EXECUTIVE OFFICE OF
ENVIRONMENTAL AFFAIRS

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Office of Technical Assistance (OTA)

November 1995

Tubed Products, Inc.
Toxics Use Reduction Case Study
Ultraviolet Curing of Inks and Coatings Introduced

Summary

In the early 1970s, Tubed Products, Inc., of Easthampton, Massachusetts, introduced production changes to allow the use of 100 % solids ultraviolet curable inks to decorate plastic squeeze tubes. Approximately five years later the technology to cure epoxy coatings for the tubes became available, enabling the company to convert to ultraviolet curing in all decorating and coating operations. This means that inks and coatings no longer need to be dried by heat-evaporation of solvents, and thus toxic solvents are no longer evaporated off into the surrounding environment. These changes have also resulted in increased line speeds, energy savings and more economical use of floor space.

Background

Tubed Products is a manufacturer of plastic squeeze tubes and caps for the cosmetic, personal care, pharmaceutical, and household chemical market. Most tubes are sold as empty containers, but some are filled in Tubed Products' Contract Packaging Department. Tubes are first molded from pelletized plastic resin, then printed, coated, and capped in the decorating department. Approximately 40 % of Tubed Products' production efforts are directed at decoration of the tubes with appropriate logos and information as specified by customers.

Before the conversion to ultraviolet curing systems, when thermally cured inks and coatings were used, the decorating lines consisted of a dry-offset printer, a thermal oven to cure the ink, a coater, a second thermal oven to cure the coating, and a capper. These lines were approximately 40 feet in length, and held about 3,000 tubes on their pin conveyors. The two thermal ovens in each line were heated using about 60,000 watts per hour of electricity, and evaporated solvents from the drying of inks and coatings were emitted to the atmosphere. From start to finish, this operation required approximately 40 minutes to produce a printed, coated and capped tube.

Toxics Use Reduction Planning

Tubed Products did not make the switch to ultraviolet inks and coatings all at once. Instead, the firm has moved continuously toward ultraviolet processes over the past 20 years, as these new production technologies have been perfected.

UV curable inks, and the curing systems to use them, first became commercially available in the early 1970s. The potential of these new technologies was first brought to the attention of Tubed Products by American Production Machine Co. of Union City, N.J., a supplier of decorating equipment. In 1973-1974, Tubed Products investigated the benefits of ultraviolet systems and found that they would reduce emissions significantly, require less energy and floor space, reduce waste ink (since UV inks do not dry on the press), and allow them to blend base inks to achieve custom colors. After several trials, Tubed Products purchased a new decorating line using UV inks and thermal coatings. This permitted the firm to do away with solvent-based inks and the solvent emissions generated by their use.

Between 1974 and 1979, several more UV decorating lines were added to keep pace with company growth. Having experienced the benefits of UV ink curing, Tubed Products began working with coating manufacturers to

develop and evaluate UV-curable tube coatings. This work came to fruition in 1979, when Tubed Products purchased its first production line to use ultraviolet curing for both inks and coatings. Several more of these integrated ultraviolet lines have been added since.

The acceptance by the industry of UV curing has enabled the design and manufacture of a new generation of tube printing presses, which are known as "on-mandrel UV curing equipment." These state-of-the-art decorating lines enable tubes to be printed, coated and capped while the tube is mounted on the same mandrel, thereby eliminating the need for the tube transfer mechanisms and creating fewer rejects. They also occupy less floor space than the previous UV curing lines since the printing, coating and capping is done on one piece of equipment.

Toxics Use Reduction Modifications

The conversion to UV-cured inks required new procedures for color matching and measurement, and the later introduction of UV-cured coatings required measurements of coating surface friction, permeation, flexibility and non-yellowing properties.

The addition of new, higher-speed presses required more sophisticated training programs for both machine adjusters and maintenance personnel. One particularly critical issue has been the development of procedures for the use and care of the UV lamp systems. However, after initial training, very little follow-up has been necessary.

Results

Reductions Achieved: The gradual conversion from thermal to ultraviolet curing has proven beneficial in many ways. Each UV decorating line occupies approximately one third the floor space of a comparable thermal line, and requires only about one-fifth the energy (12,000 watts per hour) to operate. While the thermal lines required 40 minutes to produce a tube, the newest high-speed on-mandrel lines do the job in five minutes. Since the UV inks and coatings contain no solvents, worker exposure to toxic and hazardous solvents has been reduced significantly, and significantly less solvent emissions are released to the environment than would be if thermal systems were still in use. Tubed Products believes the continued use of thermal cure inks and two-part epoxy coatings could have compromised their long-term compliance with air emissions standards.

Economics: Since the changes were made gradually, and since production rates are far higher than they were when thermal curing was still in effect, Tubed Products never made any determination of the costs or savings realized, or the reductions in emissions which have resulted from the change to UV-curable systems.

The firm believes that this early conversion to UV ink and coating systems has been an important factor contributing to its growth in the industry, helping it to become a low-cost producer and the largest U.S. supplier of plastic squeeze tubes.

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:

Office of Technical Assistance, 251 Causeway Street, Suite 900, Boston, MA 02114-2136

Phone: (617) 626-1060 Fax: (617) 626-1095 Website: http://www.mass.gov/ota