January 2003

National Pollution
Prevention Roundtable

An Ounce of Pollution Prevention is Worth Over 167 Billion* Pounds of Cure:

A Decade of Pollution Prevention Results 1990 - 2000

January 28, 2003

Produced by the National Pollution Prevention Roundtable (NPPR) with funding provided by the United States Environmental Protection Agency's Office of Prevention Pesticides and Toxics' Pollution Prevention Division and NPPR.

Acknowledgements
NPPR would like to thank EPA's John Cross, Acting Division Director for U.S. EPA's Pollution Prevention Division, Cindy McComas, Director - Minnesota Technical Assistance Program (MNTAP) and Ken Zarker, NPPR Board Chair (Texas Commission on Environmental Quality), for all of their support and input into this seminal document. NPPR hopes that this paper becomes the starting point as well as launching pad for further work measuring pollution prevention successes across the country and globally.

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On the cover:
The number in the report's title, 167 billion pounds, includes the data from the air, water, waste, combined and electricity column of Table 1.4. This Electricity was factored in by multiplying the kilowatt hours reduced by the average amount of SOx, NOx and CO2 emitted for each kilowatt-hour produced in the United States. These averages were taken from the American Wind Energy Association. The report can be viewed at the following address: http://www.awea.org/pubs/factsheets/EmissionKB.PDF.

It should also be noted that the number of pollution reduced or eliminated due to P2 is the compilation of data reported from 24 programs. More programs reported results but only 24 provided detailed enough data to use throughout the entire report. This helps illustrate that with minimal resources and dollars P2 programs are able to reap big rewards.

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The National Pollution Prevention Roundtable, a 501(c)(3) non-profit organization, is the largest membership organization in the United States devoted solely to pollution prevention (P2). The mission of the Roundtable is to provide a national forum for promoting the development, implementation, and evaluation of efforts to avoid, eliminate, or reduce pollution at the source. The Roundtable believes that the efficient use of materials and resources is vital to the protection and enhancement of human health and the environment, and the conservation of natural resources. The Roundtable further believes that these efforts are integral to the pursuit of environmentally responsible economic development.

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I. Executive Summary and Recommendations

The objective of this study was to evaluate and report state and local pollution prevention program achievements over the past decade. This report is the National Pollution Prevention Roundtable's first cohesive attempt to collectively document and explore the myriad of innovative pollution prevention (P2) activities and results on the state and local levels, and translate the data into aggregate nationwide results.

The three main parts of this report consist of a general overview of state and local programs, quantitative data demonstrating the effectiveness of P2, and several examples of successful case studies from across the country to help give a more detailed illustration and demonstration of P2 in practice.

The data included in this report is compiled from more than 60 programs across the United States. This study documents the progression and growth of P2 programs across the country from the passage of the Federal Pollution Prevention Act in 1990 to 2000. During this period, thousands of companies and state and local governments implemented pollution prevention programs and activities. In almost every case, these efforts have not only led to environmental improvement, but have been cost-effective, saving millions of dollars per year.

Some results from this study include:

- For the period 1990-2000, NPPR calculated that more than 167 billion pounds of pollution were prevented, calculating air, water, waste, and energy efficiency measures as reported in the surveys;
- In addition to pounds of pollution prevented, the P2 community also reported more than 4 billion gallons of water being conserved;
- In 1998 alone, programs reported saving as much as $256 million nationwide;
- During the period 1998 to 2000, 13 P2 programs with a total average budget of $1.9 million annually reported total cost savings equal to $404 million. This represents average savings equal to 5.4 times the budget allocated to implement the P2 programs responsible for these results; and
- In response to questions about barriers hindering successful implementation, 70 percent of respondents said that they had a lack of capital and 40 percent complained of the high rate of staff changes as well as a lack of management commitment. Please see Table 1.5.

Table 1.5 P2 Implementation Barriers

State Agencies	AL	AK	AZ	AR	CA*	CA**	CT	DE	FL	GA	HI	ID	IL*	IN*	IN**	IA	KS	KY	LA	ME	MD	MA	MI*	MI**	MN	MS	MO	MT*
Lack of capital	x	x	x	x	x	x			x	x		x		x		x	x			x		x	x		x	x	x	
Staff changes	x		x			x		x		x				x		x	x					x			x		x	
Lack of management commitment						x			x	x	x			x	x			x			x	x	x		x		x	

California*= California Integrated Waste Management Board
California**= Department of Toxic Substance Control
Illinois *= P2 Program, Il. Waste Management and Research Center
Indiana*= Indiana DEM
Indiana**= IN Clean Manufacturing Tech and Safe Materials Institute
Michigan*= DEQ EAD
Michigan**= DEQ Field Unit
Montana*= Montana DEQ

The report concludes with an outline of some of the works in progress related to pollution prevention and gives an idea of what the future might bring in a *Looking Forward*, section. This prospective section includes outlines of some of the cutting edge work being done in the measurement field by a variety of organizations including the Northeast Waste Management Officials' Association (NEWMOA), National Environmental Trust (NET) and Florida State University.

It is important to note that pollution prevention, as defined in this report, is multi-media in scope, and means to reduce or eliminate pollution at the source. End-of-pipe data is not included, such as recycling, control or treatment results. NPPR's interpretation of P2 is also broader than most state definitions, including energy efficiency. The organization also considers conservation a prevention approach. Unfortunately we were unable to include the water conservation results into the overall reduction number from this study, due to the difficulty in finding a uniform unit of measurement.

Innovative sustainability measures that do not transfer pollution from one medium to another and instead reduce or eliminate waste streams are prevention. Pollution prevention encompasses any and all innovative approaches focused on reducing the environmental footprint of mankind. All types of tools and practices are part of the toolbox used to identify P2 opportunities and implement them including Environmental Management Systems (EMS), industrial site visits and inspections, permitting, voluntary private-public partnerships and even software tools such as environmental management accounting software. For more specifics on the definition of P2, see chapter I containing background information.

The appropriation and actual federal budget for state and local government pollution prevention programs nationwide amounts to less than $6 million annually. This is less than one percent of what is allocated for state media grant programs (air, water and land). Taking into account this small allotment of resources and support over the past decade and the fact that these programs compete for support and resources against established media programs with strong regulatory requirements, the results are impressive.

This report also highlights the fact that pollution prevention efforts, due to poor funding, are still in their infancy and are just scratching the surface of the environmental landscape. Tepid political support and weak legislation such as the 1990 Federal Pollution Prevention Act, which contained a good framework but lacked real teeth and was never fully implemented, also contributed to the lack of nationwide focus on prevention.

It is reasonable to deduce from this report, that if these programs, which emphasize efficiency, were funded comparatively to their sister media programs such as the air, water and hazardous and solid waste

Table 1.5 P2 Implementation Barriers

State Agencies	MT**	NE	NV	NH	NJ	NM	NY	NC	ND	OH	OR	PA*	PA**	SC	SD	TN	TX*	TX**	UT	VT	VA	WI*	WI**	WY	**Total**	**%**
Lack of capital	x	x	x	x	x			x	x	x		x	x	x			x	x	x	x	x	x		x	**36**	**69**
Staff changes	x		x		x				x			x		x			x			x	x		x		**21**	**40**
Lack of management commitment			x		x								x	x							x		x		**18**	**35**

Montana**= Peaks to Prairies P2 Information
Pennsylvania*= PA DEP
Pennsylvania**= PENNTAP
Texas*= Lower Colorado River Authority
Texas**= TNRCC
Wisconsin*= Wisconsin DNR
Wisconsin**= Solid and Haz Waste Education Center, UW Extension

departments, the United States would reap serious environmental and financial benefits. This focus on efficiency would lead to increased global market competitiveness for the United States.

Much more is being accomplished than NPPR can capture in this report, due to time limitations and resources. We want to underscore the fact that this report is just the beginning of the process to measure the effectiveness of P2 efforts nationwide, in both the private and public sectors. NPPR's study is focused on the public sector side, since this is where the organization's voting membership resides. However, in the future with more resources, it is conceivable that we will be able to more comprehensively identify, track and quantify the impact of all types of innovative, eco-efficiency programs promoting P2, including federal agency initiatives and private sector programs. This will in all likelihood leads to results that far surpass our current calculations.

An Ounce of Pollution Prevention is only the beginning – it is not the ultimate dissertation on the subject regarding P2 measurement and does not pretend to be. This report is a good starting point in documenting the significant results that have been achieved nationwide, focusing on prevention rather than clean up and control. Ideally this document will provide a good foundation for future work on this subject.

NPPR would also like to point out that there are several other publications similar to *An Ounce of Pollution Prevention.* These publications, although smaller in scope, provided much insight into helping produce this report. The Northeast Waste Management Officials' Association (NEWMOA) project, "*Pollution Prevention Progress in the Northeast*", and the Iowa Waste Reduction Center's' report, on the "*The State of Pollution Prevention*", are among the reports that were referenced while conducting this study.

Table 1.5 P2 Implementation Barriers

Local Agencies and other non-state agencies	AL	CA	CO	FL	IL**	IL***	KY	OK	OH	DC	**Total**	**%**
Lack of capital	x		x	x	x	x	x	x			**7**	**70**
Staff changes			x	x				x			**3**	**30**
Lack of management commitment			x	x	x	x	x		x		**6**	**60**

State and non-state aggregate	**Total**	**%**
Lack of capital	**42**	**69**
Staff changes	**23**	**38**
Lack of management commitment	**23**	**38**

Illinois**= Great Lakes Regional P2 Roundtable
Illinois***= NORBIC Environmental Assistance Center

II.

Background Information

NPPR subscribes to the Environmental Protection Agency's environmental management hierarchy and uses the definition of pollution prevention found in the federal Pollution Prevention Act of 1990 and embraced by U.S. EPA.

Pollution Prevention: EPA Statement of Definition[1]
(Pursuant to the Pollution Prevention Act of 1990 and the Pollution Prevention Strategy)

Under Section 6602(b) of the Pollution Prevention Act of 1990, Congress established a national policy that:

- Pollution should be prevented or reduced at the source whenever feasible;
- Pollution that cannot be prevented should be recycled in an environmentally safe manner whenever feasible;
- Pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and
- Disposal or other releases into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.

Pollution prevention means "source reduction," as defined under the Pollution Prevention Act, and other practices that reduce or eliminate the creation of pollutants through: increased efficiency in the use of raw materials, energy, water, or other resources, or protection of natural resources by conservation.

The Pollution Prevention Act defines "source reduction" to mean any practice which:

- Reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and
- Reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

The term includes: equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control. Under the Pollution Prevention Act, recycling, energy recovery, treatment, and disposal are not included within the definition of pollution prevention. Some practices commonly described as "in-process recycling" may qualify as pollution prevention. Recycling that is conducted in an environmentally sound manner shares many of the advantages of prevention – it can reduce the need for treatment or disposal, and conserve energy and resources. Recycling however, while beneficial, is still an end-of-pipe technology and is not as attractive or effective an option as P2.

Pollution prevention approaches can be applied to all pollution-generating activity, including those found in the energy, agriculture, federal, consumer, as well as industrial sectors. The impairment of wetlands, ground water sources, and other critical resources constitutes pollution, and prevention practices may be essential for preserving these resources. These practices may include conservation techniques and changes in management practices to prevent harm to sensitive ecosystems. Pollution prevention does not include practices that create new risks or concerns. In the agricultural sector, pollution prevention approaches include:

- Reducing the use of water and chemical inputs;
- Adoption of less environmentally harmful pesticides or cultivation of crop strains with natural resistance to pests; and
- Protection of sensitive areas.

In the energy sector, pollution prevention can reduce environmental damages from extraction, processing, transport, and combustion of fuels. Pollution prevention approaches include:

- Increasing efficiency in energy use;
- Substituting environmentally benign fuel sources; and
- Design changes that reduce the demand for energy.

The Evolution of Pollution Prevention in the United States

P2 has a rich history in this country. A timeline, which is sprinkled throughout the document, is included to provide readers a snapshot of the watershed events in the P2 movement as well as shed some light on how pollution prevention evolved.

Only the names of authors of noteworthy publications, as well as high-level political officials are included in this timeline. There are so many people involved with the P2 movement over the years, that it is impossible to include some and not others.

1969 - 1980

1969/1970's

Enactment of major environmental statutes, including NEPA, the Clean Water Act, the Clean Air Act, and the Resource Conservation and Recovery Act (RCRA) that are single media in scope and focus on end-of-pipe pollution control. [RCRA was multi-media for Treatment, Storage or Disposal Facilities (TSDF's) but not for generators.]

1970

U.S. Environmental Protection Agency (EPA) is created under the Nixon Administration and approved through Congressional action.

1975

The company 3M establishes its Pollution Prevention Pays Program (3P). This program was novel, since the concept of applying pollution prevention company-wide and documenting results had not been tried before.

1976

EPA first mentions "source reduction" in a document discussing the hierarchy of preferred approaches for minimizing and managing solid waste.

1979

M.G. Royston published his landmark book, "Pollution Prevention Pays", which promoted the idea that preventing pollution, rather then controlling it was the better course of action. This book factored heavily in 3M's early pioneering efforts.

1980

U.S. Superfund legislation passes in December, establishing a "superfund" to clean up major toxic waste dumps as well as instituting private party liability for cleanup.

1980's

State efforts to site hazardous waste landfills and incinerators (as alternatives to dumpsites) met by community opposition. RCRA had set standards for landfills and CERCLA (Superfund) had established liability, but not standards. Communities demand that waste must first be reduced at the source. With nothing occurring on the federal level, several states take charge and develop programs to promote source reduction and recycling.

III.

Methodology for Gathering and Reporting on Data

The majority of the information found in this document was collected from surveys, filled out by regulatory (State, County, Municipal Environmental Agency) and non-regulatory (University- and State-based) pollution prevention programs on the state and local levels. The survey was developed with input from several key NPPR members and experts in survey development. Edits and modifications were made based on feedback and the final result is the survey instrument found in Appendix A.

In some cases information was also gathered from each respective program's website in addition to the surveys. If a certain program is not cited in this document it does not necessarily mean that the program failed to respond. Every program was given the option of not having their data individually reported. Some opted to have their data incorporated into the aggregate results. The survey can be found in Appendix A.

In order to verify and clarify the information in the survey, NPPR staff contacted (many times for some programs) either by e-mail or telephone, the person listed as the program contact. More than two hundred surveys were mailed out to targeted programs as part of NPPR's extensive outreach effort. In addition, copies of the survey were included in conference packets for both NPPR's fall meeting in Charleston, South Carolina and the spring conference in Portland, Oregon. The survey was also sent to potentially interested parties through network listservers and was posted on NPPR's website, in the hopes of soliciting good feedback and data.

In order to build on work already done in this area, NPPR also explored the reports produced by the Iowa Waste Reduction Center and the Northeast Waste Management Officials Association.[2], [3]These reports provided invaluable information that was used in this report.

In some cases survey information was also checked against other published reports to compare data submissions. In the case of aggregate numbers for example, the 169 billion pounds of total avoided pollution, includes the data from the air, water, waste, and combined columns as well as the electricity column of Table 1.4. This number also includes 192 million pounds worth of combined waste from TNRCC during the period 1993-1996 that is only recorded in the total combined total and New Jersey numbers of 243 million pounds because the data was combined for a six-year period. Electricity was factored in by multiplying the kilowatt-hours reduced, by the average pounds of SOx, NOx and CO2 emitted for each kilowatt-hour produced in the United States. These averages were taken from the American Wind Energy Association.

IV.

General Program Information

The information provided in this report is based on responses from over 60 state agencies representing 48 states and 10 non-state agencies. Of the programs responding, the most common were those identifying themselves as P2 technical assistance programs, making up 82 percent of respondents. These technical assistance programs were housed in both regulatory and non-regulatory departments. A little over 50 percent of respondents identified themselves as small business environmental assistance programs or as compliance assistance programs.

Table 1.1 General Program Information

State Agencies	AL	AK	AZ	AR	CA*	CA**	CT	DE	FL	GA	HI	ID	IL*	IN*	IN**	IA	KS	KY	LA	ME	MD	MA	MI*	MI**	MN	MS	MO	MT*
Program type																												
Small business env assistance	x	x		x	x		x	x					x	x	x		x	x	x	x				x		x	x	x
P2 tech assistance	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x			x	x	x		x	x	x	x	x	x
Regulatory				x	x	x														x	x	x				x		
Compliance assistance		x	x	x	x		x	x					x	x	x	x	x		x	x			x	x		x	x	x
Information clearinghouse																												
Other		x				x										x		x					x	x		x		
Assistance provided																												
Training	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x		x		x	x	x	x	x		x	x	x
Grants or loans				x	x			x		x				x									x	x				
Facility planning assistance		x	x					x			x		x					x		x			x			x		
Student interns						x				x	x	x	x			x		x		x	x		x	x	x		x	
EMS		x	x		x		x	x	x	x			x	x	x	x	x	x		x	x	x	x	x		x	x	
Telephone assistance	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Regulatory flexibility (SEP's, permits)	x	x				x			x		x			x	x			x		x		x	x	x		x		
Retired engineers									x									x					x	x		x		
Publications	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x		x	x	x
Other					x	x	x						x	x				x					x	x		x		
Site visits per year		20-50	27	x	x	100	x	25+	75	30	10	150	200+	500	200+	30	70	45	400+	x	10		92		x	65	x	x
Number of staff	1.5	5	6	4	7	27	6	3	6	17	1	1	55	13	13	5.5	1	11	12		3	17	32	100	14	9	5	4

Within these programs, the most common kinds of assistance offered were, telephone assistance and site visits at 82 percent, informational publications at 75 percent, and training at 70 percent. The average number of site visits made annually, for those who reported doing so, was 72. Excluding non-state agencies increases this average to 92 annually.

Please see tables 1.1 and 1.2 for the breakdown of program information.

Table 1.1 General Program Information

State Agencies	MT**	NE	NV	NH	NJ	NM	NY	NC	ND	OH	OR	PA*	PA**	SC	SD	TN	TX*	TX**	UT	VT	VA	WI*	WI**	WY	**Total**	**%**	**Avg**
Program type																											
Small business env assistance			x	x			x			x		x		x		x	x		x	x		x		x	29	57	
P2 tech assistance		x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	45	87	
Regulatory					x		x				x							x				x			13	25	
Compliance assistance			x	x			x			x		x				x			x			x		x	27	53	
Information clearinghouse	x																								1	2	
Other			x			x						x													9	18	
Assistance provided																											
Training	x	x	x	x	x	x	x	x	x	x		x		x	x	x	x	x	x		x	x	x	x	45	87	
Grants or loans		x								x		x			x						x			x	13	25	
Facility planning assistance				x	x			x	x	x		x	x			x	x	x		x		x		x	24	47	
Student interns		x		x			x	x				x					x								19	37	
EMS			x	x		x	x	x		x		x	x			x		x		x	x	x	x		34	65	
Telephone assistance		x	x	x	x		x	x	x	x		x	x	x	x	x		x	x	x	x	x	x	x	46	88	
Regulatory flexibility (SEP's, permits)			x	x	x					x		x				x					x	x			21	41	
Retired engineers								x						x											7	14	
Publications	x	x	x			x	x	x	x	x		x	x	x	x	x		x		x	x	x	x	x	42	81	
Other	x			x		x						x	x					x							15	29	
Site visits per year		5-20	100	8-10	50		x	60		34		40	300	45	4	50	12	70	x	35	240	x	25	200	45	87	94
Number of staff	2	1	7.5	2	9	2	22	31		8.5	1	27	3	3	1	10	2.5	21	1	4	10	6	2.5	1			11

x in site visits column = program makes site visits but did not provide a number

Table 1.2 General Program Information continued

Local government and other non-state agencies	AL	CA	CO	FL	IL**	IL***	KY	OK	OH	DC	**Total**	**%**	**Ave**	State and non-state aggregate	**Total**	**%**	**Ave**
Program location																	
Regulatory			x	x			x				3	30					
Non-regulatory	x	x			x		x		x		5	50					
University						x					1	10					
Economic development	x					x					2	20					
Local government		x	x					x	x		4	40					
Small business development center						x	x				2	20					
Non-profit	x					x				x	3	30					
Program type																	
Small business env assistance	x		x			x	x				4	40			33	55	
P2 tech assistance	x			x	x	x	x	x			6	60			51	82	
Regulatory				x			x	x			3	30			16	26	
Compliance assistance				x		x	x	x	x		5	50			32	52	
Information clearinghouse											0	0			1	1	
Other	x	x						x	x		4	40			13	21	
Assistance provided																	
Training	x	x	x	x	x	x			x		7	70			52	84	
Grants or loans					x						1	10			14	23	
Facility planning assistance						x		x			2	20			26	43	
Student interns									x		1	10			20	32	
EMS	x	x			x				x		4	40			38	61	
Telephone assistance		x			x	x		x	x		5	50			51	82	
Regulatory flexibility (SEP's, permits)				x			x	x			3	30			24	39	
Retired engineers	x			x							2	20			9	15	
Publications			x	x	x			x	x		5	50			47	76	
Other	x				x				x		3	30			18	30	
Site visits per year	100+	30	6	100		30		10			6	60	46		51	82	71
Number of staff	14	5	1		25	1	6	1	1				7				10

California*= California Integrated Waste Management Board
California**= Department of Toxic Substance Control
Illinois *= P2 Program, Il. Waste Management and Research Center
Illinois**= Great Lakes Regional P2 Roundtable
Illinois***= NORBIC Environmental Assistance Center
Indiana*= Indiana DEM
Indiana**= IN Clean Manufacturing Tech and Safe Materials Institute
Michigan*= DEQ EAD
Michigan**= DEQ Field Unit
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Montana**= Peaks to Prairies P2 Information
Pennsylvania*= PA DEP
Pennsylvania**= PENNTAP
Texas*= Lower Colorado River Authority
Texas**= TNRCC
Wisconsin*= Wisconsin DNR
Wisconsin**= Solid and Haz Waste Education Center, UW Extension

V.

Funding

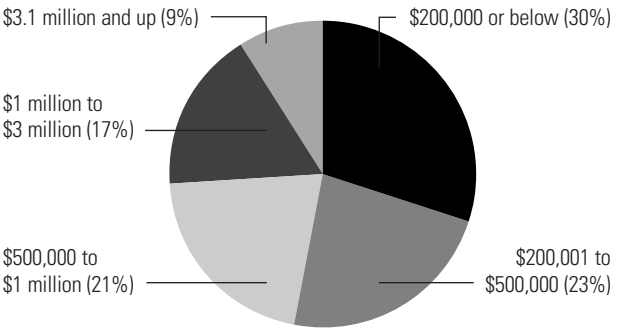
The average annual budget for state agencies was $1 million. State agency budgets ranged from $35,000 to $5.6 million with the majority of programs below the $1 million level. Removing the three programs with the highest budget dropped the average to $736,000.

Reporting data for this report was similar regardless of a program's budget. Programs with budgets below $200,000 reported data as frequently as those with budgets exceeding $1 million.

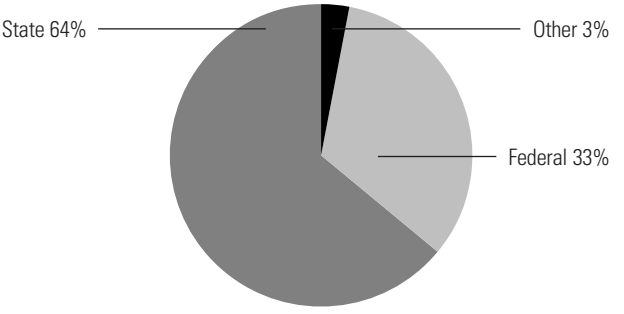
In addition, the types of services offered did not appear to have a direct correlation to the agencies' budget. This also applied to the number of site visits reported each year. Many agencies whose budgets were below the average actually reported more site visits than those with higher than average budgets. However this usually leveled out, where the smaller funded program provided fewer services in another area. This is also a result of programs placing more emphasis on site visits than others and having different priorities. Approximately 70 percent of programs complained about a lack of funding and resources for their programs.

A correlation could be identified within the programs reporting larger than average cost savings and reductions in pollution as these programs also tended to have larger than average budgets. However, there were exceptions. Some states, such as Ohio, reported results well above the averages of other respondents, yet had a budget almost 25 percent below the average. Where this was the case, it appeared it was the result of a more experienced program focusing on fewer services.

State Agency Budget Breakdown



State Budget Contributors



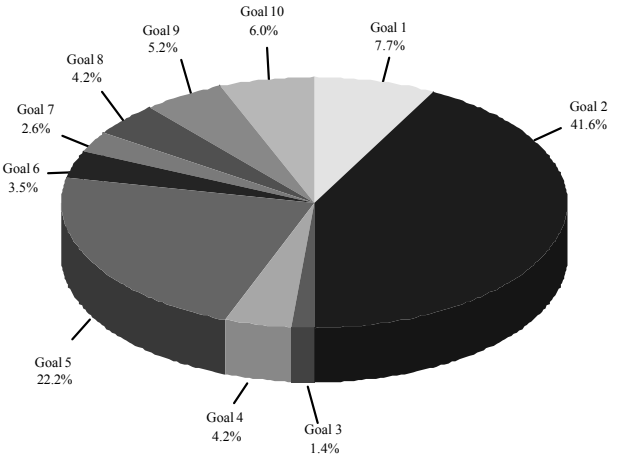
The average state agency received 63.9 percent state funding, 33.4 percent federal funding and 2.7 percent from other sources. Other sources included sales of products, university funding, conference fees and contributions from project partners.

The federal funding for P2 programs came from EPA grants. According to the EPA's 2000 Annual budget, P2 received $5.9 million in grants for the years 1998 and 1999. The FY 2000 budget also set aside $5.9 million for P2 grants which makes pollution prevention the smallest beneficiary of EPA grant money[4].

The 2003 EPA budget states that programs "preventing pollution" receive 4.2 percent of the $7.7 billion budget[5]. This works out to approximately $320 million, of which only $5.9 million is actually allocated as grant money for pollution prevention programs. Please see the chart below for more information on the EPA's 2003 Budget. This chart was taken from the EPA's FY 2003 Annual Budget.

Environmental Protection Agency's 2003 Budget by Goal

Total Agency: $7,723.6 million*



Goal 1: Clean Air
Goal 2: Clean & Safe Water
Goal 3: Safe Food
Goal 4: Preventing Pollution
Goal 5: Better Waste Management
Goal 6: Reducing Global Risks
Goal 7: Quality Environmental Information
Goal 8: Sound Science
Goal 9: A Credible Deterrent to Pollution & Greater Compliance with the Law
Goal 10: Effective Management

*Includes $4.0M in offsetting receipts.
*Resources associated with the pending health benefits legislation account for 1.3% of the Agency's budget.

1980 - 1985

1980's
In the early part of the 1980's, the Maryland Hazardous Waste Facilities Siting Board conducted a study to test the effectiveness of a pollution prevention technical assistance program. The results, represented at Massachusetts Hazardous Waste Source Reduction Conference and Exhibition in 1983, formed the basic structure and function of most P2 technical assistance programs. The first state program in the country was North Carolina's Pollution Prevention Pays Program established in 1983.

1980's
Industry programs, such as DOW's WRAP (Waste Reduction Always Pays) and Chevron's SMART (Save Money and Reduce Toxics) emerge in response to public pressure and cost-savings opportunities.

1984
Congress reauthorizes RCRA requiring hazardous waste generators to certify that they have a waste minimization program in place. First appearance of environmental hierarchy, establishing a preferred place for source reduction and recycling appear in statute as well.

1985
The U.S. National Pollution Prevention Roundtable (NPPR) – known then as the National Roundtable of State Pollution Prevention Programs (NRSPPP)--is started when a small group of state officials begin to meet to discuss prevention approaches within their states. Some of the earliest state programs involved in this effort include North Carolina, Minnesota, Illinois, California and Massachusetts. One of the most active states to play a leadership role in mobilizing others to form a state P2 network was North Carolina.

1985
Woods Hole Pollution Prevention Conference, Woods Hole, Massachusetts-The first of a series of small high level policy meetings of pollution prevention experts invited from both the private and sectors. The conference convened annually until 1999.

1985
INFORM publishes study on Cutting Chemical Wastes, identifying potential reductions from 29 chemical facilities.

VI.

Data Collection

Due to the complex nature of the data included in this study, many states were unable to present their results in a uniform manner. Many programs use different units of measurement to track the same data thus complicating the collection and compilation process.

In addition, many programs work with a limited budget that in effect makes it impossible to track their own success in a reliable and accurate manner. This disturbing trend can have the effect of making successful programs appear unproductive simply because funds were spent entirely on program implementation rather than data gathering. As a result, not all respondents completely filled out the survey.

84 percent of respondents collect data on their P2 efforts, yet only 41 percent were able or willing to provide quantitative data for this report. The main reason for this apparent disparity is that the majority of programs only began tracking their performance within the past two or three years, therefore they felt their data was not relevant for this study. In addition, some of the smaller programs did not have the available man-hours to designate for compiling the necessary data and thus skipped this section.

See Table 1.3 to view data gathering statistics for each program.

Table 1.3 Data Gathering Statistics

State Agencies	AL	AK	AZ	AR	CA*	CA**	CT	DE	FL	GA	HI	ID	IL*	IN*	IN**	IA	KS	KY	LA	ME	MD	MA	MI*	MI**	MN	MS	MO	MT*
This program collects data	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x		x	x
Documented cost savings	x	x		x		x				x			x		x	x		x					x		x			
Surveys	x	x				x		x	x	x			x	x		x		x			x		x		x	x		x
Case studies	x	x	x	x		x		x	x			x	x		x	x		x		x			x	x		x		
Other																							x		x			x

The above are measures used to collect data.

Table 1.3 Data Gathering Statistics

State Agencies	MT**	NE	NV	NH	NJ	NM	NY	NC	ND	OH	OR	PA*	PA**	SC	SD	TN	TX*	TX**	UT	VT	VA	WI*	WI**	WY	**Total**	**%**
This program collects data	x	x	x	x	x	x	x	x		x		x	x	x	x	x	x	x		x	x	x	x	x	**46**	**88**
Documented cost savings			x	x	x			x		x		x	x			x						x		x	**21**	**40**
Surveys	x		x	x	x		x	x		x		x		x		x	x		x			x	x		**29**	**56**
Case studies			x	x	x	x	x	x		x		x	x		x	x	x		x			x	x	x	**32**	**63**
Other				x								x													**5**	**10**

The above are measures used to collect data.

Local Government and Other Non-State Agencies as Listed in Table 1.1 and 1.3

- California, City of San Diego Environmental Services Department, Community Sustainability Program, The City of San Diego
- Colorado, Pollution Prevention Program, Tri-County Health Dept.
- Florida, Air Management Division P2 Strategy, Environmental Protection Commission of Hillsborough County
- Illinois, ** Great Lakes Regional P2 Roundtable, Il Waste Management and Research Center
- Illinois, ***NORBIC Environmental Assistance Center, North Business and Industrial Council (NORBIC)
- Kentucky, APCD P2 Program, Jefferson County Air Pollution Control District
- Oklahoma, City of Tulsa P2 Program, City of Tulsa
- Ohio, P2 Program, City of Cincinnati, Office of Environmental Management
- Washington, DC, Once In Always In, STAPPA/ALAPCO

Table 1.3 Data Gathering Statistics

Local Agencies and other non-state agencies	AL	CA	CO	FL	IL**	IL***	KY	OK	OH	DC	**Total**	**%**	State and non-state aggregate	**Total**	**%**
This program collects data	x	x			x	x	x		x		6	60		51	84
Documented cost savings	x				x	x	x				4	40		24	39
Surveys	x				x						2	20		30	49
Case studies	x		x	x	x				x		5	50		37	61
Other														5	8

The above are measures used to collect data.
Illinois**= Great Lakes Regional P2 Roundtable
Illinois***= NORBIC Environmental Assistance Center

VII.

Quantitative Data

During the period 1998 to 2000, 13 P2 programs with an average budget of $1.9 million annually reported total cost savings equal to $404 million. That represents average savings equal to 5.4 times the skeletal budgets used to implement the P2 programs responsible for these results.

Although the data in Table 1.4 does not represent all 50 states, the information available for analysis shows stunning results from P2 programs. The data shows that P2 is not only a viable and effective solution for protecting the environment, but it is even more impressive as a cost saving measure. In fact, during the period 1990 to 2000, survey respondents claimed a joint total cost savings of $652 million.

Much of the cost savings came as a result of decreased utility bills. This can be seen in the "Water Conservation" column, where over ten years a total of 4 billion gallons of water was saved. The "Energy Conservation" column also demonstrates enormous savings with a total of over 215 million kilowatt hours of energy conserved during the same ten-year period.

One of the most common barriers to the implementation of P2 cited by respondents was the perceived high cost. Despite this, in every case documented in this report, all costs were recuperated within several years after implementation and in some cases companies began seeing added profits as soon as a few months after the adoption of P2 measures[6].

The 167 billion pounds of total avoided pollution cited on the cover of this report includes the data from the air, water, waste, and combined columns as well as the electricity column of Table 1.4. This number also includes 192 million pounds worth of combined waste from TNRCC during the period 1993-1996 that is not seen itemized by year table 1.4 because the data was combined for a four-year period. Also included in the combined total on the chart are the figures for New Jersey which also sent in combined information. Electricity was factored in by multiplying the kilowatt hours reduced, by the average pounds of SOx, NOx and CO2 emitted for each kilowatt hour produced in the United States.

Table 1.4

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1990	NA	NA	NA	4,900,000	NA	NA	700,338	NA
1991	NA	NA	57,212,749	1,500,000	NA	NA	498,450	NA
1992	NA	NA	56,819,001	1,800,000	NA	228,000	2,148,622	108,700
1993	73,000	6,086,000	70,504,845	4,300,000	9,950,700	3,503,107	6,553,680	112,300
1994	13,465,495	13,128,035	170,028,741	2,000,000	150,700	30,600,000	6,850,173	858,191
1995	858,043	7,166,726	107,966,076	50,000	332,500	117,004,500	2,626,176	1,411,250
1996	3.7E10	229,019,655	3.0384E10	3,000,000	14,368,300	382,857,318	128,913,123	901,400
1997	1.1E10	1,259,966,957	2.405E10	200,838,662	7,446,500	1,244,234,855	97,193,109	2,429,011
1998	1.67E10	1.266E10	1.428E10	329,526,411	84,510,560	366,466,200	256,976,968	112,376,335
1999	25,595,600	5,417,635,672	893,995,152	157,000,251	72,770,924	893,647,984	50,949,572	8,997,300
2000	122,011,189	488,483,448	4,521,112,448	87,385,857	25,787,663	1,078,826,263	112,913,997	17,088,953
Total	**6.486E10**	**2.008E10**	**8.043E10**	**1,228,138,181**	**215,317,847**	**4,117,368,227**	**666,324,208**	**144,283,440**

Please see chart explanation on the following page.

Chart Explanation:
Some programs do not track individual types of reduction. The "combined" column only lists numbers given by program, tracking their reductions as one combined number. Also note that in the case of New Jersey, the number submitted that was applicable for the study was one combined total representing a decrease in non-product output for the 1994-2000 period. That number is included in the "combined total" number. The combined total also includes the results submitted for Texas of 192 million.

The "combined" column does not include data already listed in the columns marked "Air," "Water," or "Waste." The data found in Table 1.4 cannot be used to ascertain whether progress has been made between years. Some of the data for each year is representative of only a few states due to a lack of accurate records as far back as 1990. In addition, in any given year a new P2 program can be implemented that will lead to a large decrease in pollution that will continue for as long as the program is in place. However, the data in Table 1.4 typically only reports results in their first year and does not demonstrate repeat savings and reductions over multiple years.

The energy conservation number was converted into pounds of pollution prevention by using the following conversion factors – carbon dioxide, 1.52 pounds, SOX, .008 pounds and NOX .0049. Using these conversions, the electricity column totals more than 330 million pounds of waste.

The data also only represents those programs that responded to the survey. Only 26 respondents were able to provide hard data based on actual implementation, for this study, and no one was able to provide more than 50 percent of the data requested. The numbers cited in this case are documented results not estimates. In many cases data was only available for the last few years of the time period. As a result, the data represents the lowest possible threshold and is the most conservative approximation for each category.

VIII.

Barriers to P2

Based on the information gathered over the course of this project, it can be concluded that one of the biggest obstacles to gauging P2 success is a common system of measurement. In some cases it was impossible to translate units into one common denominator that would allow for broad comparison and aggregation. In other cases the causality of certain reductions in pollution was impossible to determine, thus complicating data gathering at the most basic level.

Contributing to the measurement problems, almost 70 percent of respondents said that they had a lack of resources and 40 percent complained of the high rate of staff changes and a lack of management commitment. Please see table 1.5.

Other barriers cited can be seen below. The following reasons, listed in order, are the most commonly cited among survey respondents.

1. Lack of man-hours to devote to P2 implementation.
2. Perceived high cost of P2 implementation.
3. Low priority among business owners.
4. Lack of awareness and interest of P2 success and programs in general.
6. Lack of regulatory enforcement.
7. Lack of strategic direction and organizational structure to help implement P2.

Another barrier facing the P2 community is the erroneous idea that all of the "low hanging fruit" opportunities are already explored. This argument is often made, even by those working in the field, yet, as stated in the United States General Accounting Office's (GAO) February 2001 report, entitled *Environmental Protection, EPA Should Strengthen its Efforts to Measure and Encourage Pollution Prevention*, "not only is low hanging fruit going unpicked, some is rotting on the ground." The report then went on to note, "a representative from the Illinois Office of Pollution Prevention remarked that state engineers rarely visit a facility without finding fairly simple pollution prevention opportunities to suggest."[7]

IX.

Looking Forward: Measurement Projects Underway

P2 Indicators
NPPR entered into an agreement in the summer of 2001 to work with EPA to coordinate and organize focus groups throughout the US to solicit feedback on the use of chemicals and pesticides as environmental indicators. NPPR worked in conjunction with the Florida Center for Public Management at Florida State University as well as several other members and staff from numerous organizations.

NPPR hosted a total of six meetings over the period September 2001 through April 2002 to discuss various issues regarding indicators. Topics ranged from determining the purpose of indicators and the level at which they are measured, to identifying what makes a strong indicator and what are some possible new P2 related indicators that may prove useful to the EPA or state and local governments.

These efforts built on, and helped raise the awareness of the EPA funded Chemical and Pesticide Results Measures Project (CAPRM). This project laid the groundwork by "developing a national set of chemical, pesticide and pollution prevention indicators that can be used by states, tribes, non-governmental organizations and the private sector as well as the EPA to describe and understand environmental trends and conditions concerning chemical and pesticide issues."[8] The outcome of NPPR's involvement in the project was an increased level of participation and integration of P2 principles into the CAPRM project.

The participants identified several P2 indicators such as multimedia results and conclusive data like those presented earlier in this report that are particularly helpful in determining the success of P2. These indicators can be used to help understand trends and conditions in the environment and public health. The best indicators would be measures of ambient conditions and overall health of certain populations of wildlife and humans alike. P2 programs rarely collect this data and thus the best means of determining progress in the field tends to be by looking at the overall reductions achieved by P2 efforts.

By analyzing this data, one can determine actual reductions as well as trends in emissions and pollution in order to determine the effect of P2 efforts on polluter behavior. These results are quite easy to identify when dealing with regulatory programs due to the need for enforcement, however with P2 the outcome is not always so readily apparent. Identifying trends in pollution levels and pollutant concentrations within specific regions, coupled with P2 data from the same region can yield specific results that help determine the effectiveness of P2 programs in altering P2 behavior as a whole.

P2 Metrics
Despite the many attempts to gather conclusive data for the success of P2, the same problem continues to arise; there is no common means of measurement. The most efficient way to resolve this issue, according to many experts in the field is to start a sustained nationwide dialogue regarding P2 metrics that engages everyone and is funded and organized by the federal government. The money and resources being used to develop several projects simultaneously could be applied in a more efficient manner if all efforts were concentrated.

The Northeast Waste Management Officials' Association (NEWMOA) is conducting one such comprehensive effort to create a common metric will open the door to increased cooperation among P2 programs and ultimately more efficient and successful measures.

Despite the past difficulties with quantifying P2 results, due to resources and complexity, there is much progress in the field. There have been several other recent documents (as noted in the beginning of this report) that have quantified P2 results data. These reports are *The State of Pollution Prevention* by The Iowa Waste Reduction Center and the August 1998 report, *Pollution Prevention Progress in the Northeast* by the Northeast Waste Management Officials' Association (NEWMOA).

The NEWMOA report cited the difficulty in aggregating P2 results due to the lack of a common metric. As a result, the NEWMOA Pollution Prevention and Compliance Assistance Metrics Project was initiated four years ago, in the hopes of addressing this issue.

The NEWMOA project formed a P2 Metrics Workgroup, consisting of state P2 and Compliance Assistance (CA) program representatives, and development of a 1998 NEWMOA report, *Pollution Prevention Progress in the Northeast*, that documents the accomplishments and activities of 16 P2 and Compliance Assistance programs in the region from 1990-1996. The report showed that the P2 and CA programs had a significant impact on businesses in the region. However, the process also highlighted the lack of consistency in terminology and data collection among the programs. Following publication of the report, NEWMOA worked with the Metrics Workgroup to improve consistency by developing a consensus menu of 40 activity and outcome environmental assistance and pollution prevention metrics."[9]

The P2 field has been faced with a unique problem due to the nature of its work in predominantly non-regulated areas of business. As a result, most experts in the field have not had to work extensively with the EPA to collect common data. The NEWMOA software offers one alternative to this problem but implementing it still requires those in the field to spend more time on data tracking and reporting. Many agencies are already overburdened with work and do not see the additional step in the process as something that will yield higher results.

The NEWMOA software helps to record results in a manner that allows relatively easy and accurate tracking. Agencies need to be able to report their results, so they can show quantifiable results assisting their customers with improving their progress. The Metrics Menu specifies 12 different types of metrics to be measured. The categories include issues such as on-site assistance, workshops and conferences, grants, environmental and financial outcome and several others. The software, funded through U.S. EPA, is offered for free and based on Microsoft Access so it can be used on all PC's. The database is customizable and NEWMOA offers training sessions at conferences.

The NEWMOA software is also based on a decentralized model. All of the data entered into the software is kept within each agencies network. When the time comes to submit results or draft reports from the database, certain information can be omitted in order to maintain confidentiality. This option encourages those using the software, to enter all of their available results without worrying about breach of confidentiality contracts or leaking information that could create enforcement issues.

In addition to the NEWMOA software there have been several other efforts to create measurement programs. The EPA Region 10 Pollution Prevention Program Results Measurement Project and the EPA Region 8 Pollution Prevention Program Measurement Tool are the other two programs in use.

The Region 10 program works on a centralized database system. The tool does not explicitly collect facility-or location-specific data and all of the data is aggregated so the user is unable to access individual program impact."[10]

Worst Case Scenario

Apart from the measured benefits to the environment and economy, a project is currently underway to prove the safety benefits of P2. The National Environmental Trust (NET) is currently working on a report to prove that P2 leads to an increase in inherent safety. Using New Jersey materials accounting data, the project identifies facilities that have a decreased non-product output and simultaneously do not show an increase in inputs shipped in the final product. Fulfilling these requirements proves that a facilities' total raw material usage has decreased.

The preliminary data suggests that the decrease in raw material usage is linked to an increase in worker safety as well as a decrease in worst-case scenario vulnerability. If this turns out to be the case, it will be one more reason to adopt P2 on a more universal basis. The report is due out in 2003.

NET is also involved in another report intended to encourage Mexican industry to start maintaining better control of their inventory and improve their materials accountability. The report shows that over a five-year period in the U.S. and Canada, more efficient use of the top four chemicals used in industry alone, has led to raw materials cost savings equal to $400 million. Although this does not take into

account the cost of switching materials or implementing new methods of production as a result, the benefits still far outweigh the costs.

Environmental Management Systems
The National Pollution Prevention Roundtable started a working group on ISO 14000 for Environmental Management Systems (EMS) in 1996. Initially NPPR's goal was to help ensure that pollution prevention was an integral component of the new international voluntary standard for environmental management systems, known as ISO 14001. The workgroup explored ways to infuse P2 and innovation practices into the standards and to develop effective tools for improving industrial environmental performance. NPPR's ISO and Facility Planning Workgroups produced two relevant white papers. One was entitled, "ISO 14001: A Discussion of Implications for Pollution Prevention", and the second, "Facility Pollution Prevention Planning Requirements: An Overview of State Program Evaluations." Both papers helped generate active discussion and promote pollution prevention activities and approaches nationwide.

Since then EMS's have received increased attention and focus within the P2 community and outside of it. NPPR used to only hold one session on the subject at the organization's annual meeting. Now it is typical to hold several sessions and sometimes a dedicated track. Several organizations are also now involved with these issues including the Multi-State Working Group on Environmental Management Systems (MSWG) and the Global Environmental and Technology Foundation (GETF). The MSWG is "an organization that convenes government, non-government, business and academic interests to conduct research, promote dialogue, create networks and establish partnerships that improve the state of the environment, economy and community through systems-based public and private policy innovation."[11] The MSWG holds quarterly meetings that are open to all those who wish to participate.

GETF focuses on the public sector and local government initiatives. GETF has partnered with the EPA and implemented pilot projects establishing EMS's in over 23 municipalities. GETF has also helped organize a workshop recently titled "The Relationship between Municipal Environmental Management Systems (EMS) and Municipal Financial Obligations."[12]

Based on the information gathered over the course of this project, it can be concluded that one of the biggest obstacles to gauging P2 success is a common system of measurement. In some cases it was impossible to translate units into one common denominator that would allow for broad comparison and aggregation. In other cases the causality of certain reductions in pollution was impossible to determine, thus complicating data gathering at the most basic level.

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X.

Stellar Case Studies

Below are listed over 25 exemplary case studies collected during the process of this report.

The categories for these include:
- Pollution prevention in industry;
- Local government;
- P2 as a tool for compliance;
- Beyond Compliance;
- Voluntary Programs;
- State program structure that leads to compliance;
- Good measurement approaches that lead to P2; and
- Good environmental management systems that result in P2

Alabama

Auto Body Repair Shop
The cost of utilities for auto body shops is high enough to warrant monitoring and study. By noting times when large usage occurs and relating those times to the utility bill, any unusual charge will become more obvious. Causes of high readings can include bad meters, bad motors, poor start-up procedures (see below), wiring problems, inefficient lighting and electrical equipment, and poor use habits (i.e. leaving unnecessary lights on, wasting hot water, and leaving office doors open). Most of these are easy to correct and the savings can be worth the effort.

For shops in the TVA power region, it is important to avoid electrical power demand in excess of the 50 kW free-of-charge power allowed by utilities distributing TVA power. The peak demand charge per excess kW is often 100 times that for the kWh energy charge and, depending upon the utility contract terms, may continue for a specified number of months up to one year. A procedure should be written for equipment start-up to be sure that at least 15 to 30 minutes is allowed between turn-on of each heavy user of electricity. For example, first turn on the lights, wait 15 to 30 minutes, then turn on the air compressors. The actual waiting period equals that specified by the utility as the period during which daily peak demands are measured. Fifteen minutes later turn on the air conditioning units, then wait 15 to 30 minutes, and finally turn on the paint/drying room. Stretching out start-up of large users of electricity may avoid any peak demand in excess of the allowable 50 kW. After trying this for a short time, determine if the results justify installing an automatic sequencing system. An electrical engineer should design and install this system.

For customers of Alabama Power the capacity requirements can vary on an individual basis. Because of the number of service options available from Alabama Power, it is important for each shop to contact the distributor to get an explanation of the plans and to choose the best one. Consistency of use and demand helps minimize electrical costs under Alabama Power rate structures.

Results
One WRATT assessed shop had electrical costs of $1200 to $1500 per month, which is about twice as much as other shops of similar size. The demand charges for this shop were 72 to 80 kW each month. Even though the first 50 kW are not charged extra, the shop was still paying for 22 to 30 kW at a rate of $9.31 per kW. Demand charges for a shop the size of this one are usually much smaller or are not incurred at all.

With the information that the bill was considerably higher than average, the shop owner called the utility department to get the meter checked and recalibrated. With the meter adjustments and by exercising care in starting up the larger groups of electricity users (lights, air conditioning, paint booths) this shop was able to reduce the electric bill by over $500 per month. Reduced demand charges saved about $200 of this amount with the remainder from more accurate meter readings and from more efficient use.

Source: Waste Reduction and Technology Transfer Foundation, Muscle Shoals, AL
http://www.wratt.org

Alaska

Dowell/Schlumberger Facility Reconstruction
After burning in a fire in 1990, the facility was reconstructed with pollution prevention in mind. For example, acid storage tanks were located inside the building to reduce the risk of acid spills. A coded concrete containment structure was installed, with a double liner and a design to allow for visual leak detection on a periodic basis. Drums were replaced with reusable 300-gallon tote containers wherever volume was significant enough to justify the change. Instead of using 150 gallons of lubrication oil each time the triplex pumps are serviced, lubricating oils are now recycled. The on-site recycled lubricating oil system cost $1,000 to install. A wastewater recycling system was also installed.

Results
- $ 1,000 payback in less than a year for the recycled lubrication oil system.
- Reduced spill potential.
- Reduced labor requirements to keep pumps oiled.
- Fewer incidents of burned out pumps.
- Acid spills due to interior location of acid storage tanks were reduced.
- The volume of water used and disposed due to the water recycling system decreased.

Source: Alaska Department of Environmental Conservation, Pollution Prevention Office. Juneau, AK. 1994. *Pollution Prevention Opportunities for the Oil Field Service Industry.*
http://www.state.ak.us/local/akpages/ENV.CONSERV/prevhome.htm

Arizona

City of Tucson Fleet Services Repair Shop
Fleet Services provides maintenance and repair services to over 2000 fleet units at two shop locations and in the field. Both shops run two shifts daily, Monday through Friday, to meet the city's transportation needs. Fleet Services includes technical staff consisting of 7 supervisory and 84 technical employees, with annual operating expenditures of $8,000,000. The main shop located at the City's Price Service Center is a full service maintenance and repair location.

Ten hydraulic piston rod cylinders on each of the City's seventy-six residential refuse tracks operate tailgates, body lift, arm (in/out, up/down and grip), dump, and packer systems. Cylinder leaks, due to seal failure, were occurring within 3 months to 1.5 years after replacement. The ten cylinders per truck come in various bores and strokes and cost $1,000 to $3,000 per cylinder to replace with new units and about $ 1,200 to replace with rebuilt units. This cost was in addition to the in house labor costs to dissemble, repair and reassemble the cylinders. Besides the cylinder repair costs, additional labor costs were incurred due to the operator's overtime needed due to vehicle down time, cost due to the operator's additional time to clean up the leaks, additional costs for the Dri-Zorb absorbent, waste disposal costs, and hydraulic fluid replacement costs.

Most of the cylinder piston rods are not protected from road dirt, grime or infrequent mud. In fact, one set of cylinders is located in the wheel well where it is a direct target for material thrown off of the tires. Upon disassembly of the cylinders, collar and removal of the gland assembly, it was confirmed that piston seal failure was occurring from road contamination that was getting past the wiper.

An idea to solve the problem was to machine another groove in the gland and add a second seal. There was a brief concern that adding the additional seal would keep oil (which also cools the seal) away from the first seal and cause its failure. This proved not to be the case. The on-site machine shop was able to perform a modification to add an additional groove for the seal. This took only 20 minutes to one-half hour for each gland. Next, instead of purchasing two $27 dollar seal kits to get the extra seal needed, a seal kit supplier agreed to provide a seal kit that included one more piston seal (+$6.00) besides the other parts in the kit.

Results
New kits with the added seal cost $75, but parts replacement costs dropped from $ 1,000-$2,000 per each cylinder per every eight months to one year with the new design. Most importantly, 90% or more of the seal failures and resultant hydraulic oil leaks were stopped. Cylinders began lasting 4-5 years before a rebuild was necessary. After the design change, the remaining rebuilds are now the result of other parts wearing out but not seal problems. Cost savings from parts alone is $918,270 a year.

Source: Arizona Department of Environmental Quality, Pollution Prevention Unit, Phoenix, AZ.
http://www.adeq.state.az.us/environ/waste/

California

Specific Plating Company

During the Specific Plating Company's plating process, parts are plated in tanks containing metals such as copper, nickel, zinc, silver, and gold. After each plating process, a rinse tank is used to wash any excess metal solutions from the parts. The water in the rinse tanks must be continuously replaced and, therefore, metal-containing wastewater is generated. The RWQCP asks companies to reduce metal discharges in their wastewater so that it may in turn reduce its discharge of metals into the San Francisco Bay. As a result, several pollution prevention projects have been used to reduce materials and water use, thereby reducing wastewater metal discharges to the RWQCP and minimizing company operating costs.

These projects include conversion to deionized water for bath make-up and rinsing; installation of process control measures to minimize water use and baths solution waste, such as drag-out rinse tanks after the plating process to capture metals and allow their reuse; addition of process tank conductivity controllers to minimize make-up water and chemical use; and installation of an electrolytic recovery unit to capture metals from drag-out.

Results

The implementation of the new plating process reduced annual costs by $30,000. The cost of implementing the new process was $62,500 making the payback period a little over two years. In addition, copper discharges were reduced by 88% and nickel discharges were reduced by 85%. Wastewater discharge flow was reduced by 27% and off site sludge disposal was reduced by 53%.

Source: City of Palo Alto, California. August 1996. *Pollution Prevention at Specific Plating Company.* http://www.city.palo-alto.ca.us/cleanbay

Colorado

Woodleys Fine Furniture

Woodelys Fine Furniture used an airless spray gun system to add finishing coats to bedroom furniture and entertainment systems. Airless spray technology uses high fluid pressure applied by hydraulic pumps to atomize the coating material, rather than using high pressure air or high volumes of air, as with

1986 - 1988

1986
Reauthorization of Superfund (SARA) includes provisions to establish the Toxics Release Inventory (TRI), which requires companies using large amounts of toxic chemicals to publicly report the quantities of chemicals released to the environment. The first national "Right to Know" program creates an incentive to prevent pollution.

1986
EPA releases a waste minimization report as a requirement of HSWA (amendments to RCRA of 1984). The report draws mixed reviews. Proponents of the report said EPA was following what Congress stipulated, and that it was the first effort to focus explicitly on ways to avoid treatment and remediation. Detractors of the report thought EPA was weak in that it did not support (nor even mention) source reduction as a method to reduce waste.

1986
The Congressional Office of Technology Assessment (OTA) releases a seminal report "Serious Reduction of Hazardous Waste", written by Joel Hirshhorn and Kirsten Oldenburg. The study advocated that U.S. policy should focus on source reduction and not waste minimization. This report was a milestone in the effort to promote pollution prevention nationwide.

1987
Meeting in Cool Font, West Virginia convened by EPA and several representatives from outside organizations. The purpose of the meeting was to bring together interested parties from different stakeholder groups, around the controversy created from the release of the 1986 EPA Waste Minimization report and the OTA report. This resulted in all parties present agreeing that source reduction (i.e. pollution prevention) was an important facet of environmental protection efforts, Subsequently, a meeting of Senior Executives at EPA was convened, to further the issue within the agency. At that meeting it was decided that a pollution prevention office be established in EPA's Policy Office.

1988
The Wolpe-Schneider bill on pollution prevention, while not enacted into law serves as the foundation for the creation of EPA's program on P2, and for the federal Pollution Prevention Act of 1990.

conventional and High Volume Low Pressure (HVLP) systems. Airless spray application is fast and may be ideal for large surfaces or heavy viscous coatings, but this system generally does not produce a high-quality appearance which is very important in the wood products/furniture industries. Transfer efficiency is 50-60%.

Woodleys installed HVLP spray guns that operate with a high volume of air delivered at 10 psi or less to atomize the coating. Atomization of the coating at low air pressures allows increased transfer efficiency (65-80%) reduced over-spray, and therefore, reduced VOC emissions. High production rates may not be possible with the HVLP system. However, HVLP is well-suited to small to medium-sized shops such as Woodley's, where high quality is more important than high production.

Results
The new system reduced clean up costs and cleaning reduced from once a month to once a quarter, saving $4000 annually. 2,240 gallons of stain/year was used in the conventional airless system at $26,000/year. With use of the HVLP system, 1,105 gallons of stain is used at $12,000/year. This is a cost savings of $14,000/year for stain. Use of the HVLP system also saved 6 55-gallon drums of sealer/year at $450.00/drum or $2,700/year.

Total cost savings of ~$20,700/year. Payback was less than 1 month.

Other results included a positive business image and improved coating quality. There were also reduced VOC and HAP emissions due to less overspray (not quantified) and unproved worker health and safety (reduced worker exposure to blowback).

Source: Colorado Department of Public Health and Environment, Pollution Prevention Program, Denver, CO
http://www.cdphe.state.co.us/el/elp_p2hom.asp

Connecticut

The Hartford Courant

This regional newspaper generates about 175 gallons of waste ink each week. Waste ink is hazardous, especially if it contains chromium or lead. The newspaper used to ship the waste off-site for reuse as a supplemental fuel. It now collects the waste, recycles solvent, and blends the waste ink back into the virgin black ink for reuse. Operation of this waste ink recycling option costs $7,100 per year. Its purchase and installation cost $318,000.

Results
- Reduction in the toxicity and quantity of the waste ink from 9,100 gallons of waste ink and solvent per year to 46 gallons of paper dust and 3,050 gallons of water. This reduction has allowed the newspaper to report its emissions as a SQG.
- The elimination of disposal costs saved $38,000 per year.
- The value of the recycled product is almost $20,000 per year and when this is added to the difference in operating costs, the total savings are $50,000 per year.
- The recycling option's purchase and installation cost payback period is 6.5 years.

Source: Office of Pollution Prevention and Toxics, USEPA- April 1996. *Pollution Prevention Success Stories.* http://www.epa.gov/opptintr

Delaware

Chrysler Newark Assembly Plant

A pollution prevention team was formed to develop ways to reduce the volume of solvent-containing chemicals, thereby reducing VOC, TRI and HAP emissions at the plant. The team used several methods to achieve the solvent reductions, including:

- Full body powder was introduced, virtually eliminating associated VOCs and HAPs.
- The use of water-based, instead of solvent-based deadner fluid, was introduced thereby eliminating the TRI chemicals associated with the solvents.
- Switching to lower HAP content paint mixtures.
- Removing unnecessary solvents and switching to prepackaged solvent wipes resulted in major VOC reductions.
- Switching to a glycol ether free cleaner for use in the post-welding body washer.
- Reduced VOC purchases in booth cleaner material due to improved maintenance practices and strict inventory control.
- The purge solvent recovery system was redesigned and ongoing process checks instituted.

Results
- TRI releases were reduced from 9.3 pounds per vehicle in 1993 to 6.1 pounds per vehicle in 1994.
- Reductions on the releases of the following were also experienced: booth cleaner by 28%, purge recovery by 20%, xylene by 93%, naphtha by 72%, lacquer thinner by 76%, and isopropyl alcohol by 41%.

Source: Pollution Prevention Program, Department of Natural Resources and Environmental Control, Dover, DE. *Delaware Industries Prevent Pollution.* http://www.dnrec.state.de.us/dnrec2000/Pollution Prevention.asp

Georgia

Weyerhaeuser Flint River Operations Methods to Reduce Water Usage
Weyerhaeuser-Flint River Operations (Flint River), a pulp and paper mill located in Oglethorpe, Georgia, has recognized that the best way to address water related issues is to place a high priority on Water Use Reduction.

Flint River continues to be recognized as an environmental leader in the Pulp and Paper industry. In May 2000 the Georgia Chamber of Commerce recognized Weyerhaeuser-Flint River Operations with an Environmental Leadership Award in the Water Quality category. Flint River is a participant in the USEPA Project XL (eXcellance and Leadership) program and is committed to a vision of being a Minimum Impact Manufacturing (MIM) facility.

Water Reduction Methods
The following are some of the methods used by Flint River to meet their water reduction goals:
1. Formed a water reduction team that used various methods to raise the awareness level of employees regarding water conservation. Team has discussed implementation of several projects to permanently lower water usage.
2. Eliminated the need to add fresh mill water in the paper machine wire pit when producing a higher brightness grade.
3. Placed a flow measurement device and control valve in the water pipeline going to the wire pit for continuous monitoring.
4. Resized and replaced several shower nozzles in the Woodyard operation with smaller nozzles.

1989-1990's

1989
The first TRI data release serves as a major impetus for the creation of P2 programs at the Federal level, and for businesses to reexamine their emissions and waste streams to prevent pollution.

1989
The Massachusetts Legislature unanimously enacts the Toxics Use Reduction Act (TURA), under which industry discloses its use of toxic chemicals and develops plans, which emphasize the reduction of toxic chemical use as a means of pollution prevention. Several other states enact pollution prevention/waste minimization planning laws.

Massachusetts also launches the Blackstone project to test different methods of coordinating inspections enforcement and technical assistance for all environmental media (air, water, waste). The state reorganizes itself to reflect the lessons learned under the project.

This same year, the Oregon State Legislature unanimously passes the Toxics Use Reduction and Hazardous Waste Reduction Act of 1989, which was signed by the Governor on July 24, the same day the Massachusetts legislation was signed into law.

1989-1993
Numerous states pass pollution prevention planning laws including California, Texas, Minnesota, Ohio, Arizona, among others. Nationwide 23 states pass some type of law during this time period requiring facilities to produce P2 planning reports. The laws vary state by state. Some are no longer enforced, but many are still in effect today.

1989-1998
Through support from EPA and the states, several regional P2 groups begin to form, including NEWMOA's Northeast P2 Roundtable (1989) and The Great Lakes Regional Pollution Prevention Roundtable (GLRPPR), in 1994. In addition a few non-governmental organizations started up to promote the message of P2 including the American Institute of Pollution Prevention (AIPP). AIPP focused on being a forum for representatives from Trade associations and was funded through EPA. It went defunct in 1998.

5. Installed an automatic shutoff valve in the Woodyard operation so that when this area of the plant is not in operation, the flow to the nozzles is turned off.
6. Installed recovery systems to re-circulate cooling water for turbine generator gland seals.
7. Approved capital funds to reclaim and reuse cooling water that passes through the bearings of several large fans in the boiler area.
8. Instituted a repair and replacement system to reduce water loses from valve leaks & steam traps.

Results
During the first six months of 2000, water use at Flint River has dropped by approximately 500,000 gallons per day. The project to reclaim cooling water used in the boiler area fans is expected to reduce water usage by about another 500,000 gallons per day. If all identified water conservation projects are completed, the future state water usage will be approximately 7.5 million gallons per day (MGD), which represents an overall reduction of 4 MGD from baseline usage. Steps have been taken to initiate the more restrictive water usage limits in the Flint River surface withdrawal permit so that the maximum 24-hour withdrawal and the not to exceed monthly average are reduced by 1 MGD respectively.

Source: Pollution Prevention Assistance Division, Georgia Department of Natural Resources, Atlanta, Georgia
http://www.p2ad.org

Indiana

Discount Labels, Inc.
Until 1994, Discount Label's 47 flexographic printing lines used a variety of solvents to keep inks at their required viscosity. Solvents were also used to clean the ink fountains and rollers. In order to reduce the generation of hazardous waste and air pollution, Discount Labels switched to a newly formulated, safer water-based ink. This change required the company's research and development team to design and retrofit every printing line with constant-turn ink fountains and to design and build an automatic ink pot wash station. In addition, the water-based ink had to be specially formulated for Discount Labels because the standard stock could not work successfully on its unique presses. This new process required press operators to undergo extensive training.

Results
- Total emissions of VOCs and HAPs were reduced by more than 39 tons per year. This reduction allowed the company to become a conditionally exempt generator of hazardous waste instead of a SQG.
- The company now saves about $22,000 annually on hazardous waste removal.
- The water-based ink process has improved production, worker safety and health, and has eliminated the fire hazards associated with solvents.

Source: Office of Pollution Prevention and Technical Assistance, Indiana Department of Environmental Management, Indianapolis, IN. 1996. *Annual Report on Pollution Prevention in Indiana.*
http://www.in.gov/idem/oppta

Kansas

Midland Brake Company
Midland Brake Company of lola, Kan., is succeeding in preventing pollution in its production processes while boosting profitability. Since 1990, Midland has taken steps to recycle paper and cutting oil, substitute water-based cleaners for solvent cleaners, and improve finish and coating processes.

Midland, a manufacturer of brakes and brake components for large trucks and tractor-trailers, with gross sales of more than $85 million a year, has been instituting source reduction and waste minimization practices with management support since the enactment of the Pollution Prevention Act of 1990. Company executives attribute Midland's success in protecting the environment to management commitment, employee involvement and a staff member who is an advocate of pollution prevention.

Midland uses water-based cutting fluids for machining zinc and aluminum parts. It pipes the fluid from the storage tank directly to the machines, virtually eliminating spills. Used cutting fluid passes through a coalescer which separates tramp oils. By using better quality equipment, tightening cutting machine seals to prevent tramp oil leaks, routinely cleaning sumps, and removing chips (where bacteria may grow), Midland has extended the life of its cutting fluids. Cost savings from switching to water-based fluids funded a new job, providing preventive maintenance

on the cutting machines. When disposal is required, oil and particulates are separated from water in the coolant. The water goes to an industrial waste water treatment facility and the oil is sent to a fuel blender.

To clean machine parts, Midland has switched from petroleum-based solvent to water-based detergent. The company installed heated parts washers so it could use water-based detergents. Midland found that liquid Tide™ or Dawn™ work well for these parts washers. Annual cost savings are $2,500. Waste from these parts washers, as well as floor scrubber water and storm water runoff, goes into a wash pit. All water from the pit passes through a $1,200 coalescer to separate oil and water. A vendor recycles the oil at no charge to Midland. The water goes to the publicly owned treatment works.

To improve chromate coating operations, Midland reduced water usage, cut immersion time and increased drain time. Improvements on this process since 1990 include reduced water usage (lower rate of water flow in the rinse tanks) and longer drain times (which reduce chemical carry-over). In the nitric acid etch bath, process improvements decreased nitric acid use by 58 percent (from 209,000 pounds in 1990 to 88,000 pounds in 1994). Midland has a waste water treatment system for the chromate conversion line. It reduces hexavalent chrome to trivalent chrome and adjusts the pH. Calcium chloride and ferric chloride are added, as is a polymer flocculent, to precipitate the chrome and zinc. The precipitate is pressed to remove excess water, forming wet filtrate cakes, which are shipped to Rockwood, Tenn. There the cakes are vaporized in a kiln; gases are condensed; and zinc and chromium are sent to foundries on the East Coast. These line changes reduced hazardous cake waste by 35 percent (from 56,700 pounds in 1990 to 36,800 pounds in 1994). This represents an annual cost savings of $34,000.

Midland switched from manual to automated powder coating in the fall of 1993. The new booth cost $100,000, but payback took less than two years. The excess powder is mixed with virgin powder in a 1:1 ratio. No air or liquid wastes are associated with this process. Because the powder application is automated, operators no longer need respiratory protection - a substantial added benefit.

1990 -1991

1990
The Pollution Prevention Act of 1990 (PPA), is signed in October, by President Bush. The PPA provides a basic foundation for adoption of pollution prevention (P2) as the top of the environmental management hierarchy. Authorizes $8 million in seed money for both state and federal P2 efforts. To date, the $8 million for states has never been fully authorized, averaging $5.9 million a year. Also establishes a Federal Pollution Prevention Division at U.S. EPA and requires a quantitative measurement standard for P2 be developed as well as a overall strategy. Companies disclosing their toxic chemical releases under TRI must also report their progress in preventing pollution.

1990
The Clean Air Act Amendments of 1990 are passed which include a section to establish new Small Business Assistance Programs (SBAP's or 507 centers). These programs, which are housed in state air offices, are charged with offering assistance to small businesses, including pollution prevention assistance. This newly formed network in some cases combines eventually with state P2 programs. However in numerous other states the P2 programs and SBAP's remain separate, creating a complicated situation with both entities struggling for limited resources.

1991
The State of New Jersey passes the New Jersey Pollution Prevention Act (8/91), which, like the Massachusetts law, requires disclosure of toxic chemical use and planning that emphasizes pollution prevention. The law is signed at two chemical plants to demonstrate support for it by the chemical industry.

1990/91
EPA launches the "33/50" program, a voluntary program under which companies commit to reducing their releases of 17 top priority chemicals by 33% by 1992 and 50% by 1995, emphasizing pollution prevention. EPA also focuses on Green Lights, the prototype P2 program for energy efficiency. These were the prototypes for proliferation of innovative and voluntary approaches to environmental protection across EPA in the 90's. These programs emphasize efficiency, an attribute of P2. These programs serve as models and inspirations for other EPA voluntary programs including Energy Star, Design for the Environment, Green Chemistry, Waste Wise and Environmental Justice through Pollution Prevention.

Every time powder is collected and mixed with virgin powder for reapplication, the particle size of the residual powder is smaller. Eventually, powder particles become so small they no longer adhere to parts. At this stage, Midland cures the powder and sends it to the landfill as nonhazardous waste and begins the process again with virgin material.

By making one small change, Midland also eliminated one hazardous chemical from its facility completely. In 1992 Midland switched from its xylene-based ink striping for stroke indicators on push rods to a tape applicator. Doing so eliminated xylene emissions from its facility. This also removed the hazardous material requirements and air permitting requirements associated with using xylene.

Results
These measures resulted in more man $190,000 in total cost savings from 1990 to 1994. Midland has reduced its oil waste stream 73 percent, from 37,000 gallons in 1990 to 10,000 gallons in 1995 (projected). The cost savings from these efforts alone are $66,000 annually. Beyond the bottom line, the pollution prevention effort has been good for Midland's image. In 1995 the Kansas Pollution Prevention Awards Committee recognized Midland as a "Trendsetter" company.

Source: Kansas Small Business Environmental Assistance Program, Lawrence, KS
http://www.sbeap.org

Kentucky

CA Garner Veneer Burns Wood Waste for Fuel and Saves at Least $300,000 Annually

In 1990, CA Garner Veneer Inc. (Garner) purchased Lake Jericho Veneer. Garner, owned by two German companies and located in Smithfield, Kentucky, decided to convert to a custom system for manufacturing veneer. Garner purchased new machines and equipment upgrades to create a state-of-the-art facility. The Smithfield manufacturing plant is housed in a 140,000-square-foot building and employs 92 people. Garner manufactures the veneer to the clients' specifications. Clients use the veneer in a variety of traditional end uses such as furniture, panels, architectural woodworking and flooring for the US and export market.

The $3 million investment included new boilers that burn wood waste to make steam that power the lights, log cookers and dryers. Garner uses their own wood waste that included anything from bark to clippings. The facility has a chipper on site for processing larger pieces of wood.

In 1999, Garner contacted KPPC to help find wood waste. Initially, KPPC used its Kentucky Industrial Material Exchange (KIME) to locate wood waste. After the completion of a KPPC wood waste survey in 2000, KPPC used the survey database to find additional possible sources of wood waste. With both KIME and the survey, KPPC first contacted companies which had a wood waste problem and the wood waste was being disposed of in municipal solid waste landfills. Garner gave KPPC permission to give its name to the potential provider of wood waste.

Results
In 1995, Garner was paying approximately $150,000 for diesel fuel. Since 1996, their production has increased and so has their demand for wood waste. With increased fuel prices and production, Garner is saving at least $300,000 annually by purchasing wood waste instead of diesel fuel.

In 1995, the facility started seeking wood waste from other companies. Garner was using about 58% wood waste and 42% diesel fuel. Currently, the facility uses 97% wood waste for fuel and purchases about 3% diesel fuel. This correlates to the facility using about 40 tons per month of wood waste in the winter and 30 tons per month of wood waste in the summer.

Source: Kentucky Pollution Prevention Center, Louisville, Kentucky
http://www.kppc.org

Maine

Hussey Seating Company

In an effort to improve the work environment at its bleacher manufacturing facility and to achieve standards set by the Clean Air Act, the Hussey Seating Company implemented a pollution prevention plan that would reduce the emission of VOCs and HAPs from its wood finishing operations. To achieve this, an automated UV coating system costing $320,000 was purchased and installed to replace the polyurethane coating system.

Results
- Annual labor savings amounted to $280,000.
- Annual material savings amounted to $55,000.
- The $200,000 construction of additional storage space was avoided.
- The new system improved product quality and employee health and safety.
- VOC and HAP emissions were reduced from nearly 50 tons per year to 219 pounds per year.

Source: Northeast Waste Management Officials' Association, NEWMOA. *Pollution Prevention Case Study: Wood Furniture Finishing.* http://www.newmoa.org/Newmoa/htdocs/prevention

Maryland

Montgomery County
The County's Ten Year Integrated Solid Waste Plan requires that solid waste be reduced or recycled by 50% by the year 2000. A yard trimmings (18% of solid waste disposal stream) disposal ban was initiated in 1994. The county compost facility could not handle the increasing yard waste, therefore, a source reduction program featuring grasscycling, home composting and mulching was initiated to avoid a $2.5 million expansion of the facility.

Results
- Almost 50% of the yard waste was reduced at its source within the first two years.
- The number of residents involved in the program increased.
- The $2.5 million expansion of the compost facility was avoided.
- There was a reduction in county vehicular emissions and gasoline consumption due to the decrease in weekly curbside collections.

Source: National Recycling Coalition. 1996. *Making Source Reduction and Reuse Work in Your Community: A Manual for Local Governments.* http://www.nrc-recycle.org

Massachusetts

Crest Foam
Crest Foam is a manufacturer of flexible polyurethane foam for furniture, cushioning applications for the home, packaging and medical applications. The foam

1990-1993

1990's
There is also a proliferation of reinvention, sustainable development and voluntary initiatives at the state and local levels including new Mexico's Green Zia award program, which patterns itself after the prestigious Malcolm Baldrige awards, focusing on efficiency and quality standards resulting in environmental improvement. Several states start fee-based systems to augment the initial seed money allocated by Congress for P2 efforts. These fee-based programs have mixed results and many of the programs remain under funded through the 1900's. States also initiate numerous innovative non-regulatory and regulatory efforts to infuse P2 into mainstream environmental policy. Several states begin to require more pollution prevention requirements into industry permits, states enhance their inspection procedures to be multi-media in scope (mirroring Massachusetts' Blackstone project), and state enforcement programs incorporate P2 elements into Supplemental Environmental Projects (SEP's).

1991/1992
Through the U.S. Congress appropriation's process, the pollution prevention policy staff office is created in the EPA Administrator's office to ensure that P2 is a high priority.

1992
U.S. EPA Administrator Bill Reilly and Deputy Administrator Hank Habicht issue memorandum defining pollution prevention as distinct from, and preferred to, recycling. This memorandum becomes the definitive statement of P2.

1992
The U.S. National Pollution Prevention Roundtable (NPPR) is incorporated as a tax-exempt organization under section 501 (c) (3) of the IRS code. This is the first national membership organization for states and local governments, devoted solely to promoting pollution prevention and cleaner production.

1992
The state of California launches the nation's first "Pollution Prevention Week." This week is designated to showcase P2 efforts throughout the state.

1993
The Clinton EPA announces on Earth Day, its support for pollution prevention as the preferred approach and the President issues the first of several executive orders promoting P2 with the federal government.

was manufactured via the "One Shot" process which used trichlorofluoromethane (CFC-11), an ozone depleting chemical, as the auxiliary blowing agent. As a result of regulations prompted by the Montreal Protocol, Crest Foam replaced CFC-11 with methylene chloride, a VOC.

In order to reduce VOC emissions, Crest Foam installed an innovative foam manufacturing process called the "Cardio Process". This process replaced methylene chloride with carbon dioxide (CO2) as the auxiliary blowing agent. Installing the Cardio Process required a year of planning and $1.5 million in capital investment.

Results

- The substitution of methylene chloride with CO2 reduced Crest Foam's VOC and HAP emissions by 190,000 pounds per year. This also meant that Crest Foam was no longer required to report methylene chloride use to the EPA and the Massachusetts Department of Environmental Protection.
- Switching to CO2 saved $50,000 per year because CO2 is three times more efficient than methylene chloride and 80% less expensive.
- The new process allowed Crest Foam to avoid installing costly air emission control equipment or reduce the type and amount of foam product it manufactures.

Source: Office of Technical Assistance, Office of Environmental Affairs, Boston, MA. March 1997. *Toxics Use Reduction Case Studies (Case Study #45).* http://www.state.ma.us/ota/

Michigan

Alpha Plastics

The P2 Loan Program provides an opportunity for Michigan small businesses who want to invest in pollution prevention to apply for loans up to $ 100,000 at an interest rate of five percent or less. Any small business that employs 100 or fewer people, is independently owned or operated, and not dominant in its field, is eligible to apply for a P2 loan. Loans are available to all private business sectors including manufacturing, farming, retail, and service.

Alpha Plastics of St. Louis, Michigan has implemented a very successful project with P2 Loan proceeds. Alpha is a custom plastic profile extruder operating ten separate manufacturing lines and processing roughly 2 million pounds of plastic resin annually. Previously, Alpha's once through cooling system utilized about 1.5 million gallons of water per month, which was filtered and discharged to the local river. The old system had a number of drawbacks: a sequential design, with undersized piping, and a direct city waterline connection that caused fluctuating water pressure and temperature, and inadequate flows during high production periods. The result was long production runs (and therefore higher energy usage), high defect rates and significant recycling and disposal of defective product. The poor quality of the city water also caused significant scaling, high maintenance requirements and additional down time.

Results

With the help of the loan program, Alpha was able to purchase and install an integrated computer-controlled, closed-loop water recycling system that dramatically reduced their waster usage, eliminated wastewater discharges to the river, and improved process, material and energy usage efficiencies. Actual results were reduced water consumption by 90%, reduced electricity use by 10%, less solid waste from defective product (30,000 pounds), and the elimination of discharge to the river.

Source: Michigan Department of Environmental Quality, Environmental Assistance Division, Lansing, MI
http://www.michigan.gov/deq

Minnesota

Sunrise Fiberglass

Sunrise Fiberglass, in Wyoming, Minnesota, produces fiber reinforced plastic (FRP) parts in a 50-person job shop. The parts vary in shape, size and end use.

Sunrise employs an open mold process which uses about one and a half drums per day of resin and gel-coat material. These materials were applied by spray method, and resulted in high styrene emissions. In 1999, nearly 36,000 pounds of styrene were emitted.

Sunrise tested low styrene resins from a variety of application and managers evaluated the quality of finished parts. A general purpose resin capable of yielding appropriate physical properties at a comparable cost to traditional resin was selected. This general purpose resin contained 38 percent styrene compared to traditional resin's 43 percent.

Traditional application equipment requires high fluid pressure and/or air to properly mix the resin with the catalyst to form an appropriate spray pattern. These finely dispersed spray droplets have a large surface area that allow styrene to evaporate. The finest droplets become overspray. Nonatomized application equipment mixes catalyst and resin together in an internal chamber and the mixture exits in a low pressure continuous stream. Surface area for evaporation is greatly reduced and finely dispersed droplets are negligible, resulting in decreased emissions. Internal mixing of catalyst also reduces the amount of "free catalyst" that enters the work environment, reducing health and flammability concerns. Because of the limited cost difference, the company decided to purchase new, state-of-the-art nonatomized equipment. Sunrise chose the Magnum fluid impingement technology (FIT) system because it was economical and the most current technology. Magnum FIT had minimal overspray in the form of fog or finely dispersed particles and operators were impressed with its clean application.

Because the FIT's internal mix chambers require frequent flushings with acetone. Sunrise anticipated an increase in hazardous waste. The mixing chambers have an air purge that blows out the residual catalyzed material, limiting the volume of acetone needed for thorough cleaning. FIT produces little overspray so general cleanup using acetone is greatly reduced. This helped keep acetone use from increasing.

Results

Less overspray has increased savings in resin and glass, and acetone for cleanup. Less labor is also devoted to overspray clean up. Styrene emissions reduced 43 percent. In 1999, total styrene emissions exceeded 36,000 pounds. Using 1999's resin and gelcoat use levels and emissions factors for new equipment and resins, styrene emissions would drop to 20,500 pounds. Sunshine Fiberglass also met requirements of a new air permit without lost production time, excess capital costs, or employee issues with accepting the new technology. Lastly, there was

1994-1995

1994

The printing industry, environmentalists, the Great Lakes states and EPA complete the Great Printers Project, developing a series of recommended reforms to environmental programs and industry practices to make pollution prevention the preferred approach of the printing industry.

1994

EPA launches the Common Sense Initiative (CSI), to apply the approach demonstrated by the Great Printers Project to six industry sectors. EPA also reorganizes 'its enforcement office, combining enforcement for all media and compliance assistance, in emulation of 'state efforts to better coordinate enforcement and assistance.

1994/1995

EPA responds to Congressional criticism by launching dozens of reform initiatives, many in emulation of then earlier 33/50, energy efficiency and CSI initiatives. The new initiatives include Project XL, as well as a host of consolidated reporting efforts and a number of federal and state environmental awards programs are conducted. Among the federal awards programs are the Closing the Circle awards, recognizing federal facilities with exemplary environmental programs including prevention efforts and Green Chemistry awards.

1995

The Small Business Development Center (SBDC) network lobbies for appropriations to develop and expand their environmental assistance services to small businesses. This environmental assistance includes pollution prevention. At the same time other assistance programs such as State P2 programs, the SBAP programs and NIST Manufacturing Extension Partnership (MEP's) programs are all lobbying for funds as well to provide environmental assistance services. This fragmented situation on the technical assistance front highlights the major competition for funding. The SBDC lobbying effort for major funding continues unsuccessfully through 2002.

less blow back of material which improved working conditions, earning operator acceptance of the new technology and decreasing the amount of employee protection equipment needed.

Source: Minnesota Technical Assistance Program, Minneapolis, MN
http://www.mntap.umn.edu

Nevada

Echo Bay/Cove Mine
The daily operations of the mine generated a large quantity of various hazardous wastes. The greatest volume of waste was halogenated solvents used in parts washing. In order to eliminate future liability costs and to attain the status of SQG under the Resource Conservation and Recovery Act, the mine formed a Corrective Action Team (CAT) to identify waste reduction actions. CAT found a safer replacement solvent that was more expensive ($11.95/gallon versus $3.50/gallon for the replaced solvent), and so decided to employ a filter recycling system that would extend its useful life. The filtration equipment and replacement solvent cost $11,400.

Results
- Elimination of the hazardous solvent waste stream that was being generated at a rate of about 12,000 pounds per year. The non-hazardous replacement solvent waste stream is now less than 1,500 pounds per year.
- Change of status from LQG to Conditionally-Exempt SQG.
- Elimination of 4,500 pounds per year of halogenated lubricant waste by switching to a recyclable, non-halogenated alternative.
- Regulatory requirements and overall environmental liability were reduced.
- Annual savings of $9,300 meant that the payback for the $11,400 investment was 14.7 months.
- Annual savings of $6,600 in disposal costs and $16,000 in LQG training costs were achieved.

Source: Office of Pollution Prevention and Toxics, USEPA. April 1996. *Pollution Prevention Success Stories.* http://www.epa.gov/opptintr

New Hampshire

Pitco Frialator
Pitco Frialator is a manufacturer of commercial frying and cooking equipment. In 1997, Pitco began testing coated, galvanized steel to replace their painted or stainless steel products. This was a major product change that required considerable upper management support because it represented a gamble that Pitco's customers would accept a new product. Encouraged by early success, Pitco is now working on a product-by-product change from painted, to coated steel, products.

Pitco Frialator management initially recognized the need to reduce emissions based on the increased time and cost that had to be dedicated to permitting and reporting requirements. Encouraged by the overall success of that environmental program, they began a program of company wide internal review to reduce waste and improve efficiency.

Although Pitco Frialtor has not undertaken ISO 14000 certification, they have been committed to internal environmental review and improvement since 1987 when they began distilling spent solvent thereby decreasing that waste stream by 90%. In addition to solid waste recycling programs, Pitco Frialtor recycles mercury-containing fluorescent lamps and eliminated solvent waste from parts cleaning by using a bioremediation process that cleans by digesting greases and oils in a water environment. In 1997, Pitco Frialator began its program to eliminate paint related wastes by changing their cabinet formulation from painted steel to a coated, galvanized steel or stainless steel. Although implementation of this program required a considerable expenditure of company resources, Management recognized not only the eventual cost savings from reduced waste disposal costs, raw material costs, permitting and reporting costs, but also the benefits from reduced liability, improved work environment and even improved company morale from such a program.

Results
Since the pollution prevention project began in 1996, Pitco Frialator has reduced their air emissions, and associated costs, by almost 96,000 pounds, and raw material costs have been reduced by over 10% in spite of increasing production. In addition to the direct material costs, Pitco realized indirect cost savings in the following areas: material handling

(1% reduction in SKU numbers), material movement and reduced non value-added labor and inventory costs. These have contributed to annual savings of over $100,000 per year. Pitco Frialator continues to explore cost savings and environmental improvement through a Management supported review process by all levels of staff.

Source: New Hampshire Pollution Prevention Program, New Hampshire Department of Environmental Services, Waste Management Division http://www.des.state.nh.us/nhppp

New Mexico

Philips Semiconductors
Philips Semiconductors is made up of approximately 900 employees and is a product division of Royal Philips Electronics.

The program currently in place at Philips Semiconductors is an environmental management system. This system consists of posting Environmental Policies and setting goals, which include reducing solid waste, energy consumption, water use, and air emissions. Each goal has a sepa-rate target, in percent reduction, that has been set. Each department in the facility is involved in reaching these goals. Philips uses a systematic approach (the Green Zia Program) in order to track goals and record results.

Philips forms teams for each reduction goal (energy, solid waste, chemicals) and tracks the progress of each goal. Further, Philips takes the corporate reduction goals and ups the ante for company teams. By using existing systems to track goals, such as the Key Performance Indicator, it is easy to see the progress, stay focused on goals, and identify who is responsible.

Philips Semicon-ductors is the first private company in the state to achieve registration to ISO 14001. Further, Philips Semiconduc-tors has developed a systematic ap-proach to planning, controlling, measur-ing, and improving environmental ef-forts. Through their system, they have set environmental goals for reducing waste, water, energy, packaging, chemi-cals, and air emissions.

One system in place at Philips is the water reuse program, designed inter-nally by Philips' employees. The system captures high-quality wastewater from

1995 - 1996

1995
National Pollution Prevention Week commences, based on the California model. NPPR helps coordinate the national effort to promote P2 activities nationwide. As part of this effort, NPPR manages to secure President Clinton support letters for National Pollution Prevention Week, from 1996-2000. NPPR also helps facilitate the production and distribution of designer P2 Posters.

1995
Starting in the mid-1990's, states develop Environ-mental Management Systems (EMS) that feature P2 as a major component. Many states work with industry partners to get ISO certification and/or establish an EMS program. NPPR establishes an ISO workgroup and eventually produces a policy paper. Eventually the interest in ISO and EMS programs leads to additional initiatives and efforts including the Multi-State Working Group (MSWG) focusing on Environmental Management Systems. MSWG along with NPPR and others work with the Tag to ensure that the wording in ISO 14000 is clarified to promote P2.

1996
International Roundtable efforts are launched by U.S. NPPR in Asia and South America. Funding is provided by U.S. AID's Asia-Environmental Partnership program. Countries in Asia include Malaysia, Hong Kong. Indonesia, Korea, India, Philippines, Singapore and Thailand. Roundtable efforts are also underway in Europe and Canada to which the U.S. NPPR sends representatives.

1996
EPA removes the Pollution Prevention Policy Staff office from the Office of the Administrator and places it with the Assistant Administrator office of OPPTS, lowering the profile given pollution prevention within the agency.

production areas within the plant and adjusts the water's acidity level. This allows the water to be used in the plant's acid scrubbers, sink aspirators, and cooling towers. The water saved by this system is enough to supply 1,150 average households for a year.

In addition, Philips Semicon-ductors is striving to reduce air emis-sions. By using process changes and installing a more efficient control tech-nology, they plan to reduce air emis-sion by over 90 percent. Additionally, top management at Philips has created the Environment Policy, which directs all employees to minimize the impact on the environment.

Results
Philips Semiconductors' Water Reuse program has reduced the average water use of the plant by 100 million gallons per year. The new program has also led to savings of $130,000 annually. Philips has also reduced their solvent air emissions leading to a projected savings of $30,000 per month over the previous system.

Source: The New Mexico Environment Department, Green Zia Environmental Excellence Program, Santa Fe, NM.
http://www.nmenv.state.nm.us/Green_Zia_website

New York

ITT Automotive-Fluid Handling Systems, RMF Plant, Rochester
ITT Automotive-Fluid Handling Systems employs 162 employees at their plant in the Town of Gates. Using purchased aluminum tubing, ITT fabricates parts for automotive air conditioning and condenser units. General Motors is the primary customer, with most shipments going to the Delphi Thermal plant in Lockport, New York. ITT also supplies GM plants in France and Canada as well as Ford and Saturn.

In 1989, it was recognized that changes would have to be made to reduce emissions of hazardous waste into the atmosphere and the waste water stream. At that time, parts in process were cleaned using 1,1,1-trichloroethane and/or acid wash tanks. (The requirements of the Montreal Protocol and the Clean Air Act were met two years prior to the scheduled timetables.) The goal was to totally eliminate the use of chlorofluorocarbons (CFCs) from the vapor degreasing process and volatile organic compounds (VOCs) from the wash process.

The RFM plant would implement a two-pronged plan which would: eliminate the use of 1,1,1-trichloroethane, replacing it with an aqueous wash system using environmentally friendly soap and eliminate acid wash lines by changing to flame brazing technology as a replacement for salt bath brazing. ITT provided the capital support for the plant's effort by funding more than $220,000 of aqueous wash equipment and more than $400,000 for improved braze equipment processes.

In the case of replacing the use of 1,1,1-trichloroethane with an aqueous wash system, the wash process time doubled from 5 to 10 minutes. In addition, the parts now had to be processed through a drying operation. The RFM plant purchasing and engineering departments worked with the suppliers to produce pre-cleaned raw material, brazeable and evaporative oils. Another major improvement was the change to plastic tooling so that machines run without the need of oil to bend parts. The change from salt bath brazing to flamebrazing with an ultrasonic rinse eliminated the use of acid lines to clean parts brazed with the old salt bath processes. With the use of flamebraze equipment and water rinse stations to remove flux, process water met Monroe County pH discharge requirements without the addition of chemicals to neutralize.

Through process changes and with the help and cooperation of their customers, vendors, management and the hourly production staff, ITT met their goals. In 1994, the use of 1,1,1-trichloroethane ceased. In 1996, the last acid wash line was eliminated. In 1997, the RFM plant was classified as a conditionally exempt generator of industrial waste. This eliminates many of the filing requirements under SARA and ends this phase of the RFM plant's environmental improvement activities.

Results
- Eliminated the release of over 700,000 pounds of chloroethane emissions.
- Eliminated over 500 tons of waste water emissions.
- Employees are no longer subjected to hazardous chemicals and hazardous waste in their working environment.

By eliminating the usage of CFC and VOC processes, the following savings are realized annually:

Hazardous waste removal of 1,1,1-trichloroethane	$12,586
Landfill	$5,000
Utilities savings	$98,019
Trichloroethane usage	$99,360
Direct labor	$260,000
Indirect labor	$26,728
Operating supplies	$143,956
Total Savings	**$645,649**

The payback period for the project was 1.68 years.
Source: Pollution Prevention Unit, New York State Department of Environmental Conservation, Albany, NY
http://www.dec.state.ny.us/website/ppu

Oklahoma

VAC Corporation
VAC is a manufacturer and major worldwide supplier of disk drive components. In order to eliminate the use of Freon TMS (an ODC) as the chosen cleaner, VAC implemented process and equipment modifications so that two aqueous cleaning lines could be installed. The first line involved an ultrasonic wash and rinse before drying, and the second one involved the use of a conveyor to move parts through pre-soap, wash, rinse, virgin deionized water rinse and drying cycles.

Results
- HFC emissions were eliminated (from 200,000 pounds per year in 1992 to 0 in 1996).
- Wastewater from the aqueous cleaning lines can now be discharged to POTWs.
- Waste management costs associated with waste water discharge were eliminated.
- Hazardous material handling and disposal cost savings amounted to $20,000 per week. In addition, there was no loss of productivity or product quality.

Source: Pollution Prevention Program, Customer Services Division, Oklahoma Department of Environmental Quality. August 1997. *Pollution Prevention in Oklahoma: VAC Corporation.*
http://www.deq.state.ok.us/CSDnew/p2.htm

1997-1999

1997/98
A number of additional initiatives and projects spring up during this time period that help promote P2 awareness within the context of sustainability and product stewardship. One of these is the launching of the Pollution Prevention Resource Exchange (P2RX), a national network of regional P2 centers, funded through EPA, to help disseminate technical information on a wide range of P2 topics. Other landmark events include the passage of Oregon's Green Permits Program legislation. This program encourages adoption of EMS incorporating pollution prevention. Wisconsin also establishes its Environmental Cooperation Pilot Program around the same time.

1998
NPPR establishes an annual MVP2 (Most Valuable Pollution Prevention Awards) program as part of the National P2 Week celebration. The event, which recognizes exemplary P2 efforts, takes place in Washington D.C. every September.

1998-2001
The U.S. National Pollution Prevention Roundtable begins the process of revisiting the Pollution Prevention Act of 1990. The result of the effort is the release of a comprehensive proposal to strengthen the Act's provisions based on the decade of practical experience since the Act's passage. Several educational briefings to congressional members and staff take place to promote the proposal, but the political climate is not conducive to any serious consideration. In addition, NPPR brings together a group of experts from EPA, environmental groups and industry to discuss ways to improve and strengthen the existing legislation.

1998/1999
NPPR helps participate in the first Roundtable of the Americas, hosted by Brazil. NPPR also lends crucial support for the International Summit of P2 Roundtables hosted by the Canadians in the fall of '99. More than 60 countries are represented. One of the outcomes of the conference are a series of detailed action agendas on a number of P2 issues.

Pennsylvania

Bell Helicopter, Textron, Fort Worth

A business partnership of Bell Helicopter Textron Inc., the Department of Defense, and a small disadvantaged business, Valco Inc in Duncan, Oklahoma was formed to outsource various metal fabrication processes from Bell Helicopter. A wastewater pretreatment system and permit was required for the effluent from aluminum, stainless steel, and titanium process lines at Valco Inc.

The Pollution Prevention (P2) and Pretreatment Design Team was Earl Turns, a retired chemist from General Dynamics, Paul Morkovsky, from Kaselco Inc., and Delmer Davis, Facilities/Maintenance Manager from Valco Inc. Counter-flow rinsing and water restriction devices were used extensively to decrease the flow of water. The process lines consists of 23 tanks situated on 8" I-beams over a floor-level, secondary containment area, instead of a below-grade pit, for safe, easy access to maintain the tanks and piping.

Paul Morkovsky's services were utilized because of his company's electrocoagulation (EC) system. The EC removes metals from the wastewater without using chemicals so little total dissolved solids remain in the effluent. A reverse osmosis system can be used to treat the remaining effluent, which is then reused in production. The waste from the reverse osmosis process can be sent to the publicly owned treatment works or the flow can be evaporated for zero-discharge. The sludge generated from the EC is not diluted with excess pretreatment chemicals so metal content is high enough to make recycling an option.

Results

Wastewater flow was reduced from 15,000 gallons per day to 2,400 gallons per day. Water conservation during the production process is at 84%. Wastewater effluent is recyclable back to the production process and the waste sludge is recyclable for metals reclamation. These results have made it possible to have no wastewater discharge.

Source: Pennsylvania Department of Environmental Protection, Office of Pollution Prevention and Compliance Assistance, Harrisburg, PA
http://www.dep.state.pa.us/dep/deputate/pollprev/pollution_prevention.html

South Carolina

Crown Cork & Seal

Crown Cork & Seal manufactures metal and plastic containers, bottle caps, and aluminum and plastic closures. It also makes filling, packaging, and handling machinery. The manufacturing process at its Spartanburg, South Carolina facility involves the coating and decorating of tinplated steel using a variety of coatings, inks, and solvents that are, or contain, VOCs. In order to achieve source reduction of VOCs and other hazardous wastes, the Spartanburg facility made four changes to its manufacturing process:

- At a cost exceeding $2.1 million, the facility installed a regenerative incinerator in which VOCs flowing through the system provide the bulk of the heat through their own combustion. This new incinerator significantly reduced the consumption of natural gas by approximately 80% over the previous incineration system.
- The facility installed an EPIC dampening system on its three lithographic printing presses, including two units on each press line at a cost exceeding $240,000.
- At a cost exceeding $260,000, an ultraviolet curing system was installed to cure the inks and varnishes used for the printing on the metal sheets.
- The Spartanburg facility also installed the Anilox coating application system at a cost of $100,000.

Results

- The regenerative incinerator improved capture efficiency from 60% to 85%, and destructive efficiency from 90% to 97%t. The airflow through the ovens also improved, providing better run efficiencies in the coating process that subsequently led to an 18% increase in productivity. Reductions in natural gas consumption amounted to $250,000.
- The EPIC dampening system improved print quality, reduced ink consumption 25%, and eliminated the need for washing cloth-covered rubber rolls. The reduction in ink consumption helped reduce the volume of VOCs generated at the facility and increased the productivity of the lithographic presses by 10 percent. The elimination of washing cloth covers also eliminated the main source of BOD contaminants discharged into the sanitary sewer. This new system also qualified the facility for semiannual monitoring instead of the previous quarterly monitoring.

- The UV curing system reduced annual natural gas consumption by 13% amounting to annual savings of $15,000. The new system also eliminated VOC emissions in the lithography press line.
- The Anilox coating application system resulted in reduced coating usage amounting to annual cost savings in excess of $140,000. This new system has also increased control of the uniform filmweight application of coatings on sheets of tinplate, there by reducing VOC emissions by about 7.5%. The improved quality of the coating application also reduced set-up time on subsequent operations.

Source: Hans VanderKnyff. P2SC: *More South Carolina Companies Leading in P2. (A Crowning Touch in Pollution Prevention)*; p.8, Spring 1998. Hazardous Waste Management Research Fund, SC. http://www.scdhec.net/eqc/admin/html/wastemin.html

Tennessee

Power Tool Manufacturer

This power tool company processes raw materials into power tool components by stamping, machining, cleaning, oxide coating, and painting. Its pollution prevention program involved:

- Changing to water-based paints to eliminate the annual purchase, use and disposal of thirty-six 55-gallon drums of paint thinner used to clean spray painting equipment.
- Cleaning parts in an existing water-based cleaning system to eliminate the annual purchase, use, and disposal of twenty 55-gallon drums of petroleum solvent.
- Switching to a black oxide coating bath that did not contain chromates.
- Identification and elimination of lead sources to reduce hazardous heavy metals from sludge, and the reduction of annual sludge generation by eight 55-gallon drums.
- Changing from manual to automatic paint spraying to reduce overspraying and annual dried paint waste by 50 percent or ten 55-gallon drums.
- Using only deionized water in phosphate baths to reduce annual phosphate sludge by 30 percent or nine 55-gallon drums.
- Developing a system to recycle cutting oil for reuse to reduce annual waste oil by 80 percent or 24,000 gallons.

2000 - 2002

2000

EPA launches a new voluntary initiative, the National Performance Track and Stewardship program. This program picks up where Project Excellence and Leadership (XL) and the Common Sense Initiative (CSI) CSI left off. P2 is not a core element of the program, but it is an objective.

2000

U.S. Senator Frank Lautenburg (NJ) introduces the "Streamlined Reporting and Pollution Prevention Act", which would consolidate reporting responsibilities for industry and states. It also contains provisions to ensure that pollution prevention technical assistance is provided to companies reporting. The U.S. NPPR joins a number of private and public sector organizations in supporting the legislation.

2002

Pollution Prevention continues to play a critical role in meeting the environmental challenges of the 21st century. Despite intensive pressures on public and private sector P2 budgets, P2 is a key element of successful programs for innovation and sustainability globally. NPPR sends an official representative to the World Summit on Sustainable Development, held in Johannesburg, South Africa in Fall 2002.

Results
- Hazardous waste decreased 35,000 pounds annually.
- Annual non-hazardous solid waste decreased 20,000 pounds. . Disposal costs decreased $23,000 annually.
- Raw material costs decreased $7,000 annually.
- Annual labor costs decreased $10,000.
- Annual material recovery savings increased $6,000.

Source: University of Tennessee, Tennessee Department of Environment and Conservation, and Tennessee Valley Authority. 1994. *Case Histories of Cost Saving Through Waste Reduction by Small Industries in Tennessee (TVA 14: Power Tools).*
http://www.state.tn.us/environment

Texas

Dickson Weatherproof Nail/CDC Coatings
Currently, zinc is precipitated out of wastewater from the galvanizing department and released to the environment when it is land-filled as a component of sludge. Some zinc is also released through a permitted outfall. Trace amounts of lead, found as a contaminant of zinc, are also released in both sources.

In order to comply with the discharge permit and reduce environmental impact, improvements were made in the efficiency of the galvanizing process through the use of proprietary chemicals and a purer grade of zinc. This reduced the concentration of both lead and zinc in the wastewater and hence in the sludge. In a process integral to galvanizing, about 20,000 gallons per day of fresh water were used to pump a slurry. It was found that fresh water was not needed for this purpose, so a totally enclosed system was constructed by rerouting existing pipe and reallocating existing tank storage.

Further reductions in the wastewater flow were realized by using treated wastewater in non-critical applications, such as preliminary rinses, solution make-up in galvanizing, and polymer and caustic dilution in the wastewater treatment system.

Results
- Through the use of treated wastewater in non-critical applications and using a totally enclosed system for pumping the slurry, wastewater flow was reduced by 30,000-35,000 gallons per day.
- A reduction in the wastewater flow resulted in compliance with the company's permitted waste water discharge. The lower flow rates also improved the performance of the wastewater treatment system, thus reducing the amount of zinc and lead released through the outfall.
- Improved zinc use efficiency in the galvanizing operation not only reduced zinc and lead concentrations in the wastewater but also in the sludge. The improvements led to a reduction of about 12,000-15,000 pounds per year of lead and zinc released to the environment, primarily in the sludge.
- Cost savings were realized primarily from the improvement in zinc use efficiency. Estimates are in the range of $42,000 per year.

Source: Office of Pollution Prevention and Recycling, TNRCC. January 1998. *Dickson Weatherproof Nail/ CDC Coatings.*
http://www.tceq.state.tx.us

Vermont

Ethan Allen
Ethan Allen, a furniture manufacturer and one of the largest air polluters in Vermont, decided to improve its image and comply with Clean Air Act standards for wood furniture. In an effort to reduce VOC emissions, a switch to nitrocellulose sealer and lacquer with higher solid content was made. This, however, meant that the sealer and lacquer had to be heated to reduce their viscosity so that they could continue to be applied by spray gun. The spray gun cap, nozzle, and tip also had to be modified to accommodate this change.

Results
- Reportable emissions and material usage were reduced by about 46% with the new lacquer \ application.
- The new system required one lacquer application. This allowed some manpower at the lacquer application stage to be transferred to other positions, created more space for the finishing department, and reduced maintenance requirements

and the amount of solvent cleaner required.
- Worker health and safety conditions were improved.

Source: NEWMOA and NESCAUM. 1996. Pollution Prevention Case Study: Wood Furniture Finishing. http://www.newmoa.org

Washington

S.E.H. America

S.E.H. America, in Vancouver, is a silicon wafer manufacturing company employing over 1,650 people. They instituted significant programs that reduce their environmental impact. Silicon sludge is their primary waste stream, and they have diverted 90,000 pounds of sludge from disposal per month by finding recycling opportunities for this material. In addition, S.E.H. invested over $1,000,000 in equipment that recovers approximately 46,000 pounds of coolant and silicon grit for reuse each month. This reduces the amount of virgin material that must be purchased.

By reducing water consumption S.E.H. not only protects a natural resource, it reduces the amount of process wastewater that must be treated and discharged to the environment. Water conservation projects imple-mented by the company included installing a new reclaim water system that recovers an average of 50 gpm of clean rinse water; replacing scrubber water makeup with reclaimed water for a savings of 35 gpm; reusing once-through pump seal water for cooling tower makeup to save 32 gpm; and using non-contact cooling water and reverse osmosis reject water for irrigation instead of well or city water.

Results

The cool-ant and grit recovery operation saves S.E.H. over $100,000 per month in disposal and purchase costs. These new efforts result in diverting nearly 3 million pounds of silicon waste on an annual basis. In addition, the average monthly city water consumption dropped from 773 gpm to 606 gpm, a 22 percent reduction.

Source: Washington State Department of Ecology, Hazardous Waste and Toxic Reduction Program, Olympia, WA.
http://www.ecy.wa.gov/programs/hwtr/index.html

Wisconsin

Mercury Reduction Activities

The Wisconsin Department of Natural Resources has partnered with 15 Wisconsin communities to reduce the public's use of mercury containing products. The Wisconsin DNR, University of Wisconsin Extension, and municipal educational programs have targeted the medical, dental, school, and HVAC sectors of the community as well as the general public. Parallel Department programs target collection and recycling of mercury dairy manometers and automobile hood and truck switches.

The Dairy Farm mercury manometer recycling project is one example of the successful implementation of a mercury reduction program. Many dairy farms contain mercury manometers, some of which are installed in exposed places where they could be easily broken and also are often kept in the milking house when dairy farms go out of business. To prevent mercury spills, the Mercury Manometer Replacement Program was developed. Dairy equipment dealers are given a $200 rebate for every mercury manometer they replace with a digital manometer and $100 for every mercury manometer they simply remove. The dairy farmer in effect sees a $200 discount off the purchase of the digital manometer. This program has been very effective around the Great Lakes area in Wisconsin mainly because dairy equipment dealers have monthly contact with their customers during equipment checks so they have been able to notify most farmers about the program.

Results

Over 400 mercury manometers, 300 pounds of mercury, have been recycled in the Dairy Farm program. Together these programs have recycled over 8,000 Ibs. of mercury over the last four years, as well as permanently replaced mercury-containing products with non-mercury products.

Source: University of Wisconsin Extension, Solid and Hazardous Waste Education Center, Milwaukee, WI
http://www.dnr.state.wi.us/org/caer/cea/mercury

ApI.

Appendix 1
The Original NPPR Survey Instrument

We need your help!
The National Pollution Prevention Roundtable (NPPR) with support from U.S. EPA's Pollution Prevention Division, is working to develop the ultimate national pollution prevention (P2) results study. Please help NPPR by completing this survey. You can email your survey to staff@p2.org or fax it to 202-299-9704.

Purpose
The objective of this project is to evaluate and promote state and local pollution prevention program achievements over the past decade. This study is the first cohesive attempt to collectively document and explore the myriad of P2 activities and results on the state and local levels, and translate the data into aggregate nationwide results.

NPPR will fully utilize its extensive network of P2 practitioners across the country to compile the most comprehensive report feasible. The organization's main project goals are to compile nationwide statistics on pollution prevention practices and determine the real impact of these activities on the nation's environment.

The Survey
The P2 Results Survey is divided into three sections,
1) basic program information;
2) quantitative results from 1990 to 2000 on P2 achieved through technical and financial assistance activities; and
3) "stellar" case studies.

The quantitative results section is seeking information on waste and pollution reduced, costs savings and the impact of P2 efforts on the environment and the economy. The "stellar" case studies section requests reports that highlight specific approaches (technology installed, management systems in place, etc.). The case studies being requested, should illustrate effective programs or individual outreach efforts at the state, local and federal levels.

Outcome
The P2 Results report will be used to establish a benchmark of measuring P2 programs' effectiveness nationwide, over the past decade. Some specific deliverables from this effort include the development of:
- A summary report of P2 results nationwide, including waste/pollution reduced, cost savings, and impact on the environment and the economy;
- Promotional materials that document the report's findings and navigate interested people to the appropriate website resources; and
- Additional and expanded website nodes that will house the case studies and new data generated from this survey project.

Please feel free to fill the survey out online to cut down on the amount paper used in the process.

Thank you.

Section 1: Program Information
(use additional paper if needed to answer)

P2 Program Name:

Contact Information:

Organization Name:

Contact Name:

Mailing Address:

Phone Number: Fax Number:

Contact Email Address:

Program Website Address:

Where is the program located? ("X" all that apply)
__ regulatory agency
__ non-regulatory agency
__ university
__ economic development
__ local government
__ small business development center
__ non-profit organization
__ NIST MEP's
__ other, please specify:

4. What type of program do you run?
Please elaborate if your office encompasses more than one type of program.
__ small business environmental assistance
__ P2 technical assistance (TAP)
__ regulatory
__ compliance assistance
__ other, please specify:

5. If you identified the program as regulatory, please describe it (toxic use reduction program etc.)

6. What is the program's approximate budget?

7. Where does the program budget come from? (list percentages)
__ state/local sources (general state revenues, special fees)
__ federal sources (grants, loans or congressional budget line item)
__ private funding? (private foundations, corporations)
__ other, please specify:

8. What is the number of FTE/staff in the program?

9. If you provide technical assistance, what is the number of facility sites visited annually?

10. What types of P2 assistance are provided? ("X" all that apply)
__ training
__ grants or loans
__ site visits
__ facility planning assistance
__ student interns
__ environmental management systems
__ telephone assistance
__ regulatory flexibility (SEP's, permits)
__ retired engineers
__ publications
__ other, please specify:

11. What types of barriers do you see as impeding implementation of P2?
__ lack of capital
__ staff changes
__ lack of management commitment
__ other, please specify:

12. What measures do you use to collect P2 costs savings data. ("X" all that apply)
__ documented cost savings from actual companies
__ surveys
__ case studies
__ other, please specify:

13. Do you collect data on your assistance/regulatory efforts?
__ Yes
__ No

14. Other comments (for example, additional types of data you collect and how this information is used)

Possible Data Sources:
- TRI
- Case studies (technical and regulatory integration)
- Program measurements
- P2 plans/program reports
- Environmental mgmt systems tracking
- Required environmental reports
- Manifest data

How did your program achieve the results reported above?
__ on-site work
__ financial
__ regulatory
__ other, please specify:

Pollution Prevention is the reduction at the source of pollutants in air, waste water and waste streams.

Explanation of Categories
- Pollution Prevented (pounds) – refers to reductions in air emissions, waste water and hazardous and solid waste.
- Energy Conservation (units) – includes energy efficiency, renewal efforts and transportation activities, etc.
- Water Conservation (gallons) – includes reductions in water use and/or water conserved.
- Total Cost Savings – savings achieved as a result of reduction practices at State/local jurisdictions.
- Impact on Economy ($) – includes jobs created, budget surpluses, industry sector impact, etc.
- Impact on Environment (multi-media results) – keeping pollutants out of the environment; pollutants no longer present (i.e. can you swim in your river.)

Please send us any brochures, newsletters, and other publications that represent examples of your program efforts. This information will be organized by State and housed in our resource library.

Section 3: "Stellar" Case Studies
Please attach 2 to 3 key case studies already developed that describe a particular approach or individual outreach effort that was effective in implementing a pollution prevention effort. Case studies should fit into at least one of the following categories:
- Pollution prevention in industry
- Local government
- Pollution prevention as a tool for compliance
- Beyond compliance (XL)
- Voluntary programs (behavior/culture changes)
- State program structure that leads to compliance
- Good measurement approaches that lead to pollution prevention
- Good environmental management systems that result in pollution prevention

Send any and all copies of reports you would like included in the bibliographical references as well as on the NPPR website to:
Steven Spektor, Program Manager
National Pollution Prevention Roundtable
11 Dupont Circle NW, Suite 201
Washington, DC 20036
phone 202-299-9701; fax 202-299-9704

Section 2: Quantitative Results

(See explanation of categories on next page. Use only actual documented numbers.)

	Pollution Prevented (pounds)			**Energy Conservation** (units)	**Water Conservation** (gallons)	**Total Cost Savings** ($)	**Impact on Economy** ($)	**Impact on Environmental** (multimedia results)
	Air	Water	Waste					
1990								
1991								
1992								
1993								
1994								
1995								
1996								
1997								
1998								
1999								
2000								

ApII.

Appendix II

The following data is some of the quantitative information provided to NPPR by the survey respondents. This data was used to compile results for table 1.4.

Data for 2001 and 2002, sent by some states, are for information only and were not compiled into the cumulative totals for this report.

Arizona P2 Program, Arizona Department of Environmental Quality

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1991			12,749					
1992			219,001					
1993		6,086,000	6,444,845			3,107		
1994	1,085,612	13,080,500	10,378,950			2,500,000		
1995	43	163,724	19,386,305			4,500		
1996		19,655	138,182,706			17,329,328		
1997	123,135	42,105,907	21,036,608			20,991,670		
1998	2,201,117	22,194,935	186,577,252		2,861,600	1,766,200		
1999	20,020	132,182,697	262,309,861		200,037	50,358,994		
2000		24,444,274	25,200,970		487,123	27,586,471		

California Integrated Waste Management Board

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1993			11,400,000					
1994			12,400,000					
1995			13,700,000					
1996			15,900,000					
1997			17,000,000					
1998			18,500,000					
1999			22,200,000					

Florida Pollution Prevention Program, Florida Department of Environmental Protection

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1993	317,000		2,200,000		4,900,000	3,500,000	1,200,000	
1997	105,000	13,300,000	277,000					
1998	8,200	12,400,000						

Florida, Air Mgmt Division P2 Strategy, Env. Protection Commission of Hillsborough County

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1994	40,000							
1995	100,000							
1996	122,000							
1997	142,200							
1998	160,000							
1999	65,000							
2000	82,000							

Georgia, Pollution Prevention Assistance Division

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
2000				5,900,000	226,439	72,000,000	7,859,850	

Illinois Waste Management and Research Center, P2 Program

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
2000			3,730,000,000				27,000,000	

Illinois, NORBIC Environmental Assistance Center

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1998	41,200	1,500	6,600					

Indiana Clean Manufacturing Tech and Safe Materials Institute

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1994	108,000							807,691
1995	758,000							1,157,850
1996	440,000							178,000
1997	886,000							968,011
1998	1,652,000							533,535
1999	1,048,000							1,126,300
2000	2,852,000							1,427,353

Iowa Department of Natural Resources, Pollution Prevention Services

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1999			1,994,000		744,127	4,600,000	124,000	
2000			16,320,000			2,100,000	634,000	

Kentucky Pollution Prevention Center

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1990							681,338	
1991							415,450	
1992							216,034	
1993							166,180	
1994							216,034	
1995							764,428	
1996							747,810	
1997							747,810	
1998							847,518	
1999							897,372	
2000							1,179,878	

Kentucky, Jefferson County Air Pollution Control District, Pollution Prevention Program

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
2000	107,000,000							

Maryland Department of the Environment, Pollution Prevention Program

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1997				3,800,000				363,000
1998				109,000,000				109,000,000
1999				980,000				3,100,000
2000				13,000,000				13,400,000

Massachusetts Department of Environmental Protection, Toxic Use Reduction Program

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1991			57,200,000					
1992			51,800,000					
1993			49,400,000					
1995			42,800,000					
1996			30,100,000					
1998			33,700,000					

Michigan Department of Environmental Quality, Environmental Assistance Division

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1998	706,278	432,740,391	7,653,347			160,000,000		
1999	12,580	14,332,607	97,530,862			351,437,400		
2000	33,000		30,800			463,000,000		

Minnesota Technical Assistance Program

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1990				4,900,000			19,000	
1991				1,500,000			83,000	
1992				1,800,000			282,000	
1993				4,300,000			113,000	
1994				2,000,000			49,000	
1995				500,000		10,000,000	144,000	
1996				3,000,000		5,000,000	892,000	
1997				45,000,000		264,000	1,300,000	
1998				237,000		106,000,000	366,000	
1999				66,000,000		62,000,000	2,600,000	
2000				1,500,000		29,600,000	2,800,000	

Montana Department of Environmental Quality, Pollution Prevention Bureau

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1993					150,700			
1994					150,700			
1995					332,500			
1996					557,300			
1997					617,500			
1998					648,960			
1999			82,985		726,760			
2000			166,563		735,260			

Nevada Small Business Development Center, University of Nevada, Reno

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1995			1,476,000				250,000	
1997			69,172				45,290	
1999			35,000				58,000	
2000			116,363				108,421	

New Jersey Department of Environmental Protection

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1994				*596,000.000				
1995				538,000,000				
1996				647,000,000				
1997				535,000,000				
1998				539,000,000				
1999				433,000,000				
2000				353,000,000				

Total decrease in non-product output = 243,837,000 (numbers above are rounded off)
**Total Non-Product Output-this is not adjusted for Production/recent studies have shown production to be flat. New jersey will be releasing a new study, a New jersey trends Report, in the summer of 2003, which should shed more light on the subject

New Mexico Environment Department, Green Zia Environmental Excellence Program

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1999							5,000,000	
2000							30,000,000	

New Hampshire Pollution Prevention Program

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1992			4,800,000				24,888	
1993			350,000					
1994			16,000				4,051,464	
1995			741,871				508,000	
1996			236,992			41,685,000	1,270,000	
1997	24,000		479,268			160,000	1,350,000	
1998			15,038				324,000	
1999			600,000			583,590	848,700	
2000	44,189		875				169,700	

North Carolina Division of Pollution Prevention and Environmental Assistance

	Pollution Prevented (pounds)				Energy Conservation (kWh)	Water Conservation (gallons)	Total Cost Savings ($)	Impact on Economy ($)
	Air	Water	Waste	Combined*				
1992						228,000	1,600,000	
1993	40,000		710,000				5,000,000	
1994		10,000				22,700,000	667,500	
1995		7,000,000	21,700,000				639,300	
1996						1,400,000	9,700,000	
1997	32,000	4,400,000	20,600,000			40,200,000	8,500,000	
1998		319,500				12,100,000	23,000,000	
1999	50,000	77,000	8,200,000			668,000	6,000,000	
2000		30,000	2,900,000				211,600	

Ohio Environmental Protection Agency, Office of Pollution Prevention

	Pollution Prevented (pounds)				Energy Conservation (kWh)	Water Conservation (gallons)	Total Cost Savings ($)	Impact on Economy ($)
	Air	Water	Waste	Combined*				
1994	12,231,883	37,535	12,776,984					
1998	69,500,000	14,000,000	13,400,000,000		32,000,000	27,000,000	192,300,000	5,000,000
1998	15,600,000	4,600,000	361,000,000					
2000			285,398,697					

Ohio, City of Cincinnati, Office of Environmental Management, P2 Program

	Pollution Prevented (pounds)				Energy Conservation (kWh)	Water Conservation (gallons)	Total Cost Savings ($)	Impact on Economy ($)
	Air	Water	Waste	Combined*				
1993	33,000							

Appendix II

Pennsylvania Technical Assistance Program, PENNTAP

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1992							25,700	108,700
1993							74,500	112,300
1994							42,900	50,500
1995							240,100	253,600
1996							550,000	723,400
1997							792,000	1,098,000
1998							2,105,900	2,842,800
1999							1,833,800	4,771,000
2000							1,355,400	2,261,600

Pennsylvania DEP, Office of P2 and Compliance Assistance

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1996	37.6 billion	229,000,000	30.2 billion		2,540,000		79,000,000	
1997	11 billion	1.2 billion	24 billion		1,800,000		39,000,000	
1998	622,000,000	12.2 billion	622,000,000		17,000,000	201,000,000	24,400,000	
1999	8,800,000	671,000,000	120,000,000		2,900,000	424,000,000	13,700,000	
2000	11,500,000	464,000,000	461,000,000		5,400,000	400,000,000	17,800,000	

South Carolina Dept of Health and Environmental Control, Center for Waste Minimization

	Pollution Prevented (pounds)				Energy Conservation	Water Conservation	Total Cost Savings	Impact on Economy
	Air	Water	Waste	Combined*	(kWh)	(gallons)	($)	($)
1994			134,456,807			5,400,000	1,823,275	
1995		3,002	8,161,900			107,000,000	80,348	
1996	142,007		517,155			44,000	6,310,522	
1997	800	161,050	844,000			19,185	100,800	
1998			109,350			2,600,000	33,550	
1999		43,368	20,080,400				23,000	
2000	500,000	9,174	111,300				513,000	

Texas Commission on Environmental Quality, Texas P2 and Industry Assistance

	Pollution Prevented (pounds)				Energy Conservation (kWh)	Water Conservation (gallons)	Total Cost Savings ($)	Impact on Economy ($)
	Air	Water	Waste	Combined*				
1993-6				192,303,300	11,271,000	317,398,990	30,442,791	
1997				152,114,600	5,029,000	1,182,600,000	45,357,209	
1998				220,399,520			13,600,000	
1999				90,065,280	68,200,000		4,900,000	
2000				67,019,300	18,938,841	84,539,792	23,282,148	

The data for Texas includes pollution prevention efforts with the Mexican maquiladora industry. As a result of the NAFTA agreement, waste generated by US companies operating in Mexico must be returned to the US. Therefore the efforts of TCEQ in reducing pollution in the maquiladora industry in Mexico are actually reducing the amount of pollution in the US.

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1 US EPA, Pollution Prevention 1997: A National Progress Report. Appendix C. Available at http://www.epa.gov/opptintr/p2_97/

2 Pollution Prevention Progress in the Northeast, Northeast Waste Management Official's Association, August 1998.

3 The State of Pollution Prevention, Iowa Waste Reduction Program, Sept. 30, 2001 (work supported by US EPA)

4 EPA Budget FY 2000. Available http://www.epa.gov/ocfo/budget/2000/2000bib.pdf, Pg 103.

5 Environmental Protection Agency's 2003 Budget by Goal. EPA Budget FY 2003. Available http://www.epa.gov/ocfo/budget/2003/2003bib.pdf

6 See section titled "Case Studies" for specific examples of P2 cost savings.

7 United States General Accounting Office. Environmental Protection, EPA Should Strengthen Its Efforts to Measure and Encourage Pollution Prevention. February 2001. http://www.gao.gov/new.items/d01283.pdf

8 Chemical and Pesticides Results Measures, US EPA OPPTS and PEPPS ISPA at Florida State University. February 2001.

9 http://www.newmoa.org/Newmoa/htdocs/prevention/metrics/

10 USEPA, Other Measurement Strategies. http://www.epa.gov/p2/resources/p2meas_oms.htm

11 Multi State Working Group Website, http://www.iwrc.org/mswg/about.cfm, December 10, 2002.

12 Global Environmental and Technology Foundation Website, http://www.getf.org/ourwork/envsecurity.cfm, 12/10/02.

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