Chemical Agent Resistant Coatings (CARC) Depaint (Low VOC CARC Removal and Disposal)

Background:

Federal and local regulations from the Clean Air Act restrict the amount of Volatile Organic Compound (VOC) emissions allowed during the application of protective coatings. Chemical Agent Resistant Coatings (CARC), used for painting military vehicles, have a VOC content of 3.5 pounds per gallon. Current annual usage nationwide is estimated to be three million gallons per year. As additional states enact more stringent VOC regulations, fewer organizations/facilities will be able to use existing CARC formulations (MIL-C-46168). The Strategic Environmental Research and Development Program (SERDP) funded a tri-service effort to develop a low VOC CARC system for use on Army, Marine Corps, and Air Force systems.

Project Sponsor/Customer: Army, Marine Corps, Air Force
Period of Performance: Sep 97 – Dec 00

Objective:

The overall objective of this project is to develop a low VOC CARC System suitable for use on military equipment by all services, in which the materials and processes for the reformulation, application, stripping and disposal are optimized and in compliance with the current and anticipated future regulatory requirements. The primary objective is to reduce the VOC of the polyurethane topcoat from 3.5 lb/gal to 1.8 lb/gal. A secondary objective will be to eliminate the hazardous air pollutants (HAPs) and toxic solvents used in the current topcoat formulation. Another secondary objective is to develop a “drop in” low VOC replacement for the current CARC material. New application and removal processes and equipment are to be minimized as much as possible.

Status:

The technical effort was divided into three phases consisting of formulation, application, and removal with each agency overseeing one of the phases. The Army Research Laboratory (ARL) conducted the formulation efforts; the Naval Surface Warfare Center, Carderock Division (NSWCCD) the application studies; and Air Force Research Laboratory (AFRL) the removal studies. AFRL initiated in-house coatings stripping, and

stripping process waste disposal study tasks to determine how existing processes should be modified (if necessary) to meet the depaint requirements of each service.

ARL developed a low VOC CARC formulation based on water-reducible chemistry along with polymeric bead extenders that met the VOC goals and exhibited improved mechanical and weathering properties than the current MIL-C-46168 CARC. This material was manufactured by Hentzen Coatings, as part of a pilot plant batch. In addition to the improved environmental properties of the low VOC CARC, improvements in weatherability and mechanical properties such as flexibility and mar resistance were observed.

Production depaint requirements were established in terms of stripping efficiencies in relation to production throughput, and surface finish constraints imposed for acceptable substrate conditions following CARC system removal. Baseline testing of the existing CARC system was accomplished to provide a basis for comparative strippability analysis. Both the application and stripping studies utilized a full range of substrates, including metallic and nonmetallic (composites) materials in the test protocols. Information derived from the Depaint Process Characterizations Phase provided the basis for development of the CARC Strippability Test Plan.

Stripping processes either identified by a requirements survey, or other processes expected to be introduced by DoD maintenance operations in the near future comprised the stripping process evaluated. Strip rates derived from baseline testing were compared with strip rates derived from testing with the new SERDP low VOC CARC to assess potential impact on maintenance operations.

The results of the CARC stripping requirements survey indicated most of the stripping is done with some form of dry abrasive blasting and other stripping is generally done by chemical methods. This survey also indicated there is a common concern pertaining to any increases of hazardous waste products associated with the new CARC. CARC strippability data for the various dry media depaint processes suggests the strippability of the new CARC should not be expected to present an adverse impact to depaint operations. The chemical strippability data suggests stripping productivity of the new CARC using these processes is not expected to be impacted significantly.

Strippability with the new CARC with applied light energy processes (emerging technologies either being implemented or of great interest for implementation) must be considered a non issue. Data did not indicate the new low VOC CARC will present any strippability problems with these processes and very likely with any similar processes.

Based on the data and results of this study there is no firm foundation suggesting the need to modify or replace current depaint processes to accommodate the low VOC CARC. Since there are no anticipated changes required for current stripping processes, there is not a need to be considered over waste disposal. The low VOC CARC coating should be considered a likely “drop-in” technology from the regards of strippability.

The Environmental Security Technology Certification Program (ESTCP) funded a follow on program to determine if the low VOC CARC can truly be a “drop in” replacement for the current solvent borne CARC.

Application Demonstrations were conducted at Barstow Marine Corps Logistics Center, Hill Air Force Base, and Tobyhanna Army Depot. A low VOC CARC formulation from Sherwin-Williams was successfully applied at the demonstration locations by their paint shop personnel. Two HMMVs, a 5-ton Truck, a Light Amphibious Vehicle (LAV), four Mobile Electric Power (MEP) units, a shelter, and several miscellaneous parts were coated with the low VOC CARC along with test panels to evaluate coating quality. Over one third less of the low VOC CARC was required to coat the MEP units at Hill AFB. Painters surveyed on spraying the low VOC CARC were very favorable about spraying this material.

Test panel results indicated the low VOC CARC sprayed at the demonstration sites was generally equivalent to the laboratory sprayed formulations. Depaint test panels were shipped to the Q-Panel facility in Tucson Arizona for accelerated aging to simulated two and four years of aging. Depaint demonstrations were scheduled at the three demonstration sites. The depaint demonstration was held at Barstow Marine Corps Logistics Center and indicated there were no issues in removing the low VOC CARC with the current removal processes.

Information on the ARL CARC effort can be found at:

“Water Dispersible CARC Report “ - www.arl.mil/wmrd/coatings

Information on SERDP and ESTCP low VOC CARC programs can be found at:

http://www.serdp.org/research/Prevention.html (Project PP 1056)

http://www.estcp.org/projects/pollution/200024o.cfm

Test Plan: CARC Strippability Test Plan, Appendix B, Final Report
Final Report: "Low VOC CARC Removal and Disposal"
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