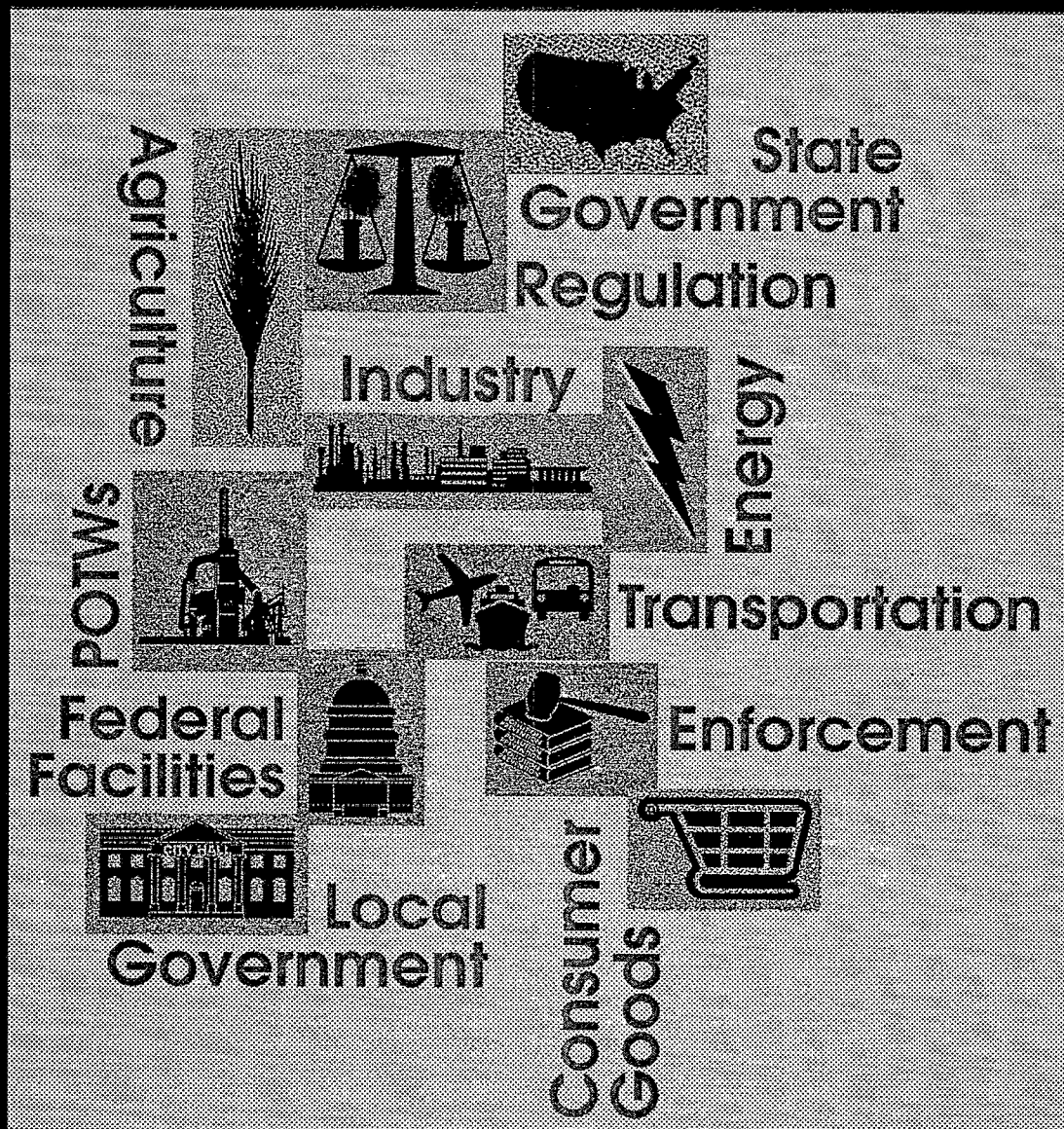
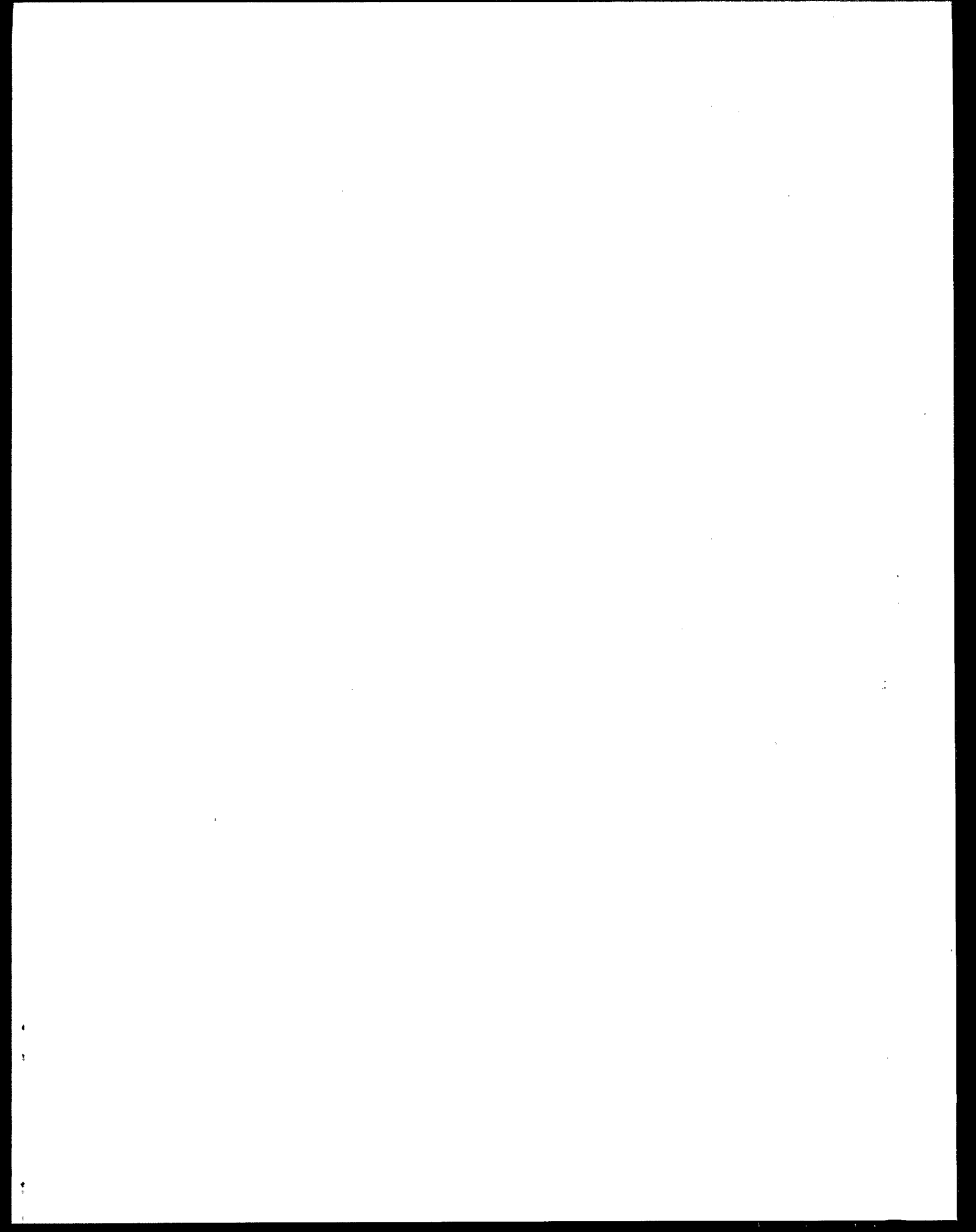




# Pollution Prevention Success Stories





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## **FOREWORD**

### **POLLUTION PREVENTION— THE FUTURE LOOK OF ENVIRONMENTAL PROTECTION**

Since the environmental movement began growing in the 1960s, people have been looking for the best and most cost effective methods to prevent pollutants from entering the environment. For over 20 years, the generally accepted approach was through regulation and then control of waste materials through chemical, physical, mechanical, or even electrical treatment and collection (for disposal), transformation, and/or destruction of pollutants after they were generated. In the 1990s, there is a growing emphasis on "pollution prevention," looking at ways to prevent the generation of the waste itself. This approach reduces the need to control the wastes, because they are not produced to begin with.

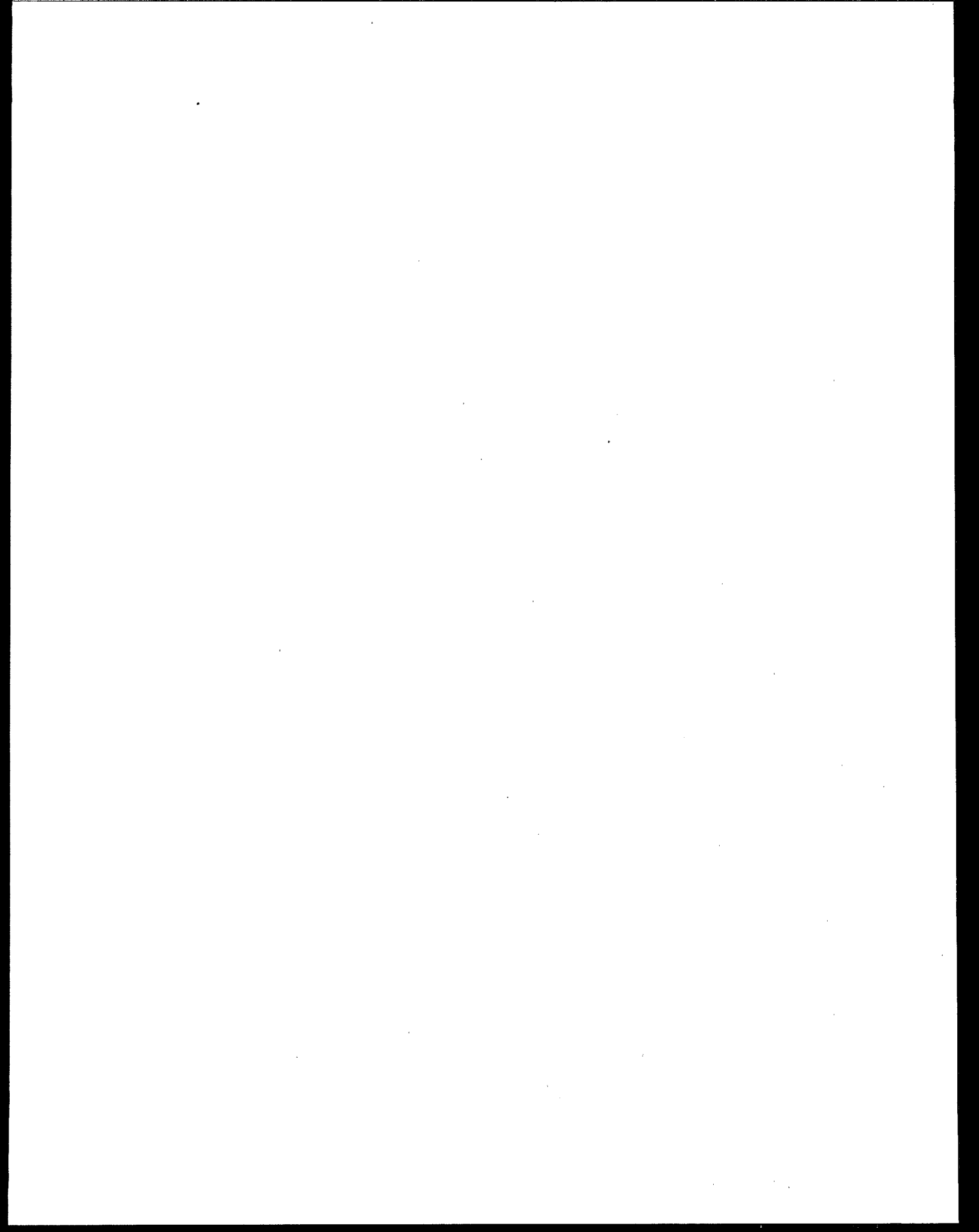
Pollution prevention takes many forms. It involves simple efforts, such as buying the correct amount of raw material so that no excess material needs to be discarded (for example, paints that have a specified shelf life), or producing less wastewater by better controlling the amount of water used in cleaning or manufacturing. Or, it may mean substituting nontoxic chemicals for the hazardous or toxic materials currently used in the process. It may even involve re-engineering and redesigning a manufacturing line to take advantage of newer, cleaner process equipment.

Pollution prevention applies well beyond the manufacturing sector. Creative ways to minimize waste generation abound in a variety of economic sectors and institutional settings. Many organizations, institutions, and industry sectors, in addition to manufacturers, can institute pollution prevention ideas and reduce or even eliminate the generation of waste materials.

It is from the perspective that more creative approaches to pollution prevention should be shared and others developed that the idea for this document was born. Considerable progress and success have been made in attaining pollution prevention in various sectors of the economy. It is the purpose of this document to provide pollution prevention success story examples that demonstrate cost-effective, environmentally preferable solutions to waste problems. Generally, the success stories illustrate that approaches based on reduction at the source can be implemented successfully by nearly everyone.

In selecting success stories for inclusion in this presentation, the Environmental Protection Agency used several criteria. First, the actions taken involve true prevention of pollution (source reduction). Second, the solutions are relatively simple and yield benefits exceeding the investment cost. Third, the actions are instructive to a relatively large audience, demonstrating a new application, innovative approach, or creative solution to a pollution problem. In several cases, it is the process, not the prevention action itself, that is worth noting.

This document highlights 26 success stories, spread over a wide spectrum. The studies include pollution prevention on farms, in schools, and within government organizations, as well as in the more traditional areas of manufacturing and operations.



# Pollution Prevention Success Stories - EPA Programs

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## 33/50 Program: Reducing Risks Through Voluntary Actions

The 33/50 Program is a voluntary pollution prevention initiative of the U.S. Environmental Protection Agency (EPA) and derives its name from its overall goals. An interim goal was 33 percent reduction in 1992, and an ultimate goal is of 50 percent reduction by 1995 in releases and transfers to offsite waste management facilities of 17 high-priority toxic chemicals. (See Table 1 on the next page.) The 1988 Toxics Release Inventory (TRI) reporting is used as a baseline. During 1988, 1.49-billion pounds of the targeted chemicals were either released to the environment onsite or transferred to offsite waste management facilities. The aim of the 33/50 Program is to reduce this amount by at least 50 percent (i.e., 744-million pounds) by 1995. The interim reduction target was more than 491-million pounds by 1992.

The program encourages pollution prevention as the best means of achieving reductions in toxic chemical emissions, and seeks to instill a pollution prevention ethic at the highest echelons of American business by directing program communications to the Chief Executive Officers (CEOs) of corporations that own manufacturing installations throughout the United States.

### Implementing 33/50

In 1990, the EPA directed initial communications about the 33/50 Program to the CEOs of the parent companies of the more than 16,000 industrial facilities that had reported TRI emis-



sions for the Program's 17 target chemicals. At the close of the Program's fourth year in February 1995, nearly 8,000 companies had been contacted by EPA to participate in the pro-

gram. Of these, 1,272 companies had enrolled, pledging to reduce voluntarily more than 368-million pounds of pollution.

The "Top 600" companies with the greatest amounts of releases and transfers were the first to be contacted and have been the focus of greater outreach followup from the Program's headquarters and regional office staffs. More than 60 percent of the larger companies have chosen to participate in the Program, while less than 13 percent of 7,500 smaller companies contacted by EPA since 1991 have chosen to enroll in the Program.

More than 1,000 participating companies have provided release/transfer reduction targets for the 33/50 Program chemicals totalling 368-million pounds. For these companies, whose base year amounts accounted for 53 percent of the releases and transfers reported by all Program participants, this reduction commitment represents slightly less than 50 percent per company.

### Operating Results

Releases and transfers of 33/50 Program chemicals were reduced significantly between 1992 and 1993, bringing total reductions just shy

# 33/50 Program: Reducing Risks Through Voluntary Actions

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Table 1.  
17 Priority Chemicals Targeted by  
the 33/50 Program

- Benzene
- Cadmium & Compounds
- Carbon Tetrachloride
- Chloroform
- Chromium & Compounds
- Cyanides
- Dichloromethane
- Lead & Compounds
- Mercury & Compounds
- Methyl Ethyl Ketone
- Methyl Isobutyl Ketone
- Nickel & Compounds
- Tetrachloroethylene
- Toluene
- Trichloroethane
- Trichloroethylene
- Xylenes

of the program's ultimate reduction goal of 50 percent by 1995.

- Releases and transfers of the 33/50 Program chemicals were reduced by 100-million pounds (11 percent) between 1992 and 1993, bringing total reductions since 1988 to 46 percent (685-million pounds), just shy of the Program's 1995 50 percent reduction goal.
- Facilities are projecting continual reductions in their release and transfers of 33/50 Program chemicals in 1994 and 1995, suggesting that the Program's ultimate reduction goal of 744-million pounds may be achieved a year ahead of schedule.

- Between 1992 and 1993, facilities owned by Program participants reduced releases and transfers of the 17 Program chemicals by 20 percent. The rate of reduction achieved by facilities owned by non-participating companies was just 0.6 percent.
- Since 1988, facilities owned by participating companies have more than halved their releases and transfers of the 33/50 Program chemicals, achieving a 57 percent reduction.
- Participating companies accounted for 98 percent of the reduction in 33/50 Program chemical releases and transfers in the last year.

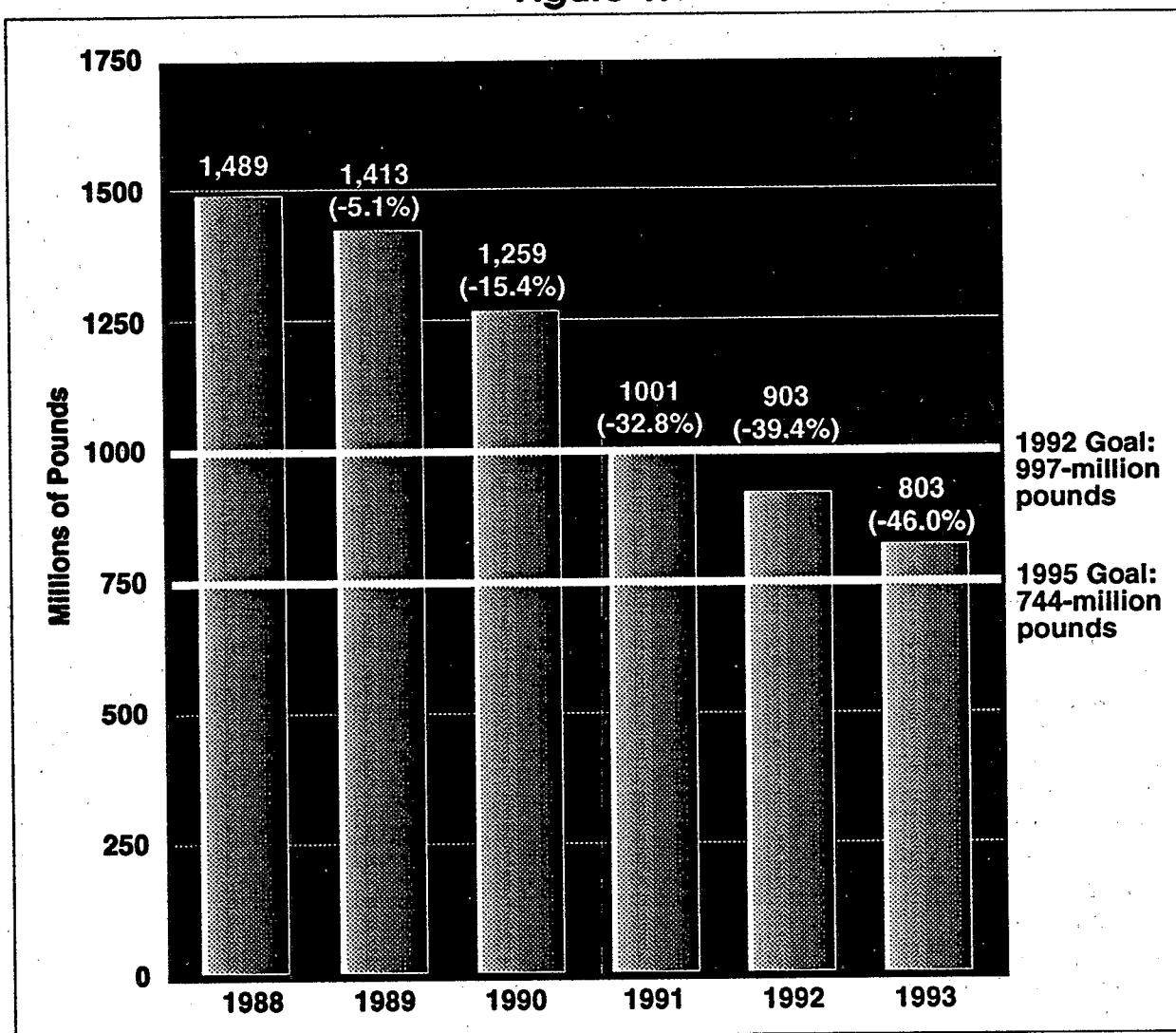


# 33/50 Program: Reducing Risks Through Voluntary Actions

As evidenced in both the TRI reporting data, actual reductions being achieved by companies in the Program's 17 target chemicals are exceeding significantly the EPA's conservative interpretation of companies' reduction pledges. The

685-million pounds of 33/50 Program chemicals releases and transfers reduced between 1988 and 1993 are nearly twice the 368-million pounds pledged by participating companies to be reduced by 1995.

Figure 1.



# **33/50 Program: Reducing Risks Through Voluntary Actions**

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## **Contact For Further Information**

Mail Code 7408  
Office of Pollution Prevention and Toxics  
U.S. EPA  
401 M Street, SW  
Washington, D.C. 20460

33/50 Program Director  
Telephone: (202) 260-6907

And, by:  
(1) Contacting the 33/50 Program  
Coordinators in EPA Regional Offices, or  
(2) Calling EPA's TSCA Assistance  
Hotline at (202) 554-1404



# Pollution Prevention Success Stories - EPA Programs

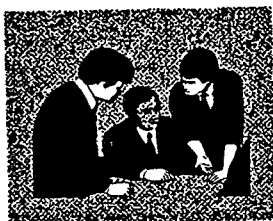
## Green Lights' Successes Shine Through

About 75 percent of the electricity produced in the United States involve the burning of fossil fuels such as coal, oil, or natural gas. Fossil fuel combustion results in the emission of air pollutants such as carbon dioxide, sulfur dioxide, and nitrogen oxides into the Earth's atmosphere. In addition, the demand for electricity continues to grow. Through the U.S. Environmental Protection Agency's Green Lights Program, companies throughout the United States are trying to reduce electricity demand and the associated pollution as much as possible.

Lighting accounts for 20-25 percent of all electricity consumed in the United States. Nonresidential lighting (i.e., for industry, stores, offices, and warehouses) represents 80-90 percent of total lighting electricity use. The Green Lights Program seeks to cut the Nation's demand for electricity by more than 10 percent by introducing energy-efficient lighting where it is practical and cost-effective.

### Approach Selected

Through the use of various media, EPA has introduced the concept of using low life-cycle cost lighting systems, rather than the lowest first cost lighting systems. Interested organizations join the program by signing the Green Lights Memorandum of Understanding, made available through their local EPA representative. The memorandum represents a commitment to put energy-efficient



lighting as one of the company's priorities.

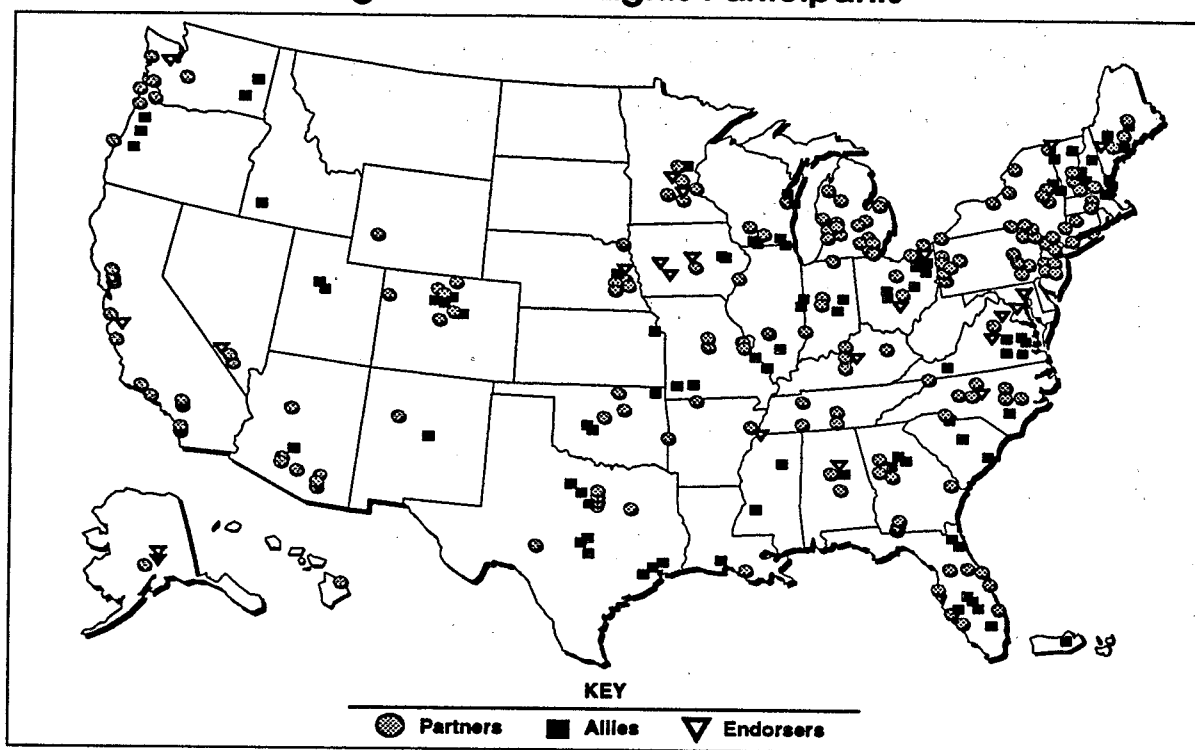
Participants in the Green Lights Program fall into one of three categories: Green Lights Partners, Green Lights Allies, and Green Lights Endorsers. Green Lights Partners are corporations and organizations that team with EPA to upgrade their lighting and use less electricity. Green Lights Allies are lighting manufacturers and electric utilities that assist EPA in surveying domestic facilities and providing guidance as to the types of lighting upgrades that would be the most beneficial for a given facility. Allies also work with EPA to encourage the development of new lighting technologies. Green Lights Endorsers assist EPA in promoting the benefits of energy-efficient lighting and endorsing the Green Lights Program. As of September 1993, there were 572 Green Lights Partners, 455 Green Lights Allies, and 122 Green Lights Endorsers. (See Figure 1.)

### Approach Implemented

Pollution prevention implementation activities include: establishing project leadership; communicating and coordinating pollution prevention activities within a Green Lights team; identifying financing needs and resources; drawing up a 5-year action plan; and determining the best approach to specifying lighting upgrades. Typically, actions and approaches include reducing wattage per square foot, changing from incandescent to fluorescent bulbs, changing ballast materials, using sodium and mercury-vapor lamps, and installing motion detectors to detect when an area is occupied. Table 1 provides

# Green Lights' Successes Shine Through

Figure 1. Green Lights Participants



a representative list of organizations participating in the Green Lights Program and steps they have taken to reduce the demand for electricity from lighting equipment.

## Operating Results

As of March 1993, over 200 participants in the Green Lights Program had reported significant progress on lighting upgrades. Table 2 shows the interim pollution reduction achievements of the representative companies listed in Table 1. On the average, companies were able (through decreases in electricity demand) to reduce CO<sub>2</sub> emissions by 826 metric tons (kkg) per year; their SO<sub>2</sub> emissions by 6.5 kkg per year; and NO<sub>x</sub> emissions by 2.7 kkg per year. This is equivalent to not burning over 2,100 barrels of oil per year. As of December 1993, participants

in the Green Lights Program had reduced air pollution by 200,000 kkg of CO<sub>2</sub>, 1,500 kkg of SO<sub>2</sub>, and 700 kkg of NO<sub>x</sub>.

It has been estimated that the Green Lights Program will reduce air pollutants and carbon dioxide emissions in the United States to 1990 levels by the year 2000. Green Lights participants are already saving over 371-million kilowatt-hours annually. This is enough electricity to run 42,000 American household for a full year.

## Cost, Savings, and Tradeoffs

The cost outlay and savings for the representative group of companies participating in the Green Lights Program can be seen in Table 2. The average cost of the Green Lights Program per company was \$245,550, and the average

# Green Lights' Successes Shine Through

Table 1. Organizational Participation

Company	Equipment Before Lighting Upgrade	Equipment After Lighting Upgrade	Square Footage
American Express Shearson Lehman Brothers	31,000 T-12 lamps 17,000 magnetic ballasts 158 incandescent lamps manual switches	31,000 T-8 lamps 17,000 electronic ballasts 158 compact fluorescents 239 occupancy sensors	1,500,000
Browning Ferris Industries	10,000 T-12 lamps 3,300 magnetic ballasts 350 incandescent lamps	6,700 T-8 lamps 3,300 electronic ballasts 350 compact fluorescents	545,000
Dresser Rand	12,200 T-12 lamps 3,300 magnetic ballasts	6,600 T-8 lamps 1,850 electronic ballasts reflectors	1,000,000
Elkhard General Hospital	7,000 T-12 lamps 2,700 magnetic ballasts 97 manual switches	3,200 T-8 lamps 1,600 electronic ballasts 82 occupancy sensors 15 timed switches	430,000
The Gillette Co.	4,300 T-12 lamps 10 manual switches	496 metal halide lamps 10 daylight switches	150,000
Hasbro	260 metal halide lamps	260 high-pressure sodium lamps	340,000
Hoechst Celanese	650 T-120 VHO lamps 450 T-12 lamps 1,100 magnetic ballasts 31 incandescent spotlights	650 T-12 VHO lamps 450 T-8 lamps 1,100 electronic ballasts 31 compact fluorescents	220,000
Mobil Corporate HQs	22,000 T-12 lamps 11,000 magnetic ballasts 496 incandescent downlights 350 incandescent exit signs	22,000 T-8 lamps 11,000 electronic ballasts 408 halogen lamps 78 compact fluorescents 350 fluorescents exit signs	2,400,000
State of Maryland Dept. of Education HQs	10,600 T-12 lamps 5,300 magnetic ballasts 68 incandescent exit signs 28 incandescent lamps	5,600 T-8 lamps 2,800 electronic ballasts 68 fluorescents exit signs 28 compact fluorescents	180,000
Union Camp	7,000 T-12 lamps 3,500 magnetic ballasts 1,000 incandescents	3,600 T-12 lamps 1,500 electronic tandem wired electronic ballasts reflectors and lenses 1,000 compact fluorescents	150,000
Westin Hotels and Resorts	1,600 incandescent lamps	1,600 compact fluorescents	1,500,000



# Green Lights' Successes Shine Through

annual savings was \$113,431 per company. Payback periods ranged from less than 1 year to over 4 years. The Green Lights Program provides various financial incentives to participants in the form of rebates and grants, and many organizations are able to recoup their investment within 1 year.

## Environmental Benefits

Not only has the Green Lights Program reduced pollution and increased profitability, the Program has also heightened public awareness about the ties between energy conservation and pollution prevention. The Green Lights Program is now being introduced to residential users as well as corporate organizations. Electric utilities, in cooperation with EPA, are promoting the benefits of energy-efficient lighting to their customers.

Momentum from the Green Lights Program

has also spawned a new family of programs designed to reduce energy consumption. These include the:

- Energy Star Buildings program, designed to target energy consuming heating and air-conditioning systems;
- Energy Star Computer program, whose goal is to increase market penetration of new, energy-efficient computers; and
- "Golden Carrot"™ Super-Efficient Refrigerator program, which challenges refrigerator manufacturers to produce the most efficient, chlorofluorocarbon (CFC)-free refrigerators quickly and cheap.

## Contact For Further Information

Maria Tikoff, Director of Marketing, U.S. EPA  
6202J, 401 M Street, SW, Washington, DC  
20460. Telephone: (202) 775-6650

Table 2. Pollution Prevented and Cost Analysis

Company	CO <sub>2</sub> Prevented (lbs/year)	SO <sub>2</sub> Prevented (kg/year)	NO <sub>x</sub> Prevented (g/year)	Cost	Annual Savings
American Express	3,991,981	12,641	4,324,646	\$710,000	\$280,000
Browning Ferris Industries	1,034,280	1,437	1,436,500	\$210,000	\$107,000
Dresser Rand	1,201,008	3,803	1,301,092	\$230,000	\$78,800
Elkhart General Hospital	3,064,488	11,849	5,107,480	\$85,446	\$102,150
The Gillette Co.	2,411,393	9,324	4,018,988	\$176,534	\$128,608
Hasbro	1,500,000	5,800	2,500,000	\$186,000	\$63,000
Hoechst Celanese	520,000	1,600	1,100,000	\$146,000	\$77,472
Mobil	2,250,000	7,500	3,400,000	\$392,400	\$125,000
State of Maryland	2,681,387	11,932	4,022,081	\$208,749	\$100,513
Union Camp	674,895	2,025	1,446,203	\$280,000	\$100,000
Westin Hotels and Resorts	867,792	3,356	1,446,320	\$75,915	\$85,200
<b>Average</b>	<b>1,836,111</b>	<b>6,479</b>	<b>2,736,665</b>	<b>245,550</b>	<b>113,431</b>



# Pollution Prevention Success Stories - Agriculture

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## "Bootstraps" Promotes Cattle Profitability With Environmental Protection

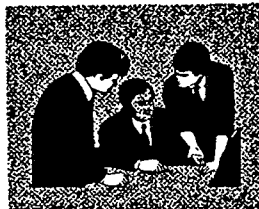
In the cattle raising industry, "pollution" can be any activity that destroys the ecosystem, hinders a ranch's ability to support cattle, or causes the ranch to operate inefficiently. On a cattle ranch, the chief resources are grass and water. Therefore, activities that maintain the efficiency of a ranch by preventing pollution or degradation of land and water resources are pollution prevention activities. These activities can include vegetation growth, erosion control, and surface water management.

The Bootstraps "Ranching for the 90s" management program successfully decreased pollution on over 100,000 acres of land in Todd and Mellette Counties in south central South Dakota. Also, over 250,000 acres of land have been positively affected by implementing management practices that use pollution prevention techniques. The loss of topsoil, onsite and offsite sediment deposits, and the use of pesticides and fertilizers have decreased on many ranches that have incorporated environmentally friendly resource management strategies.



### The Problem

Allowing cattle to graze too long in one portion of a field may damage the ability of the plants in that field to recover properly, leading to inadequate vegetation cover later in the season which can eventually increase runoff and erosion.



Sometimes family-run ranches face financial difficulties because of improper field maintenance and use of vegetation (e.g., grass).

### Approach Selected

"Bootstraps" is a program developed by the Todd and Mellette Conservation Districts in South Dakota to help farmers and ranchers increase, among other things, the financial stability of their operations. The program's goal is to teach people "to wisely use natural resources to stabilize agriculture, the economy and the community." The program uses a Holistic (interdependent) Resource Management (HRM) approach to ranching and "capitalizes on harvesting grass resources without hurting the range."

"Bootstraps" began with a series of meetings and studies to identify concepts, consider suggestions, and determine stock rates that would not degrade the natural resources. Recommendations on watering and fencing techniques were also made. Some of the program factors recognized as essential to financial success included: addressing all resources; family teamwork; good recordkeeping on all aspects; long-range planning; knowledge of marketing options; and land management practices that improve or maintain soil and water quality.

# "Bootstraps" Promotes Cattle Profitability With Environmental Protection

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## Approach Implemented

The Bootstraps program began in 1991 included 26 families and 23 ranches. The second group of participants included 30 families and ranches. Expansion of the original program included ranch families who live on or near the Ogallala Aquifer, Little White River, Rock Creek, Keyapaha River, and several large dams. The pollution prevention management practices implemented by ranchers participating Bootstraps directly benefited those water sources. Bi-weekly classes, resource inventories, and one-on-one technical assistance enhanced life-long learning skills. Awareness of all environmental concerns and methods of prevention were accentuated throughout the program.

Planning is crucial to the success of a ranch. A ranch plan includes: short- and long-term goals, and activities necessary to attain those goals; inventories, including land, livestock, machinery, etc.; natural resource information, such as climatic condition patterns, pasture records, and water quality inventory checklist; livestock production records, crop production records, and soil loss and erosion control plans; financial records for all enterprises of ranch operation; and best management practices to protect the environment while increasing ranch production. A ranch plan has been completed by 29 percent of the local Bootstraps participants.

The major "cost" of implementing an HRM approach at a ranch is time. The 2-year Bootstraps program was successful in creating more interest in grass replenishment and its response to various treatments. In this regard, staff members and ranchers installed a transect at each ranch. The transect allows for uniform clipping and weighing of grass production. The clipping and weighing provide an ongoing charting of production and analysis of planned grazing systems outcomes. By tracking all aspects of ranch management (inventory, seeding requirements, grass production,

etc.), the rancher can measure the success of implementing best management practices. Success is generally based on how many cattle the rancher can produce per acre of land, and the weight of cattle sold.

## Results

Of the participants involved in the Bootstraps Program, 80 percent have implemented one or more best management practices; 60 percent have implemented several. The local Bootstraps participants instituted: cross fencing (a procedure that allows for uniform distribution of grazing), native grass seeding, changing calving dates for better utilization of pastures, improved grazing systems, weighing cattle to access pounds per acre, purchasing hay instead of cutting hayland, reducing cattle numbers, and increasing studies of grasses and the benefits of grasses. These practices generally yielded less runoff and erosion, which in turn, decreased nonpoint source pollution.

Future ranch plans include 39 percent of the Bootstraps participants developing improved grazing systems to reduce runoff and gully erosion; 28 percent changing cattle numbers to match ranch potential; 11 percent installing new wells to evenly distribute watering locations, thereby, decreasing over grazing and gully erosion; and 44 percent adding more cross fencing to ensure proper use of available grass. Followup services will continue to be provided to the ranchers in Todd and Mellette County by local and State agencies.

## Cost, Savings, and Tradeoffs

The Bootstraps program was funded by a 2-year, \$50,000 EPA and the South Dakota Department of Environment and Natural Resources grant, starting in 1992. In addition, money from the Conservation Commission and other sources funded a significant portion of the project.



# **"Bootstraps" Promotes Cattle Profitability With Environmental Protection**

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In regard to the success of the program on a ranch-specific basis, at least 75 farms and ranches in South Dakota now know that using practices that maintain or improve the environmental health of their range and crop lands are essential to sustain a profitable operation. One ranch family that turned to HRM went from a situation of having unmanageable debt and facing the possibility of losing their ranch, to a profitable operation with the projection of paying off their land debt seven years ahead of schedule. Another participant discovered that their herd size could be increased by 20 percent without affecting the surrounding ecosystem.

## **Contact For Further Information**

U.S. Department of Agriculture  
Natural Resources Conservation Service  
White River, SD 57579-0709  
Telephone: (605) 259-3252

## **Sources**

"Water and Environment Today," Summer 1994, Issue. Volume 8, Number 2: 6-7.

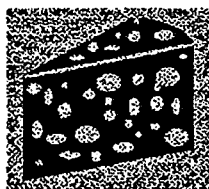
"Bootstraps; Ranching For The 90's; Final Report (with attachments)." Todd County Conservation District, undated.

# Pollution Prevention Success Stories - Agriculture

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## Cheese Corporation Reduces Waste Generation 75 Percent; Dollar Savings Began in Two Months

Cheese production is a biochemical process in which milk is converted to a solid intermediate product known as curd. After the liquid by-product, whey, is drained from the curd, salt is added to remove additional whey. Because of its saltiness, this salt whey cannot be used as a food grade additive and is treated as a waste.



Frigo Cheese Corporation manufactured a wide variety of cheese at its Morgan, Wisconsin, plant. Approximately 2,000 gallons per day of salt whey were generated at the facility.

For some time, Frigo Cheese spread the salt whey on nearby agricultural land. This was a common practice for plants that could not discharge their high strength wastewater to a publicly-owned treatment works (POTW). This method of waste disposal, however, increased the level of chlorides in the soil and could result in crop damage if the salt whey was applied incorrectly. In addition, the Wisconsin Department of Natural Resources (DNR) had recently placed limitations on chlorine land loadings.

### Approach Selected

Frigo Cheese Corporation investigated better methods of salt whey disposal to reduce the amount of chlorine in its discharge. Some alternatives that were available included process

modifications, offsite disposal of the salt whey, and onsite treatment (e.g., reverse osmosis) of the salt whey with subsequent discharge to a POTW. After considering its options, Frigo Cheese decided to modify the processes involved to recover salt from the salt whey and reuse it in production.

### P2 Approach Implemented

The salt recovery process involved modifying an evaporator previously used for recovering edible whey. A stainless steel process pipeline was installed from the salting tanks to the evaporator.

The evaporation recovery process significantly reduced the salt whey waste by separating the pumpable salt whey from water. The salt whey was then recycled in the production process (i.e., a "partially" closed-loop system), while the recovered water was used for cleaning and other purposes that do not require potable water.

### Operating Results

As a result of the "partially" closed-loop recycling process, Frigo Cheese reduced its waste generation by 75 percent to 500 gallons of salt whey per day. Fresh salt usage was cut in half, from 1,000 to 500 pounds per day. Water consumption also was reduced.

# Cheese Corporation Reduces Waste Generation 75 Percent; Dollar Savings Began in Two Months

## Cost, Savings, and Tradeoffs

The capital costs for the purchase and installation of additional stainless steel piping was approximately \$2,000. The operating and maintenance cost for the recovery process was \$0.03-per-pound of salt recovered. The *payback period* was approximately 2 months, based upon the capital cost and an annual salt purchasing savings of \$12,500.



## Other Benefits

Initially, concern existed that the recovered salt would adversely affect the flavor and shelf life of the cheese. However, almost the opposite has occurred; the recovered salt whey enhanced the flavor of the cheese and did not affect the cheese composition shelf life.

The United States Department of Agriculture (USDA) prohibited Frigo Cheese from reusing any salt whey that has contacted a wooden con-

tainer due to sanitation concerns. The company hoped to eventually replacing wooden containers with plastic ones, thus allowing the recovery of all the salt whey.

The salt whey that cannot be reused is still spread over agricultural areas. However, the quantity of waste, along with the level of chlorides in the soil and the risk of crop damage, have been greatly reduced.

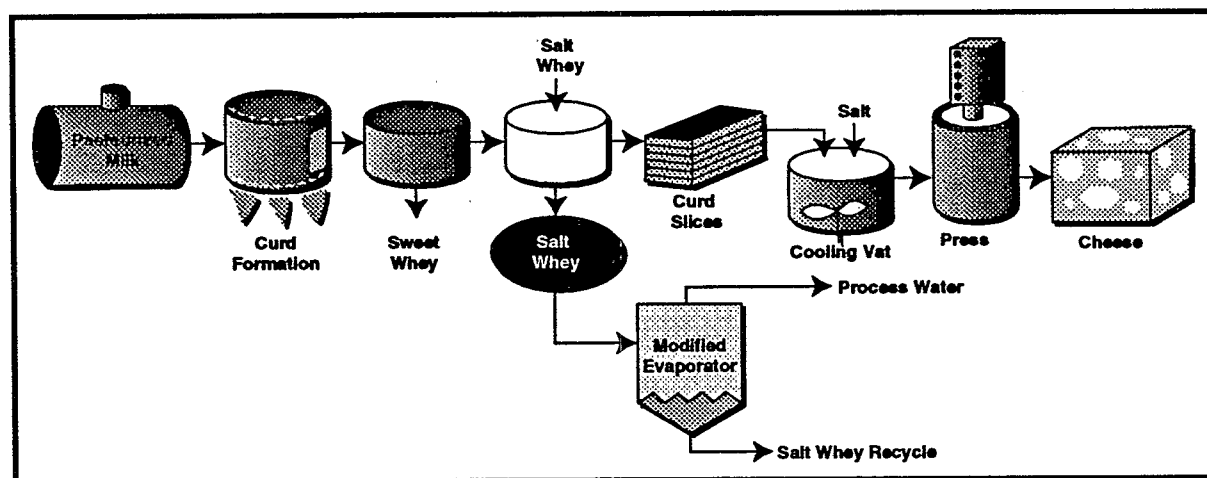
## Contact For Further Information

Greg Sevener, District Office, Wisconsin DNR  
Telephone: (715) 732-5525

## Source

Pollution Prevention Case Study: Frigo Cheese, Wisconsin DNR.

## Basic Cheese Manufacturing Process

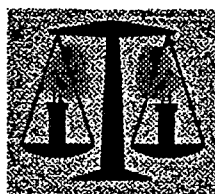


# Pollution Prevention Success Stories - Agriculture

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## Pollution Prevention Engineering Increases Fertilizer Production

Here's how one company lowered its fuel and other costs by using a Pollution Prevention Engineering Approach. Producing ammonia for fertilizer utilizes water for steam generation and natural gas as fuel. Burning of natural gas produces carbon dioxide, carbon monoxide, and oxides of nitrogen as air pollutants. These "greenhouse gases" are released to the atmosphere. Process condensate is generated as a wastewater stream. The wastewater is managed by a holding pond and injection wells.



duced was reduced by replacing existing plant parts with newer material that improved the heat transfer. The original convection section and heating coil modules were replaced with more efficient units that resulted

in reduced heat and improved heat transfer. This reduced nitrogen oxide emissions and lowered fuel consumption. The original ammonia converter reactor was modified, and a new, more efficient equipment was installed to lower steam consumption. The new designs reduced fuel consumption and raised the ammonia production rate. Finally, additional new equipment was installed as part of the new convection section. Wastewater is now recovered for conversion to steam, reducing make-up water and fuel consumption.

### Approach Selected

Cominco America Incorporated retained the engineering services of M.W. Kellogg Company to provide a re-engineered design of its ammonia plant that would lower fuel and make-up water usage. Such re-engineering aimed at reducing fuel and water requirements would reduce the wastewater and air emissions from ammonia production.

Re-engineering to reduce waste generation is the modification of an existing process to take advantage of pollution prevention without sacrificing production. The re-engineering at Cominco America Incorporated was an innovative application of existing technologies.

### Approach Implemented

Fuel consumption per ton of ammonia pro-

### Operating Results

The pollution prevention measures took by Cominco significantly reduced greenhouse and acid gas emissions and wastewater generation. Fuel consumption was lowered by 22 percent, and emission rates of oxides of nitrogen were reduced by 35 percent. Fresh make-up water consumption was reduced with 95 percent recovery of the process condensate.

Overall, the re-engineering resulted in improvements in production efficiency and reduced energy consumption, disposal costs, and environmental pollution.



# Pollution Prevention Engineering Increases Fertilizer Production

## Cost, Savings, and Tradeoffs

Actual and estimated cost savings for the pollution prevention re-engineering measures included:



- Reductions in annual natural gas usage equivalent to 1-billion cubic feet per year, for a savings of over \$1.7 million;
- An average reduction of water for steam production of over 110-million gallons per year, saving \$65,000; and
- Other savings realized through reduced disposal costs of wastewater into injection wells.

The capital costs for the project were approximately \$16 million. The plant anticipates payback in approximately 6 years from the plant restart date.

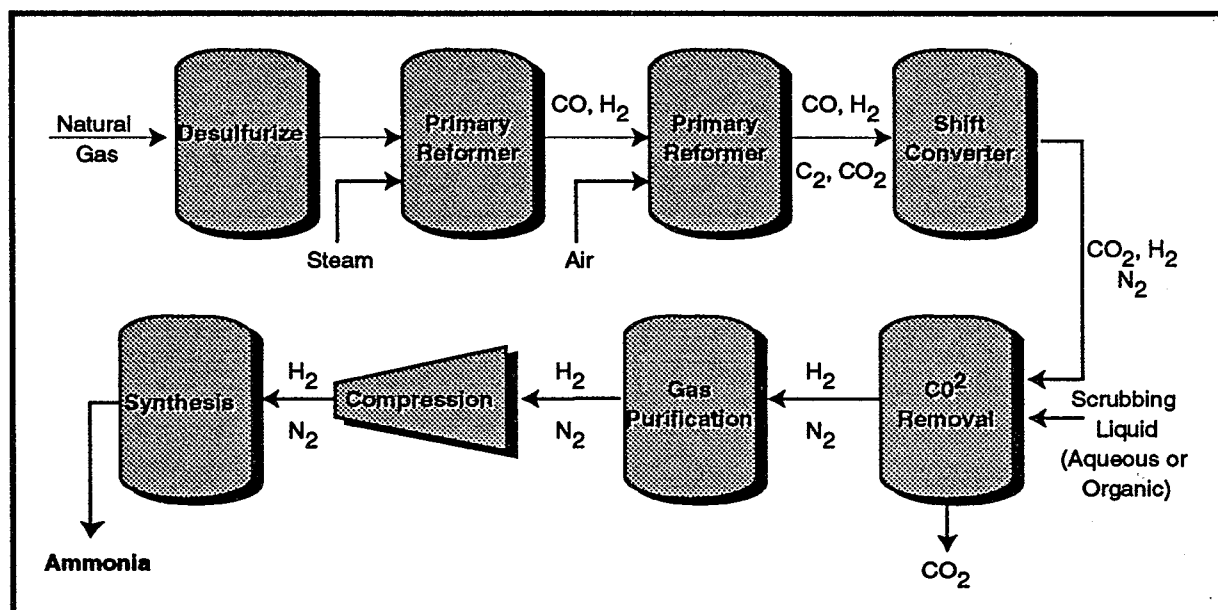
## Other Benefits

Re-engineering has produced greater plant reliability. Ammonia production has been much higher on an annual basis than any time in the plant's history.

## Contact For Further Information

Larry E. Wood, (806) 274-5204

## Ammonia Production



# Pollution Prevention Success Stories - Consumer Goods

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## Dry Cleaning Firm Shows 80% Waste Reduction

### The Problem

Perchloroethylene (PERC) is used as a cleaning solvent in the dry cleaning industry. In the 1980s, PERC was considered to be a potential cancer-causing agent. (The carcinogenic effects of PERC are currently being studied). The dry cleaning industry made operational changes to reduce environmental discharges and employee exposures. Then the Clean Air Act Amendments of 1990 required the industry to develop pollution prevention plans to reduce emissions by 1995, to strictly monitor current consumption, and to report PERC emissions to the air and transfers to hazardous waste landfills (adsorbed on filters from dry cleaning machines).

### Approach Selected

Rather than just plan for future pollution prevention, Leff-Marvins Cleaners took a proactive approach and looked to immediately replace all its old dry cleaning machines with new equipment that could condense, distill, filter, and recycle the PERC within a self-contained unit. By reducing its emissions earlier than required, Leff-Marvins Cleaners realized that it would have to deal with less stringent control requirements and less recordkeeping than would be imposed in 1995.

### Approach Implemented



Leff-Marvins Cleaners spoke with a number of equipment vendors to find machines that could provide closed-loop handling of PERC. They sought to replace a transfer dry cleaning

unit and two reclaimer units that handled 150 pounds of dry cleaning. The units had significant PERC fugitive emissions and generated two disposable filters that were treated as hazardous wastes because of the nearly 200 gallons (per month) of trapped PERC.

The old equipment was replaced with two new dry cleaning units that had a combined capacity of 110 pounds of dry cleaning. The new units used a cold water, closed loop, chiller process to capture and recycle the PERC. Nylon, reusable filters for capturing lint replaced the disposable hazardous waste filters. The permanent filters were stripped of lint by distillation through the system, reducing the hazardous wastestream to 35 gallons per month of still bottoms. Four dye-clarifying, activated carbon filters are replaced annually and disposed as hazardous waste.

### Operating Results

Since installation of the new equipment, Leff-Marvins' purchases of PERC have dropped from 200 gallons per month to less than 40 gal-

# Dry Cleaning Firm Shows 80% Waste Reduction

lons per month, a reduction of 80 percent. Annual hazardous waste disposal volumes have dropped from 1,600 gallons of spent PERC and lint to 420 gallons of still residues (also an 80 percent decrease) plus the number of hazardous waste filters requiring disposal was reduced to four from 24 per year.

## Cost, Savings, and Tradeoffs

The changeover to new equipment produced a net annual savings of about \$17,000. The environmental and hazardous material savings were actually \$2,000 per month, but this was offset by an increase in the electric power bill of \$500. The additional power requirements reflected electrical needs for condensation/distillation and an increase in business. Leff-Marvins Cleaners estimated that payback of the \$81,400 in new equipment would be achieved in 4 years through reduced PERC purchases, waste disposal savings, and fewer returns of clothing for reclean-



ing, because the new equipment proved to clean better than the old dry cleaning machines. In addition, the new equipment had lower maintenance costs.

## Environmental Benefits

Leff-Marvins Cleaners achieved other benefits in addition to decreasing PERC emissions well before the mandated deadline and reducing waste disposal by 80 percent. The new equipment brought an increase in business, a reduction in clothing returns for recleaning, and lower downtime with less maintenance. Also, employees expressed a greater satisfaction with their working environment.

## Contact For Further Information

Pennsylvania Department of Environmental Resources, P.O. Box 8472, Harrisburg, PA 17105-8472. Telephone: (717) 787-7382

## Pollution Prevention Advantages and Disadvantages

Pollution Prevention Advantages	Pollution Prevention Disadvantages
Reduced PERC emissions	Increased electric bills
Reduced waste disposal volumes	Capital cost of new equipment
More efficient cleaning	
Less downtime	
Less hazardous material purchases	
Less stringent air control requirements	
Less recordkeeping	
Increase in business	
Improved worker satisfaction	

# Pollution Prevention Success Stories - Consumer Goods

## Dydee Diaper Service Achieves Pollution Prevention Through Customer Outreach

### The Problem

After 59 years in business, the Dydee Diaper Service Co. is New England's largest diaper service. The 85-employee Dorchester-based firm washes about 200,000 pounds of linen and diapers per week in its 18-chamber, continuous batch tunnel washer, which consumes only a fourth to a fifth of the water used by conventional washers. This type of system, however, tends to concentrate wastewater contaminants, leading to potential compliance difficulties. For Dydee, the problem contaminant was zinc. In January 1992, the Massachusetts Water Resources Authority (MWRA) cited Dydee for violating zinc discharge limits, resulting in adverse publicity and loss of customers.



Officials considered three alternatives to address the zinc problem. The first alternative was to install a conventional pretreatment system. This option was expensive and required a licensed operator. The second alternative was to invest in a closed-loop, ozone-activated laundering system. Research indicated that this type of system was still developmental and might not be available commercially for another 5 to 10 years. The third alternative was to avoid use of zinc oxide by changing the habits of the customers through a customer education program.

### Approach Implemented

Although not a technological "fix" like the pretreatment or the ozone washing system, Dydee's customer education program had its own set of challenges. The fundamental question facing Dydee was, "After being informed of the problem, would customers be willing to change their habits and make the program work?"

In the spring of 1992, Dydee sent a letter to its customers explaining the problem and asking that they use zinc-free ointments. In the letter, Dydee offered to (1) purchase zinc oxide-based ointment from its customers for \$1 per container, and (2) sell zinc-free products at approximately half of their retail cost. All customers were sent multiple samples of the zinc-free products.

### Approach Selected

Dydee was aware in 1991 that its zinc discharges were likely to lead to compliance problems, but the source of the problem remained a mystery because the company does not use zinc. After extensive tests on its cleaning chemicals and water supply, Dydee determined the zinc had to be entering the facility on the diapers themselves, primarily in the form of zinc oxide, an ointment used to treat diaper rash.



### Operating Results

Dydee has received positive feedback since





# Dydee Diaper Service Achieves Pollution Prevention Through Customer Outreach

the very beginning of the "no zinc" campaign. Dydee has bought back more than 900 containers of zinc oxide-based ointments, sold more than 2,000 containers of zinc-free creams and ointments, and distributed about 20,000 sample-sized containers of these same products.

More importantly, zinc discharges have been significantly reduced. Prior to the education campaign in March 1992, zinc concentrations in the wastewater discharges ranged from 2 to 4.5 parts per million (ppm) versus the zinc discharge limit of 1 ppm in the permit. Since July 1992, zinc discharges have not reached the discharge limit of 1 ppm, except on very rare occasions. (See Figure below.) In fact, there have been no violations of the zinc discharge limit in the past 2 years.

## Cost, Savings, and Tradeoffs

Capital costs for the conventional pretreatment system considered as alternative 1 ranged from \$150,000 to \$200,000, with an annual operating cost of \$25,000 to \$35,000. Increased salary and/or training fees would also have been necessary to ensure a certified operator was available to manage the system.

Dydee spent approximately \$1,000 buying old tubes of zinc-oxide based ointments from

customers, and about \$7,000 more giving out free samples of zinc-free ointments and creams. Dydee continues to sell larger containers of the zinc-free creams at a small loss.

The Dydee Diaper Service, Co. estimates the company has saved \$250,000 in correcting its zinc problem.

## Environmental Benefits

In addition to the cost savings achieved, Dydee has been able to help protect the environment and satisfy those customers who had chosen cloth diapers as a way to save the environment.

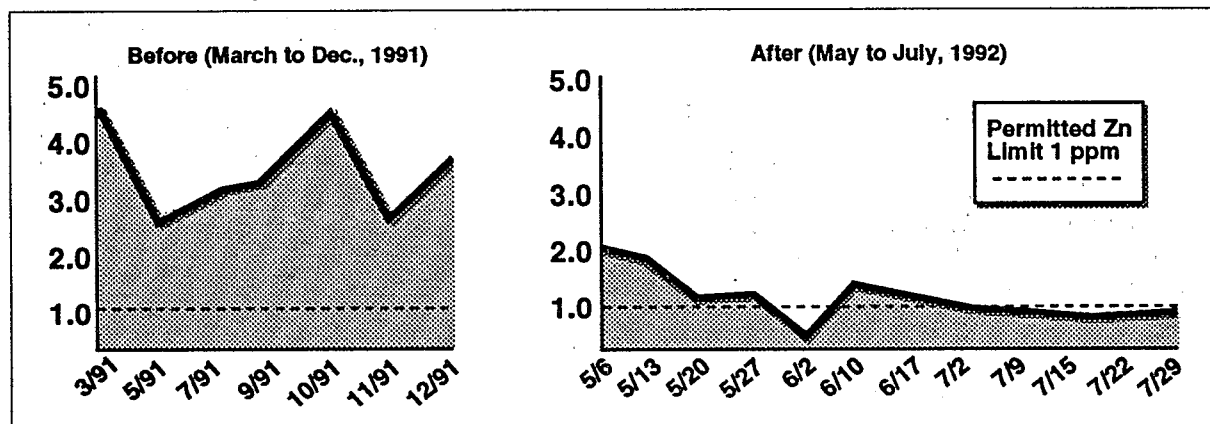
In fact, Dydee recognized that many of its customers use the linen diaper service because they believe it is more environmentally friendly than throw-away diapers. The no-zinc campaign was viewed as consistent with its customers' values. Presently, Dydee continues to remind customers of its "no zinc" campaign in its monthly newsletter, "Bottoms Up."

## Contact For Further Information

Office of Technical Assistance, Executive Office of Environmental Affairs, Suite 2109, 100 Cambridge Street, Boston, MA 02202  
Telephone: (617) 727-3827



Comparison of Zinc Concentrations in Dydee's Wastewater



# Pollution Prevention Success Stories - Energy

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## NICE<sup>3</sup> Promotes Energy Efficiency and Clean Production Technologies

The U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) have combined to sponsor an innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. The grant program, known as NICE<sup>3</sup>, provides funding for projects that develop and demonstrate advances in energy efficiency and clean production technologies. From 1991 to 1994, NICE<sup>3</sup> sponsored 26 projects, totaling \$7.8 million of government funding.

The program requires an industry applicant to submit project proposals through a State energy, pollution prevention, or business development office. Funds are awarded to State/industry partnerships that can match the DOE/EPA Federal funds at least dollar-for-dollar. Awardees receive a one-time grant of up to \$400,000 for the proposed project. After the initial funding, the awardee is expected to commercialize the process or technology. NICE<sup>3</sup> project proposals are evaluated on the following criteria: concept description, innovation, cost efficiency, applicant capabilities, energy savings, waste reduction, economic competitiveness, commercialization/marketing plan, and impact on jobs. The following example illustrates just one of the successful NICE<sup>3</sup> Projects.



### Case Study: Carpet Manufacturers Reduce Pollution via Automated Dyebath Reuse

In a conventional batch dyeing process, water is pumped into a dyeing machine, and fabric is placed in a bath and saturated with water. Chemicals and dye are then added to the water. The bath is heated to dyeing temperature and held at that temperature until dyeing is complete. When complete, the dyebath is emptied, the machine is refilled, and the process is repeated for the next load. When a dyebath is emptied, large quantities of energy, water, and useful chemicals are sent to treatment and subsequently discharged.

A more efficient procedure would be to analyze the spent dyebath for remaining dye, add make-up chemicals to the bath to bring it to the required strength, and then reuse it for subsequent dyeings (i.e., closed loop recycling). The technical and economic viability of reusing dyebaths has been demonstrated in the past; however, applying the process requires skills that were not always available to the textile manufacturer. For example, this procedure usually requires chemical analysis of the dyebath to determine what chemicals need to be added for reuse. If a chemist is not available to analyze each bath, automation of the process can be accomplished with an analytical system that will simply, accurately, and economically determine the concentration of the remaining dyebath, and add the proper amount of make-up chemicals.

# NICE<sup>3</sup> Promotes Energy Efficiency and Clean Production Technologies

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## Implemented Approach

Through a grant from the NICE<sup>3</sup> program, several innovative techniques were investigated and evaluated that could allow full automation of the dyeing process. With a fully automated process, low-cost precision pumping systems allow a small volume of dyebath chemicals to be used for numerous dyeing operations. Using innovative monitoring instruments, a system is being developed that can analyze the dyebath and communicate the results to a computer for calculation of what chemicals need to be added for the next dyeing operation.

## Operating Results

The waste reduction in the automated dyebath reuse process is straightforward; approximately 6 percent of the dyes, 60 percent of the auxiliary chemicals, and 42 percent of the water are directly reused in the manufacturing process and removed from the wastestream. Nationwide, waste would be reduced by 36-million pounds (16.3-million kg) of chemicals each year.

Widespread implementation of the automated dyebath reuse process would enhance U.S. industrial competitiveness by lowering costs. In addition to applications in the carpet industry, this technology could prove useful in the dyeing and finishing sectors of the textile industry.

## Cost, Savings, and Tradeoffs

The cost to implement the program was \$832,741 (Industry share: \$432,741). By implementing this program, the savings at the test facility (Shaw Industries) were \$1.6-million per year. Based on the industry share of \$432,741, the payback period for this project was less than 3 months. Cost projects indicated that implementation of the dyebath reuse process could save money in terms of carpet production at almost all carpet plants.



## Energy Benefits

The project has energy savings that are derived from three sources: (1) the reduction in direct thermal and electrical energy to heat dyebaths; (2) the elimination of energy to produce additional dyes, auxiliary chemicals, and water; all of which are reused with the new technology; and (3) reduction in energy associated with treatment of wastewater. If fully implemented throughout the carpet industry, dyebath reuse technology could save up to 3.6-trillion Btu per year. On a national scale, and including the textile industry, full implementation would produce energy savings of up to 7-trillion Btu (7.4-quadrillion joules) each year by the year 2010. Based on the national average, residential energy consumption of 7-trillion Btu could supply all of the energy needs for about 70,000 homes for 1 year.

## Contact For Further Information

Eric Hass, (MATEC), U.S. Department of Energy, Golden Field Office  
Telephone: (303) 275-4728  
Charlie Pike, State of California,  
Telephone: (916) 327-1649  
Greg Andrews, State of Georgia,  
Telephone: (404) 651-5120

## Sources

NICE<sup>3</sup> Project Summary: "Automated Reuse of Dyebaths in Carpet Manufacturing." (DOE/CH10093-235; DE93017075) Revised September 1994.

NICE<sup>3</sup> Program Summary: "Wouldn't it be NICE ..." (DOE/CH10093-349; DE94011821) September 1994.

# Pollution Prevention Success Stories - Enforcement

## EPA Encourages Pollution Prevention Through Compliance and Enforcement Settlements

### EPA's Pollution Prevention Approach

The U.S. Environmental Protection Agency (EPA) encourages pollution prevention when negotiating enforcement settlements with industrial facilities that have violated environmental laws or regulations.



In most settlements with pollution prevention conditions, the pollution prevention activities are negotiated as supplemental environmental projects (SEPs); the prevention activity is included in exchange for some degree of penalty mitigation. Promoting pollution prevention within the enforcement context gives EPA the ability to pursue a settlement that optimizes environmental performance, rather than a settlement aimed only at achieving compliance with the regulations.

When implementing pollution prevention in enforcement settlements, the Office of Enforcement (OE) suggests the following strategies: maintain flexibility when creating settlements; use pollution prevention SEPs/injunctive relief cases to develop new technologies; provide an avenue for EPA to verify that pollution prevention activities are being successfully implemented at the facility; design demonstration projects; and use multimedia inspections to promote multimedia pollution prevention SEPs/injunctive relief

outcomes. During the settlement process, EPA's compliance and enforcement programs have two basic avenues for promoting pollution prevention within the regulated community. The first avenue is to use the settlement conditions to require the respondent/defendant to use pollution prevention methods to redress the original violation and to achieve compliance. In the absence of statutory, regulatory, or permit language, members of the regulated community are free to choose how to comply. However, once a civil or administrative action has been initiated, the specific means of returning to compliance are subject to mutual agreement between EPA and the respondent/defendant. Therefore, under the mutual agreement process, EPA can establish pollution prevention compliance methods in place of more traditional end-of-pipe compliance methods.

The second important avenue is the inclusion of SEPs in settlement agreements. As part of a settlement agreement, a respondent/defendant will agree to conduct a project(s) that reduces risks posed to human health and the environment beyond what would be required by law. Unlike settlement conditions, SEPs are not designed to redress the original violation(s); instead, the SEP serves to mitigate the size or gravity component of an assessed penalty. The voluntary and flexible nature of SEPs allows companies to explore various of options to both mitigate their penalties and benefit the environment. These options may include more traditional methods, or new, innovative pollution prevention approaches.

# EPA Encourages Pollution Prevention Through Compliance and Enforcement Settlements

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## Approach Implemented

Enforcement of environmental acts (in particular the Emergency Planning and Community Right-to-Know Act or EPCRA) has been successful in requiring violators to undertake SEPs to reduce penalties. Examples of how pollution prevention was successfully incorporated into settlement agreements are presented on the next page.

## Cost, Savings, and Tradeoffs

In this program, two types of costs require consideration. The first is the cost to the facility, and the second, is the cost to EPA to implement a program to encourage the use of pollution prevention. Obviously, the cost for a facility to implement a pollution prevention project will vary, depending on project size and complexity. And, although the examples presented here only cover a small price range, facility pollution prevention implementation costs can vary from under \$10,000 to millions of dollars. Payback time can range from immediately to many years.

Regarding EPA costs, sufficient resources must be available to accommodate the increased time and attention that pollution prevention enforcement activities require. In June 1990, various EPA offices received funds to develop regulatory, compliance, and analytical pollution prevention projects. The Office of Enforcement is providing technical support to help incorporate pollution prevention conditions in regional enforcement cases, as well as to conduct analyses of the environmental, institutional, and (innovative) technological impacts of pollution prevention settlements.

Pollution prevention injunctive relief offers the opportunity for both EPA and the respondent/

defendant to reduce or eliminate an environmental problem at the source, without cross-media transfer of pollutants. Pollution prevention SEPs, and injunctive relief, in some cases, offer the possibility of reducing environmental impacts in excess of that which is required by regulation.

Significant "indirect" environmental, health, and economic benefits can be achieved through the transfer of pollution prevention technology to other processes in the subject plant or to other plants owned by the company; organizational changes that lead to improved environmental practices; and further implementation of other pollution prevention technology. Furthermore, particularly in the case of SEPs (where penalty relief is granted), the option to include a pollution prevention project creates an opportunity to turn a negative situation into a better or positive situation for the facility and to improve the relationship between the company and EPA.

## Contact for Further Information

Pete Rosenberg  
Office of Enforcement  
U.S. Environmental Protection Agency  
Telephone: (202) 260-8869

## Sources

"Recent Experience in Encouraging the Use of Pollution Prevention in Enforcement Settlements; Report Summary" prepared for the USEPA, Office of Enforcement by the MIT Center for Technology, Policy and Industrial Development; February 1994.

"Pollution Prevention Through Compliance and Enforcement; A Review of OPTS Accomplishments." USEPA, Office of Pesticides and Toxic Substances, January 1993.



# **EPA Encourages Pollution Prevention Through Compliance and Enforcement Settlements**

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## **Settlement Agreements That Successfully Incorporated Pollution Prevention**

- An industrial coater was fined \$50,000 for not submitting reports on toluene and methyl ethyl ketone (MEK) (both high-priority toxic chemicals) under the Emergency Planning and Community Right-to-Know Act (EPCRA). This fine was reduced to \$30,000, and the facility implemented a project to reformulate its coating material and change its coater equipment. By using ultraviolet and infrared radiation to aid in the application of scratch-resistant coatings to polyester film, the company reduced its use of the toxic chemicals (toluene by 90 percent and MEK by 50 percent). The project cost \$54,000 to implement, and the payback time was estimated to be between 6 months and 2 years.
- A casted metal products manufacturer was fined \$95,000 for Clean Water Act (CWA) violations. The penalty was reduced to \$30,000, and the facility implemented a project to redesign its rinse system on several coating and cleaning process lines to reduce the amount of water used and the amount of wastewater generated. Also, the facility substituted organic solvents and Freon with aqueous and semi-aqueous cleaners. The project cost was not available; however, the payback time was estimated at 5 to 8 years (excluding the \$65,000 "savings" in the fines).
- A pump service and sales company was fined \$17,000 for not reporting emissions of Freon 113 under EPCRA. This fine was reduced to \$8,500, and the facility implemented a project to make process changes and material substitutions at multiple facilities. The company replaced its freon-based cleaning systems with water-based systems that eliminate emissions of toxic chemicals into the environment. The project cost \$54,000 to implement, and the payback time was estimated to be between 6 months and 2 years.
- A powder metallurgy manufacturing company was fined \$76,000 for EPCRA violations. This was reduced to \$30,550, and the facility had a waste minimization opportunity assessment performed at the site. The facility instituted product substitution (blended hydrogen/nitrogen sintering atmosphere for anhydrous ammonia); eliminated a trichloroethylene (TCE) vapor degreaser by switching to an aqueous tapping fluid; and installed a closed loop cooling system. The project cost \$78,300, and the payback time was estimated at 3 to 7 years, with a savings of \$1,000 per month in energy costs. If the "savings" for a reduced fine are included, the payback is reduced to 2.5 years.

# Pollution Prevention Success Stories - Federal Facility

## Kelly Air Force Base Soars With Pollution Prevention

### The Problem

The daily ground operations of an Air Force base involve many sources of environmental contaminants. Airborne emissions occur as a result of painting, degreasing, and maintenance operations. Plating and metal refinishing operations generate large quantities of metal-contaminated wastewater. De-painting can produce large quantities of hazardous wastes. In the past, these individual pollution problems were typically dealt with by "end-of-pipe" controls. That is, wastewaters were conveyed to wastewater treatment plants, air emissions were controlled in the stack or vent, and solid wastes were disposed of in landfills.



transfers of the 17 33/50 program chemicals using the 1988 Toxic Release Inventory (TRI) report as a baseline. A 50 percent reduction is the goal for 1995. The 33/50 program encourages pollution prevention as the best means of achieving these goals.

At Kelly Air Force Base, the approach was to target individual operations for development of pollution prevention and waste management techniques that would reduce or eliminate targeted wastestreams. Overall pollution prevention and waste generation reduction goals were set by the Air Force Materiel Command (AFMC) and implemented at the base.

### Approach Selected

In 1992, the U.S. Air Force embarked upon an ambitious program to reduce hazardous wastes, ozone-depleting chemicals, and particularly, the U.S. Environmental Protection Agency's 17 33/50 Program toxic chemicals. This program is aimed at determining whether voluntary reduction programs can achieve targeted reductions more quickly than the EPA's traditional command-and-control approach to environmental protection regulations.

The 33/50 program derived its name from its goals. The goals are to have a 33 percent reduction by 1992 of releases and offsite

### Approach Implemented

In order to implement the overall pollution prevention and waste generation reduction goals set by AFMC, the following pollution prevention measures were adopted:

- Replaced a chromated deoxidizer with a phosphoric acid deoxidizer in the bonding shop anodizing line;
- Changed from a manual, labor-intensive method of cleaning paint guns to totally enclosed paint gun washers;
- Replaced all cyanide metal strippers with noncyanide metal strippers for nickel and silver strippers;
- Constructed and uses a plastic media blasting facility large enough to enclose a C-5A transport aircraft. The process replaced chemical-based (methylene chloride) paint

# Kelly Air Force Base Soars With Pollution Prevention

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removers with physical, dry, abrasive paint removal;

- Replaced vapor degreasers with 13 small, more efficient and compliant vapor degreasers that reduce the use of perchloroethylene up to 90 percent; and
- Upgraded the aluminum oxide blasting system in the plating shop and improving wastestream segregation to improve reclamation efficiency and reduce the generation of hazardous waste.

## Operating Results

In only 2 years, these pollution prevention measures cited produced significant reductions in ozone-depleting substances (88 percent), EPA 17 chemicals (59 percent), and hazardous waste generation (24 percent). Specific successes include:

- Reducing perchloroethylene use by 47 percent in 2 years by using aqueous cleaners and degreasers for parts washing, with a projected reduction of 88 percent by 1996;
- Eliminating use of methylene chloride as a paint stripper, resulting in a 20 percent reduction in base-wide EPA 17 chemical use, a 50 percent reduction in waste generation from paint removal operations, and a decrease in water consumption of about 20-million gallons per year;
- Cutting cyanide use by about 75 percent in metal stripping operations;
- Eliminating over 1,000 pounds per year of sodium dichromate, thereby reducing the chromium discharged to the base industrial waste treatment plant; and
- Realizing a 55 percent reduction in aluminum oxide blast media purchases (150,000 pounds per year) and a 60 percent reduction in hazardous waste disposal.



## Cost, Savings, and Tradeoffs

Actual and estimated cost savings for the implemented pollution prevention measures included:

- Eliminating the use of sodium dichromate in the anodizing process generated cost savings of approximately \$1,100 per year.
- Increasing the efficiency of the degreasing operations yielded an annual savings of \$31,000 per year in material purchase and approximately \$18,000 per year in waste disposal.
- Replacing nickel and silver cyanide metal strippers with noncyanide strippers saved over \$100,000 per year in disposal costs alone.
- Converting from methylene chloride to a dry abrasive paint removal process saved approximately \$343,000 per aircraft; and cut the time required to strip the paint from an aircraft from 14 to 7 days.
- Upgrading the efficiency of the aluminum oxide blasting process generated a savings of \$75,000 per year in blast media purchases and \$16,000 per year in hazardous waste disposal.
- Realizing cost savings from the process change in paint gun washing of at least \$13,000 per year in chemical purchases and waste disposal costs, and labor savings of approximately 215 hours each year in cleaning time.

The above reflect a combined annual savings of over \$500,000 per year, excluding other associated costs, such as recordkeeping, reporting, and liability.

## Contact for Further Information

Greg Vallery, Paul Hughes, and Dave Leeson,  
Pollution Prevention Division, Kelly Air Force  
Base. Telephone: (210) 925-3100



# Pollution Prevention Success Stories - Federal Facilities

## Navy Pollution Prevention Results in Quick Payback

The Naval Aviation Depot (NADEP) in Jacksonville, Florida, is an industrial facility commissioned by the Navy to perform rework, repair, and modification of aircraft, engines, and aeronautical components. Due to the nature of the depot's operations, large quantities of waste were generated daily. A series of Executive Orders, Department of Defense directives, and policy announcements directing military operations to initiate pollution prevention activities were followed the Federal Facilities Compliance Act of 1992. The NADEP response to these directives was rapid and effective.

In 1992, a special State of Florida waste reduction task force assisted NADEP with categorizing industrial processes used at the Jacksonville station. The group developed short-, medium-, and long-term strategies to identify various pollution prevention objectives and the corresponding timeframe in which to achieve them.

The short-term strategy encompassed objectives to be achieved within 1 to 3 years. Such tasks included properly managing hazardous materials, implementing off-the-shelf pollution prevention technologies, and investing in low-risk, high-payback pollution prevention alternatives. Medium-range strategies, those to be achieved within 3 to 8 years, included setting standards for pollution prevention development, and fostering long-term partnerships between the DOD and the various defense contractors and tenants working at NADEP. Long-range strategies, which are those to be achieved within 9 to 15 years, included communicating new



design criteria to the defense industry, identifying emerging regulations and waste management requirements, and developing new approaches to acquisition and maintenance which incorporate pollution

prevention techniques at the outset.

### Approach Implemented

NADEP's pollution prevention plan called for translating its strategy into waste minimization actions. NADEP implemented 13 waste reduction projects at its Jacksonville station, that addressed:

- Substituting nonhazardous materials and processes for hazardous:
  - paint strippers;
  - chromic acid strippers;
  - corrosion inhibitors;
  - carbon removers;
  - degreasing agents; and
  - miscellaneous wipe solvents;
- Changing to more efficient and nonhazardous plating and metal deposition processes;
- Centralizing control management of hazardous materials; and
- Constructing a closed-loop treatment plant.

### Operating Results

Although NADEP's operations continued at the same level of activity in 1992 and 1993, raw material purchases decreased, as well as procedures that generated hazardous waste.

# Navy Pollution Prevention Results in Quick Payback

NADEP's 13 short-term pollution prevention projects led to reductions of approximately 1.5-million pounds of waste in 1 year. Table 1 provides a more detailed breakdown of the project's results.

## Cost, Savings, and Tradeoffs

Table 1 shows the cost for NADEP's major projects has totaled almost \$19 million. Savings are exceeding \$5 million annually, resulting in a total payback period of approximately 3.5 years. Nine pollution prevention projects paid for themselves in less than a year. Only two pollution prevention activities had payback periods greater than 5 years. The median payback period was 4 months.



## Other Benefits

Chemical substitution and process changes have prevented the release of hazardous air

pollutants and improved the quality of the working conditions at NADEP. The waste reduction measures have been so successful that the DOD plans to incorporate these same methods at five other naval depots throughout the country.

## Contact For Further Information

M.G. Linn, NADEP, Jacksonville, FL  
Telephone: (904) 772-2457

## Sources

Success Story, US Naval Air Station Jacksonville. Florida Waste Reduction Assistance Program. December 21, 1992.

Briefing Presentation. NADEP Pollution Prevention: The 90's Margin for Corporate Survival. EPA Region 4 Pollution Prevention Conference. December 15, 1994.

**Table 1. Pollution Prevention Results**

Pollution Prevention Category	Total Investment (\$)	Pollution Reduction (lbs/yr)	Cost Avoided (\$/yr)	Payback Period (yr)
Ion Vapor Deposition (IVD) Aluminum (Process Change)	900,000	13,000	140,000	6.4
Two Buss Bar (Metal Plating Operation)	130,000	500	205,000	0.6
Noncyanide Stripper (Substitution)	0	3,200	23,700	Immediate
High Velocity Oxygen Flame (HVOF) Metal Deposition (Process Change)	50,000	1,000	193,000	0.3
Aqueous Cleaning, Parts Washer (Substitution)	249,200	99,200	453,000	0.5
Wipe Solvent (Substitution)	0	26,500	116,000	Immediate
Ultrasonic Cleaner (Substitution)	0	9,800	159,000	Immediate
Metal Treating (Corrosion Inhibitor Substitution)	900,000	75,900	275,000	3.3
Paint Stripping (Substitution)	1,310,000	124,000	264,000	5.0
VOC Compliant Paint Usage (Substitution)	0	45,000	200,000	Immediate
Environmental Control Center (Chemical Consolidation)	409,000	72,000	3,670,000	0.1
Closed-Loop Treatment Plant	14,700,000	1,000,000	300,000	49.0
Nonhazardous Air Pollutant (HAP) Paint Stripper Usage (Substitution)	23,000	66,000	93,000	0.2



# **Pollution Prevention Success Stories - Industry**

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## **Furniture Manufacturer Assembles More With Lower Emissions**

New England Woodcraft, Inc. manufactures household and institutional furniture at its factory in Forestdale, Vermont. The plant determined that it was emitting significant amounts of volatile organic compounds (VOCs) on the order of 6 to 7 pounds per gallon of finish. (VOCs can result in the formulation of smog in reaction to ozone.) The nitrocellulose coatings being used contained toxic and carcinogenic ingredients such as formaldehyde. Significant amounts of solid and hazardous waste were generated at the plant as well.

Nitrocellulose coatings have been used by many furniture manufacturers to produce high quality coatings. However, New England Woodcraft sought to reduce worker exposure to toxics and reduce the emissions and hazardous waste generated from the use of nitrocellulose coatings.

### **Approach Implemented**

In 1988, this company, began testing water-based coatings as a replacement for the traditional nitrocellulose coatings. In 1990, New England Woodcraft, in a joint effort with C.E. Bradley Laboratories, formulated a successful water-based coating and the necessary application equipment to replace the old nitrocellulose coatings.

### **Operating Results**

The pre-mixed water-based emulsion finishes now used at New England Woodcraft contain only 1.67 pounds of VOCs per gallon of finish, a 75 percent reduction when compared to nitrocellulose finishes. Also, the new formulation contains no formaldehyde. Moreover, the high solids, wa-

ter-based finish covers more area with less material. These factors have combined to reduce VOC emissions at the facility from 90 tons to 9 tons annually (90 percent reduction). Also, hazardous waste generation was reduced by over 90 percent, from greater than 2,200 pounds per month to less than 220 pounds per month.

### **Cost, Savings, and Tradeoffs**

Significant cost reductions were realized in waste management, waste disposal, and taxes associated with hazardous waste generation. As a result of a 90 percent decrease in hazardous waste generation, the facility's regulatory status changed from a large quantity generator to a small quantity generator. Hence, the facility is conditionally exempt from some reporting and regulatory requirements under the Resource Conservation and Recovery Act (RCRA). Additionally, the facility received a 25 percent decrease in insurance rates due to decreased fire hazards.

### **Other Benefits**

Reduced employee exposure to toxics and hazardous waste has improved the employee's work environment and subsequently their health and safety.

### **Contact For Further Information**

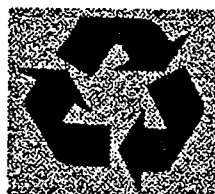
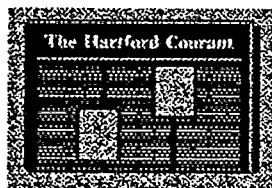
Mr. Harmon Thurston  
New England Woodcraft, Inc.  
Route 53, Box 165  
Forestdale, VT 05745  
Telephone: (802) 247-8211



# Pollution Prevention Success Stories - Industry

## Newspaper Recycles Waste Ink

*The Hartford Courant* is a regional newspaper with a daily circulation of 225,000 and a Sunday circulation of 320,000. Approximately 175 gallons of waste ink are generated each week. The lithographic presses produce waste ink that is a mixture of mostly black ink blended with other colors and press cleaning solvents. During printing, excess ink contaminated with the blanket wash solvent, fountain solution (mostly water), and paper dust is collected in trays under the presses. In general, the ink and solvent wastestreams generated by a printing operation are considered hazardous wastes, especially if they contain chromium or lead or have a low flash point. Prior to implementing pollution prevention actions, the waste is shipped offsite for reuse as a supplemental fuel.



decreased both the toxicity and quantity of its hazardous waste from 9,100 gallons of waste ink and solvent to 46 gallons of paper dust and 3,050 gallons of water, a significant reduction that has allowed the facility to report its emissions as a small quantity generator.

The major components of the recycling unit at the *The Hartford Courant* were purchased on a skid, and other equipment was added as required. The waste ink goes to a large waste ink storage tank; when enough ink is collected in this tank, a batch is processed through a recycling unit back into a reusable black ink product. The recycling process primarily involves vacuum distillation, filtration, and blending.

After solvent and water from the waste ink are separated tests are performed to determine the amount of virgin black ink required for blending. The ratio of virgin ink to processed ink can vary from about 3:1 to 5:1. The virgin ink is added to improve the color, consistency, and other functional properties of the processed ink to an acceptable range. After blending, the recycled ink is transferred to a clean holding tank. The recycled ink is then drawn by a pump through a final filter to the presses.

### Approach Selected

The newspaper set out to essentially eliminate the generation of hazardous waste inks by cleaning and recycling waste ink. A study was performed under the U.S. Environmental Protection Agency's (EPA) Waste Reduction and Innovative Technology Evaluation (WRITE) Program to evaluate a technology that could be used to recycle waste printing ink for reuse in lithographic printing operations.

### Approach Implemented

*The Hartford Courant* now collects the waste, recycles the solvent, and blends the waste ink back into virgin black ink for reuse. The facility has

### Operating Results

Product quality of the spent, recycled, and virgin inks was evaluated by conducting selected performance tests and comparisons of the printed material by qualified professionals. The recycled ink fared well in laboratory performance tests such as viscosity, grind, residue, tinting strength, water content, and water pickup. In addition, there was



# Newspaper Recycles Waste Ink

no significant difference in print quality between the virgin and recycled inks in the opinion of experienced readers.

The waste volume reduction potential of this technology involves the amount of waste ink prevented from being disposed into the environment (by landfilling, waste incineration, or as a supplemental fuel). The facility generates approximately 175 gallons per week or 9,100 gallons per year of waste ink. The waste ink contains about 40 percent water and solvent (mostly water) and 60 percent ink. By recycling, the ink is recovered. The recycling wastestreams consist of water (wastewater) from the separator and the paper-dust paste residue from the filters. Any solvent that distills off is reused in the printing process. The facility plans to discharge the wastewater to the municipal sewer, but is considering installing an activated carbon filter for removing organics in the wastewater, so that the water can be reused. The paper-dust residue (about 1 gallon for every 200 gallons of waste ink processed) is disposed of by an offsite contractor for incineration or use as a supplemental fuel.

## Cost, Savings, and Tradeoffs

The company has eliminated the disposal costs for the hazardous waste that they no longer generate. The disposal cost was \$38,000/year. The major cost of the recycling option is for utilities (energy), labor, and disposal of wastewater and paper-dust residue, which is \$7,100/year. The value of the recycled product is almost \$20,000/year. When this is added to the difference in operating costs, the total "savings" are \$50,000/year. With a

purchase and installation cost of \$318,000, a rough estimate of the payback period is about 6.25 years, based upon the current rates of items such as labor and utilities. When inflation and taxation are taken into account, the payback period is more accurately calculated as 10 years.

## Environmental Benefits

By recycling virtually all of the potential pollutants in the waste ink (chromium, lead, barium, organics, etc.) are reused and, thus, prevented from entering the environment. In addition, the recycling unit was easy to install and operate. At *The Hartford Courant*, no additional labor was needed to operate the recycling equipment. Current employees were utilized to perform tasks similar to their previous job descriptions.

## Contact For Further Information

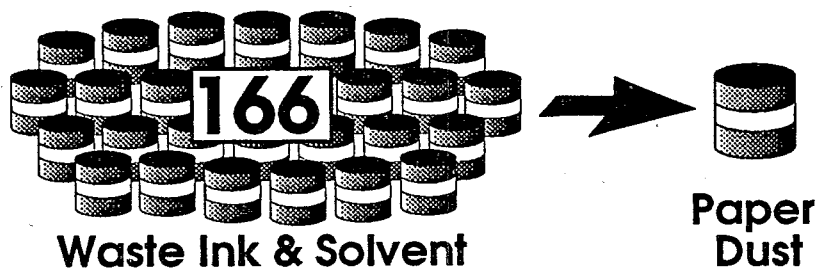
*The Hartford Courant*; 285 Broad Street, Hartford, CT 06115

Telephone: (203) 275-1917

## Sources

Final Report; On-site Waste Ink Recycling. Technology Evaluation Report; WRITE Program. Risk Reduction Engineering Laboratory, Office of Research and Development, U.S. Environmental Protection Agency. Cincinnati, Ohio. August 1992.

"Connecticut WRITE Today" ConnTAP Quarterly, 1993, 6(1):4.



By implementing its recycling process, *The Hartford Courant* was able to reduce hazardous waste generation from 9,100 to 46 gallons/year.



# Pollution Prevention Success Stories - Industry

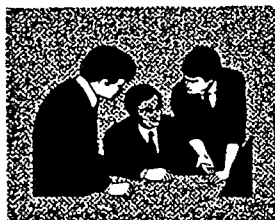
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## Mine Finds Gold In Pollution Prevention Measures

The daily operations of the Echo Bay/Cove Mine near Battle Mountain, Nevada, generated a considerable variety and significant quantity of hazardous wastes. The greatest volume of waste was halogenated solvents used in parts washing. In addition, the high volume of wastes resulted in the mine's classification as a Large Quantity Generator (LQG) under the Resource Conservation and Recovery Act (RCRA). So, in addition to the costs associated with the use of solvents and management and disposal of waste solvent as a RCRA hazardous waste, additional costs were annually incurred for training to comply with RCRA requirements. The Echo Bay/Cove Mine also realized the liability associated with its continued use and disposal of halogenated parts washing solvents.

### Approach Selected

Echo Bay/Cove Mine formed a Corrective Action Team (CAT) composed of one member of each affected department in the Company. The goal of CAT was to identify courses of action to reduce the mine's liability associated with the use of halogenated solvents and shipping large volumes of hazardous waste offsite for disposal. CAT held 14 meetings over an 8-month period. During the course of these meetings, CAT added the goal of attaining Small Quantity Generator (SQG) status.



To achieve its goals, CAT began its study of solvent use by identifying actual needs. Discussions were held with the solvent vendor on its supply and disposal service as well as on solvent use and options.

Cabinet hot water washers were also evaluated onsite as a possible replacement for some solvent washers.

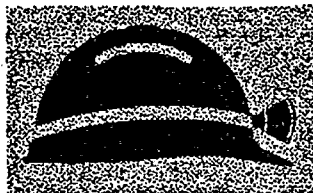
A list of products (i.e., solvents) in use was compiled. Material Safety Data Sheets (MSDS) were obtained and compared to the list of EPA's Toxicity Characteristic (TC) chemicals. Products containing TC-listed constituents were targeted either for replacement or elimination. CAT members reviewed regulations pertaining to the use, handling, and disposal of hazardous chemicals.

CAT members also evaluated processes to extend the useful life of solvents. Data from manufacturers and industry organizations were collected and studied. Solvents were rated using a system that evaluated hazard ratings (i.e., toxicity, reactivity, etc.), flash point, relative cleanability, user comments, and cost. A particular product was considered unacceptable if it did a poor job of cleaning, had a flash point lower than 140°F (and, therefore, was a fire hazard) and a RCRA hazardous waste code (i.e., D001 Ignitable), oxidized parts; was not amenable to onsite filtration; was too costly; or was difficult to handle. A suitable product both

# Mine Finds Gold In Pollution Prevention Measures

met these criteria and did not contain halogenated compounds or EPA TC constituents.

Due to the higher cost of a suitable replacement solvent, i.e., \$11.95/gallon versus \$3.50/gallon for the replaced product, the team examined methods for extending the useful life of the replacement solvent. Distillation and microfiltration were evaluated as ways to implement closed-loop recycling by separating the solvent from metallic particles. Distillation was eliminated as too manpower intensive and too costly. Several filter systems were investigated. The one selected utilized a high flow pump, stainless steel screens, and a paper media filter. Removal efficiency was down to the 0.05-micron particle size. The paper filter also could absorb and reduce the heavy oils suspended in the solvent.



## Operating Results

The results of implementing the pollution prevention measures cited above have had a significant impact on reducing the amount of waste produced at the Mine. The reductions include:

- Elimination of halogenated parts washing solvent and replacement with a nonhazardous solvent. This hazardous wastestream was being generated at a rate of approximately 12,000 lbs./yr. The total generation of the nonhazardous replacement solvent waste is now less than 1,500 lbs./yr.
- Elimination of the mill open gear lubricant wastestream, which accounted for approximately 4,500 lbs./yr. of RCRA hazardous waste, was accomplished by replacing the halogenated open gear lubricant with a nonhazardous, environmentally safer alternative.
- Change in status from Large Quantity Generator to Conditionally Exempt Small Quantity Generator, with greatly reduced regulatory requirements and overall environmental liability.

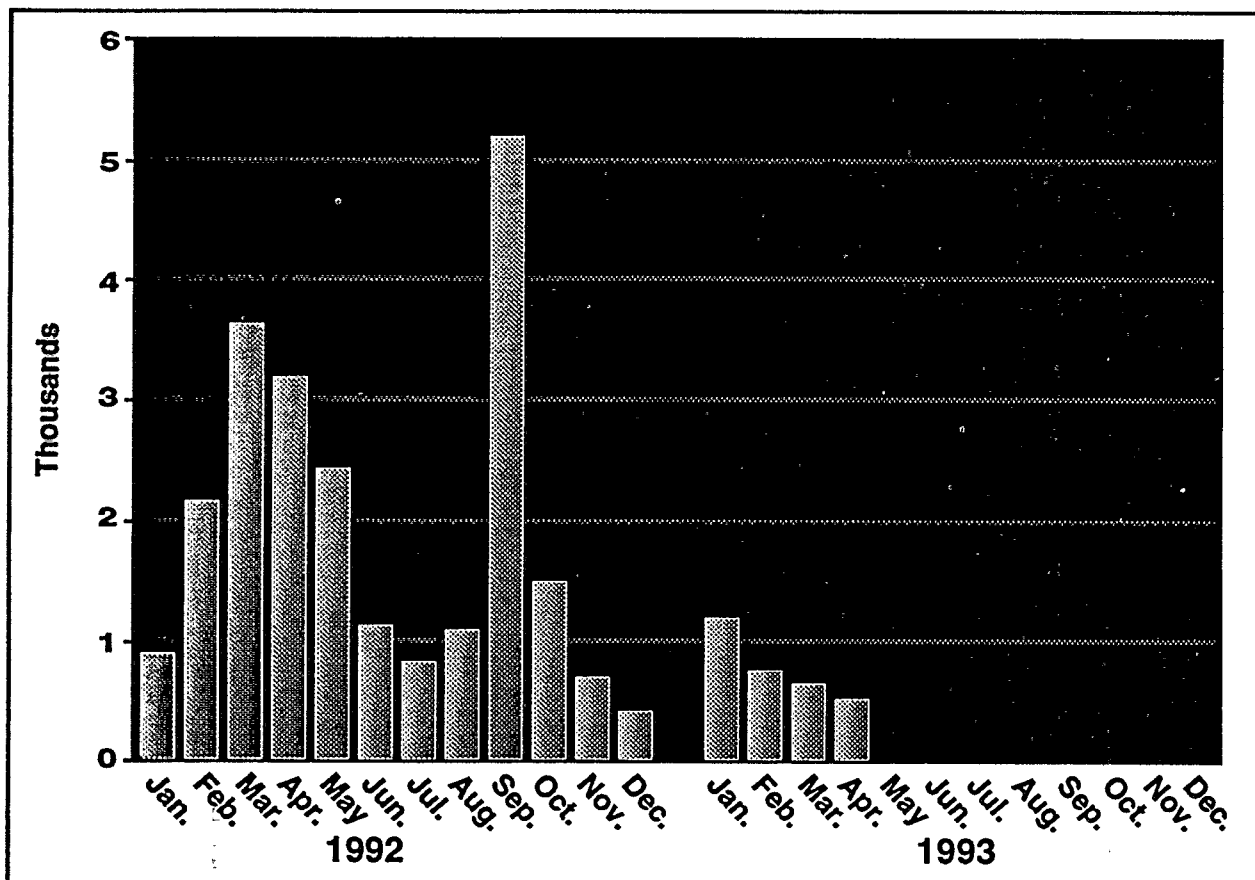
## Approach Implemented

Six different pollution prevention measures adopted by the mine included:

- Minimizing solvent use;
- Using environmentally acceptable solvents;
- Extending solvent use onsite;
- Controlling products that could contaminate wastestreams or constitute personnel hazards;
- Replacing aerosols with reusable, rechargeable sprayers and bulk products; and
- Using an environmentally acceptable cleaner in hot-water washers to replace solvent washers when effective soil removal has been demonstrated.

# Mine Finds Gold In Pollution Prevention Measures

Figure 1.  
Monthly RCRA Wastes Quantities



## Cost, Savings, and Tradeoffs

The initial investment in the replacement solvent filtration equipment and replacement solvent was \$11,400. After accounting for this investment, the mine realized a 154 percent return on its investment with a payback period of 14.7 months and an annual savings of \$9,300. This was based on the elimination of the \$18,000 annual expense related to the vendor service for the halogenated solvent and incurring an annual operating cost of \$8,700 for the replacement solvent filtration system.

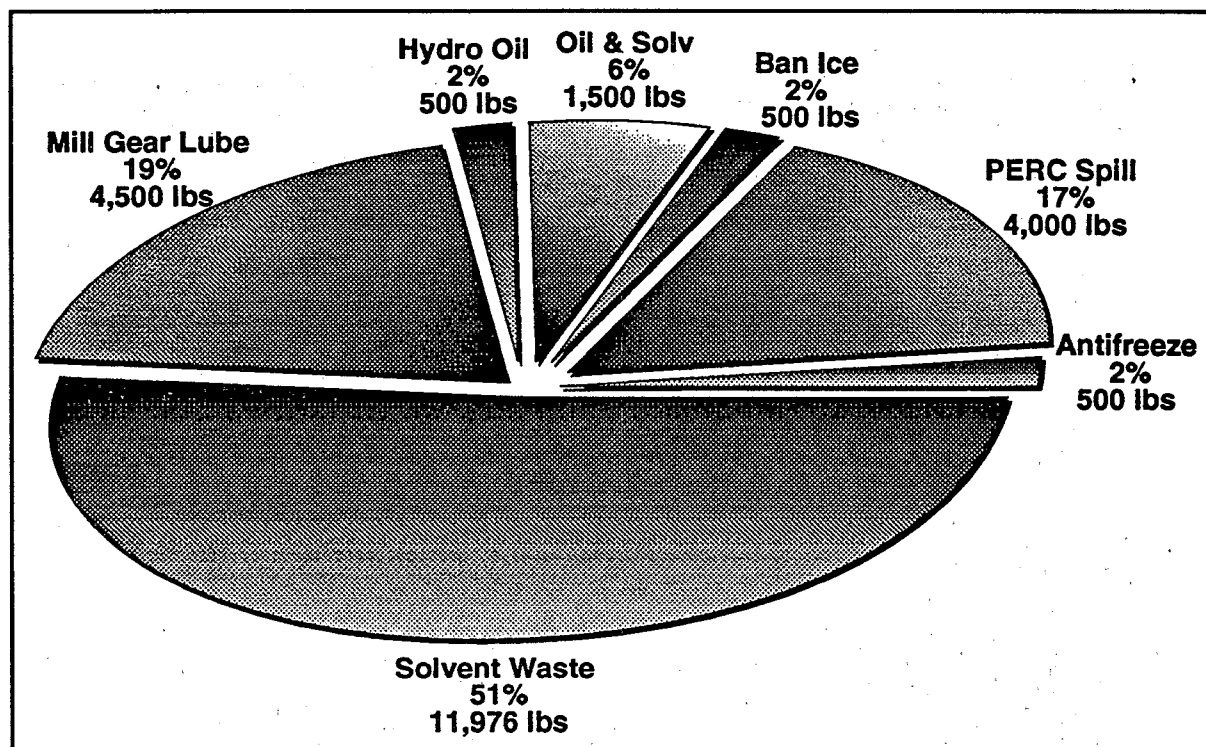


Significant savings were also realized in other areas. Replacing the halogenated mill gear lube with a nonhalogenated lube grease at approximately the same purchase price resulted in a \$6,600 savings in disposal costs. The used grease was re-refined instead of incinerated. Changing of the regulatory status from large quantity generator to conditionally exempt created generated an additional savings of \$16,000 per year in reduced training costs.



# Mine Finds Gold In Pollution Prevention Measures

Figure 2.  
1992 Lbs and Percents



## Environmental Benefits

The work of the CAT members has resulted in an increased environmental and pollution prevention awareness among individual departments and employees. For example, the purchasing department now researches MSDSs to identify environmentally friendly products before purchase. Cleaners, sealants, penetrating fluids, and lubricants that do not contain EPA listed toxic ingredients are specified. Employees receive regular updates and training in the use and management of hazardous materials.

## Contact For Further Information

University of Nevada, Reno, NV

Nevada Small Business Development Center/032  
Business Environmental Program  
Reno, NV 89557-0100  
Telephone: (800) 882-3233

# Pollution Prevention Success Stories - Industry

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## Motorola Goes Solder-less

Traditionally, soldering methods use chemical fluxes to remove oxides from metal surfaces prior to soldering. Unfortunately, these fluxes leave corrosive residues, which must be removed with chemical rinses. Freon 113 and trichloroethane (TCA), both known ozone depleting chemicals (ODCs), were commonly used as part of these chemical rinse activities.



### Approach Selected

Motorola Government Systems and Technology Group, in an effort to eliminate ODCs from its manufacturing processes, entered into a Cooperative Research and Development Agreement (CRADA) with the Department of Energy's National Laboratories at Sandia and Los Alamos. Motorola provided manufacturing technology while the labs provided analytical expertise and reliability predictions. Successful approaches were likely to either eliminate production of oxides or eliminate corrosive residues requiring rinses. Ultimately, the team developed a soldering process that is so clean that no chemical rinses are needed.

### Approach Implemented

The new soldering process replaces flux with a preparation fluid that is lightly sprayed onto the bottom side of circuit boards. The fluid is a 2 percent mixture of adipic acid in isopropyl alcohol. Adipic acid is a safe, nontoxic, organic acid that is used in various commercial food

products as a neutralizer and flavoring agent.

The circuit boards travel into an inert gas section of a wave soldering machine. The inert atmosphere in the chamber prevents oxide formation while the board is heated to soldering temperatures. When the board passes onto the liquid wave of solder metal, the adipic acid breaks down to scavenge oxides from the metal surfaces being soldered. A small amount of formic acid can be introduced into the atmosphere to assist in oxide removal. The acid is almost totally decomposed to carbon dioxide and water vapor. The boards do not require cleaning. Residues left after soldering were noncorrosive in the normal life cycle of electronics hardware.

### Operating Results

Typical old-style soldering machines use up to 8,000 pounds of cleaners per month, or 48 tons of cleaners per year. The use of the new soldering process has eliminated the need for a rinsing stage and, therefore, has eliminated the use of Freon 113 and TCA cleaners and their associated air emissions.

### Cost, Savings, and Tradeoffs

Costs for the cleaning solvents ranged from 52 cents to \$2.55 a pound. Each machine that employs the new soldering process now saves between \$50,000 and \$245,000 per year in chemical use alone. The machines used in the development effort cost from \$300,000 to \$400,000 each. However, conventional wave solder machines can be



# Motorola Goes Solder-less

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retrofitted with nitrogen inert capability for \$40,000 to \$100,000, depending on the degree of mechanical and computer control modification required.

## Environmental Benefits

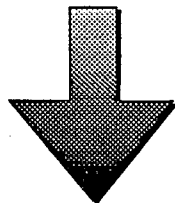
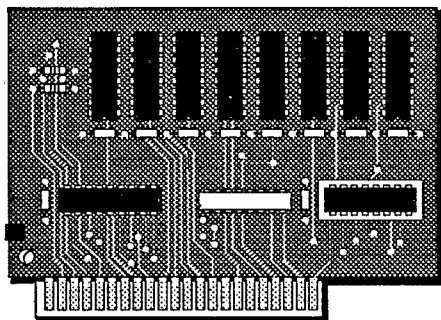
As a result of the new soldering process, Motorola has helped eliminate the chemical air emissions of Freon 113 and TCA. For its efforts, Motorola has received the U.S. Environmental Protection Agency's Stratospheric Ozone Protection Award for the second time in 3 years.

## Contact For Further Information

Jim Landers, Motorola Government Space and Technology Group, Scottsdale, AZ  
Telephone: (602) 441-3600

## Source

Arizona Pollution Prevention, Arizona Department of Environmental Quality APPLE+ Newsletter.



**Process Change**  
**=**  
**48 Tons**  
**in Waste Reduction**



# Pollution Prevention Success Stories - Industry

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## Parker Pen Reduces Hazardous Waste

Trichloroethylene (TCE) is used as a solvent in manufacturing refillable writing instruments. Industry-wide use of TCE was growing yearly, based on the Toxics Release Inventory (TRI) emissions data, with apparently little or no attempt to reduce consumption.

To enhance the quality of its products, including reducing emissions to all media, Parker Pen USA adopted quality management teams and statistical process control analyses. The Parker Pen program was referred to as the Voluntary Improvement Process (VIP). A VIP team was formed to attack the TCE problem. This integrated Team consisted of three degreaser operators, a maintenance technician, an engineer, a solvents buyer, and the plant engineer.

### Implemented Approach

The VIP Team initially approached Dow Chemical, the TCE provider, for advice and assistance. Dow responded by reviewing solvent use operations and equipment maintenance procedures for each of the plant's degreaser/distillation units. Working with the Dow representative, the Team identified a number of new procedures for reducing TCE vapor production while improving operation of the degreasing units. The new procedures included:

- Reducing heat input to the boiling sumps to reduce TCE volatilization,

- Reducing contaminants from upstream operations to prolong TCE lifetimes in the degreasers, and
- Improving distillation/recovery of used TCE.

The latter action increased the contaminant level in the spent solvent by up to 350 percent, thereby reducing the amount of solvent needing to go offsite for reclamation.

A programmable logic controller was added to the degreaser control circuit to alert operators when the solvent was becoming ineffective and needed to be distilled. The controller then automatically transferred the TCE to the distiller, reducing the risk to operators, reducing potential operating errors, and improving process consistency.

While studying degreasing operations, the VIP Team identified wire coil stock as a problem part that used excessive amounts of TCE. The VIP Team then calculated the cost for cleaning coil stock and discovered that the department requiring coil cleaning was being allocated (internally) less than full cost for the service. A change in accounting allocations transferred the full costs of cleanup to the responsible department. Faced with this cost increase, the affected department formed its own VIP Team which recommended purchase of a specialty parts washer exclusively designed for efficient cleaning of wire coil stock.

### Operating Results

Within 6 months, monthly usage of TCE dropped 40 percent, from 25 drums per month



# Parker Pen Reduces TCE

to 15 drums, while annual usage (over a 3-year period) averaged a 54 percent decrease.

## Cost, Savings, and Tradeoffs

The waste reduction of 36,000 pounds per year translates into an annual savings of \$23,000 (\$70,000 over a 3-year period). The capital cost was \$14,500: \$10,000 for the new (design) coil coating degreasers and \$4,500 for the programmable controllers. That represents a payback in 7.5 months. There has been no adverse effect on pen manufacturing operations.



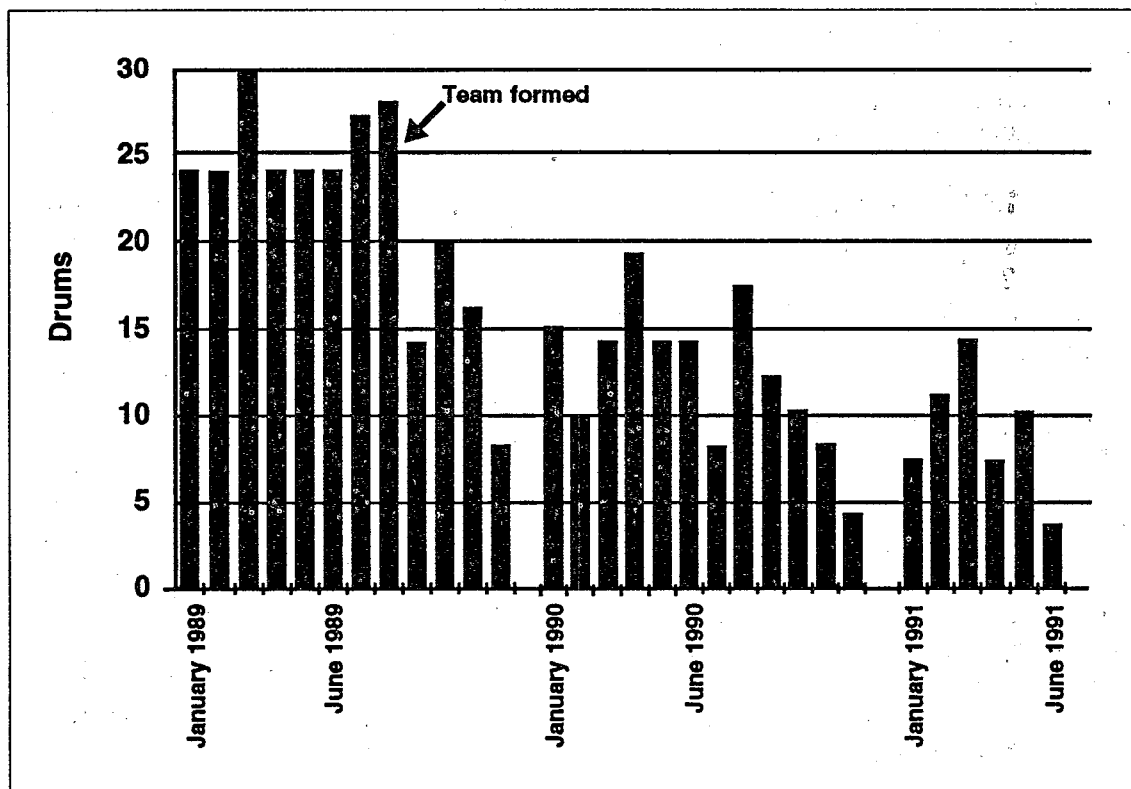
## Environmental Benefits

Annual hazardous waste volume transported for reclamation and disposal decreased by 36,000 pounds. In 1991, Parker Pen received a Business Friend to the Environment Award from the Wisconsin Environmental Working Group and the Wisconsin Manufacturers and Commerce Group.

## Contact For Further Information

John Houseman, Plant Engineering Manager  
Parker Pen USA, Ltd.  
1400 Parker Drive  
Janesville, WI 53545  
Telephone: (608) 755-7000

Reduction in TCE Use  
January 1989 - June 1991



# **Pollution Prevention Success Stories - Local Government**

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## **Los Angeles Takes Innovative Pollution Prevention Approaches**

A large metropolitan government with many agencies and internal organizations may find it difficult to plan and implement waste minimization activities. Yet, the Pollution Prevention Act of 1990, Federal and State orders, and fiscal shortages have forced municipalities to face the issue of adopting pollution prevention within their own operations. In addition, small commercial and industrial concerns often request help from municipalities. The City of Los Angeles has taken several innovative approaches to addressing these problems.

### **Approach Selected**

One of the first steps Los Angeles took in setting up its pollution prevention program was to form the Mayor's Advisory Committee on Hazardous Waste Reduction. The committee was comprised of industry experts, researchers, environmental scientists, engineers, and government regulators. Subsequently, Los Angeles established the Hazardous and Toxic Materials (HTM) Project. The HTM Project is a nonregulatory initiative that provides assistance to small- and medium-sized businesses concerned with waste minimization. Its goal is to ensure that the City of Los Angeles conforms to and promotes the national hazardous waste minimization policy. The Project provides direct regulatory and waste minimization assistance to city departments, industry, and businesses that use hazardous materials and generate hazardous waste, using new and existing city resources to accomplish its objectives.

The City of Los Angeles Environmental Affairs Department is a participant in the U.S. EPA Region 9 Merit Partnership for Pollution Prevention. This program brings the business community together with Federal, State, and regional regulatory agencies to facilitate adoption of pollution prevention methods that reduce environmental impacts and enhance industrial efficiency.

### **Approach Implemented**

Under the HTM Project, the supervisors of all city departments are required to participate in an interdepartmental Hazardous Waste Management Task Force and to adopt the city-wide policy.

The Project conducts training programs and conferences for businesses, trade associations, and city employees; and provides free technical assistance to industry through education and outreach programs. Every city facility has been inspected and audited to determine where and how much waste is being generated by city operations. The city also makes use of the Bureau of Sanitation's water pollution control inspectors to help enforce hazardous waste control laws and encourage hazardous waste minimization.

### **Operating Results**

The HTM Project provides the following services to assist with pollution prevention efforts:

- **Onsite Technical Assistance.** Provides assistance in identifying and implementing



# Los Angeles Takes Innovative Pollution Prevention Approaches

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pollution prevention methods and process technologies. The HTM Office acts as a facilitator between business and enforcement agencies on waste minimization regulations.

- **Industry Outreach.** Provides onsite training, public workshops, and trade shows presentations.
- **Vendor Data Base.** Provides information on environmental consulting services, hazardous waste treaters, disposers, and manufacturing equipment.
- **Technical Library.** Provides cost effective pollution prevention case studies and free publications on financial resources, hazardous waste regulations, industry specific fact sheets, waste reduction, and compliance checklists and videos.

The USEPA Merit Partnership for Pollution Prevention Program has several pollution prevention projects in progress, which include:

- Formation of a roundtable of major California refiners, regulatory agencies, and pollution prevention experts to share information;
- Creation of a Distribution Spill Prevention Group with Dow Chemical leading the effort to strengthen industry standards for safe transportation of chemicals;
- Information Sharing by Northrop and other corporations on cost-effective manufacturing processes that reduce pollutant releases;
- Development by Xerox Corporation of a new soldering process to replace pollutant-forming compounds with water-based fluxes; and,
- Conduct waste minimization workshops for small metal plating companies, sponsored by the Metal Finishers Association of Southern California.

## Environmental Benefits

Information from numerous case studies provided by the HTM Office shows that pollution

prevention efforts effectively reduce air emissions, wastewater discharges, and hazardous waste generation, as well as improved the operation of businesses in the Los Angeles area.

Los Angeles provides a leading example of how waste reduction can be an integral part of city business. The HTM Office's innovations and successes have caught the attention of cities around the world. Some have expressed interest in replicating the office activities in their own government structure. For example, officials from Rio de Janeiro met with Los Angeles Mayor Tom Bradley, officials from the Los Angeles Board of Public Works, and members of the Mega-Cities Project to sign an agreement that marked the beginning of cooperation and information exchange on pollution reduction methods between the two cities. Currently, other cities such as Bangkok, Jakarta, Buenos Aires, Manila, and San Paulo have contacted the HTM Office to set up similar exchange agreements.

## Contact For Further Information

The Hazardous & Toxic Materials Office  
200 North Spring Street, Room 353  
Los Angeles, CA 90012  
Ms. Donna Toy Chen (Director)  
Telephone: (213) 237-1209

The Merit Partnership Program  
U.S. EPA Region 9  
75 Hawthorne Street  
San Francisco, CA 94105-3901  
Mr. Dan Reich (Co-Chair)  
Telephone: (415) 744-1336



# **Pollution Prevention Success Stories - Local Government**

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## **School District Gets A Lesson in Pollution Prevention**

School districts have a range of activities with the potential to generate waste. Vehicle maintenance and repair, building cleaning and maintenance, grounds keeping, and instructional and specialized programs such as science laboratories and art classes are just some of the areas that produce waste. As of the 1993-1994 school year, approximately 595 school districts operated in the State of New Jersey. The New Jersey Institute of Technology (NJIT), with funding from the U.S. Environmental Protection Agency and the New Jersey Department of Environmental Protection (NJDEP), assessed one school district's administration activities and high schools for appropriate pollution prevention opportunities.

The district operates from a common administration building which includes a supply warehouse, facilities for maintenance and repair of 56 assorted vehicles, and a wood shop for building and repairing furniture. There is also a high school, a middle school, and six elementary schools. The pollution prevention opportunity assessment by the State officials focused on the administration building and the high school. Selected pollution prevention opportunities are listed in Table 1.

Some pollution prevention practices were already in place at the school district: ordering only the amount of materials that could be used in a single year; stocking materials near the point of use; converting solvent-based copiers with dry

copier systems; replacing solvent-based paint products with water-based paints and cleaners; and recycling cutting oil used in the industrial arts metal shop. Laboratory wastes, solvents, and spent antifreeze were treated as hazardous wastes and collected by a contractor for offsite treatment.

### **Operating Results**

Upon implementation of pollution prevention opportunities, a significant amount of waste was reduced. Hundreds of empty paint cans that required some form of waste disposal were eliminated. An estimated 67 percent reduction in cleaning solvent wastes would occur if spilled chemicals and leaking containers were stored properly and inspected regularly. Antifreeze waste was completely eliminated and approximately 50 percent of the hazardous waste from laboratory experiments were no longer generated. In summary, over 600 gallons of waste were (potentially) prevented for this one high school and administration building. Extrapolating this number to the 595 operating school districts in New Jersey, over 360,000 gallons of waste could be reduced.

### **Cost, Savings, and Tradeoffs**

The following table outlines the various costs and savings achieved in implementing the pollution prevention opportunities mentioned above:



# School District Gets A Lesson in Pollution Prevention

**Table 1. Pollution Prevention Opportunities**

Waste Generated	Pollution Prevention Opportunity
Empty Paint Cans	<ol style="list-style-type: none"> <li>1. Purchase paint in returnable containers.</li> <li>2. Reduce varieties of paint purchased by consolidation of uses. Consider acquisition of equipment for tinting and purchasing large containers of base color paint and tinting to standard colors.</li> </ol>
Spilled Chemical and Leaking Containers	<ol style="list-style-type: none"> <li>1. Store containers to allow for visual inspection.</li> <li>2. Maintain appropriate distance between reactive or incompatible chemicals, store chemicals in separate sections to minimize cross contamination.</li> <li>3. Store materials near point of use.</li> </ol>
Sawdust and Wood Scraps	Use residues from woodworking for composting or for mulch.
Solvent-based Coatings	Continue to seek water-based substitutes with needed performance.*
Degreasing Solvents	Use contracted solvent supply and recycling service.
Waste Oil	Install collection/drip pans to recover spills.
Antifreeze Solution	Utilize technology for recovery, reconditioning, and reuse.
Laboratory Waste	<ol style="list-style-type: none"> <li>1. Modify student experiments to use smaller amounts of hazardous chemicals. Extend use of video material.</li> <li>2. Decline industrial gifts of chemicals that include materials that will not be used or quantities of materials larger than can be used within a reasonable time.</li> <li>3. Develop central inventory of chemicals to encourage sharing among high school laboratory and middle and elementary schools.</li> </ol>
Art Projects Wastes	Select and encourage use of nontoxic and nonhazardous materials for art projects.*

\* Primary pollution prevention advantage would be reduced levels of solvent emissions.

# School District Gets A Lesson in Pollution Prevention

## Cost, Savings, and Tradeoffs

The replacement of solvent-based coatings with water-based coatings and the pollution prevention measures implemented for art project wastes were designed to reduce the level of atmospheric emissions resulting from solvent evaporation. Therefore, a complete cost analysis of these pollution prevention methods was not completed. However, annual savings of at least \$3,000 were identified for this school



district. Extrapolated to the 595 active school districts in New Jersey, the annual savings are approximately \$1.8 million.

## Environmental Benefits

In addition to the potential cost savings, fugitive emissions to the atmosphere would be greatly reduced. The potential of exposing students and school officials to hazardous chemicals is also greatly reduced.

Table 2. Various Costs and Savings

Waste-Stream	Annual Cost	Annual Savings from Implementing Pollution Prevention	Cost to Implement	Payback Years
Empty Paint Cans	1. \$500	\$500	\$0	0
	2. \$0	\$450	\$750	1.5
Spilled Chemical	\$750	\$500	\$0	Immediate
Sawdust and Wood Scraps	Unknown	\$200	\$0	Immediate
Degreasing Solvents	\$150	\$150	\$2,000	14
Waste Oil	\$195	\$30	\$50	1.6
Antifreeze Solution	\$600	\$900	\$5,000	5.5
Laboratory Waste	\$700	\$350	0	Immediate

## Contact For Further Information

Mary Ann Curran, Pollution Prevention Research Branch, Risk Reduction Engineering Laboratory, USEPA, Cincinnati, OH 45268

## Sources

Pollution Prevention Successes: A Compendium of Case Studies from the Northeast States. Northeast Waste Management Officials' Association. December 1993.

# Pollution Prevention Success Stories - Local Government

## Tastes Better - Costs Less

The Village of LeRoy is a rural community located in western New York State with a population of approximately 5,000.

LeRoy depends on two village-owned reservoirs, Lake LeRoy and Lake LaGrange, for its water supply. For a number of years, the village experienced serious taste, odor, and color problems with its water supply. As a result, the village installed a new water filtration plant in 1983. Improvements were immediate, but brief. Within 2 years, the problems reoccurred.

In 1986, officials from Kent State University identified the source of the water quality problems to be algal blooms and weed growth resulting from nutrient runoff into the lakes from nearby farms. Traditionally, the village would remove the weed overgrowth, select source water for the village from higher lake elevations to avoid the anoxic zones in the lakes, and aerate the water using lake circulators. However, the farmers in the surrounding area realized that a long-term watershed management program was necessary to recover the lakes and prevent further degradation. In 1988, these farmers initiated the reservoir and watershed management program and created the LeRoy Watershed Advisory Committee (LeWAC).

LeWAC, in cooperation with the Cornell Cooperative Extension from Genesee County, aimed to improve the water quality, abate nitrate contamination, and enhance agricultural and recreational activities in the watershed. To accomplish this, LeWAC developed programs



focused on fertilizer use and controlling nutrient runoff.

### Approach Implemented

To control the amount of nutrients leaching to the lakes, a survey of the farmers in the watershed area was initiated. The survey focused on existing land use and farming practices. Soil sampling kits were provided to the farmers, who in turn were responsible for testing the nitrogen content of their soil and decreasing fertilizer use if the nitrogen content was shown to be excessive.

LeWAC members met with individual farmers to review proper fertilizer and manure management practices and the need to control land erosion through the use of filter strips. LeWAC also developed an education program to better inform the surrounding community, to increase cooperation with the landowners and residents, and to provide a forum to demonstrate the equipment used for lake monitoring and testing.

### Operating Results

Since the inception of LeWAC, the public water supply no longer has taste, odor, or color problems. In addition, the following conservation practices have also been implemented:

- Installation of diversion ditches, open ditches, grass waterways, terraces and tile drains;
- Initiation of permanent hayland planting, tree planting, and forest management; and
- Introduction of pasture management, rotational grazing, and no-till and conservation management.

# Tastes Better - Costs Less

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## Cost, Savings, and Tradeoffs

Initially, funding for the LeRoy watershed management program was not available. However, the Village of LeRoy pursued the development of the program and sought to increase awareness with the resources it had available. Eventually, funding for the \$206,000 project was obtained through a series of grants and loans from the New York State Cost-Share Aquatics, the U.S. Environmental Protection Agency, the Cooperative Extension and Soil Conservation Service, and the village landowners.

Financially, the Village of LeRoy was able to decrease the use of chemicals in the area at an estimated savings of \$9,000 per year. Additional capital improvements have also been eliminated that would have been necessary to comply with the safe drinking water requirements for the public water supply system. Detailed information on these capital improvements was not available.



## Environmental Benefits

The Village of LeRoy is an example of how a rural community with a population under 25,000 can successfully implement a reservoir and watershed management program. Not only did the program improve the quality of the water and abate nitrate contamination, it also enhanced the agricultural and recreational activities in the watershed.

## Contact For Further Information

Administrator for the Village of LeRoy,  
Telephone: (716) 768-2527

The Great Lakes Pollution Prevention Centre,  
Telephone: (800) 667-979.

## Source

Pollution Prevention Case Study, Watershed Management. Village of LeRoy, New York. Great Lakes Pollution Prevention Centre.

# Pollution Prevention Success Stories - Publically Owned Treatment Works

## Septic Facility Reduces Odors While Increasing Capacity

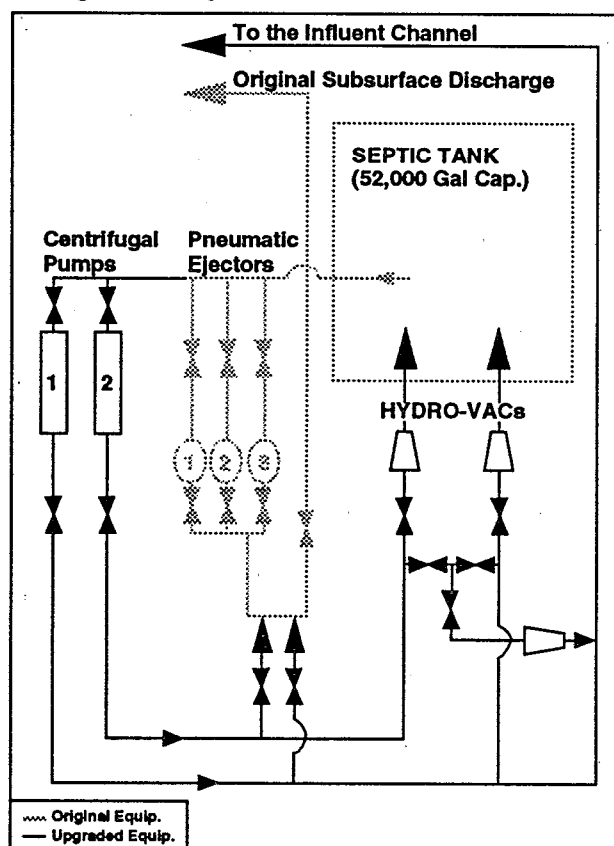
The Greater Lawrence Sanitary District (GLSD) has a 52-million gallon per day, activated sludge, wastewater treatment plant to serve approximately 168,000 residents on the local system. In addition to piped wastes from homes and businesses, GLSD provides septic disposal for communities throughout the Merrimack Valley and southern New Hampshire. When the sewage receiving facility operated in excess of 40,000-gallons per day (gpd), unacceptable odors escaped into the surrounding community. This problem seemed to occur most frequently during the warmer months. The available pollution (i.e., odor) control technologies were only effective up to 40,000 gpd. As a result, GLSD was losing sewage revenue by operating below its approved sewage receiving capacity of 100,000 gpd.

### Approach Selected

In early 1992, State officials recommended using an aeration system that would both oxygenate the sewage and completely eliminate generation of hydrogen sulfide ( $H_2S$ ) during handling and storage. This was a radical departure from

typical wastewater treatment plants that use mechanical stirrers or bubble diffusers to bubble air or oxygen through the liquid waste as part of the sewage handling process. This activity results in the release of  $H_2S$ , a principal cause of noxious odors. Traditional end-of-pipe use of oxidation chemicals such as potassium permanganate and hydrogen peroxide successfully control the odorous  $H_2S$ , but only for limited quantities of waste. These types of chemicals also pose fire and explosion hazards, and in high concentrations, can themselves be highly toxic.

Figure 1. Hydro-Vac® Unit Schematic



# Septic Facility Reduces Odors While Increasing Capacity

## Approach Implemented

In July 1992, GLSD was the first wastewater treatment plant to put into operation a wastewater conditioner unit to oxygenate and condition sewage. (See Figure 1.) The conditioner pumps wastewater or sewage through a high velocity nozzle into a low velocity mixing chamber where the material is mixed with aspirated air and the solids are reduced to macroscopic levels. This releases the embedded grease and gas bubbles trapped within the organic solids. If enough oxygen is introduced into the liquid to combine with all the available hydrogen (produced by the anaerobic digestive process), then no hydrogen ions are available to form  $H_2S$ .

## Cost, Savings, and Tradeoffs



Since installation of the conditioner unit, GLSD has been able to increase its sewage receiving volume to well beyond 40,000 gpd without creating offensive odors and without use of chemical conditioners. (See Table 1.) GLSD experienced no mechanical or process problems with the new method of septage handling after 15 months of operation.

Prior to installation of the unit, GLSD was spending \$2,000 per month on odor-reducing chemicals. More significantly, the plant was losing up to \$2,700 per day in operating revenue be-

cause the facility was receiving less than its approved sewage receiving capacity of 100,000 gpd.

A capital investment of \$77,000 was required for the conditioner system and its installation. This investment was paid back within 4 months of system installation due primarily to increases in the volume received and the elimination of the \$2,000 per month cost for odor reducing chemicals. The system installation payback calculation is shown in Table 1.

## Environmental Benefits

In addition to reducing noxious odors, GLSD has also eliminated storage of odor-controlling, but hazardous, agents at the facility. Also, prior to installation of the unit, sewage had to be delivered during both day and night shifts to handle the maximum capacity of 40,000 gpd. Now, due to the increase in sewage receiving capabilities, all sewage receiving can be accomplished during the day shift where more operating and laboratory personnel are available to handle and test it.

## Contact For Further Information

Office of Technical Assistance, Executive Office of Environmental Affairs, Suite 2109, 100 Cambridge Street, Boston, MA, 02202  
Telephone: (617) 727-3827

Table 1. Wastewater Conditioner Installation Payback

Month (1992)	Daily Average Sewage (gpd)	Average Daily Sewage in Excess of 40,000 gpd	Monthly Revenue From Excess Sewage	Monthly Chemical Savings	Capital Investment Remaining
July (23)	57,467	17,467	\$18,078	\$2,000	(\$56,922)
Aug (21)	56,552	16,552	\$15,642	\$2,000	(\$39,280)
Sep (21)	66,188	26,188	\$24,748	\$2,000	(\$12,532)
Oct (21)	70,669	30,669	\$28,982	\$2,000	+\$18,450
Nov (20)	66,598	26,598	\$23,938	\$2,000	+\$44,388
Dec (22)	51,714	11,714	\$11,597	\$2,000	+\$57,985

The figures in parenthesis in the "Month" column of the table are the number of days that sewage was received; the facility is open Monday thru Friday.



# Pollution Prevention Success Stories - State Government

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## Connecticut Initiative Encourages Pollution Prevention

Hazardous waste management in the United States is dynamic. The last 10 years have seen major shifts in hazardous waste generation, increased demand for waste management services, and sporadic shortfalls in available capacity. While commercial capacity is generally sufficient in the near term, States must remain aware of national trends in hazardous waste management because of the nature of the industry and the changing regulations that govern hazardous waste. A program that encourages facilities to properly manage and reduce their hazardous waste generation is important in any State to ensure that management capacity remains available to industries that rely on it. Connecticut has developed such a program to provide information about pollution prevention initiatives at other facilities, and to provide expertise to help facilities identify and implement pollution prevention techniques within their own facilities.

In 1983, the Connecticut Hazardous Waste Management Service (Service) was established as an independent, nonregulatory entity, with statutory responsibility to promote and encourage appropriate management of hazardous waste in the State. The Service's Hazardous Waste Program, through the Connecticut Technical Assistance Program (ConnTAP), contributes to successful waste minimization efforts by generators throughout the State. ConnTAP encourages waste reduction, recycling, and sound

hazardous waste management practices by providing Connecticut businesses with free, technical and financial assistance. The program focuses on multimedia pollution prevention (i.e., minimizing air emissions, wastewater discharges, and hazardous waste requiring land disposal).

### Approach Implemented

Some of the services provided by ConnTAP include: site visits that bring retired industry professionals to businesses to offer customized pollution prevention solutions and an information and referral hotline to answer requests for publications, technical information, referrals to State and Federal agencies, and information on ConnTAP programs. It also provides a library with over 1,000 documents on hazardous waste management, waste minimization, and pollution prevention; videotapes on pollution prevention and hazardous waste management, and access to EPA computerized data bases that provide the latest technical information; a free quarterly newsletter that features waste minimization case studies and articles on pollution prevention; and workshops and seminars on pollution prevention that promote technology transfer and pollution prevention training.

In 1988, ConnTAP established its ongoing Matching Challenge Grant Program to help recipients identify opportunities for pollution prevention to evaluate the feasibility of specific methods and technologies for preventing pollution and to generally improve waste management. Also, through the Connecticut



# Connecticut Initiative Encourages Pollution Prevention

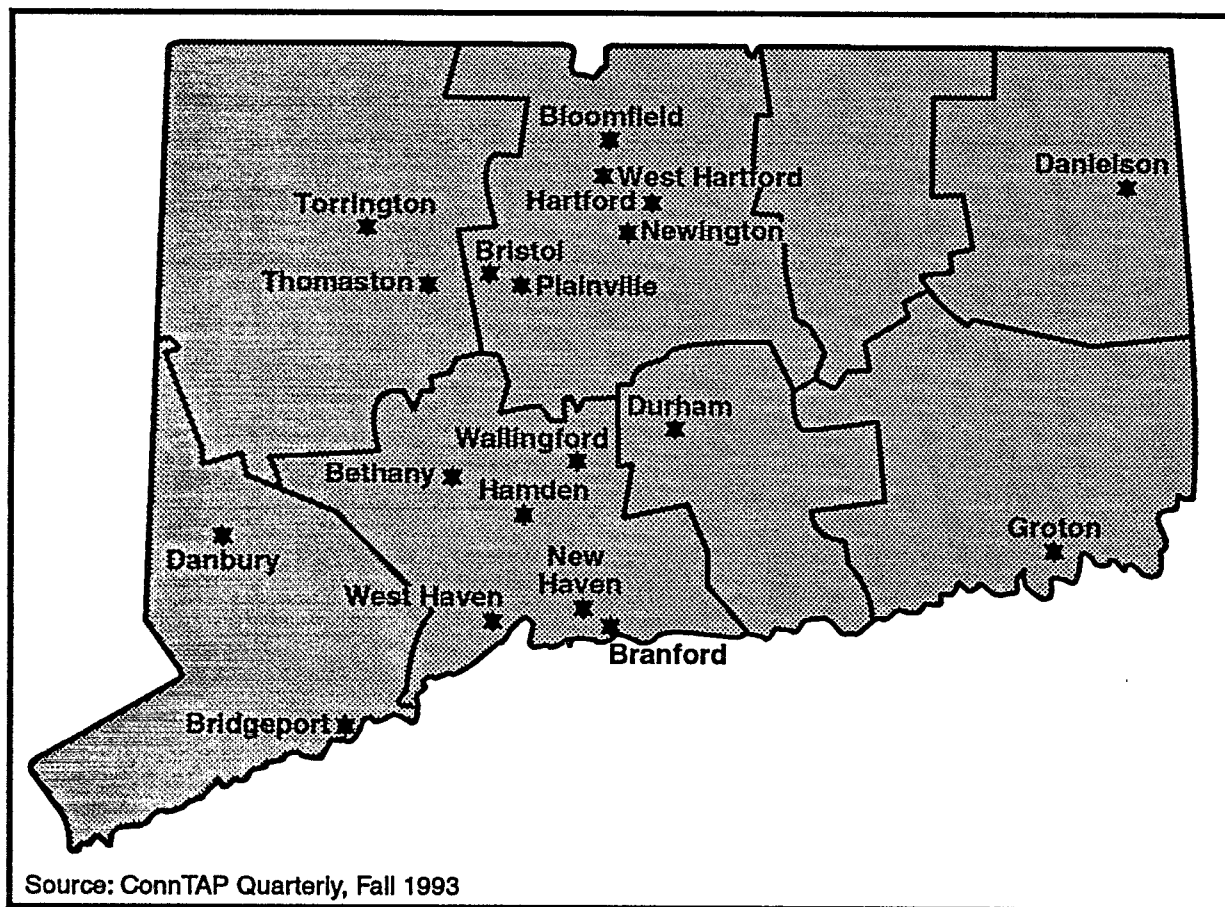
Development Authority, small Connecticut businesses can receive loans up to \$250,000 to implement pollution prevention projects that are approved by ConnTAP.

The Matching Challenge Grant Program demonstrates that a relatively small amount of money can go far toward minimizing or eliminating hazardous waste and encouraging pollution prevention. From its inception through 1994, the grant program has awarded about \$100,000 to 22 Connecticut organizations.

## Environmental Results

As a result of this program, the Service anticipates a total annual reduction of almost 1,000 tons of hazardous metal hydroxide sludge. Over 560-million gallons of water can also be saved annually as a result of the grant program projects. Further projections of the grant program's impact include an annual 177-ton reduction in other hazardous waste and hazardous air emissions. In addition ConnTAP has been selected by EPA to participate as one of six

## Location of ConnTAP and WRITE Project Cases





# Connecticut Initiative Encourages Pollution Prevention

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technical assistance programs in the Waste Reduction Through Innovative Technology Evaluation (WRITE) project. The WRITE project evaluates, in typical workplace environments, examples of innovative or prototype commercial technologies for pollution prevention. The success of the project is dramatically illustrated in the following examples:

- Automatic Plating of Bridgeport, Inc. invited ConnTAP to help evaluate the use of electrodialysis technology in its nickel plating process. Electrodialysis allows recovery and reuse of both nickel and rinsewater and removes as much as 90 percent of the nickel so that acceptably clean water is recycled back to the process. This recirculation reduced wastewater generation by more than 1-million gallons each year. Automatic Plating also found that almost 30,000 pounds of nickel could be recovered and reused each year. The capital cost of the equipment, for purchase and installation, was \$110,000, with an estimated payback time of 1 year. The system has relatively high operating costs due to its high energy and maintenance requirements. However, these costs are offset by the value of the recovered nickel and the savings from elimination of wastewater treatment.
- Quality Rolling and Deburring Company, Inc. (QRD) in Thomaston wanted ConnTAP to evaluate the recovery system that it had been operating for a year on its chromating line. ConnTAP concluded that the recovery system had potential use in many other manufacturing

applications that generate wastewater. The fully-automated recovery system unit combined vacuum evaporation and flash distillation, in conjunction with a patented liquid/vapor separation system to remove chromate, zinc, and other dissolved solids from the wastewater. The system provided a continuous supply of good quality rinsewater back to the chromating line. The closed-loop recirculation unit prevented nearly 450,000 gallons of wastewater from being generated each year. The contaminant stream is concentrated to 200 gallons per year, and disposed of offsite. QRD realized a \$22,000 savings in annual operating costs for wastewater treatment alone. The capital cost of the equipment was \$87,000, with an estimated payback time of 4 years.

## Contact For Further Information

Connecticut Hazardous Waste Management Service  
900 Asylum Avenue, Suite 360  
Hartford, CT 06150-1904

## Sources

"1993 Status Report on Connecticut Hazardous Waste Generation and Management." Connecticut Hazardous Waste Management Service. June 30, 1993.

"ConnTAP Quarterly." Volume 7, Number 3. 1994. Connecticut Technical Assistance Program.

# Pollution Prevention Success Stories - State Government

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## Ohio Promotes Pollution Prevention Goals

Ohio's pollution prevention goal is to reduce solid and hazardous waste generation statewide by 50 percent and toxic chemical releases by 75 percent by the year 2000 from 1987 levels. Ohio defines pollution prevention as the use of source reduction techniques to reduce risk to public health, safety, welfare, and the environment. As a second preference, Ohio encourages the use of environmentally sound recycling. Ohio believes that pollution prevention avoids cross-media transfers of waste and/or pollutants and is multimedia in scope.

On September 20, 1991, Ohio's Governor George V. Voinovich announced the formation of the Pollution Prevention Development Workgroup (PPDW). The purpose of the workgroup was to develop and coordinate pollution prevention initiatives throughout State government, businesses, and consumers in Ohio for implementation of pollution prevention activities. PPDW developed a pollution prevention strategy for Ohio that proposes 121 initiatives to promote pollution prevention throughout all sectors of Ohio.

The U.S. Environmental Protection Agency. Prevention is integrating pollution prevention into every program and operation activity of the Agency. Ohio EPA is making a parallel transition toward an environmental protection program that more strongly promotes pollution prevention.

### Approach Implemented

#### The Ohio Prevention First Program

A major initiative by the State of Ohio is the Ohio Prevention First Program, which involves

voluntary pollution prevention and pollution reduction planning. It has three primary objectives. The first requires the "Top 100" toxic chemical reporters (based on the 1991 Toxic



Release Inventory (TRI) reports) to prepare comprehensive pollution prevention plans. The second to encourages facilities to initiate or expand existing pollution prevention or pollution

reduction practices through development of comprehensive pollution prevention plans. The third publicizes the exemplary pollution prevention or pollution reduction efforts being made by these organizations. Currently, 82 of the "top 100" toxic chemical reporters, and 150 companies overall, are participating in this program.

### The Ohio Prevention Loan Program

On November 21, 1994, Ohio's Governor announced creation of the \$10-million Ohio Pollution Prevention Loan Program to provide low interest capital improvement loans for the construction and/or purchase of equipment to complete pollution prevention activities at small- and medium-sized facilities throughout Ohio. Loan amounts range from \$25,000 to \$200,000 per facility and have a fixed interest rate currently set at 2/3 the prime rate. The program is jointly administered by the Ohio Department of Development and the Ohio EPA Office of Pollution Prevention.



# Pollution Prevention Activities in Ohio

## 33/50 Program

Ohio EPA is involved with U.S. EPA's 33/50 Program which is a voluntary initiative seeking a 50 percent reduction of 17 targeted chemicals by 1995. There are 490 Ohio facilities associated with parent companies participating in the 33/50 program.

Ohio EPA pilot project to determine effective measures in waste minimization and pollution prevention (i.e., assessment of the benefits and shortcomings of pollution prevention projects).

## Waste Minimization Measurement Pilot Project

The Ohio EPA Waste Minimization Measurement Pilot Project is a joint U.S. EPA/

## Lake Erie Basin Pollution Prevention Activities

Ohio EPA, Office of Pollution Prevention activities in the Lake Erie Basin include projects that dealt with the following:

### 1991-1995 Achievements

#### Technical Assistance

- Development of Pollution Prevention Fact Sheets (18).
- Development of Pollution Prevention Information Packages (6).
- Development of a Guidance Manual for Waste Minimization Planning Guidance for Ohio Hazardous Waste Treatment, Storage, and Disposal Facilities in the Lake Erie Basin.
- Provided Technical Assistance to 15 Waste Generators focusing on the Lake Erie Basin portion of Ohio.
- Provided Technical Assistance for Preparing and Implementing Waste Minimization and Pollution Prevention Facility Plans. (Information available on OPP bulletin board)

#### Regulatory Integration

- Review and Analysis of Waste Management Alternative Plans Required Through Ohio's Waste Profile Review System.
- Compiled Series of Recommendations for Improving the U.S. EPA's Great Lakes Pollution Prevention Strategy.
- Review of Waste Generator Survey to Identify Barriers to Pollution Prevention.
- Analysis of Ohio EPA's Efforts to Integrate Pollution Prevention into the Agency's Regulatory Programs.
- Investigation of the Extent to Which Laboratory Waste Contribute to the Generation of Hazardous Waste.
- Revision of the Ohio EPA Pollution Prevention Strategy.

#### Pollution Prevention Data Management

- Analysis of Hazardous Waste Generation and Management Data in Order to Provide Foundation for Future Pollution Prevention Activities.
- Assessment of Hazardous Waste Minimization and Toxic Release Inventory Information.



# Pollution Prevention Activities in Ohio

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## **Green Lights Program**

Ohio EPA is a member of the Green Lights voluntary program sponsored by the U.S. EPA. This program challenges businesses and government agencies to reduce air pollution associated with the production of electricity by using energy efficient lighting.

## **Pollution Prevention Roundtable Participation**

Ohio EPA is a member of the National Pollution Prevention Roundtable (NPPR) and the Great Lakes Pollution Prevention Roundtable (GLPPR) and serves on the Board of Directors for the NPPR and on the Steering Committee for the GLPPR. These organizations share information from State, local, and Federal programs throughout the United States (NPPR) and the Great Lakes Region (GLPPR).

## **Tri-State Geographic Initiative**

Ohio took part in the Tri-State Geographic initiative that is concerned with identifying risk reduction efforts in the Ohio River Valley.

## **Governor's Awards**

Since 1986, Ohio EPA has coordinated the Annual Governor's Awards for Outstanding Achievement in Pollution Prevention. These

awards recognize companies, organizations or individuals who have made outstanding efforts to reduce waste.

## **Operating Results**

Based on the Ohio Toxic Release Inventory from 1988 through 1993, Ohio facilities participating in the 33/50 Program have achieved a 24 percent reduction in the 17 chemicals targeted in the program. Overall, a 55 percent decrease in the 17 chemicals targeted in the 33/50 Program has been achieved in Ohio when facilities not participating in the program are included.

On July 9, 1992, the State of Ohio signed the U.S. EPA Green Lights Program Memorandum of Understanding officially marking Ohio's participation as a partner in the Green Lights Program. The State of Ohio expects to save approximately \$4 million annually in energy costs, in addition to saving natural resources and reducing emissions from power plants.

## **Contact for Further Information**

Mike Kelley, Ohio EPA  
Office of Pollution Prevention  
1800 WaterMark Drive  
Columbus, OH 43215-1099  
Telephone: (614) 644-3469



# Pollution Prevention Success Stories - State Government

## Techniques and Technologies for Toxic Use Reduction

Within the Commonwealth of Massachusetts there are few facilities and little capacity to dispose of hazardous wastes. Historically, there has been major public resistance against siting new hazardous waste facilities. Therefore, a program to motivate facilities in the Commonwealth to reduce its hazardous waste generation was essential.

In July 1989, the Massachusetts Legislature enacted the Toxics Use Reduction Act (TURA) by a unanimous vote. The Act establishes a goal of 50 percent reduction in the Commonwealth's toxic waste generation by 1997, and addresses this issue by promoting toxics use reduction achieved through: process modification, substitution, improved operation and maintenance, product reformulation, and recycling. The Act focuses on reducing or eliminating the use of toxic substances and by-products in the production process itself.

The facilities covered under the Act include those that employ the equivalent of 10 or more full-time employees, and are primarily engaged in one of the following activities: mining; manufacturing; transportation, communications, gas, electric, and sanitary services; wholesale trade; and certain service industries. The Massachusetts Department of Environmental Protection (DEP) has a specific list of chemicals that are covered and usage thresholds for these chemicals that trigger planning and reporting requirements for the covered facilities. DEP can also require the submission of information from a facility even if it does not use these chemicals in quantities above the threshold amounts.



The Act requires that covered facilities establish a baseline year to measure future pollution reduction progress and submit reports containing information on emissions annually. However, the core of the Act is the development, by industry, of toxic material use reduction plans for each facility covered under the Act. Covered facilities

must declare 2- and 5-year goals for toxics reduction and develop plans to meet those goals. The plans must cover: current and projected toxics use; economic impacts of each chemical used; appropriate technologies for meeting reduction goals; training, technologies, and procedures to be implemented; anticipated savings; and an implementation schedule for the planned program.

Under the Act, the Office of Technical Assistance (OTA) was formed to provide industries with a nonregulatory resource base to assist in the use reduction planning process. OTA offers a variety of free services to Massachusetts businesses. The Act provides funding for the implementation of the program through a scaled fee structure. Each facility is charged a fee based upon the number of employees at the facility and the number of chemicals that are used above the thresholds, with maximum fees established.

### Approach Implemented

There have been a number of instances where simple process changes and other pollution prevention techniques have been successfully implemented at Massachusetts facilities. Two examples involving implementing simple changes that improve operating practices through process modifications follow.

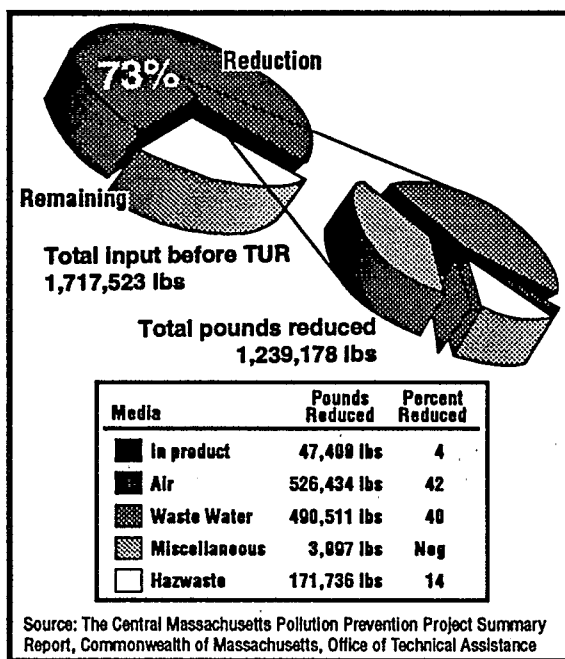
# Techniques and Technologies for Toxic Use Reduction

- The Kilmartin Tool Company in southeastern Massachusetts used 300 gallons of ozone depletion chemical (chlorofluorocarbons or CFCs) per year as degreasers for a stamping operation that was performed six times per year. Although the facility employed good management practices with its degreasing unit, the rising cost and eventual phaseout of CFCs prompted further conservation. The facility decided that to reduce evaporative losses, it would pump the CFCs from the degreaser when it was not being used into capped 55-gallon drums. The procedure reduced the CFC purchases from 300 to 50 gallons per year, with the corresponding purchase cost reduced from \$6,000 to \$1,000 per year.
- The Lowell Corporation of Worcester, Massachusetts, is a racket manufacturer that uses zinc phosphate to improve the corrosion resistance of its products. Its phosphating process was discharging wastewaters containing zinc at concentrations exceeding the limits specified in its permit. If this process was shut down, the facility would have had to send the parts out to a vendor to be phosphated. Therefore, the facility invited OTA to visit the plant and explore use reduction options. OTA proposed the addition of a dead rinse tank after the phosphate tank to decrease zinc drag-out. Past experience had shown that a dead rinse tank can reduce drag-out by 50 percent. The tank took 10 minutes to install, and the concentration of zinc in the discharge dropped (over 60 percent) from 4.77 parts per million (ppm) to 1.55 ppm (Lowell's permit discharge limit is 2.61 ppm). The company estimates that the savings for not having to contract out the phosphating pro-

cess to a vendor at roughly \$26,000 annually.

As examples show, the implementation of even simple pollution prevention activities at facilities can have multiple benefits. As an initial motivator, cost savings are derived from reduced raw material purchase costs and reduced reporting fees. Other benefits include reduced waste disposal costs and the reduction or elimination of potential fines for violating a permit discharge limit. OTA also sponsored the Central-Mass Pilot Project, which culminated a progression of pollution prevention efforts by expanding and coordinating the Commonwealth's technical assistance program with regulatory source reduction efforts. The focus of the project was one industrial sector, metal-using industries, in central Massachusetts, centered around the Upper Blackstone River Watershed. A 73 percent reduction in toxics use was documented from interviews with facilities that participated in the Central-Mass project. Overall toxics use reduction for 18 selected facilities in the Commonwealth can be seen in the Figure 1.

**Toxics Use Reductions  
(18 companies, 24 chemicals)**



## Contact For Further Information

Office of Technical Assistance, Suite 1904  
100 Cambridge Street  
Boston, MA 02202  
Telephone: (617) 727-3260

## Source

Fact Sheet: "Mass Reduction; Techniques And Technologies For Toxics Use Reduction." Massachusetts Department of Environmental Protection, Office of Technical Assistance. Boston, Massachusetts.

# Pollution Prevention Success Stories - Transportation

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## Biodiesel: "Not Blowing Smoke"

The combustion of diesel fuel in mass transit vehicles generates emissions such as particulate matter (PM), hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NOx), and sulfur oxides (SOx). The Clean Air Act Amendments of 1990 (CAAA) and the corresponding U.S. Environmental Protection Agency (EPA) regulations specify the reduction of these pollutants by imposing requirements such as stricter emission standards for newer vehicles and limiting the sulfur content in the fuels.

To meet the requirements of the new CAAA, and potential, tougher diesel regulations in the future, transit authorities across the country have begun to consider the use of alternate fuels for their mass transit vehicles. In 1993, more than 30 transit authorities participated in a program, sponsored by the biodiesel industry, to evaluate biodiesel as an alternative fuel. Biodiesel (methyl esters) is a cleaner-burning fuel made from natural, renewable resources such as vegetable oils.

### Approach Implemented

In 1993, the biodiesel industry distributed enough fuel to log nearly 7-million road miles in more than 100 demonstrations involving more than 1,500 vehicles. During that time, transit authorities and school districts recorded information on emissions, performance, and oil contaminants. The practical road demonstrations included million-mile tests with transit authorities in Baltimore, Cincinnati, and Oakland, as well as more than 30 50,000-mile tests. For this program, mass transit authorities used a mix of 20 percent biodiesel and 80 percent petroleum die-

sel. However, some municipalities have used a blend of up to 40 percent biodiesel without experiencing any operational problems.

### Operating Results

When biodiesel was used in place of conventional diesel fuel, transit managers noticed a reduction in smoke, odor, and diesel engine emissions. Some operators reported a 20 to 30 percent reduction of smoke. In tests conducted by independent researchers comparing emissions from vehicles using biodiesel vs. conventional diesel fuel, PM was reduced by 31 percent, HC was reduced by 47 percent, CO was reduced by 21 percent, and NOx was reduced by 3 percent. SOx emissions were not quantified, but would also be reduced, compared to conventional fuels, because biodiesel contains no sulfur, while diesel fuel contains about 0.05 percent sulfur.

Biodiesel performs similarly to petroleum diesel in terms of torque, horsepower, and miles per gallon but provides about 2 percent fewer Btus/gallon than conventional diesel. Also, maintenance shop supervisors have noted that biodiesel appears to provide slightly better lubrication to engine parts than standard diesel fuel.

### Cost, Savings, and Tradeoffs



The cost of biodiesel depends on the cost of its components, diesel, and vegetable oil. In general, a 20/80 blend can cost up to 40 cents per gallon more than petroleum diesel. However, not all of the costs of meeting tougher emission standards have been quantified. Therefore, an

# Biodiesel: "Not Blowing Smoke"

emission management system based on biodiesel could be an inexpensive option for meeting these standards. According to an April 1994 study commissioned by the National SoyDiesel Development Board, the cost of biodiesel can range from about 18 cents per mile for a commercial medium-duty truck fleet to 28 cents per mile for a transit fleet. The study also found that a truck or bus fleet using 20 percent biodiesel blended with conventional diesel would experience lower total annual costs than with other alternatives.

## Other Benefits

Biodiesel is made from natural, renewable resources such as soybean and vegetable oils. (Based on the Institute for Local Self-Reliance, one unit of energy used to produce biodiesel can supply a minimum of 2.5 units of fuel energy.) The primary by-product of the biodiesel production process is glycerine, which has more than 1,600 commercial applications. A principal feedstock source of biodiesel is soybeans, a major crop produced by nearly 400,000 farmers in 29 States across the Nation. The supply (equivalent) of 40-million gallons/year is nearly equal to projected demand if biodiesel use is implemented in all urban transportation buses.

The use of biodiesel requires no expensive engine modifications. Because it has a higher flash point, offers low-pressure storage at ambient temperatures, handles like diesel, and is nontoxic and biodegradable, biodiesel is safer to transport and safer for the environment than conventional diesel fuel.

## Contact For Further Information

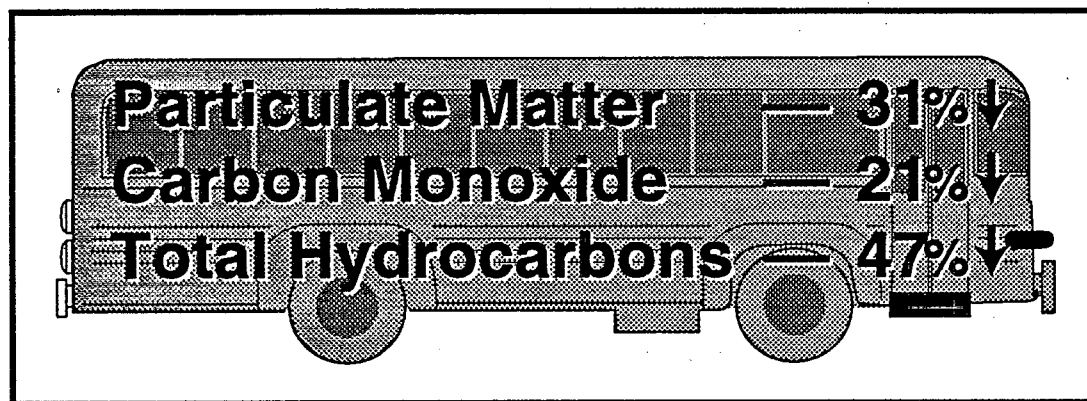
National SoyDiesel Development Board  
1907 Williams Street  
P.O. Box 104898  
Jefferson City, MO 65110-4898  
Telephone: (800) 769-3437

## Sources

Passenger Transport, APTA, May 16, 1994.

Excerpt from April 1994 issue of "Bus Ride."

Biodiesel Information Kit, National SoyDiesel Development Board, July 1994.





# **Pollution Prevention Success Stories - Transportation**

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## **Cleaner Bus Operations and Maintenance**

Bus (and rail) transportation companies recognize the need to keep their revenue-generating equipment constantly serviced with the goal of maximizing the longevity of the equipment. Operations in bus servicing include refueling, fluids check and replenishing, interior and exterior cleaning, and washing. Principal maintenance operations are engine and under chassis washing, minor repairs, tune-ups, and chassis lubrication. Both bus servicing and maintenance generate significant amounts of oily wastes and wastewaters.

The Washington Metropolitan Area Transit Authority (WMATA) Four Mile Run bus maintenance facility in Virginia received a Notice of Violation of its pretreatment permit for effluent violations of lead, cadmium, and total petroleum hydrocarbons. All sanitary sewers from the facility discharge to the Arlington County Pollution Control Treatment Plant located across the street from the plant. The facility had no central treatment system, and most oily wastes were conveyed to oil-water separators located near the discharge points to the sanitary sewer.

The discharge problems appeared to result from several sources that, when combined, were overloading the oil-water separators and adding emulsifiers to the oily wastestreams that adversely affected oil-water separation. In addition, the only onsite control for metals was settling in sumps and separators prior to discharge. There was no system for removing dissolved metals in the wastewaters.

In response to the Notice of Violation, WMATA told the Arlington County Department

of Environmental Services that rather than attempt to upgrade the oil-water separators or put in expensive metals removal systems, that the Authority would conduct a pollution prevention study that would significantly reduce all discharges to the sanitary sewer. The pollution prevention approach concentrated on two major waste generating operations: bus refueling at the bus service building and repair operations in the bus maintenance facility. The approach would classify all pollution prevention options into short-term (implemented within 1 month), moderate-term (implementable within 6 months), and long-term (1 year or longer required for implementation). The 1-month pollution prevention study resulted in identification of 24 actions that could reduce the quantity and improve the quality of the discharge.

### **Approach Implemented**

Some pollution prevention measures that are scheduled for implementation at WMATA for both the bus service building and the bus maintenance building are shown below and are identified as either short-term (S), medium-term (M), or long-term (L) solutions.

#### **Bus Service Building**

- Reduce fuel and oil spills to the pavement and surrounding soil by:
  1. Retraining employees to discontinue the practice of "topping off" or milking fuel into buses; (S)
  2. Using absorbent materials (S) and purchasing explosion-proof portable

# Cleaner Bus Operations and Maintenance

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vacuums to immediately collect spilled diesel fuel/oil/hazardous materials; (L)

3. Installing new efficient refueling nozzles; (M)
  4. Using oil catchment canisters under parked buses and adding secondary pans under bus engines during servicing. (M)
- Construct an internal trench drain system to separate the runoff from the refueling operations and the external paved area. (L)
  - Increase environmental awareness by providing training; and review maintenance/repair techniques to minimize waste generation and contamination to the environment. (S)

## Bus Maintenance Building

- Clean the oil/water separators of the excess sludge to eliminate the source of leaching metals and oils. (S)
- Discontinue use of detergent in engine wash water and replace the engine wash system with a medium pressure steam cleaner to eliminate dissolving small quantities of the metal substrate from the bus engine. (S)
- Purchase an explosion-proof, portable vacuum for spills of fuel/oil/hazardous materials. (M)
- Disconnect the washrack from the oil/water separator and connect it to a holding tank to eliminate contamination to the sanitary sewer system. (L)
- Install a self-contained recycling wash system to the wash rack to reduce the cost of liquid disposal. (L)
- Install a cabinet-type parts washer to preclude personnel from washing bus components outside the building and contaminating the outside pavement with metals and oil. (L)
- Purchase an antifreeze reclamation unit. (M)
- Purchase a recycling floor scrubber (M), and discontinue washing down the maintenance bay areas to reduce metal and oil loading to the oil/water separator. (S)

## Operating Results

The short-term pollution prevention initiatives were implemented quickly at the Four Mile Run facility. Visible improvement were immediate in the facility's discharge. The facility now expects to more effectively comply with its pretreatment effluent limitations, thereby reducing Notices of Violations. Generation of solid and hazardous waste requiring disposal has decreased significantly.

## Cost, Savings, and Tradeoffs

The waste minimization initiatives discussed above include a combination of source reduction or elimination, recycling/ reclamation, and wastestream reduction. The cost of implementing the pollution prevention initiatives range from negligible to approximately \$145,000. A number of highly effective short-term initiatives were implemented at a minimal cost either by changing operational procedures or through the purchase of relatively inexpensive equipment.

In addition, the list of recommendations was sent to all 15 bus and rail facilities throughout the entire system. It is anticipated that many of the pollution prevention activities could be implemented system-wide, resulting in significant reductions in discharges for the Authority and a concomitant reduction, if not elimination, of Notices of Violations for WMATA facilities.

## Contact For Further Information

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# Pollution Prevention Success Stories - Transportation

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## Pollution Prevention Takes Off

### The Problem

The day-to-day operations of an airport provide a multitude of pollution-related emissions. From air discharges associated with the aircraft and support vehicles, to the organic solvents and deicing agents used in airline maintenance, to the tons of daily waste generated by the restaurants, gift shops, rest rooms, etc., pollution sources abound at an airport. Each individual pollution problem can be dealt with by "end-of-pipe" controls, as has been done at most airports in the past. That is, wastewaters can be conveyed to onsite wastewater treatment plants, engine or boiler, air emissions can be controlled after generation, and waste can be disposed of in landfills.

At the new Denver International Airport (DIA), the solution to airport waste generation was to develop pollution prevention and waste management techniques before the waste was generated. And, because the airport had more than a 10-year horizon for design and construction, the U.S. Environmental Protection Agency's regional office in Denver had the opportunity to work with the City and DIA designers to incorporate pollution prevention into the airport operations before it opened its doors.

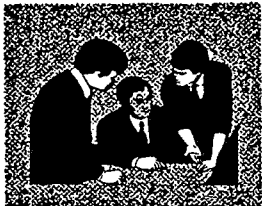
EPA assigned a full-time staff scientist and other Agency resources to provide regulatory and technical assistance to the new airport. Of significance, EPA used a "multimedia" rather than

single media approach in the development of pollution prevention strategies for DIA. In addition, the Region worked in cooperative partnership with the City of Denver and County personnel to prevent pollution and provide a win-win situation for all participants. By working outside of its traditional enforcement role, EPA Region 8 proved to be influential in the design, construction, operation, and maintenance activities, ensuring the airport minimized its impact on the surrounding environment.

### Approach Implemented

Some of the pollution prevention measures implemented at DIA include:

- Aircraft servicing area recycling systems, including deicing pads that reduce the release of glycol deicing fluids to the environment;
- Wastewater volume reduction by using ultra-low flow toilets, reclaiming wastewater for irrigating outside vegetation, landscaping with water-stingy plants, and requiring accountability for stormwater management by onsite tenant;
- A central heating and cooling plant that uses boilers with low NO<sub>x</sub> burners and flue gas recirculation;
- Above ground storage tanks with floating roofs to prevent ground-water contamination from corrosion-produced leaks (a major problem at airports);
- Use of fly ash from nearby power plants as additive for 180,000 tons of concrete;
- Development of a solid waste management



# Pollution Prevention Takes Off

plan by EPA's onsite coordinator to reduce solid waste generation by 30 percent; and

- Addressing energy conservation through efficient lighting consistent with the EPA's Green Lights Program, designing a fiberglass roof to take advantage of natural lighting, including air intakes for terminal cooling in the winter months, and developing an alternative fuels policy for DIA tenants.

## Operating Results

The pollution prevention measures cited above are expected to produce impressive reductions in various emissions and releases resulting in significantly less impact than comparable airport facilities. The reductions include:

- Recovery of 95 percent of the glycol deicing agents that are applied to the aircraft. This results in an annual savings in glycol purchases of 760 tons per year.
- Use of low flow restroom facilities and application of reclaimed, nonpotable wastewaters for plant irrigation. As a result, DIA will save 700-million gallons of water per year; enough water to supply almost 7,500 households annually.
- New designs for automobile parking facilities, staggered employee shifts, compressed workweeks, use of natural gas-fueled fleet and shuttle vehicles, and operation of special burners and flue gas recirculation, all contribute to reducing nitrogen oxide and carbon monoxide emissions by almost 100 tons per year.
- Floating roof tanks and fuel transfer equipment that capture and recover vapors. This new design will eliminate over 50 tons per year of volatile organic emissions.



## Cost, Savings, and Tradeoffs

Actual cost savings are difficult to calculate until after the airport has been fully operational, with the new pollution prevention activities in place. However, savings of chemicals (i.e., glycol), water, and waste disposal can be quantified with associated annual savings, as follows:

- Reduced glycol purchases of \$650,000;
- Water consumption savings of about \$1.5 million; and
- Solid waste disposal savings of \$32,000.

Because DIA is the Nation's largest airport, there will still be a net increase in pollution over the current conditions. However, the impacts from additional pollution were outweighed by the need for more efficient and modern airport facilities, and the anticipated growth in the area's economy with improved transportation systems. In addition, DIA provided positive examples of both pollution prevention by design and EPA contributions that involve partnerships rather than controls and oversight.

## Contact For Further Information

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## **Appendix A**

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