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ALTERNATIVE SOLVENTS/TECHNOLOGIES FOR PAINT STRIPPING

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Paint stripping is a necessary part of maintenance at U. S. Air Force Air Logistics Centers (ALC). The waste from Air Force paint stripping operations contains toxic chemicals that require special handling and must be disposed of as hazardous waste at considerable cost. Emissions from these solvents into the atmosphere as volatile organic compounds (VOC) are another source of pollution. These wastes are hazardous to the environment and to operating personnel. The paint stripping wastes are regulated by the U. S. Environmental Protection Agency (USEPA), which can impose fines on operations whose wastes exceed the established limits.

The purpose of this program is to identify and test alternative solvents and/or technologies to strip paint from aircraft parts and equipment efficiently with the overall objectives of minimizing hazardous wastes and volatile organic compound (VOC) emissions. Commercially available chemical paint strippers will be tested for paint stripping efficiency, biodegradability, and corrosion characteristics. An extensive literature search has been completed to obtain background information, abstracts, patents, military specifications, and ASTM testing standards for paint stripping. Several mechanical paint stripping methods have been discovered during the literature search and are being monitored for their applicability in Department of Defense operations. A joint program has been established between Boeing Aerospace, Pacific Northwest Laboratory, and the INEL with the goal to expand the collaboration effort with other industries.

Phase I of this program has been completed. Phase I involved gathering baseline information, conducting laboratory screening of potential alternative paint strippers for their ability to remove paint, determining the biodegradability of the solvent, and determining the corrosion characteristics of the solvent. Phase II is currently being implemented in FY-91 and will involve extended performance testing of the alternative paint strippers surviving Phase I testing. Phase III will be conducted in later years and will involve full scale demonstration of the paint strippers selected.

Paint stripping efficiency was evaluated by determining the ability of the stripper to remove various types of paint systems from metal coupons. The test methods were developed from military and federal specifications for paint stripping. A preliminary test was conducted on all samples to eliminate those that cannot remove paint under moderate conditions. The effects of each stripper on the paint system were determined by visual inspection of the coupon after paint stripping, since this is the standard procedure at the ALCs. For the preliminary test, Al 2024 and an epoxy paint system were selected as the representative paint system. Paint strippers passing the screening requirements of -/>50% paint removal were subjected to a more stringent test to provide accurate performance data. The second test used Al 2024 and carbon steel 1010 as the substrates and utilized six paint systems for the test.

The paint systems used were:

1. Epoxy polyamide primer with epoxy polyamide topcoat.

2. Elastomeric polysulfide primer and urethane topcoat.

3. Water-thinned epoxy primer and CARC urethane topcoat.

4. Zinc chromate primer and alkyd topcoat.

5. Epoxy polyamide primer, polysulfide sealant, epoxy polyamide primer, and a urethane topcoat.

6. Epoxy polyamide primer with epoxy polyamide topcoat that differed in formulation from #l.

The painted coupons were subjected to accelerated aging by immersion in 2% hydrogen peroxide for 18 hrs. This accelerates oxidation, which normally occurs with ultraviolet (UV) light and time. Coupons for the preliminary test were not aged before testing.

Corrosion testing will be performed in accordance with ASTM F483-87, Immersion Corrosion Testing. Those paint removal solvents passing the extended performance testing will be subjected to corrosion testing, hydrogen embrittlement testing by ASTM F519-77, and biodegradation studies.

Currently 60 paint removal formulations have been screened. Out of this screening test, 10 immersion paint strippers passed into extended testing. These ten paint removal solvents are: Chemical Methods CM-3707, Chemical Solvents SP-800, Fine Organics FO 606, Frederick Gumm Clepo Envirostrip 222, GAF M-Pyrol, McGean-Rohco Cee Bee A245, McGean-Rohco Cee Bee A477, Patclin 126 Hot Stripper, Rochester Midland PSS 600, and Turco T-5668. These solvents are currently undergoing extended testing, VOC studies, and recycle/recovery studies.

Several new process technologies for paint removal have also been identified and are being monitored by the INEL. These new technologies include: wheat starch blasting, CO_2 ice blasting, ice blasting, water jet blasting, flash lamp stripping, laser stripping, and sodium bicarbonate blasting.