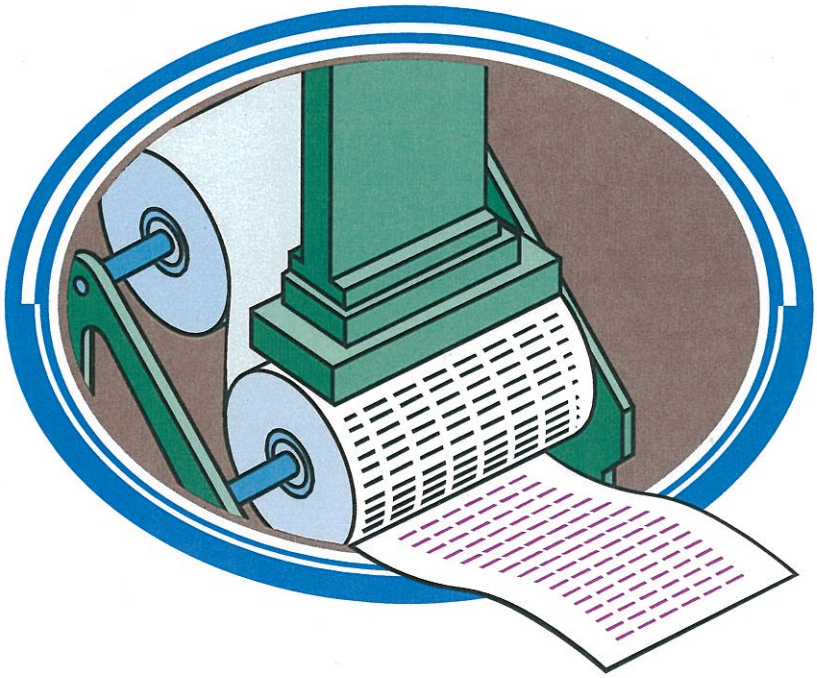
Wisconsin Department of Natural Resources

State Innovation Grant Technical Project Report



Cooperative Agreement No. PI 965809-01
Printing Sector Environmental Results Program Evaluation

July 2009

Wisconsin Department of Natural Resources
State Innovation Grant Technical Project Report

Project Title: Improved Environmental Results and Increased Regulatory Flexibility in Air Permitting for the Printing Sector Using EMS and ERP

Report: Printing Sector Environmental Results Program Evaluation

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EXECUTIVE SUMMARY

In June 2005, the Wisconsin Department of Natural Resources (WDNR) received a state innovation grant from the United States Environmental Protection Agency (EPA) to implement two projects involving Wisconsin's commercial printing industry. The pilot Environmental Results Program (ERP) created for small printers in Wisconsin is evaluated in this report. The second project focuses on establishing operating flexibility for large printing facilities required to have air operation permits under the Clean Air Act. An approved Environmental Management System (EMS) and commitments to achieve superior environmental performance are the foundation for establishing a Title V permit that establishes that flexibility. This EMS project is ongoing with an evaluation and final report expected to be completed by October 2009.

The printing industry in Wisconsin was selected as a focus of the innovation grant because of their longstanding interest in exploring alternatives that will enhance the ability of their industry, regardless of size, to meet environmental responsibilities. In addition, the printing industry in Wisconsin is economically important to the state, diverse in size and responsible for managing numerous environmental responsibilities. The printing industry in Wisconsin was viewed as an appropriate candidate for the EMS and ERP projects developed under this innovation grant from EPA.

The Wisconsin Department of Commerce (Commerce) Small Business Clean Air Assistance Program was instrumental in developing a comprehensive ERP covering air, waste and water regulations that affect small printers. Development of program specifics was a collaborative effort involving the EPA, other states, WDNR, Commerce, and national and local printing industry representatives. During the course of the ERP pilot, a website was developed, http://commerce.wi.gov/bd/BD-CA-PrinterERP.html, which outlines the project, purpose and materials available.

Despite obstacles, a successful pilot Environmental Results Program (ERP) for small printers was implemented yielding valuable information about this alternative regulatory approach and its potential use in Wisconsin. Numerous changes to tasks and schedule adjustments were made to address unanticipated issues that occurred during development and implementation of the ERP for small printers in Wisconsin. This included mid-course adjustments to the sample size; revisions to the database of printing operations; changes in the schedule for some milestones; new inspectors; and modifications to data entry procedures. In addition, during the three-year period that this pilot ERP was undertaken, the printing sector in Wisconsin was undergoing significant change, with consolidations and closures dramatically reducing the numbers of small printers' and making it difficult to achieve the planned sample size for either baseline evaluations or post-certification inspections. Limited WDNR resources were also a significant contributing factor to the reduced sample sizes.

Below is a summary of key findings, important lessons learned and recommendations concerning the future of the small printers ERP and potential for broader use of ERPs in the state.

Findings

- Overall, the ERP pilot measured improved understanding by small printers of all regulatory requirements.
- Printer performance was higher in the post-certification sample than in the baseline sample as demonstrated by an improvement in 17 of 32 Environmental Business Practice Indicators (EBPI). A statistically significant increase in achieving the following was observed:
  - Meet one of the following limits for the blanket or roller wash: ≤30% VOC by weight, or ≤10 mmHg vapor pressure at 68°F
  - Show compliance with state Hazardous Air Pollution (HAP) requirements
  - Use recycled solvent in any process (Best Management Practice or BMP)
  - Post warning signs regarding disposal of wastes and hazardous materials at every sink (BMP)

- The typical small printer in Wisconsin is a lithographic or offset printing operation with less than 10 employees, emitting less than 3 tons per year of volatile organic compounds (VOC) and generating less than 220 pounds of hazardous waste in any month.
- Of the printers inspected, 90% had VOC emissions of less than 3 tons per year and were Very Small Quantity Generators (VSQG) of hazardous waste.
- There is room for improvement in every environmental program. Programs with the greatest room for improvement include storm water; spill prevention and response; emergency response and preparedness; and wastewater. There appeared to be a better level of understanding among the smaller printers for air and hazardous waste program requirements. However, both of these programs had some requirements that were not being achieved by a substantial number of small printers.
- Incentives provided for self-certification participation were either misunderstood or did not fill a need for the types of printers eligible to participate in the pilot printer ERP.
- WDNR could achieve administrative efficiencies with inspections and permit issuance through the implementation of a comprehensive ERP that includes air, waste and water regulatory requirements. These efficiencies would increase as permits, licenses and approvals are replaced by the ERP and as inspectors gain experience with multi-media responsibilities. If ERP-based compliance inspections replaced not only Registration Operation Permit (ROP) inspections in air, but also inspections for small quantity generators in hazardous waste and small facilities in waste water, the time spent regulating a particular sector by the department could be reduced by 80%.
- This ERP pilot provided WDNR with a wealth of information about small printer compliance and their use of Best Management Practices. Distinct from our traditional approach, a comprehensive picture of the printing sector's understanding of compliance requirements and needs for additional compliance assistance was established through this project.

Lessons Learned

- Cost Savings and Efficiencies
  - Target a survey of likely participants at the inception of the project to better understand small printers, issues facing small printing facilities, and to improve compliance assistance (e.g. workbook contents, training workshops, compliance certifications).
  - Better position/locate inspectors to reduce travel time.
  - Maintain consistent inspector participation throughout the project.

- Improved Compliance Assistance and Self-certification Materials
  - Improve the self-certification checklist and include questions to filter whether a printer fits a certain category. There were many places where a facility did not need to answer a question but was not comfortable leaving it blank.
  - Modify the workbook to make it easier to use for very small printers. The smallest were quite intimidated by all the information. A better screening tool or simple guide to which sections apply based on amounts of ink, number of employees, etc. would help them find and read only the applicable sections.
  - Streamline the approach for the very small printers. It may be more effective to provide fact sheets and an abbreviated checklist to be returned and/or just retained on site.
  - Provide better incentives for printer sizes defined as "small" and "medium." Provide better publicity on incentives and explain "why does this help me?" in the self-certification process to improve the rate of return.

- Improved Inspection Procedures
  - Modify the inspection checklist to make more efficient use of inspectors' time and streamline the inspection process. (Example: make more effective use of filtering questions and arrange the order of questions to minimize need for repeated cross-checking during the inspection.)
  - Improve inspector training to increase knowledge and improve efficiency. (Example: The inspector training materials lists common violations but it would be helpful to provide examples of

common practices within the industry that comply with the requirements, such as using Chemgon containers to capture small amounts of contaminated wastewater and send it offsite for disposal.)

- Mandatory or Voluntary ERP
  - A mandatory self-certification requirement would improve the effectiveness of an ERP for small printers.
  - The results indicate there would be continued performance improvements if ERP were adopted as a permanent program by WDNR.

Future of the Wisconsin Printing ERP

- Offer the printing ERP as an annual certification option for those with printing registration operation permits (ROPs). Make modifications to the Environmental Compliance Assistance Workbook and self-certification to make it useful to ROP participants by eliminating information for the smallest facilities and improving the self-certification format.
- Increase the reach and effectiveness of Wisconsin's printer ERP by conducting additional outreach to printers that did not participate in the ERP during this project. Mail remaining workbooks (approximately 500) to printers that have not received evaluations or inspections or participated in voluntary self-certification and invite them to participate. Take actions to ensure that only open and operating printers are engaged.
- Support continuation of a voluntary ERP for all small printers in Wisconsin by providing ongoing support and training.

Future of ERPs in Wisconsin

- Wisconsin is continuing to explore the use of ERPs. Development of a Region 5 states (IL, IN, MI, MN, OH, WI) autobody ERP, supported by an Innovation Grant from USEPA and coordinated by Wisconsin, will soon commence.
- ERPs have a future in assisting business sectors to meet their environmental responsibilities in Wisconsin. This pilot has provided an important learning experience and relevant background information that support ongoing dialogue in WDNR concerning the future use of ERPs to meet regulatory responsibilities and improve environmental outcomes.

BACKGROUND

In June 2005, the Wisconsin Department of Natural Resources (WDNR) received a state innovation grant from the United States Environmental Protection Agency (EPA) to implement two projects involving Wisconsin's commercial printing industry. The pilot Environmental Results Program (ERP) created for small printers in Wisconsin is evaluated in this report. The second project focuses on establishing operating flexibility for large printing facilities required to have air operation permits under the Clean Air Act. An approved Environmental Management System (EMS) and commitments to achieve superior environmental performance are the foundation for establishing a Title V permit that establishes that flexibility. This EMS project is ongoing with an evaluation and final report expected to be completed by October 2009.

ERP is an innovative approach to improving and measuring the environmental performance of selected business sectors or groups. ERP uses a unique combination of linked compliance assistance, compliance certification and statistical performance measurement that leverages traditional compliance assurance activities to achieve improved performance for the selected group.

The Wisconsin Department of Commerce (Commerce) Small Business Clean Air Assistance Program was instrumental in developing a comprehensive ERP covering air, waste and water regulations that affect small printers. Development of program specifics was a collaborative effort involving the EPA, other states, WDNR, Commerce, and national and local printing industry representatives.

The printing industry in Wisconsin was selected as a focus of the innovation grant because of their longstanding interest in exploring alternatives that will enhance the ability of their industry, regardless of size, to meet environmental responsibilities. In addition, the printing industry in Wisconsin is economically important to the state, diverse in size and responsible for managing numerous environmental responsibilities. The printing industry in Wisconsin was viewed as an appropriate candidate for the EMS and ERP projects developed under this innovation grant from EPA.

The printing industry's interest coincided with an air permit streamlining project undertaken by the WDNR in 2003. This initiative came about due to broad based concerns about the amount of effort and time involved in air permitting as well as reservations about the value of this activity in achieving environmental improvement. Implementing process improvements is also desirable because resources at WDNR are declining, a trend likely to continue. All these circumstances provided a strong incentive for the development of innovative and efficient permit alternatives as an integral part of the streamlining project.

PROGRAM GOALS AND DESIRED OUTCOMES

The primary project goal was to improve compliance with air, waste and water regulations through an ERP program for small printing facilities. Secondary, but additional important goals included development of a pilot ERP that would achieve the following:

- Replace the need for state-required printing industry air quality registration and general permits and cover the compliance responsibilities of smaller printing facilities exempted from air permit requirements.
- Provide the state experience with this alternative regulatory tool.
- Assess if ERPs have a future potential to assist other business sectors in meeting their environmental responsibilities in Wisconsin.

A logic model was prepared at the inception of the project (Appendix A). The logic model is a comprehensive planning and evaluation tool that links resources, planned activities and participants with desired outcomes that relate to project goals. The desired outcomes are categorized into short-term, intermediate and long-term. The goals and outcomes identified in the logic model establish the foundation for the program evaluation in this report.

ERP DEVELOPMENT AND IMPLEMENTATION

The Wisconsin ERP for small printers was established as a voluntary program and implemented following the model established by Massachusetts, which includes compliance assistance that promotes pollution prevention, facility self-assessment and self-certification, and regulatory agency inspections to evaluate the success of the program at improving performance of an entire business sector. Under this model, ERP effectiveness is measured by collecting data from randomly selected samples of facilities before and after compliance assistance is provided and then conducting statistical testing to compare compliance rates in the two samples. A schedule of critical milestones was established to guide ERP development (Table 1).

Table 1: ERP Project Milestones

Original Milestone	Environmental Results Program Elements	Completed
September 2005	Develop performance indicators Identify universe of printers Gather data on administrative effort for current compliance or permit activities	August 2006 February 2007 Ongoing throughout, but finalized January 2009
December 2005	Develop workbook and inspection checklists Database development Develop statistical methodology	April 2007 workbook, November 2006 checklist November 2006 February 2007
March 2006	Conduct inspector training	November 2006
June 2006	Evaluate and revise QAPP and work plan Perform baseline evaluations	Initial QAPP was not revised June 2007
September 2006	Workbook and checklist to printers Analyze data and develop targeted materials for training based on inspections	May 2007 June 2007
December 2006	Prepare and provide technical assistance workshops	July 2007
January 2007	Facilities conduct self audits and submit self-certification Conduct State-to-state ERP Collaboration	November 2007 May 2008
April 2007	Evaluate self-certifications and implement targeted follow-up activities including response to RTC plans	February 2008
July 2007	Perform post-certification inspections	November 2008
October 2007	Prepare evaluation that compares data from post-inspections to pre-inspections and self-certifications concerning performance goals – make revisions to materials as needed, based on issues that the results highlight as areas to target	June 2009

A number of elements were not completed by the original milestones established. The creation of a pilot ERP for Wisconsin's printing sector was greatly assisted by the pioneering efforts of other states. However, as other states have experienced, unanticipated issues and issues unique to the printing industry sector in Wisconsin occurred, requiring modifications to the schedule and adaptations to certain tasks during ERP development and implementation.

Universe of Small Printers

Based on information provided by national printing associations early in the project, it appeared that Wisconsin might have as many as 3,000 facilities fitting the definition of a small printer. For the purpose of the pilot, printers with actual air emissions of any criteria pollutant less than 25 tons per year were included in the ERP. This definition of small printers fit with the facility emission thresholds established in the WDNR's air permit streamlining initiative to guide the development of new regulatory approaches. A confirmation of this initial estimate was made through a review of state databases using surrogate information, such as number of employees, since air emissions data for small printers is not readily

available. During implementation, the universe of facilities was discovered to be much smaller than 3,000 facilities. In part, this is due to consolidation and significant closure of small printers that occurred since 2005, when the pilot was initiated. The number of small printers fitting the definition in this pilot is currently estimated to be less than 1,500. A discussion of the ways our universe changed is found later in the report, in the section on adaptations made during the course of the project.

Environmental Compliance Assistance Workbook

In the fall of 2004, an ERP Working Group was formed. Their main task was to develop a plain language Environmental Compliance Assistance Workbook. Industry stakeholders on this group included representatives from Printing Industries of Wisconsin, Graphic Arts Technical Foundation, Specialty Graphics Imaging Association, Printers' National Environmental Assistance Center, Flexographic Technical Association, and Photo Marketing Association International. Representatives from each of the programs within WDNR that would have regulatory jurisdiction over printing activities were also included. It was the interest of the working group to include additional useful topics such as pollution prevention opportunities and guidance to meet federal spill prevention and emergency planning and communication responsibilities. Regulatory experts from EPA, OSHA, or Wisconsin Emergency Management (WEM) were consulted as needed to ensure that the requirements of these additional topics were accurately represented in the workbook.

Environmental Business Practice Indicators

The ERP Working Group reached agreement on 32 Environmental Business Practice Indicators (EBPIs) in August 2006 after careful study of numerous regulatory requirements affecting small printers and many relevant beyond compliance actions. Because these 32 EBPIs are high priority issues for small printers in Wisconsin, the Working Group agreed they would be the focus of the comparative evaluation of information obtained in the baseline evaluations and post-certification inspections.

Sampling Design and Statistical Methodology

The sampling design and statistical methodology for this project were planned between January 2006 and January 2007 and, in February 2007, we prepared a report summarizing our proposed statistical methodology (Bashel and Goldowitz 2007). We used the EPA spreadsheet tool Sample Planner (US EPA 2004) to examine how both sample size and confidence level affected the ability to detect differences in estimates of performance rates when comparing baseline evaluations to post-certification inspections. We proposed conducting statistical tests at the 95% confidence level, partly to facilitate comparisons with other states' ERPs and partly to maximize chances that the confidence intervals around observed compliance rates would contain the true performance rates (in other words, minimize chances of error). Facilities were selected for baseline evaluations and/or post-certification inspections by simple random sampling from the estimated population (universe) of small printers in the state. The proposed sample sizes were 190 facilities in both baseline evaluations and post-certification inspections. For the estimated population size (2910 printers), a sample of 190 inspections would yield a confidence interval, at most, ± 6.8% around a measured performance rate. In statistical comparisons between baseline and post-certification performance, samples of 190 inspections would allow us to detect differences of 13-15%. Our population size did change during the course of the project, and this is discussed later in the report.

Baseline Evaluations

Baseline evaluations were conducted between March and June 2007. Inspectors received multi-media training in advance of the initial evaluations. The original project plan was to complete the baseline evaluations within two to three months. It was determined at the end of May 2007 that inspectors would be unable to complete the planned 190 evaluations in advance of the Technical Assistance Workshops scheduled for July 2007. We discovered that many of the facilities contacted in the random baseline sample of 250 potential small printers were not engaged in printing. A drop-out rate of 76% occurred, with 54 baseline evaluations completed out of 222 contacts.

Technical Assistance Workshops

In July 2007, technical assistance workshops were conducted at two locations followed by a separate webcast. The two workshops were held at technical colleges regularly used by Printing Industries of Wisconsin for their events and training programs. These technical colleges are located in the two large

urban areas known to have the majority of printing facilities in the state. The webcast was a shortened version of the workshops; cutting down 3 hours to 90 minutes. There were 30 viewers for the live broadcast and a total of 110 additional viewers of the recorded broadcast over the following months.

Self-certification

The deadline for self-certification submittal was extended from September 2007, until early November to encourage more participation. Along with paper forms, an online self-certification form was made available. The final tally was 86 completed self-certifications. Some online forms were started but never completed, and others only included a signature page without a completed self-certification checklist.

Post-certification Inspections

Inspector refresher training took place in November 2007. Between December 2007 and November 2008, 80 post-certification inspections were completed. Workload issues affected the ability of inspectors to complete this task sooner.

Statistical Analysis and Evaluation of Results

Data from the baseline evaluations and post-certification inspections were analyzed and statistical testing was conducted between December 2008 and April 2009. The statistical analyses compared rates of environmental performance in baseline versus post-certification samples and tested for differences in those rates. We used EPA's spreadsheet tool, Results Analyzer 2006, to perform the analyses (US EPA 2006). The sample sizes achieved for baseline evaluations (n=54) and post-certification inspections (n=80) allowed us to detect differences in performance of 20-28%. This report presents analyses of the 32 EBPIs plus 13 additional important compliance measures. We also summarized the data in the voluntary self-certifications submitted and compared those with post-certification inspection results.

During May and June 2009, after the analyses and evaluation of results were completed, a draft of this report was also subjected to an external review process. Printing industry representatives, inspectors and WDNR program experts involved in ERP development and implementation were also provided an opportunity to review and comment on the draft report. Select comments are included in Appendix B.

Outreach

During the course of the ERP pilot, a website was developed, http://commerce.wi.gov/bd/BD-CA-PrinterERP.html, which outlines the project, purpose and materials available. Additional materials were developed to promote the training workshops (two postcards) and a reminder postcard was sent to increase participation in the self-certification.

In addition, the WDNR developed a webpage as part of the air permit streamlining initiative, Printers' Guide to Air Permits and Environmental Opportunities, http://dnr.wi.gov/air/permits/printers.htm. The website provides an overview of air permits for printers and features online links to permit materials, factsheets and useful resources. In addition, a full-color, glossy brochure, "Air Permit Options for Wisconsin Printers," was published for technical assistance. The brochure outlines the steps to take to determine which permit (or permit exemption) is best for a printing business. It includes a table of the permit types, purposes, eligibility, thresholds and the review and approval process time.

Initial and Final Allocation of Grant Funds

Cost savings in training and materials development permitted a shift in funds to cover needed personnel costs to complete the project. Two grant modifications were made to accommodate this need. Without this reallocation the baseline evaluations and post-certifications would have had a limited geographic coverage. The following is a comparison of the initial allocation and final allocation. Note that this includes the small printing ERP project and the large printing facility Environmental Management System Title V permit project.

Table 2: Initial and Final Allocation of Grant Funds

Category	Initial Allocation - June 2005	Final Allocation - February 2009
Personnel	76,560	105,235
Fringe Benefits	21,092	31,011

Table 2: Initial and Final Allocation of Grant Funds

Category	Initial Allocation - June 2005	Final Allocation - February 2009
Travel	15,584	17,343
Equipment	0	0
Supplies	30,000	13,835
Contractual	45,427	26,527
Construction	0	0
Other	0	2,453
Total Direct	188,663	196,404
Total Indirect	16,337	18,596
Total	$205,000	$215,000

DATA QUALITY ASSURANCE

Actions were taken to ensure that accurate and representative data was collected and that analysis of the collected data followed accepted statistical practice. This included an inspector training program, set procedures to guide inspection data entry, statistical evaluation of collected data and an external review of data evaluation and reported results. It should be noted that a methodology for statistical analysis was completed in February 2007 with the assistance of EPA's ERP consultant. The actions outlined below supplemented the initial Quality Assurance Project Plan (QAPP).

Inspector Training and Resources

To promote consistency, inspectors received training and were provided resource materials prior to conducting baseline evaluations and post-certification inspections. WDNR program experts from the air, waste and water quality programs were involved in this effort. The following actions occurred:

- A training session to review the inspection checklist and establish a common understanding of what constitutes compliance with regulatory requirements.
- Orientation visits to two printing facilities involving program experts and inspectors prior to performing baseline evaluations. The purpose of these visits was to provide practical experience with the checklist and improve the ability of the inspectors to assess compliance in all program areas and evaluate beyond compliance practices.
- Inspection tip sheets were created by program experts that contained common violations and problem practices.
- Inspectors were provided information packets including compliance assistance fact sheets and required compliance forms to provide to small printers during their visits.
- Inspectors had bi-weekly conference calls early in the baseline evaluation phase to share observations and clarify interpretations.
- A second training session was held prior to the post-certification inspections that included a discussion of lessons learned from the baseline evaluations.
- A compilation of interpretations and lessons learned from baseline evaluations was provided to inspectors involved in post-certification inspections.
- The inspection checklist was revised to streamline data collection in post-certification inspections.
- First-time inspectors enlisted for the post-certification phase were accompanied by an experienced inspector on at least one of their initial visits.

Inspection Data Entry

A quality check on each inspector's data entry was made by manually entering the results into a final database. Where answers were unclear or conflicted with other responses, the inspector was asked to clarify. Corrections were entered in the final database and notes regarding the changes were written on the hard copy inspection report.

Analytical Accuracy

Using EPA's Results Analyzer (2006 version) a comparison of the baseline and post-certification data was performed. The Results Analyzer is a spreadsheet-based tool that calculates the confidence interval around a particular compliance rate for a specified sample of facilities. Data are manually entered into

the spreadsheet to specify sample size, population (universe), and percentage of facilities complying. The Results Analyzer is also capable of calculating the confidence interval around the change between baseline and post-certification observations, as well as testing whether that change is statistically significant. Since the Results Analyzer can only accommodate manual data entry, a quality assurance check was performed to ensure that data were entered accurately and results accurately recorded. This involved two individuals separately entering data and recording results for all 45 questions analyzed in this report. The two sets of data were compared, and any inconsistencies were corrected.

External Review

A draft report was provided to EPA's ERP consultant for a critical review of analytic methods employed. Questions and comments from that review have been considered and incorporated or clarified in the final report.

ERP EVALUATION

Printer Profile

The ERP in Wisconsin was designed for the smaller printing businesses in the state. Specifically, the ERP targeted facilities whose primary business activity is printing but whose air pollution emissions are below the threshold where a facility-specific operation permit would be required. The collective environmental impacts of these small printers are a substantial portion of the printing industry's impacts. Printers with actual emissions below the following thresholds (the same as those in WDNR's Registration Operation Permit [ROP] for Printers, a generic permit available to any printer that can meet the eligibility criteria) were eligible for participation:

- 5.0 tons per year of any one federal hazardous air pollutant (HAP)
- 12.5 tons per year of all federal HAPs, and
- 25 tons per year of VOCs and each of the criteria pollutants (particulate matter, nitrogen oxides, sulfur dioxides, carbon monoxide)

The typical printer in the ERP project was a very small lithographic or offset printer with less than 10 employees, emitting less than 3 tons per year of VOCs and generating less than 220 pounds of hazardous waste in any month. More detailed information about the composition of printing businesses included in this project can be found in Appendix C.

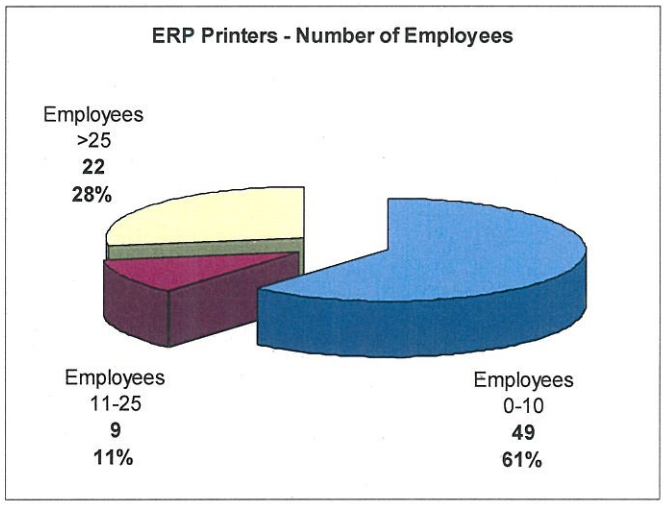


Figure 1: ERP Printers Number of Employees
Number and percentage of employees in printing facilities observed in post-certification inspections.
(80 inspections conducted during 2008.)

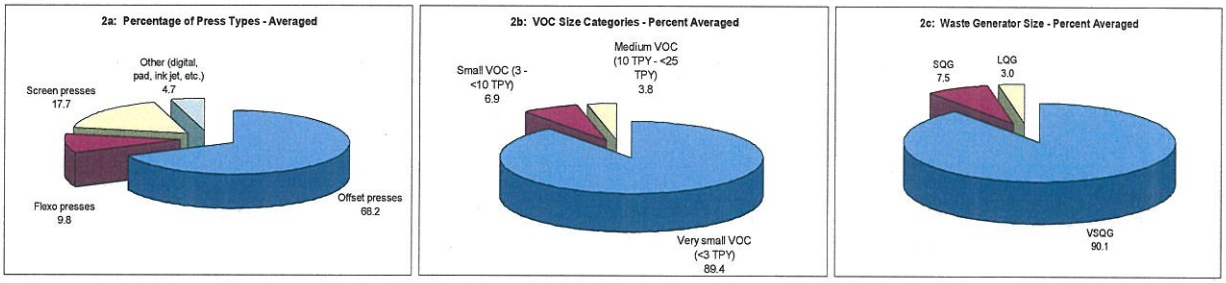
The number of employees was determined from post-certification inspection data (Figure 1). This information was not collected during baseline evaluations or self-certifications, but it was added during post-certification inspections to help inspectors filter the appropriate questions for each facility. Applicability of some questions depended on the number of employees (e.g., emergency planning). The

large majority of facilities (61%) had between 0 and 10 employees, and six (7.5%) were owner-operated and had no employees other than maybe a family member managing the office. The number of very small printers, especially the owner-operators, was much greater than expected.

Data characterizing printers are based on averages of both the baseline evaluations (n=54) and post-certification inspections (n=80). Figure 2 shows a characterization of the two samples by press types found at a facility, the size based on VOC emissions and the hazardous waste generator size. The printing operations were very similar in both baseline and post-certification samples.

Among the groups we observed, the printing facilities were largely comprised of lithographic printers, most of whom print on sheet-fed and/or non-heatset presses (Figure 2a). Based on volatile organic compounds (VOC) emissions, 90% of the printers inspected were Very Small (Figure 2b – less than 3 tons per year.) The majority of printers were also Very Small Quantity Generators of hazardous waste (VSQG; Figure 2c - 90.1%).

Figure 2: Printer Characterization
Each figure represents the average of baseline and post-certification inspections conducted during 2007 and 2008.



Data Collection

Data were collected from the small printers in three ways: baseline evaluations (simple random sample, n=54), voluntary self-certifications (n=86), and post-certification inspections (simple random sample, n=80). More information regarding differences in the two random sample sizes can be found under the section "What adaptations were made during the course of the project?" found later in this report. For the baseline evaluations and post-certification inspections, inspectors used a checklist of 160 questions. These data were then compiled to evaluate the performance of printers on:

- selected Environmental Business Practice Indicators (EBPIs);
- compliance with environmental requirements; and
- use of best management practices or pollution prevention practices.

EBPIs are the high-priority compliance issues and best management practices for printers. The 32 printer EBPIs were developed, early in the project, through discussions among WDNR staff as well as stakeholders. They are used to measure and compare printer performance on key environmental issues and include 7 BMPs, 22 compliance practices, and 3 questions to characterize the printers in the samples.

Compliance with environmental requirements is the traditional measurement for regulatory agencies. Compliance with environmental requirements was measured for air pollution, waste, waste water, storm water, spills and emergency response programs. Although the selected EBPIs include some priority compliance requirements, we also measured compliance with all existing environmental requirements to provide information to the regulatory programs.

Best management practices or pollution prevention practices go beyond compliance with traditional regulations and represent additional methods for reducing the environmental impact of a facility. Inspector checklists included best management practices that inspectors indicated were not required but would aid printers in reducing emissions and/or waste. A list of 100 recommended pollution prevention practices

was developed with the assistance of the Printers' National Environmental Assistance Center (the list was included in the Compliance Assistance Workbook also). Ten were selected for analysis as Best Management Practices (BMPs) and included on the inspectors' list of questions for both baseline evaluations and post-certification inspections.

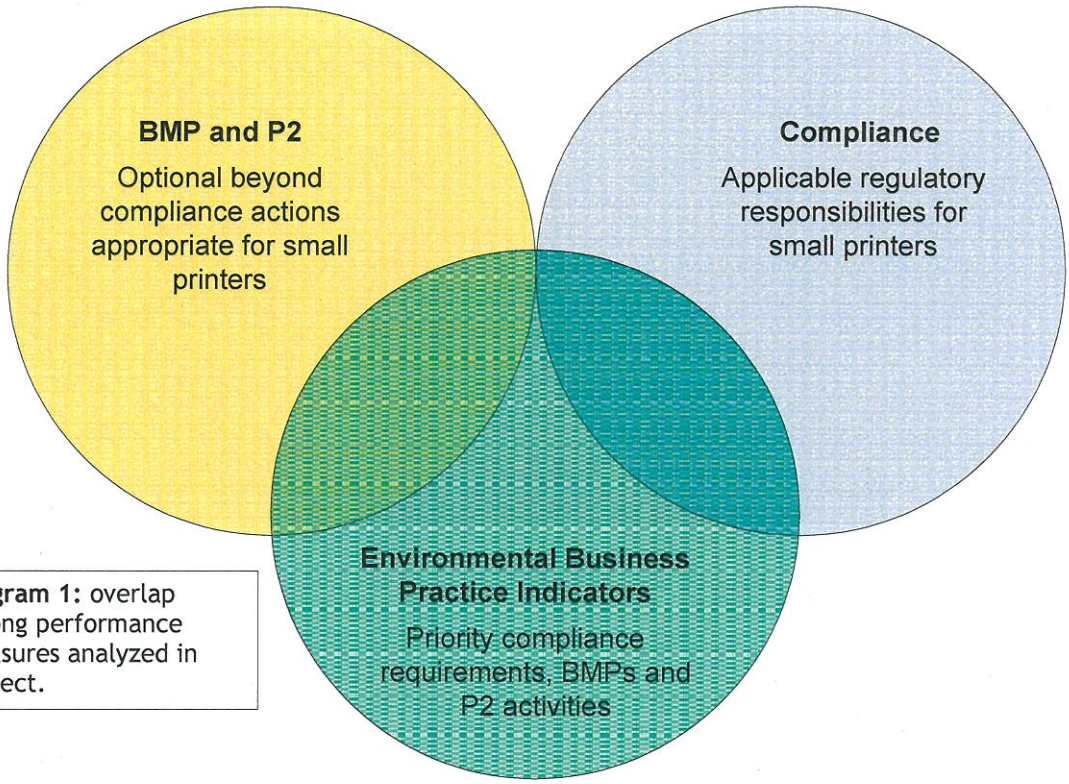


Diagram 1: overlap among performance measures analyzed in project.

What do the results of overall performance among printers tell us?

The results indicate there would be continued performance improvements if ERP were adopted as a permanent program by WDNR. Overall printer performance was higher in the post-certification sample than in the baseline sample. Out of 160 questions asked of printers during inspections, 32 had been selected as EBPIs. Overall, there was improved performance for 17 EBPIs, and for four of those 17 there was a statistically significant improvement at the 95% confidence level. Of the remaining EBPIs, two were unchanged and 13 showed decreases in performance, though the decreases were not statistically significant. Two additional EBPIs showed significant improvement at the 90% confidence level. (In our statistical methodology for this project, we planned to conduct analyses at the 95% confidence level, in part for consistency with other ERP projects but also to minimize the chance for errors in analysis.)

In order to establish a simpler way of looking at performance, the data were also reviewed qualitatively to determine thresholds for high, average and low performance. Setting thresholds for high and low performance is a way to identify both the compliance practices that are well understood (high) and those for which printers need more information to achieve better compliance (low). Based on the data, we set a threshold for high performance among printers at a compliance rate greater than 85%, and low performance at a compliance rate below 30%. (Cases where the compliance rate did not fall within the selected threshold in both baseline and post-certification samples are identified.) The Massachusetts Department of Environmental Protection (MassDEP) provided a similar performance comparison in its July 2003 *ERP Industry Progress Report* on its Printing Industry ERP, except that MassDEP selected 90% compliance as the only threshold to define high versus low performance.

Fifteen of the 32 Environmental Business Practice Indicators (EBPIs) selected for this analysis showed high performance, defined as more than 85% of the printers achieving a particular EBPI. There was very low performance (defined as 30% or less of the population in compliance) primarily in the best management practices that were very operation specific, and in program areas that were expected to have low compliance. In particular, there was low performance in storm water permit compliance, using secondary containment for oils and chemical containers, and having a HAZWOPER emergency response plan. It is in these areas of low performance where additional targeted training and outreach, beyond the initial compliance assistance provided during the ERP, would be likely to produce the largest improvements in performance.

In other important performance areas related both to regulatory compliance and adoption of Best Management Practices (BMPs) – for example, improving compliance with hazardous waste storage and disposal requirements, and improving management of clean-up wastes (solvents and rags) – the data yielded less distinctive results. There were eight performance areas that increased, three that decreased, and two that stayed the same. None of these changes was statistically significant.

For more detailed statistical analyses of the 32 EBPIs and 13 additional compliance practices which were included as project goals, see Appendix D of this report, which also includes the list of EBPIs selected. It is important to note that of these 45 practices we analyzed, 16 of them had sample sizes less than 20 facilities. This occurred because in some cases regulatory questions only applied to a small number of facilities. Detecting differences in statistical analyses is more difficult when sample sizes are small; this typically occurs because of larger margins of error, and thus confidence intervals, around samples that contain only a few observations.

Printer Performance Measured by EBPIs

Printers showed a slight improvement across all EBPIs. Figure 3 compares the distributions of facility scores on the 32 EBPIs for baseline versus post-certification samples. For the facility EBPI scores, the median increased from 5.1 to 5.6 between baseline evaluations and the post-certification inspections, indicating increased compliance with EBPIs.

Individual facility scores were calculated by counting the number of questions where the facility met the requirements, dividing by all the questions that applied to that facility, and then multiplying by a factor of ten to express the score as an index from 1 to 10. For example, if they met requirements for 5 questions and 14 applied to that facility, then 5 ÷14 x 10 or 3.6 is their facility score. Then an average and median of all facility scores for each sample were calculated to summarize overall performance. The median of the facility scores, shown in Figure 3, marks the midpoint of each distribution, i.e., half the facilities in that sample had lower scores and half had higher scores.

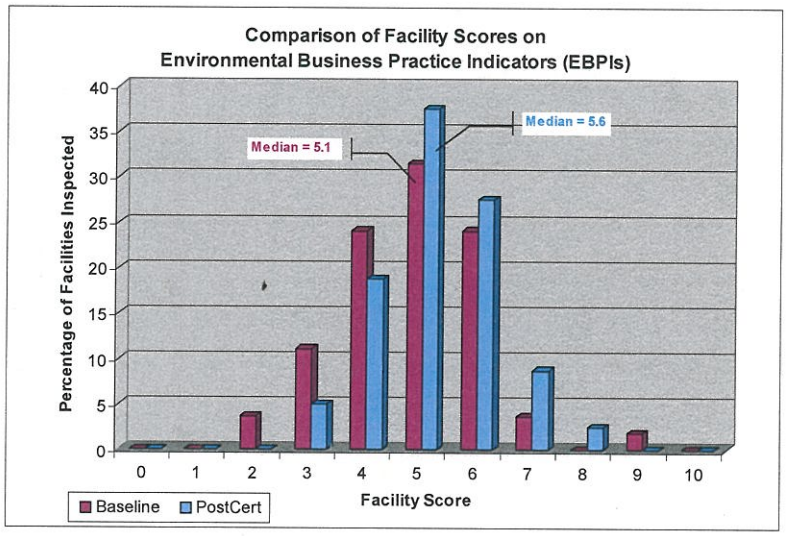


Figure 3: Comparison of Facility Scores on EBPIs

This figure compares the distributions of facility scores on the 32 EBPIs for baseline vs. post-certification inspections. Facility scores are grouped into classes, e.g., the bars at 3 show percentages of facilities with scores of 3.0-3.9. (Average baseline score = 5.2; average post-certification score = 5.7.)

There were observed increases in facility scores in air, waste, wastewater, spills, overall compliance, EBPIs, and best management practices (BMPs). Figure 4 shows the scores for baseline and post-certification performance in all categories analyzed.

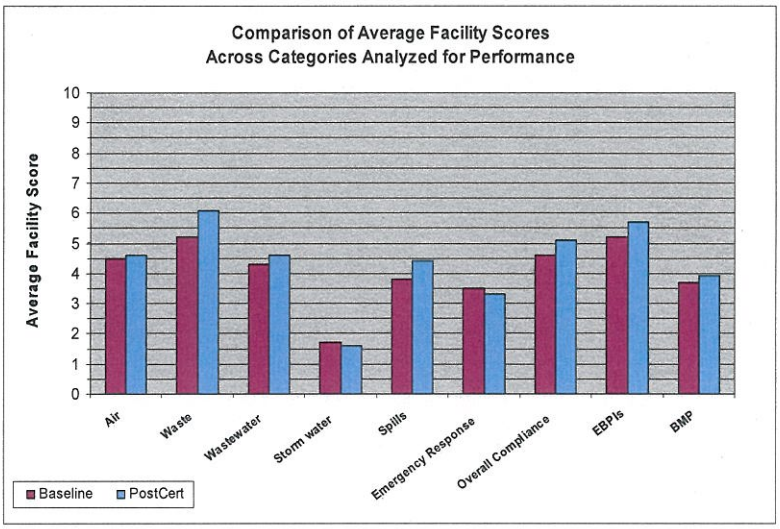


Figure 4: Comparison of Average Facility Scores by Categories Analyzed for Performance
This figure compares the average scores for baseline vs. post-certification inspections for each of the categories of questions analyzed.

Table 3: Average Facility Scores by Category

Category	Baseline	PostCert
Air	4.5	4.6
Waste	5.2	6.1
Wastewater	4.3	4.6
Storm water	1.7	1.6
Spills	3.8	4.4
Emergency Response	3.5	3.3
Compliance	4.6	5.1
EBPIs	5.2	5.7
BMP	3.7	3.9

The evaluation also looked at the performance rates for the EBPIs. The performance rate is high (above the chosen threshold of 85% or more of printers) for the following EBPIs:

- Close all press material containers except when filling/dispensing (only by post-certification)
- Cover all fountain solution mixing and storage tanks except when adding or draining solution
- Emit less than 3 tons per year of VOCs (Very Small category)
- Less than 1.5 gallons per day added to cold cleaner
- Meet one of the following limits for the blanket or roller wash: ≤30% VOC by weight, or ≤10 mmHg vapor pressure at 68°F (only by post-certification)
- Meet the limit of ≤5% VOC by weight, or ≤8.5% VOC by weight if refrigerated to ≤60°F for any sheet-fed presses
- Fountain solution meets one of three limits, depending on restricted alcohol content and refrigeration
- Maintain heatset press dryer at lower pressure than press room
- Meet state HAP requirements (only by post-certification)
- Generate or store hazardous waste (only by post-certification)
- Had no spills in the last 12 months
- Any spills were exempt from reporting
- Understand spill clean-up responsibilities
- Not using a septic system
- Meet all local POTW's requirements (only by post-certification)

A statistically significant increase in achieving the following EBPIs was observed:

- Meet one of the following limits for the blanket or roller wash: ≤30% VOC by weight, or ≤10 mmHg vapor pressure at 68°F
- Show compliance with state HAP requirements
- Use recycled solvent in any process (BMP)
- Post disposal of wastes and hazardous materials warning signs at every sink (BMP)

Printer Performance Measured by Overall Compliance Rates

In addition to statistical analysis of EBPIs and the thirteen additional practices listed under project goals, we have summarized some observations regarding the more traditional measures of compliance. In traditional regulatory enforcement (inspecting facilities and pursuing enforcement actions), a sector's performance is evaluated by comparing the rates of compliance with the regulatory requirements. A similar comparison was done for this project, comparing performance with the regulatory requirements included in ERP inspections.

Out of 106 regulatory questions, just 13 applied to all the printers. (These 13 are a different subset of regulatory questions than the previously mentioned 13 additional practices analyzed to meet project goals.) Four of the 13 regulatory questions that applied to all printers showed high performance, over the chosen threshold of 85% of the printers in compliance. Overall, observed performance improved for eleven regulatory areas, and one was a statistically significant improvement. The remaining two regulatory areas decreased in performance, but not significantly. The comparison of performance across the 13 compliance requirement questions that apply to all printers showed that:

- Compliance was high (above the chosen threshold of 85% or more printers) in four areas:
  - shop awareness of spill clean up requirements
  - keeping containers closed when not in use (high at post-certification)
  - showing compliance with the state HAP requirements (high at post-certification)
  - floor drains plugged or directed to holding tank (high at post-certification)
- Compliance was low (below the chosen threshold of 30% or fewer printers) in four areas—all of which were low for both samples:
  - use of secondary containment for oil and chemical containers
  - have an emergency response plan for HAZWOPER
  - submitted No Exposure Certification
  - have Storm Water discharge permit

The median of the facility scores for all regulatory questions increased from 4.4 to 5.2 from baseline to post-certification, as shown in Figure 5. This is among the better rates of improvement in performance from all the categories evaluated.

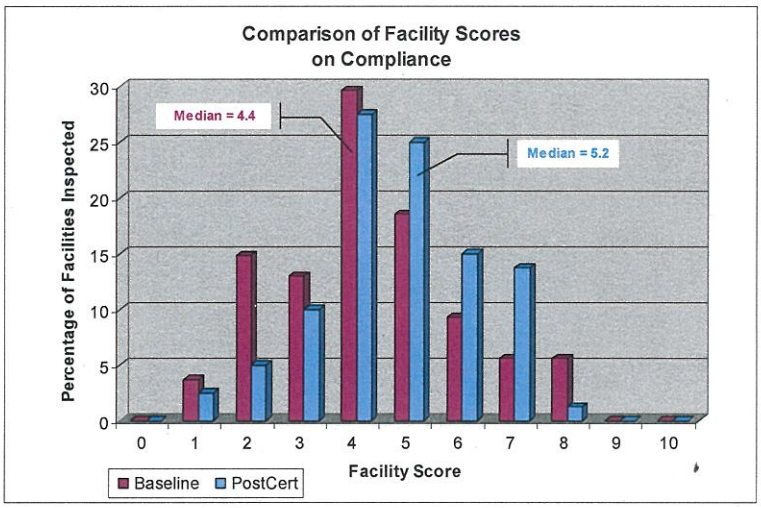


Figure 5: Comparison of Facility Scores on Compliance
This figure compares the distribution of compliance related facility scores for baseline vs. post-certification inspections. (Average score for baseline = 4.6; average score for post-certification = 5.1.)

NOTE: Individual facility scores were determined by counting the number of questions where the facility met the requirements, dividing by all the questions that applied to that facility and then multiplying by a factor of ten to express it as an index from 1 to 10.

Printer Performance Measured by Best Management Practices or Pollution Prevention Practices

The inspections measured printers' performance for ten best management practices (BMPs) selected from over 100 pollution prevention practices listed in the Compliance Assistance Workbook. The printers' performance across these baseline and post-certification samples on BMP questions was generally low. Some were practices that not every printer could adopt because of applicability or expense, and two were not selected as EBPIs. Among these BMPs:

- Performance was high (above the chosen threshold of 85% or more printers) on one practice—use of a recycling program in the facility
- Performance was low (below the chosen threshold of 30% or fewer printers) on five practices
  - reuse clean up solvent
  - posting warning signs at sinks
  - records of waste container inspections (low only at post-certification)
  - use onsite solvent recycling
  - use recycled solvent in process
- Performance increased from baseline to post-certification for seven practices—six of seven were EBPIs, and two increased significantly
- Performance decreased for three practices

A large number of facility scores for the BMPs were low in both samples. The median of facility scores for BMPs decreased from 3.8 to 3.3 from baseline to post-certification, while the average score increased from 3.7 to 3.9 (Figure 6). Low performance was expected given that many of these BMPs are either expensive to adopt or may not apply to the type of printing operations at a particular facility.

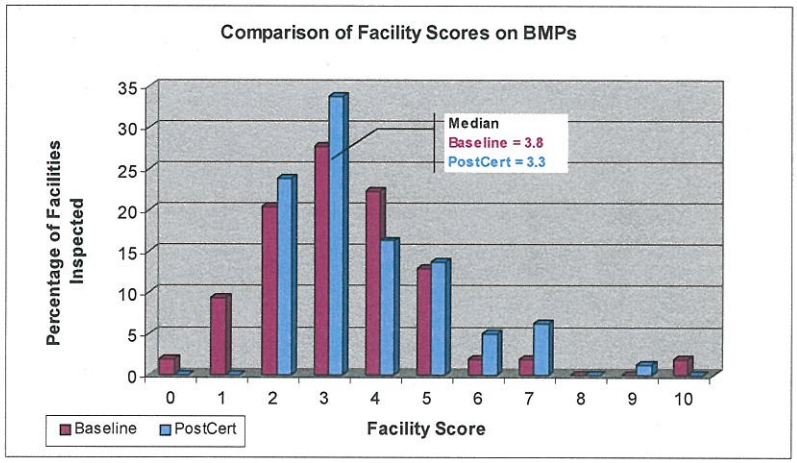


Figure 6: Comparison of Facility Scores on BMPs
This figure compares the distribution of BMP related facility scores for baseline vs. post-certification inspections. (Average score for baseline = 3.7; average score for post-certification = 3.9.)

What do the results of compliance with regulatory requirements within each program area tell us?
An evaluation of compliance with regulatory requirements shows that every program could improve performance with additional outreach and compliance assistance. The evaluation compared compliance results from the baseline evaluations to the post-certification inspections. Programs with the greatest room for improvement include: storm water; spill prevention and response; emergency response and preparedness; and wastewater. Air and hazardous waste also show room for improvement, but there appears to be a better level of understanding among the smaller printers of these program requirements.

Highlights from this evaluation are described below, and detailed information is in Appendix E. All of these statements are based on observations, rather than statistical analysis. We only conducted a statistical analysis of the EBPIs, and some of these compliance requirements were not among them. Again we are using the thresholds previously defined:

- high performance means printers had a compliance rate greater than 85%, and
- low performance means printers had a compliance rate below 30%.

If the compliance rate did not fall within the selected threshold in both baseline and post-certification samples, it will be identified.

Air Quality
Out of 50 questions about air quality practices, six applied to all the small printers and are summarized. Key results show:

- high performance on keeping containers closed unless in use (post-certification)
- high performance on complying with HAP requirements (post-certification)
  - compliance is due to the fact that many small printers will simply be exempt from the HAPs requirements
- low performance on reusing clean up solvent; however, this is expected, as the equipment to distill used clean-up solvents is expensive and only the larger printers could consider this option

Based on the median facility score for all 50 of the air questions, the understanding of all air requirements was less than 50% and showed slight improvement from baseline to post-certification.

Hazardous Waste
Ten of the 37 questions on waste practices applied to all the small printers and are summarized. Key results show:

- high performance on using a recycling program (post-certification)
- low performance on using onsite solvent recycling as well as using recycled solvent in the process (primarily cold cleaners)

The median facility score for all waste questions was above 50% and showed improved compliance from baseline to post-certification.

Wastewater
Three of the 33 questions on wastewater measures applied to all the small printers and are summarized. Key results show:

- high performance on plugging all floor drains or direct drainage to a holding tank
- low performance on posting warning signs at sinks

The median facility score for all wastewater questions was less than 50% but showed some improvement and highlighted an opportunity for further education.

Storm Water
Four questions on storm water measures applied to all the small printers and are summarized. Key results show:

- low performance on 1) facility had likely sources of contamination; 2) facility could make changes to cover exposed material; and 3) facility has a storm water discharge permit

The median facility score for all storm water questions was the lowest overall in any program area. Storm water program staff expected low compliance since little or no outreach has been done on the need for obtaining a storm water permit or submitting the No Exposure Certification. With some directed outreach, performance improvements are likely to occur.

Spills Prevention and Response
Four of the 13 questions on spills applied to all the small printers and were summarized. Key results show:

- high performance on a basic understanding of how to address spills
- high performance on avoiding spills in the previous 12 months
- low performance on having secondary containment for oil and chemical containers

The median printer score for all spills questions was low overall, but saw a modest improvement. This area presents an opportunity to improve performance with targeted outreach and education.

Emergency Response and Preparedness
Four of the 12 questions on emergency response, preparedness, and community right-to-know issues applied to all the small printers and were evaluated. Key results show:

- low performance on the requirements to file a form and pay a fee with Wisconsin Emergency Management (WEM), and
- high performance on not storing any hazardous chemicals in quantities above reportable thresholds

The median facility score for all 12 questions improved slightly, while the average score decreased. These are requirements that many small businesses are unfamiliar with, so there is an opportunity to make great improvements with targeted outreach and education.

What can we learn from the self-certifications?
While statistical analysis of the self-certification results was not a goal of this project, we were able to learn how the process could be improved for broader implementation. An evaluation of the self-certification process reveals two key points:

1) A mandatory self-certification would improve the ability to make comparisons with the inspectors' findings as well as offer a better fit among all the participants for the incentives provided. If there is not mandatory self-certification, the post-certification inspection sample should target self-certification participants in some way in order to better gauge accuracy of facility self-assessment. If you want to compare the self-certification data using statistical analyses, then a sufficient sample size would be necessary among the post-certification inspections.
2) Additional improvements to the Compliance Assistance Workbook and Checklist could increase participation and provide better assistance. (Some suggestions offered by participating printers are described below.)

Facility self-certifications and other voluntary participation were not used to measure overall performance. However, it is important to examine these elements to determine if there are gaps in understanding requirements. The following table shows the number of printers participating in voluntary elements of the ERP.

ERP component	Number of printers participating
Outreach	130 printing owners or employees attended the workshops or viewed the webcast to gain an understanding of their environmental responsibilities
Compliance Assistance	Commerce staff received 158 requests for assistance throughout the self-certification process
Self-Certification	86 facilities used the ERP workbook and checklists to submit timely self-certifications

More printers took the opportunity to review the ERP materials and ask for assistance than actually submitted a self-certification. While the numbers of those who participated in outreach or compliance assistance can't be directly matched against those who submitted self-certifications, there were a number of self-certifications started online that were never completed. These were deleted prior to downloading the data for analysis. Additional observations from workshop and/or self-certification participants can be found in Appendix C.

Accuracy of Self-certification Information
There were not enough data to make a meaningful comparison between any individual printer's self-certification and their baseline evaluation and post-certification inspection results. However, nine printers submitted self-certifications and also received inspections in the post-certification sample, allowing a small sample of responses to be compared qualitatively.

The comparison results are highlighted below:

- Air— 78% were in agreement on general VOC compliance questions, and 89% agreed on whether printers showed compliance on the state hazardous air pollutant rule; 55% agreed on use of BMPs
- Waste— 55% agreement on whether printers generated any hazardous waste, and among those facilities, 100% agreement on compliance with management requirements
- Water— 67% agreement on posting signs; 50% agreement on whether printer was generating industrial wastewater; 43% agreement on whether wastewater sent to POTW
- Storm Water— 22% agreement on submittal of No Exposure Certifications as needed; however, in some cases printers submitted exemption statements between the time of self-certification and the follow-up inspection
- Spills and Emergency Response— 55% agreement on secondary containment for oil and chemicals

This was a limited analysis but emphasizes the need to include an accuracy determination when designing a program. Determining the accuracy of self-certification responses would be much more informative if the self-certification was a mandatory requirement. Such an analysis was not a primary objective of this ERP. However, if analyzing the accuracy of self-certifications is a future goal, then the post-certification inspection sample should look closer at self-certification participants, and select a subset with a sample size that would be sufficient for statistical comparisons.

Return to Compliance Plan Submittals

A Return to Compliance Plan (RTCP) is required when a facility is out of compliance with a requirement. This is a voluntary disclosure of non-compliance found by a facility's self-certification that would likely not otherwise be known by the agency. We received 19 RTCPs submitted by seven facilities, out of 86 total that submitted self-certifications. A review of the actual self-certification responses revealed that seven RTCPs were required, and only three of those were addressed in the RTCP submitted. This discrepancy means that four required RTCPs were missing and 16 unnecessary RTCPs were submitted. The differences between the required and submitted RTCPs are summarized in the following table.

Compliance Measure	RTCP Required	RTCP Submitted
Air — VOC records sufficient to demonstrate compliance		1
HW — properly label containers	1	1
HW — rags handling		1
Water —warning signs at sinks, don't put wastes down drain		1
Water — haul silver waste to recycler	2	
Water — meet Computer-to-plate requirements	4	2
Storm Water — No Exposure Certification		3
Spills — prevention, Emergency Action Plan, etc		10
Total	7	19

Pollution Prevention Practices

Printers were asked as part of their self-certifications to count the number of pollution prevention practices implemented from a list of over 100 in the Compliance Assistance Workbook. Printers indicated that many practices had been applied. According to certified and completed forms from 86 small printers:

- 21.2% implemented 50 or more practices
- 27.1% used at least 10 but less than 50 practices
- 51.7% implemented at least 1 and up to 10 practices

Comments from Participants
Surveys of the self-certification participants and comments from printers calling for compliance assistance show that participation may increase if several changes are made. The comments emphasized two key areas:

- **Too detailed** — provide a shorter summary that tells me if I use this amount of ink and have this amount of waste, then I only have to follow certain requirements
- **Liability concerns** — very helpful process to go through, but I'm concerned about answering questions that don't apply and then signing the certification statement

These comments could be addressed by making minor changes to the self-certification questions and providing an additional screening tool for the smallest printers that directs them to the relevant sections of the Compliance Assistance Workbook to review and understand.

What benefits would WDNR see if ERPs were adopted?
In the short term, there are resource savings that would result if ERP is adopted to complement traditional permit and compliance programs. The WDNR plans to continue collecting self-certification data from printers with ROPs and using permit exemptions to improve environmental performance, reduce costs, and reduce emissions to improve air quality, even if other ERP elements are not adopted. Additional outcomes will need to be measured beyond the term of this project to determine whether the printer ERP can achieve continued performance improvement.

Administrative Efficiency
A comparison of inspection and permit workloads shows that WDNR would achieve administrative efficiencies through the implementation of a comprehensive printing ERP that encompasses air, waste and water regulatory requirements. These efficiencies would increase as permits, licenses and approvals are replaced and as inspectors gain more experience with multi-media requirements.

Early evaluation of WDNR administrative and engineering time saved by using ERPs compared to the traditional program and ROPs shows that, while ERP does not save much more time than ROPs for the air program, significant savings do come from addressing the regulations from two additional programs in a single visit. If ERP-based compliance inspections replaced not only ROP inspections in air, but also small quantity generators in hazardous waste and small facilities in waste water, the time spent regulating a particular sector by the department could be reduced by 80%. Where the ERP inspections took an average of 6.8 hours, the average time for the combination of inspections conducted for air ROPs, HW at small printers, and WW at similar sized small facilities was 33 hours. Refer to Appendix F for more details.

ERP	ROP + HW + WW	Time Reduced
6.8 hrs	16 + 9 + 8 = 33 hrs	[1- 6.8/33] * 100 = 79.3%

The ERP inspections may not include the same level of detail in a full compliance inspection in some or all of these programs, but by addressing the performance indicators of greatest concern to the agency they will capture whether a stronger enforcement presence is necessary. This could also offer a more efficient way to target limited inspection resources.

Replacing Permits
A Registration Operation Permit (ROP) for printers, developed during the ERP project, allows use of the ERP self-certification process to satisfy the permit's requirement for annual compliance certification. The ERP workbook and checklist work well for those printers that are eligible to use the air permit exemptions—particularly the new actual emissions based exemptions. While the overall development time was similar for ROP and the ERP, the multimedia aspect lends additional benefits. Although the hazardous waste and wastewater programs might not have similar permits, the storm water No Exposure Certification process could be incorporated in an ERP certification to save time and effort. The No Exposure Certification is WDNR's exemption process for the storm water program. If a printer can answer "No" to eleven questions about storm water exposure, it can be exempt and is eligible to submit

the No Exposure Certification. In an ERP, this could be summarized in one 'roll-up' question asking "Do you qualify for No Exposure Certification?," and thus could eliminate the additional form required currently.

Sector-wide Improvement in Regulatory Understanding and Compliance
While environmental performance among printers was higher in some regulatory areas than others, the ERP improved understanding of the regulatory requirements sector-wide. ERP could be used to improve understanding and compliance among many businesses that are too small to need their own air permits. Using ERP could then benefit WDNR by educating a wider range of businesses and bringing them into compliance also.

What were the obstacles during ERP implementation?
There are a number of lessons learned regarding obstacles to implementation of the ERP project. Resources and incentives to drive participation were two main obstacles to achieving some of the project goals. If ERP were adopted by WDNR, but not as a mandatory program, then it is recommended that additional incentives be provided to increase facility participation rates. For example, printers may have stronger incentive to participate if the ERP self-certification could be used to satisfy other reporting requirements, such as WDNR's storm water No Exposure Certification (exemption) form or WEM's Emergency Planning Notification Determination form.

Resources
Each phase of inspections took much longer than planned, primarily due to the additional workload of this project and the travel time to facilities. The compliance inspectors did not get a break from their normal inspection commitment and resulting enforcement actions, so ERP inspections were put off until their schedules cleared to some degree. Also, it is clear that travel well beyond their normal area of jurisdiction took more time and made it harder to schedule the ERP inspections. Normally, inspectors have an assigned area where facilities are likely to be within an hour drive, maybe two. Many ERP inspections were 3 hours or more away from the inspector's home base. The ERP inspections took less time to prepare and conduct on-site, when compared with traditional or even Registration Operation Permit inspections, but these time savings were significantly offset by the extra travel time.

Incentives
Wisconsin's ERP did not have a very high participation rate due to few meaningful incentives for smaller printers and lack of a regulatory driver. States with higher voluntary self-certification rates (around 50%) had a good mix of both incentives and regulatory drivers. Incentives ranged from placing the non-participating company's name on a high priority inspection list (Rhode Island), to extending compliance deadlines for participants when a new regulation was implemented (Massachusetts dental ERP), to recognizing participation through an Environmental Leader program (Maine).

The primary incentive that WDNR provided was the ability to use the Environmental Compliance Audit program under Wisconsin's Green Tier law, which would have offered limited protection from enforcement action assuming all eligibility criteria were met. However, implementing this became problematic because the timing of the ERP made eligibility for the compliance audit program difficult. The biggest difficulty came with meeting the requirement that a "Notice of Intent" must be received by WDNR at least 30 days prior to the facility submitting a self-assessment. Printers were provided with a return postcard to submit to WDNR to satisfy the "Notice of Intent" requirement. But the time between mailing of the self-certification materials (approximately July 3, 2007) and the self-certification deadline (September 21, 2007) gave printers less than 90 days to complete the whole process.

Out of 36 printers who submitted "Notice of Intent" postcards, only 3 submitted RTCPs with their self-certifications. A total of seven facilities submitted RTCPs, so four facilities either did not understand or feel the need to participate in the Environmental Compliance Audit program by submitting the "Notice of Intent" postcard.

The self-reported violations submitted in the RTCPs were, in nearly every case, corrected by the time the forms were submitted or very shortly thereafter. Also, none of the corrections was a violation that would

have triggered a major enforcement action on the part of any WDNR program. It is likely the programs would have used their enforcement discretion to allow the printers time to come into compliance without penalties.

What adaptations were made during the course of the project?

Several modifications were made during the ERP project, including: mid-course adjustments to the sample size; revisions to the database of printing businesses; changes in the schedule/timing of milestones; changes in the inspectors involved; and modifications of the data entry procedures for the inspectors.

Sample Size Adjustments

Based on an estimated population of 2910 printers, our sample size goal was 190 printers. This would have yielded a confidence interval width, at the 95% confidence level, of 13.6% around proportions from this sample. Our inspectors experienced a very high drop-out rate, 76.3%, among the facilities in the random sample. Attempting to stay on schedule, these and other obstacles dropped the final sample to 83 printers. However the data for 29 printers were subsequently lost—when a Tablet PC was stolen before any data had been transferred—and our final baseline sample was down to 54 printers. Unfortunately the workshops had been conducted prior to the loss of data, so no additional baseline evaluations could be conducted without potential bias. None of the facilities with lost baseline data either participated in self-certification or was inspected in the post-certification phase, so we should not have any bias in later samples as a result of losing these data.

Additional information obtained during the outreach, compliance assistance and self-certifications combined with inspectors' drop-outs reduced the population of printers to 2079. The goal for the post-certification inspections was reduced from 190 to 100 due to the smaller estimated population of printers and resource limitations. Again, a mix of obstacles and scheduling decisions cut the planned sample short of the goal, and the final sample was 80 printers. Throughout the post-certification inspection stage, the drop-out rate in the random sample remained high, 59.3% for the post-certification sample.

Even with the smaller sample sizes than planned, the resulting margins of error around performance rates for indicators (excluding informational questions and those that did not apply to all facilities) were always less than ±15% (yielding a 30% confidence interval). If we had been able to collect larger inspection samples, as originally planned, we would have had greater ability to detect differences between baseline and post-certification performance levels.

Accurate Database of Printers

Creating an accurate list of small printers in Wisconsin proved to be challenging. There is no business registration requirement in the state, so two sources were used to develop the initial list of printers: Reference USA, a business database subscription service; and Wisconsin Department of Workforce Development (WDWD) worker's compensation records. The list from Reference USA was a year old when it was downloaded and is corrected on a cyclic basis (i.e., some percentage of the list is updated each month). The state's list of companies holding worker's compensation insurance, indicating the presence of employees at a business, was out of date. For example, one facility that was listed on WDWD's list had been out of business for five years.

The use of Standard Industrial Codes (SIC) and North American Industrial Classification System (NAICS) codes also caused some difficulty in correctly identifying printers. The printing associations provided a list of likely codes used by printing operations, including plastics manufacturing facilities that may print on their products. This long list of possible printer industry codes expanded the population beyond our original intent. A number of businesses use codes for printing activities or even include printing terms in their company name—like publisher, communications, or copy center—but are not printers with onsite printing presses. Many of these facilities did not get filtered out until inspectors called to arrange a visit.

Maintaining an accurate list of printers was also difficult. If the observed drop out rates of 76% (baseline) and 60% (post-certification) applied to the population as a whole, we might estimate that there are between 698 (2910 - (0.76 x 2910)) and 832 (2079 - (0.6 x 2079)) small printers in Wisconsin. Later in the

project, the printing trade groups indicated their sources showed approximately 1,100 printers in the state, much lower than they had originally estimated. We also observed a high rate of closures and down-sizing going on within Wisconsin's printing industry during the three years of the project. Inspectors repeatedly came across one or two-person print shops where the owners had either just retired or were about to retire. Other small printers had recently consolidated or were in the process of consolidating and selling their equipment to larger printers. The consolidations were due to a range of issues including retirement, greater competition for new markets, and getting jobs done quicker for lower costs.

It is recommended that states look carefully at the sources used to compile their target list of businesses. If the only resources available are broad business databases, find a way to filter out the list early in the process and ensure accuracy. Conducting a targeted survey up front, to characterize the industry, could save valuable time.

Changes in Timing of Milestones

The projected and actual completion of milestones is presented in the Implementation portion of this document. Baseline evaluations concluded at the end of June 2007 and fell short of the 190 sample size goal, in part due to the fact that workshops were slated for the first two weeks in July and the self-certification phase needed to take place soon after training. The next available time for these workshops would have been late Fall 2007 or early in 2008, in order to avoid conflicts with the printing associations' national conferences. One of the association representatives whose participation was essential to the ERP workshops had this conflict. The goal was to start and complete the post-certification inspections by the end of 2007 with a final report by June of 2008. Pushing workshops back to the end of 2007 would have pushed the rest of the schedule back by six to nine months.

Following the self-certification deadline in September 2007, the original schedule planned for post-certification inspections to be completed by the end of 2007. However, the self-certification period was extended through early November 2007 to encourage higher participation. Inspector refresher training for the post-certification inspections took place during November 2007, since new self-certification submittals seemed unlikely. Post-certification inspections began in late November 2007. Illness and enforcement actions combined to delay ERP inspections for months at a time. Finally, one year later (November 2008), 80 post-certification inspections were completed. Inspections would have been completed within the intended schedule of two to three months if inspectors were able to give the ERP inspections a high priority.

Inspector Changes

The project encountered various complications in the workloads and schedules for individual inspectors that contributed to the need for a sample size adjustment. During the baseline evaluation round, one inspector left before conducting any inspections. Three remaining inspectors were unable to complete a minimal number of inspections within a few months, so two additional inspectors were added to complete the baseline evaluations. Two new inspectors were added for the post-certification round, replacing two of the baseline inspectors who dropped out. One of the new inspectors was from a regional office close to the area with a large number of printers in the hope that having inspectors more evenly spread out would resolve some of the travel issues. In order to minimize any potential bias that might arise from using different inspectors, individual training and standardized tools to guide data collection were provided to each new inspector that came on board.

Data Entry Changes

We saved time by eliminating the inspectors' use of Tablet PCs to enter data electronically during site visits. Inspectors found that using the Tablets was not efficient. Midway through the baseline evaluations, the majority of inspectors resorted to completing their inspection checklists on paper and sending copies to the project lead.

Issues with electronic data entry included: the MS Access data entry application did not work as expected, use of the Tablet PCs during the walk-through made asking questions and logging answers awkward and slow, and the project lead did not always have timely data because of the inspectors' problems sending Access databases via email (state email system makes this complex).

Project staff would consider future use of Tablet PCs if professional database development were available to ensure smooth functioning of the data entry process. On the other hand, as technology improves, it would make sense to evaluate smaller devices that could be used for a similar purpose since the Tablet itself was rather cumbersome.

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