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V.H. Blackinton & Co.
Toxics Use Reduction Case Study
Halogen Solvent Elimination, Chemical Reduction, and Zero Discharge

Summary

In the early 1990's V.H. Blackinton began a continuous improvement program to reduce chemical use and eliminate certain hazardous chemicals. By engaging company employees and working with vendors, along with the help of the Office of Technical Assistance (OTA), V.H. Blackinton eliminated the use of ozone depleting Freon, trichloroethylene (TCE), ammonia, and volatile organic compounds (VOC). The company made substantial investments to modernize their plating and finishing operations, leading to significant reductions in water use and in the use of acids and bases in waste treatment and plating operations. As a result, V.H. Blackinton is no longer required to report under the Toxic Use Reduction Act (TURA) and have closed the loop on their wastewater discharge.

Background

V.H. Blackinton & Co., Inc., North Attleboro, MA, is the largest manufacturer in the United States of metal uniform insignia such as badges, medals and service pins. The company also makes jewelry and other metal plated novelties. With a staff of 210 people, the company manufactures products from start to finish; from designing artwork to processing raw materials to packaging products for shipping. The manufacturing operations include blanking, stamping, punching and machining raw stock prior to cleaning, enameling, brazing, polishing, plating and finishing.

Toxics Use Reduction

In 1990, Blackinton eliminated the use of Freon by replacing the existing finished work dryer with one that uses a deionized water rinse and hot air. Although the new dryer, heated with in plant steam, requires a longer drying time compared to Freon, the time requirement does not adversely affect productivity or production quality. Then in 1992, all of the TCE cleaning operations were replaced with an aqueous cleaning system using "simple green crystal cleaner." Approximately 45 gallons of water-based cleaner is used annually, achieved by carefully monitoring the bath chemistry and ultra-filtering the cleaner weekly for reuse. In addition, a small in tank filter, an oil skimmer, and conversion to compatible water-based pressing and stamping oils, made the new aqueous cleaning system more efficient.

More recently, new brazing furnaces with belts twice as wide as those in the old furnaces were installed, doubling the process capacity. The new furnaces use a 25% hydrogen and 75% nitrogen mix, eliminating over 20,000 pounds of disassociated anhydrous ammonia that was used annually in the old furnaces. The cost of using the new system and quality of the finished product is the same or better. The company also close-looped the cooling water used for the furnaces, conserving 5000 gallons of water per day.

Changes were then made to the company's bright dip operations reduced the copper and zinc loading to the wastewater by 85 percent. These changes include chemistry, metal recovery, improved process management, and the installation of drag-out tanks and a closed-loop system for rinsing operations. For example, badge clasps used

to be loosened in a separate bright dip step, are now freed during aqueous cleaning. The unnecessary bright dip step added copper and zinc metals to the wastewater and during waste treatment generated large quantities of metal hydroxide sludge and waste sulfuric acid, which was neutralized with sodium hydroxide. Reducing the use of the bright dip process has cut the annual use of sulfuric acid from 20,000 pounds to 8,500 pounds and sodium hydroxide from 16,000 pounds to 8,000 pounds. An ion exchange unit was added to the final countercurrent rinse tank at the bright dip station so that water is recycled continuously. The changes to the bright dip process and the significant water reduction, has enabled the company to close loop the entire plating and finishing operations.

Cyanide, another chemical used at the facility, was also reduced by 95 percent. This was achieved by reducing the size of the plating tanks (from 60 gallons to 10 gallons), decreasing the concentration of cyanide used in the plating bath, and replacing the cyanide used in one specific process with less toxic sulfuric acid and phosphoric acid. These changes, along with switching from a 2-stage to a single stage cyanide destruction, also reduced the amount of sodium hypochlorite (bleach) used by 75 percent.

Modifications were also made to the wastewater treatment system to incorporate the use of a vacuum distillation unit. The technology recovers distilled water from the wastewater for use in the plating process and concentrates dissolved salts that are dried and disposed of as a hazardous waste. The unit alone has reduced sulfuric acid and sodium hydroxide use by an additional 25 percent. Currently, Blackinton has switched to magnesium hydroxide for all pH adjustment, which is safer and less toxic than sodium hydroxide and will reduce chemical use even further. The company generates approximately 6 tons of hazardous waste per year from the enclosed evaporator, down from 35 tons per year from the previous conventional flow-through wastewater treatment system.

Results

Reductions: Blackinton streamlined its plating and finishing processes to meet increasing product demand and more stringent environmental requirements. In doing so, they tested and implemented several conservation techniques that eliminated freon, enabled metal recovery, and closed-the-loop on rinse water and wastewater discharges. By May of 2001, the company eliminated the use of over 25,000 gallons of water per day and cut individual chemical use ranging from 50 to 100 percent, summarized in Table 1. Throughout these improvements, maintaining product quality was always the primary consideration.

Table 1. Summary of Chemical Reductions

Chemical Use	1992	2000	2001
Sulfuric acid	10,046 lbs	6,095 lbs	4,661 lbs
Sodium hydroxide	13,967 lbs	7,540 lbs	5,116 lbs
Sodium hypochlorite (Bleach)	2,000 lbs	1,200 lbs	522 lbs
Cyanide Use	2,000 lbs	800 lbs	89 lbs
Trichloroethylene	30,000 lbs	0 lbs	
Ammonia	20,070 lbs	0 lbs	
*Freon eliminated in 1990			

Economics: V.H. Blackinton is no longer required to pay TURA fees, which was $5,725 in their last reporting year. Additionally, the company has realized savings on chemical purchases and disposal cost, regulatory reporting, permitting and monitoring, and water and sewer use charges. The capital cost savings of the new Nitrogen/Hydrogen furnace system totaled $18,110 and an annual savings in overall operating costs of $1958. Blackinton also annually saves approximately $5,000 on water charges. The chemicals purchased for the system have dropped to a bare minimum, especially in the reduction of bleach and sulfuric acid. Other indirect savings occur, such as energy efficiency of the new furnace. Within three years, the savings from avoided TURA (Toxic Use Reduction Act) fees have practically paid for the new furnace system.

This case study is one in a series prepared by the Office of Technical Assistance (OTA), a branch of the Massachusetts Executive Office of Environmental Affairs. OTA's mission is to assist Massachusetts facilities with reducing their use of toxic chemicals and/or the generation of toxic manufacturing byproducts. Mention of any particular equipment or proprietary technology does not represent an endorsement of these products by the Commonwealth of Massachusetts. This information is available in alternate formats upon request. OTA's **non-regulatory** services are available at **no charge** to Massachusetts businesses and institutions that use toxics. For further information about this or other case studies, or about OTA's technical assistance services, contact:

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