CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	1994
DateRun:	06/14/1994
Experimenters:	Donald Garlotta, John Bulko
ClientType:	Manufacturer of Cooking Systems
ProjectNumber:	Project #1
Substrates:	Aluminum, Carbon Steel
PartType:	Part
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil
Cleaning Methods:	Low Pressure Spray
Analytical Methods:	Smoke
Purpose:	Results of testing
Experimental Procedure:	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 Manufacturer of Cooking Systems personnel. A petroleum distillate solvent substituted for TCA proved unsuccessful in removing pickling and cutting oils from carbon steel and aluminum parts. Prior to 1993, Manufacturer of Cooking Systems used a 1,1,1-trichloroethane (TCA) vapor degreasing system to degrease 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. Manufacturer of Cooking Systems 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 Manufacturer of Cooking Systems, 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 Magnuflux, a light aliphatic naphtha solvent (CAS 64742-89-8).
Results:	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 testing 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 130 F, 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 project team chose a pressure spray wash aqueous cleaning system for Manufacturer of Cooking Systems' carbon steel and aluminum parts. The goal then was to find a more practical method of cleaning the metals. Samples of both metals were cleaned with an aqueous cleaner, at 130 F, using no agitation for 10 minutes. The parts were not rinsed. A shop weld trial proved that the welding was 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

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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, WR Grace's Daraclean 283, 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.

Summary:

Substrates:	Aluminum, Carbon Steel				
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil				
Company Name:	**Product Name:**	**Conc.:**	**Efficiency:**	**Effective:**	**Observations:**
Magnaflux	Daraclean 283	10	0.00	☑	

Conclusion:

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

Process Implementation Manufacturer of Cooking Systems 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 TURI's "Clean Alternatives Project" funded by EPA's Risk education Engineering Laboratory in Cincinnati, OH.