

*THE MASSACHUSETTS TOXICS USE REDUCTION INSTITUTE*  
*SURFACE CLEANING LABORATORY*  
*CASE STUDY #1*

**Market Forge**  
**Everett, MA**

**Summary**

Results of testing in the Surface Cleaning Lab indicated that pressure spray aqueous cleaning effectively removed pickling and cutting oils from Market Forge's carbon steel and aluminum boiler parts.

**Background**

This company is part of the Toxics Use Reduction Institute (TURI) Clean Alternatives Project, funded by the US Environmental Protection Agency. The project consists of technical, total cost, and substitution analyses of alternatives to chlorinated solvents for vapor degreasing. The technical analysis of alkaline aqueous degreasing was performed in TURI's Surface Cleaning Lab. The project team included TURI and Market Forge personnel.

Located in Everett, MA, Market Forge manufactures cooking steamers. Prior to 1993, A petroleum distillate solvent substituted for TCA. Market Forge used a 1, 1, 1-trichloroethane proved unsuccessful in removing pickling and (TCA) vapor degreasing system to degrease cutting oils from carbon steel and aluminum parts. carbon steel and aluminum boiler parts prior to welding. The performance of TCA was satisfactory, but its use was discontinued because of the labeling requirements of the Montreal Protocol. On the advice of their supplier, a switch was made from TCA to an aliphatic petroleum distillate solvent. To accommodate the switch, the vapor degreaser was modified to remove the heating capabilities and add filter capacity. Besides the equipment modifications, it was assumed that the petroleum distillate solvent would be a drop-in replacement. However, as

soon as the switch was made, the welders of both the carbon steel and aluminum parts began to experience problems.

### *Carbon steel*

The carbon steel parts are received from the supplier coated with a pickling oil, a heavy paraffinic petroleum distillate, to prevent rusting, during storage and shipping. Market Forge adds two petroleum oils to the carbon steel parts during processing. One oil is TRIM SOL, an aliphatic petroleum naphtha containing sulfonates and chlorinated alkenes and reported on the Material Safety Data Sheet to be 100% soluble in water. The second oil is C-EBLIS Cutting Oil, a naphthenic petroleum distillate which is not soluble in water. After cleaning the parts in the petroleum distillate solvent, the welders report that the parts are visibly less clean than parts cleaned with the TCA system and that the parts produce fumes when welded. The welders have noticed an "eggshell" film on the parts and describe the parts as appearing "wet" following cleaning with the petroleum distillate and drying.

### *Aluminum*

Unlike carbon steel, the aluminum parts are received "clean" with a protective coating of plastic (peel coat). However during processing at Market Forge, the parts are contaminated by C-EBLIS cutting oil used in the stamping operation and aliphatic hydrocarbon oil used for drilling and tapping operations. Cleaning of these contaminants using the replacement petroleum distillate solvent proved - unsuccessful and resulted in a visible oily film which prevented proper welding. Consequently, the welders were spraying and hand wiping with Magnflux, a light aliphatic naphtha solvent (CAS 64742- 89-8).

## Testing in the Surface Cleaning Lab

The first course of action taken was to determine if it was possible to use no oil, less oil, water soluble oils or consolidate the types of oils used. The supplier of the carbon steel was contacted and indicated that the pickling oil could be removed with "soap and water".. The water soluble oil, TRIM SOL was tested in drilling and tapping operations of the aluminum and it was found to be unacceptable.

The next step was to establish a baseline clean for samples of carbon steel and aluminum. For testin(y purposes, an ultrasonics system was used to establish an acceptable level of cleanliness for both materials. Samples of both metals were cleaned with an aqueous cleaner, at 130F, using ultrasonic agitation for 10 minutes. A shop weld trial proved that the cleaning was sufficient. The parts were not rinsed during this lab test for two reasons., First, the rust inhibitors in the detergent were needed to protect the parts from rusting during storage prior to welding. Second, because current processes at the company, do not require a wastewater discharge permit, it was desirable to minimize the use of water in the aqueous system. The company plans to explore options for extending cleaner bath life by filtration.

The goal then was to find a more practical method of The project team chose a pressure spraycleaning the metals. Samples of both metals were cleaned with an aqueous cleaner, at 130F, usina no wash aqueous cleaning system for Market Forge's carbon steel and aluminum parts.agitation for 10 minutes. The parts were not rinsed. A shop weld trial proved that the welding was I unsuccessful.

Now having acceptable and unacceptable samples, a lab test was established to simulate the welding process. The plates were subject to flame from an oxy-propane gas torch and two observers watched for fumes. There was a visible difference between the acceptable and the unacceptable samples. This test was

then used to determine the acceptability of various immersion and pressure spray cleaning tests.

There were successful cleaning tests for both the immersion and the pressure spray systems. The project team chose a pressure spray aqueous cleaning system because less water is required compared to the immersion system. The cleaner used in the lab tests was an alkaline, low foam formulation containing rust protectors.

During initial site visits, the project team discussed process issues affecting parts cleaning. Current parts stacking procedures for the degreaser are not always followed to ensure that parts are not covering each other thus preventing efficient cleaning. In addition, the company is exploring methods of more efficient materials movement. Currently, cleaned parts may be stored for months before use. Storage conditions of the dirty and clean parts were also discussed. Current storage conditions add contaminants to the dirty parts and do not adequately protect the cleaned parts from leaking roofs and other shop dirt. -Improvements in these areas will be necessary for the success of any alternate cleaning system.

### **Process Implementation**

Market Forge evaluated many commercial spray washers before deciding to purchase an American Metal Wash spray washer. The spray washer has been successfully degreasing the carbon steel and aluminum parts for approximately four months.

*This case study is part of TURIs "Clean Alternatives Project" funded by EPA's Risk Reduction Engineering Laboratory in Cincinnati, OH. For more information on this project, contact Karen Thomas at (508)934-3143. For further information on the TURIs Surface Cleaning Lab, contact Carole LeBlanc at (508)934-3249.*

*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.*