THE MASSACHUSETTS TOXICS USE REDUCTION INSTITUTE

SURFACE CLEANING LABORATORY

CASE STUDY #3

A. W. Chesterton Company, Inc.

Groveland, MA

Summary

Agitated aqueous cleaning combined with manual scrubbing proved successful for cleaning stainless steel and cast iron parts contaminated with epoxy resins and curing agents. Tests were performed to determine an acceptable replacement for a methanol, xylene and methyl ethyl ketone (MEK) cleaning operation. Potential operator exposure to solvents will be eliminated and waste disposal problems reduced when the hazardous solvents are substituted with an aqueous cleaning process. The company estimates a significant cost savings over solvent cleaning.

Background

The Technical Products Business Division of A. W. Chesterton Company, Inc. operates a facility in Groveland, Massachusetts for the production of curing agents and resins for the specialty adhesives market. The plant employs approximately 600 employees.

Various tooling components, such as mixing blades and transfer equipment couplings are used in the manufacture of highly viscous adhesives. Tooling surfaces become contaminated with epoxy resins and curing agents and require cleaning at least once a day. The cleaning process involved immersion of contaminated parts into solvent soak tanks at ambient temperature using methanol for removing arnine- based curing agents (e.g., Curing Agent 27) and a 50:50 mixture of xylene and MEK for removing epoxy bisphenol resins (e.g., Novolac).

The duration of the cleaning cycle varied and was directly proportional to the amount of surface contamination and the age of the resin or curing a ent contanunant. Substrate materials are 304 stainless steel mixing blades and cast iron transfer couplings. After chemically softening and loosening the contaminants in the solvents, parts were hand-wiped clean.

Toxics Use Reduction Planning

The solvent-based cleaning processes were effective; however, the potentials for operator exposure, environmental release and disposal of the solvents were a concern to management and the environmental engineering staff. Solvent acquisition costs were considered stable but disposal costs of spent solvent were rising. Aqueous cleaning was chosen as a feasible alternative.

Through. a reference from the Massachusetts Office of Technical Assistance for Toxics Use Reduction, the firm contacted the Surface Cleaning Laboratory (SCL) at the Massachusetts Toxics Use Reduction Institute (TURI) to assist them in evaluating aqueous chemistries and cleaning techniques.

Testing in the Surface Cleaning Laboratory

A series of tests were conducted to detemiine the optimal conditions of temperature, agitation, concentration and time for aqueous cleaning. Based on empirical data and input from the. client company, three cleaners were selected for the experiments: MacDermid ND Supreme, Sky Products Cleaner #10 and Modem Chemical Blue Gold Cleaner. Concentrations ranged from 10% to 20% by volume in tap water and temperatures ranged from 680 to 1500 F. Cleaning cycles varied from 5 to 17 minutes.

Smooth, flat test coupons (approximately 2 inches x 4 inches) of 304 stainless steel were (1) pre-cleaned, rinsed and dried according to standard SCL practices, (2) surface-contaminated with Novolac resin, Curing Agent 27 or other amine-based curing agent -by a hand-held foam swab, (3) aged for up to 24

hours, (4) soak-cleaned with magnetic stir bar agitation in glass beakers followed by timed, manual scrubbing with a nylon brush, as necessary (5) tap- or deionized (DI)-water rinsed for 10 seconds at 1400-1500 F and (6) dried under ambient, pressurized (shop air) air knives for 2 minutes. The coupons were visually inspected for adhesive residue.

Results

While adequate results were achieved with all three cleaners, MacDermid ND Supreme provided acceptable to excellent cleaning over the range of concentrations tested at both ambient and elevated bath temperatures. Cleanliness was subjectively assessed by the SCL Assistant using No Visible Traces (NVT) in collaboration with A. W. Chesterton technical staff.

This information was sufficient for A. W. Chesterton technical staff to initiate steps to eliminate solvent cleaning. A manually-operated, immersion aqueous station is being installed to clean the tooling components. Because none of the off-the-self cleaners were ideal, A. W. Chesterton decided to develop their own aqueous chemistry and equipment. The formulation will be finalized after in-house testing is complete.

The Toxics Use Reduction Institute is a multi-disciplinary research, education, and policy center established by the Massachusetts Toxics Use Reduction Act of 1989. The Institute sponsors and conducts research, organizes education. and training programs, and provides technical support to promote reduction in the use of toxic chemicals or the generation of toxic chemical byproduct in industry and commerce.