*Office of Technical Assistance*
**Executive Office of Environmental Affairs**
**Commonwealth of Massachusetts**

# Toxics Use Reduction Case Study

## FREON ELIMINATION, VOC REDUCTION AT V.H. BLACKINTON & CO., INC.

### SUMMARY

In order to eliminate both the health concerns and increasing environmental compliance costs associated with the toxic chemicals used to manufacture its metal insignia, novelties and jewelry — and because the Clean Air Act will end production of some of those chemicals — V.H. Blackinton began a program to find ways to replace and reduce use of those materials. Working on their own and with the help of the Office of Technical Assistance, V.H. Blackinton installed a deionized water rinse and hot air dryer to replace Freon parts drying. The company has decreased use of trichloroethylene (TCE) by substituting an aqueous cleaner for most degreasing as well as by ending some parts cleaning and brite dipping steps. A 50 percent reduction in zinc and copper in wastewater has been achieved through improved process management of brite dip chemicals; this has also resulted in reduced use of chemicals for wastewater treatment. The hot air drying system and aqueous cleaning process cost approximately $23,000 to install. To purchase in 1994 the quantity of Freon that was used in 1989 could cost upwards of $60,000. There have also been significant annual savings realized from reduced chemical purchases, water and sewer charges and energy usage. Product quality and productivity are unchanged or improved.

### BACKGROUND

V.H. Blackinton & Co., Inc., North Attleboro, Mass., is the largest manufacturer in the United States of metal uniform insignia — badges, medals, service pins. The company also makes jewelry and other metal plated novelties. V.H. Blackinton's staff of 190 people manufacture products from start to finish — artwork and raw materials to packaged products ready to be shipped. The manufacturing operation includes blanking, stamping, punching and machining raw stock prior to enamelling, brazing, polishing and plating. Five thousand gallons of water is used daily for noncontact cooling of brazing furnaces in addition to that used for rinsing. Copper and zinc contaminate the rinse water required to wash off the acids used to etch the badges.

In 1989, Blackinton began to research and make plans to reduce or eliminate:

- Freon used for parts drying;
- TCE degreasing;

- sulfuric acid used in brite dipping;
- waste from a 60 gallon cyanide activation tank, and
- the 25,000 gallons of water used each day — including the 5,000 gallons of noncontact cooling water, which the North Attleboro wastewater treatment plant no longer allows to be discharged directly into the sewer system.

## TUR PLANNING

V.H. Blackinton moved to its present location in 1982 and as the company streamlined its processes to meet increased demand they also tested and implemented source reduction and conservation techniques. TCE and Freon emissions were reduced and the company was able to reduce water usage from five million to one million gallons a year. V.H. Blackinton participated in the Department of Environmental Management Southeast Jewelry Platers Project (SJPP), which provided technical assistance from 1986 to 1989 to metal finishers and platers in southeastern Massachusetts. V.H. Blackinton's Emilio Abatecola attended SJPP workshops and seminars and had on-site consultations from OTA and its predecessor, the Office of Safe Waste Management (OSWM). A number of toxics use reduction and resource conservation opportunities were identified in a 1989 OSWM audit.

Emilio, who took over as finishing manager in 1990, saw that concerns over the environmental impact of toxic chemicals would lead to increased fees, costs and regulations. He sought input and assistance from the company's workers, and began implementing a program to use less chemicals and reduce water consumption. Emilio first focused on substitutes for Freon and TCE and then introduced additional water conservation and pollution prevention techniques. He also carefully assessed the need for each cleaning, degreasing and brite dipping step.

"I've always taken a conservative approach to my work and I don't waste anything if possible," Emilio says, adding, "I like to work with the plating personnel by asking questions about why they do things a certain way. Generally the answer is 'that is the way it always has been done.' Usually at this point I can reason with them and suggest that we try something different and see if it works. Making changes in the shop requires that you get the cooperation of the people doing the work. If you can't get them to go along with you and at least give it a try, you'll never be able to make improvements and keep up with environmental regulations."

## TUR MODIFICATIONS

In 1990, Blackinton replaced the Freon dryer used to dry finished work pieces with a deionized water rinse and a hot air dryer. The new dryer, heated with inplant steam, requires five to eight minutes instead of 45 seconds with Freon, but because production is done in batches the increased drying time has had no significant effect on quality or productivity.

All but one of the TCE degreasing procedures have been replaced by a basic aqueous cleaning system with four countercurrent rinse tanks. At the brite dipping station, Emilio added a conductivity probe to the fourth and final countercurrent rinse tank so that fresh water is no longer added continuously, but only when needed. Careful monitoring of the chemistry in the aqueous bath has reduced the amount of cleaner used by half. Removing solids from the cleaning system by decanting from the bottom doubles the time between bath replace-

ments, and countercurrent flow in the rinse tanks substantially reduces water use. Addition of a small intank filter, an oil skimmer, and conversion to compatible aqueous based pressing and stamping oils also facilitated the changeover and made the new cleaning system more efficient. V.H. Blackinton's priority goal is to eliminate all use of TCE within a year; at present one small tank of TCE with increased freeboard and a cover to prevent evaporation is still used to remove buffing compound.

Decreased concentration of the cyanide bath and reducing the size of the tank from 60 gallons to 10 gallons resulted in an 80 percent decrease in the chemicals needed for those operations.

The badge clasps, which used to be loosened in a separate brite dipping step are now freed during the aqueous cleaning. The unnecessary brite dipping added copper and zinc metals

## Some Chemical Use and Costs Before and After TUR Modifications at V.H. Blackinton

| | 1989 | | 1992 | | 1993 | |
|---|---|---|---|---|---|---|
| | lbs | / $ | lbs | / $ | lbs | / $ |
| Freon | 7,000 | $10,000 | | | | *$60,000 |
| TCE | 30,000 | $12,000 | | | 8,000 | $6,000 |
| Aqua Ease ($H_2O$ cleaner) | | | | | 30 gal | $345 |
| Cyanide | | | 2,000 | $1,700 | 800 | $1,000 |
| Sodium hypochlorite (bleach) | | | 2,000 | $1,700 | 1,500 | $1,500 |
| Sulfuric acid | 20,000 | NA | 10,000 | $1,200 | 9,000 | $1,200 |
| Sodium hydroxide | 16,000 | NA | 10,000 | $2,500 | 8,000 | $1,500 |

**estimated cost for 7,000 pounds at current prices*

to the waste water treatment system, generating large quantities of waste sulfuric acid which then required the addition of sodium hydroxide to neutralize the spent acid.

### RESULTS

**Reductions Achieved:** In 1989, the dryer used 6,900 pounds of Freon, which escaped into the atmosphere. With the installation in 1990 of the hot air dryer, Freon emissions have been completely eliminated. The workers had routinely degreased everything, sometimes treating the same piece several times during its production; reducing cleaning operations to the minimum continues to reduce the amount of TCE used. Unnecessary brite dipping steps, like that used for loosening clasps, have also been eliminated. In 1989, V.H. Blackinton used over 30,000 pounds of TCE; in 1993, 6,000 pounds of TCE were used. The reduced brite dipping has cut $H_2SO_4$ and sodium hydroxide (used to neutralize the $H_2SO_4$ before discharge)

respectively from 20,000 pounds per year to 8,500 pounds and 16,000 pounds per year to 8,000 pounds.

Through careful monitoring of chemisty and redisign of the tank the cyanide activation tank and the cleaning bath in the plating line, the cyanide and sodium hypochlorite used in these two operations have been reduced by 80 percent.

**Economics:** The cost to purchase and install the hot air dryer was $11,400, and the deionized water rinse cost $1,500. The aqueous cleaning system and four rinse tanks cost a net of $9,384 — a small profit was realized from disposal of the old unit. The savings realized from the reduced and alternative chemical purchases for these two processes over the amount the original materials would cost today comes to at least $70,000 per year. Initial payback on the capital costs for new equipment, based on the savings in chemicals and waste management, was achieved in less than a year.

## OTHER REDUCTIONS

In 1989, V.H. Blackinton used over 20,000 gallons of water a day in its plating operations. Aggressive conservation efforts including installation of flow restrictors, downsizing tanks and implementing counter current rinses, had cut usage to 5,000 gallons per day in 1993. Additional implemented conservation efforts include shutting off rinse tanks during lunch, the careful monitoring of chemistry, modernization and regular preventative maintenance of valves and piping.