

Shawmut Corporation Eliminating TCE Use by Switching to a Hot-melt Adhesive Process

Summary

Shawmut Corporation, based in West Bridgewater, MA, is a producer of coated and laminated performance materials. The company has 400 employees at eight locations and has been headquartered and operating in the Commonwealth since 1916. The company laminates a variety of flexible substrates to create automotive headliner and interior trim materials, disposable medical products, protective work suits, filtration, military textiles, footwear, and breathable waterproof barriers. Shawmut historically utilized three principal processes: flame lamination, solvent-based adhesive lamination and thermoplastic adhesive lamination to bond a variety of substrates, including fabrics, foams, films, nonwovens, papers and foils. Since 1990, the company has been working consistently at toxics use reduction (TUR) to reduce both the use and emissions of trichloroethylene (TCE) from the solvent adhesive lamination process and in March of 2013, the company successfully eliminated all use of TCE at the facility by converting to a hot-melt adhesion process.

Background

Shawmut laminates over 40 million yards annually on 16 laminating lines, making it the largest laminator of its kind in the U.S. The various lamination techniques historically used by Shawmut include: flame lamination – a process for bonding polyurethane foam to fabrics or films by passing the foam over an open flame and using molten foam as a binding agent; solvent-based adhesive lamination using a two-part solvent-based urethane adhesive printed at very low coating weights; and thermoplastic adhesive lamination using both molten adhesives and precast adhesive webs. Shawmut laminates for a variety of industries including the automotive, medical, protective/performance wear, military, hospitality, and filtration industries.



Corporate Headquarters West Bridgewater, MA

Control and Recovery of TCE Emissions

Prior to 1990, Shawmut's adhesive lamination process occurred within a room-temperature enclosure. The process used a two-part urethane adhesive, which contained approximately 56% TCE and 44% urethane solids by weight. The process involved applying the adhesive to a face substrate by an engraved roll. A lining substrate was then brought into contact with the adhesive-coated face material at a laminating drum. The materials were then pressed together and passed over a large-diameter drum to assure proper lamination. The finished product then proceeded to a take-

up reel for removal. Throughout the adhesive lamination process, all volatile organic compounds (VOCs) were emitted without control, with hoods and blowers to minimize the exposure to employees. The company's first TUR project involved the installation of a carbon adsorber to capture VOCs, rather than emit them. Shawmut reclaimed TCE from the adsorber and sold it back to the adhesive vendor. Over the years, the company put in significant effort to ensure capture by enclosing the lamination lines, resulting in a more efficient flow to the carbon adsorber. Because residual TCE contained in the product was hard to quantify, Shawmut decided to evacuate the product prior to inspection, resulting in the development of a method to extract the VOCs from the roll and capture them with the carbon adsorber.

Shawmut continued to look at cleanup, mixing operations, and general storage as further ways to reduce usage and emissions. One example of this was the introduction of mixing/pumping stations and an enclosed cleaning and storage area that vented into the carbon adsorbers. The company also discovered that sealing the equipment hoods and monitoring the amount of TCE being removed during lamination helped increase the overall effectiveness of the carbon adsorbers.



Kevin Souza with obsolete carbon adsorbers

Elimination of TCE Use in Facility

In addition to recovering TCE emissions with carbon adsorbers, Shawmut has worked to eliminate TCE, the solvent, from the adhesion lamination process. In 1995, the company introduced a new hot-melt lamination process, which uses a 100% solid and VOC-free adhesive. In the new process, the adhesive was pre-melted, applied to a moving web, in low coating weights, in molten form. With

the new process, some of Shawmut’s products transitioned easily, but other products required extensive process engineering, equipment innovation and chemical engineering before they could comply with specifications of the new “green” process. In October of 2011, the company had made sufficient progress with the new process and decided to discontinue the use of adhesive with TCE. Over the next 18 months, Shawmut worked toward moving all their products to the hot-melt line, completing the transition in March of 2013.

Year	Adhesive	In Formula	TCE (pounds)			Solvent	Production Units	
			Recovered	HazWaste	Emitted		Hot Melt	Total
2004	789,109	431,793	325,532	18,648	87,613	7,673,444	4,891,135	12,564,579
2005	359,570	198,544	159,937	10,731	27,876	6,771,782	5,264,378	12,036,160
2006	368,405	203,954	165,435	12,802	25,717	6,756,651	5,621,605	12,378,256
2007	198,314	109,385	82,596	16,747	10,042	2,676,441	1,527,333	4,203,774
2008	128,081	70,657	48,298	13,670	8,690	24,608	22,963	47,571
2009	40,002	21,868	14,303	6,383	1,183	4,500,288	3,536,665	8,036,953
2010	53,246	29,331	8,572	8,572	12,188	577,218	4,839,975	5,417,193
2011	28,539	15,547	9,871	5,062	614	424,278	4,367,799	4,792,077
2012	22,158	12,244	8,888	1,580	1,775	358,916	3,614,751	3,973,666
2013	3,663	1,857	1,280	556	21	93,728	3,251,319	3,345,047

Results

Over the past several years, as Shawmut worked toward the elimination of TCE, the company has had the support and assistance of the Office of Technical Assistance (OTA). OTA assisted Shawmut with the identification of safer alternatives to TCE, leading to the recovery and eventual elimination of TCE use in Shawmut’s processes, which has resulted in several benefits for the company. Shawmut saved approximately \$1,000,000 per year in the solvent-based adhesive lamination process as a result of lower adhesive application weights and less waste, resulting from the implementation of better process controls. The complete elimination of TCE in 2013 has led to an additional \$750,000 in annual savings, which includes savings in the maintenance and operation of the solvent recovery systems, the recovery of valuable floor space, and the handling and controls associated with

hazardous waste, such as costs of material handling, hazmat supplies, engineering support, administration, and waste disposal.

Shawmut has nearly eliminated their hazardous waste; they are currently a very small quantity generator (VSQG). Before eliminating TCE, the company was a large quantity generator (LQG) and typically spent approximately \$20,000 annually on hazardous waste disposal costs. In 2014, the cost was only \$600, which is a savings of over 95%. OTA also provided compliance assistance to Shawmut, including TURA reporting clarification. Recently, OTA assisted Shawmut on communication with EPA concerning the company's petition to eliminate their Title V Operating Permit, leading to a successful resolution.

Shawmut's TUR projects have also led to an improvement in the quality of their product. Lighter coating weights and improved process controls led to a "softer and more consistent product." The elimination of TCE in Shawmut's products has produced a greater acceptance in the marketplace and the company is proud that they have become a "greener" company by eliminating the use of TCE in their facility.

"I want to thank the TURA program and especially OTA, for assisting Shawmut throughout this process. OTA worked alongside us to identify safer alternatives to TCE and provided guidance on the changing face of compliance here at Shawmut, including guiding our status change from a large-quantity generator of hazardous waste to a very small-quantity generator and assisting with our petition to eliminate our EPA Title V Operating Permit."

-Kevin Souza, Regulatory Compliance Manager for Shawmut Corporation

This case study was prepared by the Office of Technical Assistance and Technology (OTA), a branch of the Massachusetts Executive Office of Energy and Environmental Affairs. The OTA helps businesses and other organizations improve their environmental performance by helping them comply with relevant regulations, reduce toxics use, and conserve energy, water, and other resources.

OTA's **non-regulatory** services are available at **no charge** to Massachusetts businesses and institutions.

For additional information contact OTA at **(617) 626-1060** or at **www.mass.gov/eea/ota**
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