanding dust. In the hazardous waste category, two states found statistically significant improvements in the percentage of shops sending waste to an appropriate facility or documentation that shows where the waste is being sent. In the water discharges category, two states observed statistically significant improvements in the percentage of shops that post signs prohibiting the discharge of industrial chemicals to non-industrial drain outlets. However, overall, the number of indicators where multiple states measured the same behavior and found statistically significant improvements is relatively small.

The indicators showing the greatest improvements varied by state, and in some cases, states found conflicting trends for the same indicator. For example, results regarding use of methylene chloride-based paint strippers were mixed. Rhode Island observed a statistically significant decline in the percentage of shops using methylene chloride-based paint strippers in the first cycle of ERP. (Note that a decline in this indicator is beneficial environmentally and from a worker health and safety perspective.) Rhode Island attributed this improved performance to the fact that the state focused considerable outreach effort on this issue. However, in the second cycle of ERP, when there were fewer resources available for outreach, the state observed a slight increase in the percentage of shops sampled using methylene chloride-based paint strippers, compared to the end of the first ERP cycle (the increase was not statistically significant). Delaware's experience was similar to Rhode Island's second cycle of ERP: Delaware observed a slight increase in the percentage of shops using methylene chloride-based paint strippers, though this increase was not statistically significant. The differences in these results may be partially due to the extent of outreach focused specifically on reducing use of methylene chloride-based paint strippers.

Note that while the overall trend in improving performance measured by states is consistent with the hypothesis that ERP leads to adoption of selected best practices, we cannot be certain that the observed changes can be fully attributed to the presence of ERP. Neither the states we evaluated nor this evaluation team measured performance in a control group of auto body shops *not* subject to ERP; therefore, there may have been one or more external factors outside of ERP contributing to the observed changes. We asked states about this possibility, and states did raise a few factors such as pre-existing regulations and concurrent roll-out of new permitting requirement for the sector. These factors are discussed in more detail in the response to Evaluation Question 10.

In addition to evidence about how behavior changed based on statistical samples, we also reviewed anecdotal reports from states and industry representatives about their perspectives on how ERP had influenced behavior. States believe that ERP promoted learning and behavior changes, based on self-certification rates, and the fact that shops were more likely to come to the state to ask for help. This is discussed later in more detail in response to Evaluation Question 11. In addition, the auto body shop representatives that we interviewed also believed that ERP was valuable in heightening shop awareness of environmental requirements, offering resources, changing attitudes, and motivating shops to take actions to achieve compliance.

Given the sum total of the evidence for the three states reviewed, this evaluation team concludes that in the auto body sector, ERP played an important role in focusing auto body shop owner and operator attention on best practices and environmental requirements. In many cases, this focused attention seems to have resulted in improved performance, while in others ERP simply affirmed and supported actions the shops were already taking. The program also seems to have created a positive relationship between state environmental agencies and auto body shops, which paves the way for ongoing communication and future outreach efforts, should they be necessary.

QUESTION 2: WHAT ENVIRONMENTAL AND HEALTH OUTCOMES ARE ESTIMATED TO RESULT FROM THE IMPLEMENTATION OF THESE BEST PRACTICES?

The ERPs included in this evaluation measured reductions in air emissions, hazardous wastes, water discharges, and risks to worker health that are expected to improve environmental conditions for people that work in and live near auto body facilities. In addition, the ERPs found that shops were taking actions to prevent pollution, such as reducing materials usage.

With regard to air emissions, all three ERPs found measurable improvements in the percentage of shops controlling sanding dust emissions; in two of the three states these improvements were statistically significant (meaning that we can infer the population as a whole is improving, not just the shops measured in the samples). Sanding dusts can contain lead and chromium, which are hazardous and pose health risks. We were also able to estimate reductions in emissions of VOCs from auto body shops in Maine and Delaware associated with improving spray gun cleaning methods. Specifically, as described in the findings chapter, we estimated emissions reductions associated with switching to automatic spray gun cleaning in Delaware, and use of low-VOC/waterbased solvents in Delaware and Maine. Of these practices, use of low-VOC/waterbased solvents had the greater potential for emissions reductions. In both states, we estimated that VOC emissions reductions associated with the use of low-VOC/waterbased solvents could be as much as 1.7 tons per year, relative to baseline (although the actual amount may be less).[107] Based on calculations presented in the final Surface Coating Rule, we estimate that this is equivalent to approximately a 1 percent reduction in total VOC emissions per shop.

[107] Up to 3,355 pounds per year over in Delaware, and up to 3,416 pounds per year in Maine over the course of the ERP.

Regarding hazardous waste management, in one state we were able to develop a first order approximation of the change in the amount of hazardous wastes subject to proper hazardous waste determination, which can serve as proxy for proper waste management. As described in the findings chapter, we calculated that in Delaware, there was an increase of 102 shops completing hazardous waste determinations. Based on the fact that these shops were likely CESQGs with a maximum waste generation amount of 220 pounds per month, we estimate that there was a potential increase of as much as 22,440 pounds per month of hazardous waste being properly identified in the state (although the actual amount is likely to be less). This amount is equivalent to the minimum waste generated by 10 large quantity generators per month.

We were not able to quantify reductions in water discharges associated with ERP, but two of the three states did find statistically significant improvements in behaviors that are expected to reduce water discharges. Specifically, both Delaware and Rhode Island observed significant improvement in the percentage of shops that post signs prohibiting the discharge of industrial chemicals to non-industrial drainage outlets, and Delaware found a statistically significant improvement in the percentage of shops that have secondary containment for all chemicals. Rhode Island also found a statistically significant improvement in the percentage of shops that have a proper system in place for recycling or properly disposing of wastewater, which should substantially reduce the likelihood of wastewater accidentally leaking into water sources.

Regarding worker health and safety, only Rhode Island measured indicators unique to this category. The state measured six specific worker health and safety indicators, and found that all of them improved over the first cycle of ERP. Three of the improvements were statistically significant: specifically, the indicators related to whether the shop has established a Personal Protective Equipment Program, whether the shop has a Lockout/Tagout Program, and whether the employer has posted the Job Safety & Health Protection poster. All of these improvements are expected to reduce worker risks, although we are not able to quantify these reductions. Note that in the second cycle of ERP in Rhode Island, three of the six worker health and safety indicators showed incremental improvements from Post-Round 1 certification inspections to Post-Round 2 certification inspections, and one indicator showed a marginal decline in performance.

In addition to the indicators unique to the worker health and safety category, it is important to consider improvements related to methylene chloride usage, since in its research leading to ERP Rhode Island found that methylene chloride exposures among automotive repair technicians exceeded OSHA limits in a number of samples.[108] As discussed in the responses to Evaluation Question 1, results for indicators related to methylene chloride usage were mixed. This indicates that further intervention may be required to convince shops to stop using methylene chloride-based paint strippers. The findings related to methylene chloride suggest that when a material is particularly effective for a certain application, and substitutes do not perform as well, auto body shops

[108] Enander, Richard T., Hute, David M., and Missaghian, Richard. "Survey of Risk Reduction and Pollution Prevention Practices in the Rhode Island Automotive Refinishing Industry." *American Industrial hygiene Association Journal*. Vol. 59, 1998, pp. 478-489.

may continue using a hazardous material, even when they have been informed about the dangers it poses to workers.

With regard to pollution prevention, the indicators in this category are a subset of those described in the air emissions category. We were able to estimate reductions in material usage associated with increased use of automatic spray gun cleaning methods at shops in Delaware. Specifically, we calculate that that material usage associated with auto body shop spray gun cleaning operations declined by between 0.6 tons per year and 1.9 tons per year in Delaware compared to baseline.

It is difficult to put these environmental and health outcomes in context, since the best way to do so would be to compare the results from ERP to results from alternate policy tools. ERP is quite unique in having a design that incorporates measurement as part of the program; most other policy tools do not have an integrated performance measurement component, and therefore we do not know whether they are as effective as ERP.

Overall, our ability to quantify environmental and health outcomes resulting from the behavior changes associated with ERP are limited. The states in this evaluation, like most ERP states, focused their measurement efforts on tracking changes in key behaviors, rather than quantifying emissions or other long-term environmental outcomes. Moreover, using available emissions models to estimate impacts from ERP data requires numerous assumptions, and the most relevant emissions model (the DfE calculator) is limited to estimating only air emissions reductions and changes in materials use. Given these limitations, if it is important to estimate long term outcomes (e.g., emissions estimates) resulting from changes in behavior, states may need to collect additional data on emissions reductions, or additional emissions reduction models may be needed to develop appropriate estimates.

QUESTION 3: WHAT ARE THE COST IMPLICATIONS OF EACH PROGRAM FOR REGULATORS AND AUTO BODY SHOPS BOTH INITIALLY AND OVER TIME?

The three states included in this evaluation have spent a range of resources developing and implementing their ERPs. In Delaware and Maine, program costs (including a portion of the state staff time involved) ranged from approximately $125,000 to $200,000 for a single cycle of ERP addressing a population in each state of between 100 and approximately 150 auto body shops. As noted earlier, these costs are not inclusive of the entirety of resources spent by the states to cover staff costs. Therefore, our cost estimates are underestimating the entire true cost of the program for these states. In Rhode Island, the state has spent between $150,000 and $250,000 since the program's inception (including staff time), which includes two cycles of ERP addressing a population of 367 auto body shops.

Costs for developing and implementing ERP also involve state staff time. In Delaware, staff time totaled 330 days over approximately 2.5 years (roughly equivalent to half of an FTE for this time period), while in Maine, 2 FTEs were occupied for 1 year during design, development and implementation, and staffing dropped to 1.5 FTEs during the two years of follow-up. In Rhode Island, the design, development, and initial implementation phases required one to two FTEs; while program follow-up/ongoing

support has required less than one FTE. Rhode Island has found that in subsequent rounds of its ERP, substantially fewer resources have been required to "maintain" the program.

Costs for auto body shop participation generally include time to participate in workshops, read compliance assistance materials, fill out self-certification forms, and complete return to compliance plans. Most of the auto body shop representatives interviewed measured the time needed to participate in each task in hours, although one shop representative said he spent as much as eight and a half days participating in ERP tasks. In general, however, auto body representatives interviewed seemed to think that the time required to participate in ERP was well spent; and in several cases participating in ERP resulted in cost savings for the auto body shop. In one case, ERP motivated an auto body shop representative to make a significant ($25,000) capital expenditure on a new vacuum system that exceeded regulatory requirements.

QUESTION 4: WHAT IS THE COST-EFFECTIVENESS OF EACH PROGRAM?

Overall, the estimated government costs[109] expended appear to range from approximately $800 - $2,000 in government expenses per auto body shop in the population for states conducting a single cycle of ERP (excluding some state staff costs). As noted earlier, these states, Delaware and Maine, had populations of 100 and 150 auto body shops, respectively. For Rhode Island, which conducted two cycles of ERP and had a population of 367 auto body shops, estimated state costs ranged from approximately $400 - $700 per shop for both cycles of ERP combined. These cost figures are only rough approximations, and this calculation of cost per shop does not account for the degree of change in behavior or environmental outcomes associated with ERP. The cost figure for Rhode Island also does not include the EPA grant money that was utilized by the University of Rhode Island to support their program. Still, this simple calculation does highlight that the costs of ERP can be considerable, particularly where the size of the population targeted is relatively small.

The best assessment of the cost effectiveness of ERP would take into account alternative approaches to regulating (or not-regulating) the target sector. For the states included in this evaluation, the alternatives to ERP considered by the states were to: 1) follow-up on complaints or other information about violations, but otherwise not focus on the auto body sector, 2) continue inspecting less than five percent of auto body shops for air, water and hazardous waste compliance each year, or 3) implement a source category permit, but without the focused compliance assistance efforts associated with ERP.

Compared to the likely outcomes of these less resource-intensive alternatives, states perceive that ERP resulted in greater improvements in performance. For the first two alternatives (following up on complaints or conducting infrequent inspections) states predicted that low levels of compliance would persist, and that ERP provided an avenue for the states to improve performance. In the case of the third alternative, the state expected ERP to make the permitting program more effective, since before the ERP, only a few facilities actually had a permit, and the ERP was designed to ensure all shops had the required permit. It is more difficult to tease out the relative benefits of ERP and a

[109] These figures include EPA grants and state contributions.

source category permit, but the state's feedback suggests that ERP led to more shops getting a source category permit than would have done so otherwise, which presumably led to improved performance/compliance. Moreover, in addition to resulting in better performance than the alternatives considered by these three states, ERP provides far more data about the results achieved than any of the alternatives.

These benefits of ERP typically come at a higher initial cost, however, compared to these three less resource-intensive alternatives. Two of the three states in this evaluation have not found sustainable funding models, and have had to discontinue ERP for the auto body sector. If states conducted successive rounds of ERP, it's likely that per facility costs would be reduced, since initial program design and development costs would be reduced or eliminated in successive rounds. For example, Rhode Island has found that subsequent rounds of its ERP have required substantially less resources than the initial phases. These topics are discussed in more detail in the response to Evaluation Question 9.

We recognize that in some cases, ERP may actually present a lower cost alternative, for example if conducting ERP-type statistically-based inspections is an alternative to inspecting every facility each year or every few years, particularly in sectors and states with very large populations of facilities. However, none of the programs included in this evaluation considered inspections at all facilities as the alternative to ERP.

QUESTION 5: WHAT DO OUR FINDINGS SUGGEST REGARDING THE CIRCUMSTANCES UNDER WHICH ERPS ARE LIKELY TO PRODUCE COST-EFFECTIVE RESULTS?

One reason for the substantial per-shop expenditures on ERP is that the population sizes for all of the states included in this evaluation were relatively small (between 100 and 400 shops). ERP can present economies of scale when applied to a larger population. The upfront costs of developing a workbook, self-certification forms, and inspector checklists should be fairly constant, regardless of the size of the population receiving these materials (with the exception of printing and mailing costs). Moreover, in order to conduct statistically-based measurement, the number of inspections needed may not increase considerably, even as the population size increases by an order of magnitude. An example from the *States Produce Results* report illustrates this point:

> "[I]magine that a state planned to conduct 50 random baseline inspections among a population of 200 facilities. If they instead had a population of 2000 facilities, they could achieve the same statistical confidence in their results by doing just 14 more inspections, for a total of 64. With 20,000 facilities, they would need to do only two more inspections, for a total of 66."[110]

It is relatively common for states implementing ERP to find that the population size subject to ERP declines as states comb through databases to eliminate facilities that have gone out of business and duplicate records. In addition, in some cases the population originally targeted may be narrowed for policy reasons (e.g., addressing only auto body shops, and excluding mechanical repair facilities which present a somewhat different set

[110] U.S. EPA National Center for Environmental Innovation, *ERP States Produce Results 2007 Report: States' Experience Implementing the Environmental Results Program*, December 2007. http://www.epa.gov/erp/ERPreport.pdf

of environmental concerns). At least two of the states included in this evaluation found that the final population size for the ERP was less than originally predicted. For example, Delaware initially estimated that there were 300 auto body shops in the state, compared to the final population size of 152.[111] Maine initially identified a statewide population of 4,000 auto body *and* mechanical repair shops and planned to focus on the subset shops in non-attainment areas;[112] ultimately, the project focus was narrowed to a population of 100 auto body shops. Given the final population size in each of these states, it seems that the potential economies of scale that are possible within ERP have not been realized. These findings suggest that ERP can be more cost effective when the population targeted is relatively large. To achieve these savings, the population would need to be relatively homogenous, with a common set of regulatory requirements and best practices, so that a shared set of compliance assistance materials and self-certification forms would apply to all shops.

Another finding is that while the auto body sector seems to offer a promising arena for ERP, for some types of behavior in some states, shops are already demonstrating strong performance or changes are more difficult to achieve. In these cases, substantial improvement may not be observed. In planning for ERP, it is important for states to consider expected baseline performance (i.e., what percentage of the population is anticipated to be following best practices at baseline), and likely extent of improvement (i.e., to what extent are facilities likely to be able or willing to change their behavior). It can be harder for an ERP to measure statistically significant improvements where the percentage of shops following a best practice at baseline is already high (e.g., if 90 percent of shops are following a best practice at baseline, there is relatively little room for improvement). So if a state is considering developing an ERP, it would be best to look to sectors and issues where a substantial number of shops are not following best practices, and therefore there is substantial room for improvement. In addition, states should recognize that some changes (e.g., posting signs, proper storage of materials, or training employees) are relatively easy to implement, while other changes (e.g., using a new type of equipment or material and installing emissions control equipment) are more difficult to make. To the extent that states do not have a good sense of baseline performance levels, or ability to improve performance, prior to starting ERP, it may be advisable for states to undertake a limited assessment before committing resources to conducting a full ERP. For example, states may find it useful to conduct a relatively small, targeted survey to assess baseline performance on key indicators and to ask facilities about what would enable or motivate them to change their behavior.

Another factor related to the likelihood of a state achieving cost-effective results through ERP is the degree to which a staff can build partnerships within and outside state agency walls. All of the states described in this evaluation forged partnerships within their agencies and with outside partners to implement the ERP. For example, Delaware worked with the permitting program staff that was developing the state's source category

[111] See State Innovation Grant Quarterly Report for November 2003-February 2004: http://www.epa.gov/NCEI/stategrants/PDFs/2002DE-Feb2004.pdf.

[112] See Maine ERP Pre-Proposal: Implementation of an Automotive Body and Automotive Repair Environmental Results Program: http://www.epa.gov/NCEI/stategrants/applications/04appllications/maine.htm

permit. Maine built strong relationships with its trade associations, and leveraged support from other regulatory offices within Maine DEP. Rhode Island developed an especially broad range of partnerships, including a university, state health officials, vocational and technical schools, and a trade association. These partners not only lent their expertise, but in the case of the university, they contributed funding toward the project, which made the overall cost to state regulators smaller. This factor probably contributed to Rhode Island's relatively smaller program cost per shop.

QUESTION 6: OVERALL, WHAT ARE THE STRENGTHS AND WEAKNESSES OF EACH OF THE THREE ERPS IN TERMS OF REACHING AUTO BODY SHOPS, GENERATING ENVIRONMENTAL AND WORKER HEALTH OUTCOMES, AND ACHIEVING COST-EFFECTIVE RESULTS?

The three states reviewed vary in their strengths and weaknesses. Each state is discussed in turn below.

The strengths of the Delaware program included the sheer number of statistically significant results that the program observed (15 out of 19 indicators measured showed statistically significant improvements; while Rhode Island and Maine each achieved seven statistically significant improvements.) Delaware also was robust in that it was implemented in conjunction with a source category permit, and the presence of the ERP allowed the permitting process to be more efficient and effective, and reach more shops, than it would have otherwise. The Delaware program achieved a relatively high participation rate (68 percent of eligible auto body shops that volunteered to participate in self-certification). A key weakness of the program was the fact that the program was not sustained beyond one full cycle of ERP (although the state did encourage facilities to renew their self-certifications). The cost of the Delaware program per shop was approximately $770, which was between the costs of the other two states.

The Maine program achieved a 42 percent participation rate, which the state viewed as successful but which is lower than participation rates in the other two ERPs reviewed here. Among the shops that self-certified, 81 percent self-identified as being out of compliance. This implies that without the outreach of the ERP program, many of these shops may have remained unaware of their non-compliance. In addition, the participating shops reported an increase in their awareness of regulations and best practices in their shops. Although the state may have had a lower participation rate than Delaware, it appears that the shops that Maine reached had a great need for the outreach provided. The costs of the Maine program were relatively high (up to $2,000 per shop) due to the small population size targeted. As with Delaware, the Maine program was not sustained beyond a single cycle of ERP.

The Rhode Island program's strengths included its relatively low cost per shop (roughly between $400 and $700 per shop for two cycles of ERP combined), its strong partnerships with external stakeholders, and its focus on worker health and safety issues. In addition, a key strength of the program is that the state has found a way to sustain its funding, and complete a second cycle of ERP. One relative weakness of the Rhode Island program is that the participation rate was not as high as that achieved in Delaware (47 percent).

QUESTIONS 7 AND 8: WHAT IS THE CURRENT STATUS OF EACH PROGRAM? WHAT FACTORS INFLUENCED THE STATES' DECISIONS TO CONTINUE, NOT CONTINUE, OR MODIFY THEIR PROGRAMS AFTER INITIAL PILOTS?

Of the three ERP programs, only one of them is currently ongoing: the ERP in Rhode Island. Both ERPs in Delaware and Maine were operational for a specific period of time, with a specific amount of funding with which to implement the program, and have not continued. Delaware and Maine each received EPA State Innovation Grants (SIG) to design and conduct their ERPs. These grants were intended to support the development and implementation of an ERP in each state, and were not intended to support an ongoing ERP effort.

Delaware's ERP was designed to work in conjunction with the existing permitting process for air source categories. Shops were offered compliance assistance, as well as resources promoting beyond-compliance best management practices and pollution prevention. One full cycle of the ERP was implemented (including pre and post-program inspections); after the SIG funding expired, the state did not continue full implementation of its ERP. In other words, the state did not provide additional compliance assistance support, nor did it conduct another round of inspections. The state did encourage program participants to renew their self-certifications in July of 2007, but no further inspections to measure sector performance occurred after the grant period. The ERP in Delaware was intended to be a pilot program, in which the state tried the ERP approach as a complement to its traditional permitting process. Without additional funding, the DNREC does not currently have the funding or the manpower to continue the program. While the state cannot continue with a full ERP, it has incorporated an outreach component to its auto body permitting program, and a self-certification component for the dry cleaning sector.

Maine's ERP was also considered a pilot project that was designed to address regulations across all environmental media. The program was designed to increase compliance and awareness, as well as promote beyond-compliance best management practices and pollution prevention. Although the ERP was *intended* to be a pilot program, the program's manager believed that the program had the potential to serve as a model that the department could use to apply to other sectors. However, once the SIG funding ended in March of 2007, the state could no longer sustain the ERP. The ERP is no longer active due to a lack of funding and a hiring freeze that has prevented the department from bringing in a new staff person to coordinate the program. The state is currently implementing another pilot ERP, funded by a separate SIG, to reduce the stormwater impacts of drive-through commercial establishments.

Rhode Island is the only state to continue its ERP. Its ERP was developed without the direct assistance of EPA SIG funding. Instead, DEM conducted its own studies prior to the development of its ERP that revealed significant pollution and health concerns arising from auto body operations. In addition, its traditional inspections reached less than five percent of shops in the state. Therefore the department saw a benefit of an ERP as a way to address the significant occupational health, safety, and environmental issues in the auto body sector, because of the program's potential to reach more shops. Rhode Island recently completed its second cycle of ERP, and intends to continue implementing the program. Moving forward, however, the state plans on spending minimal additional

resources in outreach efforts. In addition, the state is adapting its program to be consistent with the federal Surface Coating Rule for auto body shops, and plans to extend it to a third and potentially fourth cycle. Finally, DEM is currently implementing ERP programs in additional sectors, including auto salvage, underground storage tanks, MS4 Construction Site Runoff Control, and reduction of fats/oil/grease discharges from food processing facilities.

QUESTION 9: WHAT ARE THE PRIMARY IMPLEMENTATION CHALLENGES STATES FACED IN DEVELOPING AND IMPLEMENTING THEIR PROGRAMS?

The primary challenge states faced in developing and implementing their programs was access to funding. Both Maine and Delaware relied on State Innovation Grants to provide the funding to develop and implement their programs. Once the funding ended, the programs were not able to continue. As discussed earlier, ERPs can require a significant amount of funds to operate, especially in the initial design phase. While it may vary state to state, developing the program, including all of the outreach and assistance materials (e.g., compliance assistance and self-certification workbooks), can demand a lot of effort and time on the behalf of the state agencies. For example, Delaware reported that a significant amount of time was required to support the participating auto body shops once the compliance assistance materials had been sent out. Furthermore, Delaware found that implementing its ERP in conjunction with the source category permit program required significantly more resources than the permit program would have incurred on its own. On the other hand, both Delaware and Maine estimate, and Rhode Island can testify that there is a steep learning curve with ERPs. In other words, costs for the program taper off as both state staff and the shops become more familiar with the process. Furthermore, Rhode Island has found that subsequent rounds of its ERP have required substantially less resources than the initial phases.

If states see ERP as a one-time trial program, and not as an alternative or complement to their traditional permitting and inspection process, they may not see the benefit of continuing to support the program once grant funding has expired. This was the case in both Delaware and Maine: program managers used SIG funding to conduct an ERP as a pilot, with the possibility of continuing the program. However, once the funding ended, the state was unable to commit the necessary resources to continue the program. If, on the other hand, regulators see ERP as a new way to approach to permitting and compliance, the state may choose to commit the resources necessary to continue the program. This was the case in Rhode Island: the state saw the long-term benefit of ERP as an effective tool to reach more shops and achieve a higher rate of compliance than with its traditional permitting process, so the state provided the support necessary to maintain the program. This “buy-in” and support, either from EPA or state agencies, is integral to the program moving beyond a one-time effort.

Successful design and implementation of ERPs that deal with multiple environmental media require the cooperation among and buy-in from the various offices that are affected. For example, in both Delaware and Rhode Island, regulators found that the high level of input and collaboration with the various media offices made the process much more successful, primarily because the workbook they developed accurately covered all of the various regulations involved. While this cooperation is integral to the success of an

ERP that deals with multiple environmental media, it can also be a challenge to coordinate and facilitate the involvement of so many offices.

QUESTION 10: WHAT EXTERNAL FACTORS INFLUENCED THE OUTCOMES OF EACH PROGRAM

Several factors may have contributed to the outcomes the programs evaluated. In Delaware, the fact that ERP was developed in tandem with a source category permit may have made the program more successful. In Maine, the fact that the program was developed for only part of the state reduced the population size, and increased the program cost per shop accordingly. In Rhode Island, the fact that the state had passed regulations specifically addressing the auto body sector, and had conducted outreach related to this rule, meant that for some indicators, baseline performance was relatively high. Also in Rhode Island, ERP was implemented in tandem with the auto body license renewal process, which may have given the program more visibility and clout with auto body shops. All of the states developed productive partnerships with stakeholders, which increased the value and credibility of the programs; this was particularly true in Rhode Island.

Note that the presence of the federal Surface Coating Rule may now be affecting shops' behavior regarding air emissions, but the vast majority of data analyzed in this report (with the exception of the Rhode Island's second ERP cycle) was gathered prior to the promulgation of the federal rule, and therefore we do not expect that the rule had a substantial impact on shop behavior reported in these ERPs.

QUESTION 11: HOW DOES THE STATE AND/OR EPA REGION INVOLVED IN IMPLEMENTING EACH PROGRAM VIEW THE PROGRAM'S RESULTS, AND WHY?

All three states believe their ERPs were successful, although they each had different reasons for considering the program a success. For example, Delaware said that the ERP initiative let shops know who to contact when they have questions or need help. Having a personal connection with the state agency gives the shops a level of comfort and makes them more willing to ask for help. Maine pointed to the high participation rates in ERP and the large proportion of self-certifiers who identified themselves as being out of compliance as evidence that shops are learning. Moreover, for Maine, the measurement component of ERP was important to knowing that the state made an impact. Rhode Island pointed to statistically significant improvements across multiple regulatory areas as evidence of their success.

II. RECOMMENDATIONS

Based on our findings from this evaluation, we offer several recommendations for consideration. Our recommendations are based on our limited perspective as external evaluators to EPA, and therefore would clearly need to be viewed within the frame of what is feasible from a staffing, resources, legal, and policy perspective. Recognizing these caveats, we suggest the following:

1. **Combine forces.** ERP offers economies of scale, but until recently states have been working independently. The Region 5 effort to conduct a multi-state ERP

offers great potential to streamline the investment in ERP (e.g., developing materials and conducting inspections); this should allow for more cost effective results.

2. **Decide on a set of common indicators.** Much work on this has already been done as part of the Common Measures project. It would be helpful to be able to compare and aggregate ERP data for the same sector across programs. Worker health indicators like those developed in Rhode Island should be expanded to other states.

3. **Collect quantitative data on facility practices, not just information on the proportions of shops utilizing specific practices, for a small number of indicators.** Measuring a few key indicators (e.g., quantity of methylene chloride used, quantity and type of paint used, amount of hazardous waste generated) could help quantify environmental outcomes. As part of this, discuss key inputs needed to use the existing DfE calculator that states conducting ERP may wish to collect.

4. **Develop a tool to help states estimate environmental outcomes.** Transforming the DfE calculator into something states could easily use themselves could encourage more states to make the effort to collect key inputs to the tool so that they can generate outcome data.

5. **Un-package ERP.** While ERP as a package offers value, it requires more resources and effort than some states can provide on an ongoing basis. We suggest that states consider different ways to apply the measurement component of ERP (e.g., for initial assessment and longer-term monitoring) alone as well as in combination with compliance assistance and self-certification. States are also conducting ERP-style self-certification and outreach without the measurement component; discuss this as a possibility. In addition, ERP components may be suitable to apply on a limited scale (e.g., developing self-certification forms for only one environmental media); some states have already tried this out of necessity, and while it doesn't offer all of the advantages of a full ERP, it may be a viable alternative for states interested in the ERP model.

6. **Consider implementing ERP primarily where larger populations of facilities are present.** This approach has the potential to reduce per facility expenditures and increase the cost-effectiveness of the program. The findings suggest that ERP can be more cost effective when the population targeted is relatively large. To achieve these savings, the population would need to be relatively homogenous, with a common set of regulatory requirements and best practices, so that a shared set of compliance assistance materials and self-certification forms would apply to all shops.

7. **Develop a clearer agreement between EPA and states whether ERP can be used to address traditional regulatory programs**. In circumstances where this is suitable, develop appropriate guidance and a sustainable funding mechanism. The Surface Coating Rules relating to auto body shops may represent an opportunity for the states and EPA to explore this.

APPENDIX A: DATA AVAILABLE FOR DFE CALCULATOR ANALYSIS

Exhibit A-1 walks through the available data for each of the three states for each of the five categories for which the calculator can estimate emissions and materials reductions.

EXHIBIT A-1: DFE CALCULATOR INPUTS

BEST PRACTICE	DELAWARE	MAINE	RHODE ISLAND
(1) Waterborne paint usage	No data available	No data available	No data available
(2) HVLP spray gun usage	9 pp[a] (not statistically significant) increase in shops that use painting techniques that comply with DE regulations	No data available	100 percent of shops use HVLP spray guns in both baseline and post-certification inspections (no measurable change)
(3) Training in spray gun usage	No data available[b]	3 pp (not statistically significant) decrease in shops that employ training programs	No data available
(4) Spray booth usage	6 pp (not statistically significant) increase in shops that carry out all painting in a spray booth	7 pp (not statistically significant) increase in shops that carry out painting in a spray booth	No data available
(5) Equipment cleaning improvements			
Manual/automatic spray gun cleaning	**11 pp (statistically significant) increase in shops that use cleaning methods that comply with DE regulations**	7 pp (not statistically significant) increase in shops that use an enclosed spray gun cleaner	5 pp (not statistically significant) increase in shops that use enclosed spray gun cleaners
Gun cup liners	No data available	No data available	No data available
Low-VOC/ waterbased solvents	**23 pp (statistically significant) increase in shops that use non-VOC cleaning methods when possible**	**47 pp (statistically significant) increase in shops that use low-VOC/HAP solvents**	No data available

Note: Observed changes in bold are statistically significant.

[a] All changes are listed as percentage point changes. These changes are calculated by subtracting the observed percentage of shops in the sample following the behavior at baseline prior to ERP from the observed percentage of shops in the sample following the behavior at post-certification. We use percentage point changes, rather than percent changes, to more clearly show the magnitude of change. For example, suppose the observed proportion of shops following a behavior increased from 6 percent at baseline to 12 percent at post certification: this change could be expressed as a 100 percent improvement, or a 6 percentage point improvement. We believe the latter approach is a clearer, more accurate description of changes in performance.

[b] Note that while Delaware did observe a statistically significant increase in the percentage of shops that employ a training program, the focus of Delaware's training was in the proper use and handling of coatings, solvents and waste products in minimizing air emissions, rather than training in spray gun usage.

For each of the statistically significant changes described above, we estimate the actual emissions reductions observed by the state below.

- **Emissions reductions associated with increased use of automatic cleaning methods**.[113] First, we calculate the confidence interval for the difference in the proportion of shops using cleaning methods that comply with Delaware regulations at baseline and post-certification using the EPA's Results Analyzer 2007 Tool.[114] The Results Analyzer calculates confidence intervals for the difference between proportions observed in two different rounds of inspections.[115] We are 90 percent confident that the confidence interval for the difference is between 5 and 17 percentage points. We apply this to the entire population of shops targeted by ERP in Delaware (152 shops), to estimate the range in the number of shops in the population that changed their behavior on this indicator (between 8 and 26 shops). According to the DfE calculator, assuming other cleaning behaviors stay constant at a minimum performance level (i.e., no disposable spray gun cup liners are used, and low VOC or waterbased cleaners are not used), each shop that switches from manual to automatic spray gun cleaning methods will reduce VOC emissions by 37 lbs/year and material usage by 153 lbs/year. When extrapolated to the estimated number of shops in the population that changed this behavior, this means that we expect that VOCs from auto body shop spray gun cleaning operations declined by between 296 and 962 lbs/year, relative to baseline. Likewise, we expect that material usage associated with auto body shop spray gun cleaning operations declined by between 1,224lbs/year and 3,978 lbs/year, relative to baseline. The DfE calculator does not estimate any reductions in PM emissions associated with switching automatic spray gun cleaning methods. Note that each practice is considered individually, but in reality the practices influence one another (e.g., type of spray gun used and training for spray gun use are interrelated, and there is overlap in the potential emissions reductions between these two indicators). Therefore, the results are not additive, i.e., the total potential emissions reductions associated with adopting all practices is less than the sum of potential emissions reductions for each practice.
- **Emissions reductions associated with increase in shops in Delaware that use non-VOC cleaning methods when possible.**[116] First, we calculate the confidence interval for the difference in the proportion of shops that use non-VOC cleaning methods when possible at baseline and post-certification. We are 90 percent confident that the confidence interval for the difference is between 13 and 36 percentage points. We apply this to the entire population of shops targeted by ERP in Delaware (152 shops), to estimate the range in the number of shops in the population that changed their behavior on this indicator (between 20 and 55 shops). According to the DfE calculator, assuming other cleaning behaviors stay constant at a minimum performance level (i.e.,

[113] To calculate this emissions decrease we assume adoption of automatic cleaning methods (the variable tracked in the DfE calculator) is equivalent to the indicator tracked by Delaware: use of cleaning methods that comply with Delaware regulations (specifically, enclosed spray gun cleaning systems that are kept closed when not in use, unatomized discharge of solvent into a paint waste container that is kept closed when not in use, disassembly of the spray gun and cleaning in a vat that is kept closed when not in use, or atomized spray into a paint waste container that is fitted with a device designed to capture atomized solvent emissions).

[114] These calculations are based on raw data provided by the states (i.e., the total number of facilities sampled at baseline and post-certification, the number of facilities sampled at each time period for which the answer to the question was "yes," and the total number of facilities in the population). Raw data was drawn from the State Innovation Grant final reports for these two states, available online at http://www.epa.gov/NCEI/stategrants/PDFs/DEautobodyfinalreport.pdf and http://www.epa.gov/NCEI/stategrants/PDFs/Maine2004Final%20Report.pdf. We then used this information to calculate the confidence interval for the percentage of shops using cleaning methods that comply with Delaware regulations at baseline and post certification.

[115] The Results Analyzer can be accessed at: http://www.epa.gov/erp/roadmap/matllist.htm#pagecontents. Calculations for the confidence intervals are based on the following source: Kish, Leslie, 1965. *Survey Sampling*. John Wiley & Sons, Inc. New York, NY. p.41.

[116] To calculate this emissions decrease we assume adoption of low VOC-waterbased cleaners is equivalent to shops that use non-VOC cleaning methods when possible.

no disposable spray gun cup liners are used, and manual spray gun cleaning methods are used), each shop that increases the percentage of cleaning solvents that are low-VOC or waterbased from 0 to 100% will reduce VOC emissions by 61 lbs/year. When extrapolated to the entire population of shops targeted by ERP in Delaware, this means that we expect that VOCs from auto body shop cleaning operations declined by *up to* 3,355 lbs/year, relative to baseline. (This is calculated by multiplying the maximum number of shops to change performance by the emissions reductions per shop, or 55 x 61.) We include only the maximum of this range because it is difficult to estimate the minimum emissions reductions, since some shops may have already begun using non-VOC cleaning methods when possible, but did not completely switch over to low-VOC/waterbased solvents. It is difficult to estimate to lower end of this range, it may in fact be zero. When calculating the emissions reductions, we assume that the shops that use non-VOC cleaning methods are now using those methods 100 percent of the time. If any of these shops were only using these non-VOC materials for a small percentage of their cleaning operations, the emissions reductions would be much lower. The DfE calculator does not estimate any material reductions or reductions in PM emissions associated with switching to low-VOC/waterbased solvents.

- **Emissions reductions associated with increase in shops in Maine that use low VOC/HAP solvents.**[117] First, we calculate the confidence interval for the difference in the proportion of shops that use low VOC/HAP solvents at baseline and post-certification. We are 90 percent confident that the confidence interval for the difference is between 40 and 55 percentage points. We apply this to the entire population of shops targeted by ERP in Maine (an average of 102 shops across the baseline and post-certification periods), to estimate the range in the number of shops in the population that changed their behavior on this indicator (between 41 and 56 shops). As noted above, the DfE calculator estimates that assuming other cleaning behaviors stay constant at a minimum performance level (i.e., no disposable spray gun cup liners are used, and manual spray gun cleaning methods are used), each shop that increases the percentage of cleaning solvents that are low-VOC or waterbased from 0 to 100% will reduce VOC emissions by 61 lbs/year. When extrapolated to the whole population in Maine, this means that we expect that VOCs from auto body shop cleaning operations declined by *up to* 3,416 lbs/year, relative to baseline. (This is calculated by multiplying the maximum number of shops to change performance by the emissions reductions per shop, 56 x 61.) We include only the maximum of this range because it is difficult to estimate the minimum emissions reductions, since some shops likely began using low VOC /HAP solvents, but did not completely switch over to these alternative solvents. When calculating the emissions reductions, we assume that the shops that use non-VOC cleaning methods are now using those methods 100 percent of the time. If any of these shops were only using these non-VOC materials for a small percentage of their cleaning operations, the emissions reductions would be much lower. The DfE calculator does not estimate any material reductions or reductions in PM emissions associated with switching to low-VOC or waterbased solvents.
- There is no discussion presented here for Rhode Island, as there were no observed statistically significant increases for any of the five categories for which the DfE calculator can estimate emissions and materials reductions.

[117] To calculate this emissions decrease we assume adoption of low VOC-waterbased cleaners is equivalent to shops that use non-VOC cleaning methods when possible.

APPENDIX B: DFE CALCULATOR INPUTS

Note that all example calculations represent the largest change a shop can make, for some indicators, there may be a continuum of changes that would result in smaller emissions reductions.

Also note that cells in gray (shaded) represent default values provided by the calculator, or standard values we found in our literature search. Cells in yellow represent facility practices and are the indicators for which we calculate emissions and materials reductions in Appendix C.

DFE INPUT #	DFE INPUT DESCRIPTION	DATA SOURCE	DATA VALUE (INPUT TO DFE)	NOTES/ASSUMPTIONS
1	How many paint jobs per week are performed at your shop?	Enander, Richard T., et al. "Chemical Characterization of Sanding Dust and Methylene Chloride Usage in Automotive Refinishing: Implications for Occupational and Environmental Health." *AIHA Journal*, Vol. 63, No. 6, November 2002, pp. 741-749	6 jobs per week	Table 1 on page 743, EPA definition of "small" shop.
2	What is the density of the solvent-based paint you use in your shop?	Default value provided as part of DfE Calculator	▪ Primer coats: 10 lbs/gallon ▪ Basecoats: 7.9 lbs/gallon ▪ Clear coats: 8.2 lbs/gallon	
3	What is the VOC content of the solvent-based paint you use in your shop?	Default value provided as part of DfE Calculator	▪ Primer coats: 4.8 lbs/gallon ▪ Basecoats: 5.0 lbs/gallon ▪ Clear coats: 5.1 lbs/gallon	
4	What is the density of the waterborne paint you use in your shop?	Default value provided as part of DfE Calculator	▪ Primer coats: 8.3 lbs/gallon ▪ Basecoats: 8.3 lbs/gallon ▪ Clear coats: 8.3 lbs/gallon	
5	What is the VOC content of the waterborne paint you use in your shop?	Default value provided as part of DfE Calculator	▪ Primer coats: 2.1 lbs/gallon ▪ Basecoats: 3.5 lbs/gallon ▪ Clear coats: 2.1 lbs/gallon	

DFE INPUT #	DFE INPUT DESCRIPTION	DATA SOURCE	DATA VALUE (INPUT TO DFE)	NOTES/ASSUMPTIONS
6	What reduction in basecoat paint usage have you found with waterborne paint?	Default value provided as part of DfE Calculator	25% reduction	
7	How much paint used at your shop is considered to be waterborne?	**Example shop calculation**	▪ Baseline: 0% ▪ Improvement: 100%	We are calculating the emissions reductions when a shop changes from using no waterborne paint to using all waterborne paint. In other words, this represents the largest improvement a shop can make. However, this may be realistic, as waterborne paint generally requires different equipment than traditional paint, and a shop may need to switch completely if at all.
8	What type of spray gun does your painter use?	**Example shop calculation**	▪ Baseline: Conventional ▪ Improvement: HVLP	For primer coats, basecoats, and clear coats, we assume here that a shop changes from using conventional spray guns to HVLP guns.
9	Are your painters trained to use HVLP spray guns properly?	**Example shop calculation**	▪ Baseline: no ▪ Improvement: yes	
10	What is the efficiency of your spray booth filter?	Default value provided as part of DfE Calculator	98%	
11	How much do your painters spray in a spray booth?	**Example shop calculation**	▪ Baseline: 0% ▪ Improvement: 100%	Assume that for primer coats, basecoats, and clear coats, painters go from never spraying in a spray booth to always spraying in a spray booth.
12	How much fresh-solvent-based thinner do you use for spray gun/cup cleaning in one week, prior to improvements?	Enander, Richard T., Gute, David M. and Missaghian, Richard. "Survey of Risk Reduction and Pollution Prevention Practices in the Rhode Island Automotive Refinishing Industry." *AIHA Journal*. Vol. 59, 1998, pp. 478-489.	0.875 gallons per week	Based on average of 42 gallons per year of solvent – gun cleaning waste in Table VI, page 484.
13	What is the density of the solvent-based thinner (cleaner) you use in your shop?	Default value provided as part of DfE Calculator	7 lbs/gallon	
14	What is the VOC content of the solvent-based thinner (cleaner) you use in your shop?	Default value provided as part of DfE Calculator	7 lbs/gallon	

DFE INPUT #	DFE INPUT DESCRIPTION	DATA SOURCE	DATA VALUE (INPUT TO DFE)	NOTES/ASSUMPTIONS
15	What method is used to clean spray guns at your shop?	**Example shop calculation**	▪ Baseline: Manual ▪ Improvement: Automatic	
16	Do you use disposable spray gun cup liners?	**Example shop calculation**	▪ Baseline: No ▪ Improvement: Yes	
17	What is the density of the low-VOC/waterbased cleaner used in your shop?	Default value provided as part of DfE Calculator	8.3 lbs/gallon	
18	What is the VOC content of the low-VOC/waterbased cleaner used in your shop?	Default value provided as part of DfE Calculator	0.0083 lbs/gallon	
19	How much of your cleaning solvents are considered to be low-VOC or waterbased?	**Example shop calculation**	Baseline: 0% Improvement: 100%	We assume that a shop goes from using no low-VOC or waterbased solvent to using all low-VOC or waterbased solvent. Again, this represents the largest improvement a shop can make.

APPENDIX C: EMISSIONS REDUCTIONS ESTIMATE

While we cannot use the calculator to directly estimate the emissions reductions associated with adoption of certain best practices in the shops in these three states, we can use the tool to describe the *potential* emissions reductions that are possible for a "typical" small auto body shop performing six paint jobs per week. For each best practice we analyze, we use the calculator to assess the potential change in emissions if the shop changes from the lowest level of performance (e.g., using conventional spray guns) to an advanced level of performance (e.g., using HVLP spray guns). As part of these calculations, we use several default values to estimate potential emissions reductions. For example, we assume that a typical small auto body shop performs six paint jobs per week. For a full description of all values used, and their source, please see Appendix B.

Exhibit C-1 below shows the potential emissions and materials reductions possible for each best practice that is adopted. These are the yellow highlighted items/DfE inputs from Appendix B. Note that each practice is considered individually, but in reality the practices influence one another (e.g., type of spray gun used and training for spray gun use are interrelated, and there is overlap in the potential emissions reductions between these two indicators). Therefore, the results are not additive, i.e., the total potential emissions reductions associated with adopting all practices is less than the sum of potential emissions reductions for each practice.

EXHIBIT C-1: SUMMARY OF POTENTIAL EMISSIONS AND MATERIALS REDUCTIONS FROM THE DFE CALCULATOR

DFE INPUT #	DFE INPUT DESCRIPTION	DATA VALUE (INPUT TO DFE)	VOC REDUCTION (LBS/YEAR)	% VOC REDUCTION	PARTCULATE REDUCTIONS (LBS/YEAR)	% PARTICULATE REDUCTION	MATERIAL REDUCTION (LBS/YEAR)	% MATERIAL REDUCTION
7	How much paint used at your shop is considered to be waterborne?	▪ Baseline: 0% (none) ▪ Improvement: 100% (all)	255	66%	73	34%	248	33%
8	What type of spray gun does your painter use?	▪ Baseline: Conventional ▪ Improvement: HVLP	71	18%	65	31%	136	18%
9	Are your painters trained to use HVLP spray guns properly?	▪ Baseline: No ▪ Improvement: Yes	62	20%	57	39%	119	20%
11	How much do your painters spray in a spray booth?	▪ Baseline: 0% (never) ▪ Improvement: 100% (always)	N/A	N/A	208	98%	N/A	N/A
15	What method is used to clean spray guns at your shop?	▪ Baseline: Manual ▪ Improvement: Automatic	61	100%	N/A	N/A	207	68%
16	Do you use disposable spray gun cup liners?	▪ Baseline: No ▪ Improvement: Yes						
19	How much of your cleaning solvents are considered to be low-VOC or waterbased?	▪ Baseline: 0% (none) ▪ Improvement: 100% (all)						
Total[a]			**362**	**81%**	**211**	**99%**	**625**	**60%**

Note:
a. Reductions for each improvement are calculated individually. Although the total reductions are calculated as the overall reductions of all improvements combined, the individual reductions are not additive, i.e., the total sum of each individual reduction will be greater than the total presented here.

APPENDIX D: DELAWARE COST SUMMARY

PROJECT PHASE	TASK	TASK DESCRIPTION	# STAFF/ #DAYS PER STAFF
# OF SHOPS IN STATE: 152 # OF WORKSHOPS HELD: 4 # OF ROUNDS OF ERP: 1			
Design and Development	Grant Submission	Prepare and submit grant request to EPA for State Innovation Grant	1/3
	Planning and Workbook Development	Coordinate with consultants, DNREC staff member, and auto body sector for implementation and development of program	1/10
		Meeting to explain ERP and get buy-in from other program staff and managers	14/1
		Kick-off meeting	6/2
		Gathering existing materials prior to ERP and finalize ERP materials	6/5
		Confirm list of shops	1/2
		Meeting with auto body shops to gather feedback on program materials	6/1
		Follow-up with contractors and auto body shops to implement suggestions from shops	1/1
Total Staff Days: 78 days			
Initial Implementation	Workshop	Prepare for workshop	6/3
		Conduct workshop	6/4
	Inspections	Inspector training	6/1
		Conduct baseline inspections	6/12
		Conduct follow-up visits for inspector checklists	6/12
	Mailings	Draft letter explaining ERP	1/1
		Mail workbooks	1/1

PROJECT PHASE	TASK	TASK DESCRIPTION	# STAFF/ #DAYS PER STAFF
		Draft and mail workshop notices	1/1
		Draft and mail reminder postcards for deadline to submit self-certification forms	1/1
	Compliance Assistance	Fielding phone calls from auto body shops with questions about ERP (over 90-day period – more than 50 calls)	2/2
		Conduct compliance assistance visits of pollution prevention audits to auto body shops requesting assistance (over 27 shop visits)	2/10
Total Staff Days: 220 days			
Program Follow-Up/Ongoing Support	Data Entry and Self-Certification Submissions	Review self-certification forms and make follow-up phone calls	1/5
		Enter inspector checklists into database	2/3
		Enter self-certification forms into database	2/3
	Website	Create website for ERP	2/1
		Update website as needed	2/1
	Analysis	Conduct statistical analysis of data	2/3
		Collect and prepare information for quarterly reports and final reports to EPA for grant commitment as well as internal reporting of project	1/5
Total Staff Days: 32 days			
GRAND TOTAL: 330 days			

APPENDIX E: STATE PROGRAM STAFF INTERVIEW GUIDE

INTERVIEW QUESTIONS

ERP Development and Status

1. To begin, what factors encouraged your state to develop an ERP program for the auto body sector?
2. What did your state hope to achieve by developing the program? What problems or issues was the ERP designed to address?
3. Would your state have taken any action regarding the auto body sector if it hadn't implemented ERP? If so, what was the alternative (including *no* action)?
4. What is the current status of your ERP program?

Experience with ERP

5. What did you learn over the course of developing and implementing your ERP? What aspects of the program worked well? What aspects of the program presented challenges?
6. What do you consider are/were the primary challenges in implementing your ERP program?
7. Did you make any modifications to your program as it unfolded?
8. What factors influenced your decision to continue/not continue/modify (based on previous responses) your program?

ERP Results

9. What are the most important things your ERP achieved?
10. Is there anything you hoped your ERP would achieve, but didn't? Please describe.
11. Overall, do you consider your ERP to be a success? Why or why not?
12. What factors do you believe may have influenced your success? Please consider both elements of the ERP itself, as well as external factors such as changes in agency budgets, changes in regulations, and changes in industry characteristics.
13. Considering the alternative approach that your state might have used with the auto body sector had it not implemented ERP (per response to Question 3 above), do you

think ERP required more or less state resources to implement than the alternative approach to this sector? Please describe.

14. Do you think ERP generated more or less environmental/health results (e.g., better compliance with requirements, improved worker health, more adoption of pollution prevention practices) than the alternative approach would have?

15. Overall, what do you see as the advantages and disadvantages of ERP vs. other approaches for reaching auto body shops, generating environmental and worker health outcomes, and achieving cost-effective results in the auto body sector?

Details on Resources Invested by the State in ERP

16. In total, what level of staff time was required for the following stages of the program? (Ideally we would like to measure this in terms of Full Time Equivalents (FTEs), but it may be easier to think about this in terms of the number of people who worked on the program, for what percentage of their time, over what period of time.)

    a. Design and Development: _____

    b. Initial Implementation: _____

    c. Program Follow-Up/Ongoing Support: _____

17. Did you use any contractor services to design and implement your program? If so, what did the contractor do? How much did this cost?

18. What would you estimate as the direct costs (non-labor costs) of designing and implementing your program, for example, printing and mailing outreach materials?

19. Did you invest other resources in the program (e.g., intern time, EPA grants or resources, partnerships with other agencies)?

20. Did the resources your state invested in ERP increase or decrease over the course of ERP development and implementation (e.g., were there relatively high upfront costs, and lower resources required after that; were costs constant over time; or did costs increase as the program got under way)?

Future of ERP for this Sector

21. What challenges/opportunities do you see for application of ERP to the auto body sector in your state in the future?

22. If you were to advise another state planning to implement ERP for the auto body sector, what elements would you say are needed to make the project a success?

23. Do you have any other comments that you'd like to share about your ERP?

APPENDIX F: AUTO BODY REPRESENTATIVES INTERVIEW GUIDE

INTERVIEW QUESTIONS

1. Prior to ERP, had you had any interactions with environmental regulators in your state? If so, please describe.
2. How did your shop participate in ERP (e.g., attending a workshop, reading a workbook, filling out a self-certification form, creating a return-to compliance plan, etc.)?
3. How much time did your shop spend on the following activities:
    a. Compliance assistance workshops: _____
    b. Reading compliance assistance materials:_____
    c. Completing self-certification forms: _____
    d. Completing return-to compliance forms: _____
    e. Other ERP-related activities: _____
4. Other than the time you and your employees spent, did your shop spend any additional resources to participate in ERP? (Note, we are not trying to account for any business practices or equipment that you changed to come into compliance).
5. How did participating in ERP change what you do at your shop?
6. Has your company seen any cost savings as a result of the changes you made during your involvement in the ERP program?
7. Do you think that that ERP program was designed to be sensitive to your operations and cost structures? In other words, did the program ask you to make changes that were not cost effective for you from a business standpoint?
8. Did you start implementing any beyond compliance behaviors or pollution prevention activities after your participation in the ERP program?
9. Has your company seen any cost savings as a result of these additional changes?
10. What aspects of the ERP do you think were well managed by the state?
11. What aspects of the ERP do you think were not well managed by the state?
12. What suggestions would you have for improving your state's ERP?

APPENDIX G: EPA STAFF INTERVIEW GUIDE

INTERVIEW QUESTIONS

1. What do you consider are the primary implementation challenges often faced during the design and implementation of an ERP program?
2. What factors do you think influence the success or failure of an ERP?
3. What factors do you think influence states' decision to continue/not continue/modify their program?
4. What does a successful ERP look like to you?
5. What kind of outcomes would you expect to see with a successful ERP?
6. Are there any common problems you have seen with the design and/or implementation of ERPs?
7. What challenges do you see in the future management of ERPs?
8. Why do you think an ERP works/does not work for a state?
9. What are the factors that were outside of the ERP that you believe influence the outcome of a program?
10. What does the ideal candidate (state and business sector) for an ERP look like?
11. What kind of state should avoid an ERP?
12. Are there any business sectors for which ERP would not be appropriate?