Improved CARCs Support Chemical Corps Mission

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The National Defense Center for Energy and Environment (NDCEE)[1] and the U.S. Army Environmental Command (USAEC)[2] recently assisted four Army facilities in switching to two improved chemical agent-resistant coatings (CARCs)—MIL-DTL-64159, Type II, water-dispersible (WD), and MIL-DTL-53039C, Type III, solvent-based—both of which contain low levels of volatile organic compounds (VOCs) and no hazardous air pollutants (HAPs). The U.S. Army Research Laboratory has fully tested, evaluated, and approved the new CARCs, with approval documented in MIL-DTL-53072C.[3] The new CARC topcoats are qualified product list items available through the U.S. General Services Administration.

CARCs were first developed in the early 1970s to protect deployed systems in extreme environments. Over the years, changes have been made to meet demands associated with the environment, performance, and safety. Today, CARCs provide camouflage and infrared signature reduction in combat zones, offer superior resistance to chemical and biological warfare agent penetration, and greatly simplify decontamination, thereby extending the service life for military vehicles and equipment. CARCs are one of the tools used by the Chemical Corps to defend against chemical and biological attacks—they essentially serve as "personal protective equipment" for tactical vehicles and equipment.

The U.S. Environmental Protection Agency is developing a new Defense Land Systems and Miscellaneous Equipment (DLSME) National Emissions Standard for Hazardous Air Pollutants (NESHAP), which will regulate HAPs in surface-coating operations. In response to the proposed DLSME NESHAP, additional MIL-DTL-53039C topcoat types that contain even lower levels of VOCs and no HAPs (Types IV–VI and VIII) have recently been approved. A significant benefit of the new lower VOC/no-HAP CARCs is the reduced exposure of personnel to potentially hazardous working conditions associated with VOC and HAP emissions. Other expected benefits include reduced material, operating, and disposal costs.

Due to the proposed DLSME NESHAP, the U.S. Army Research Laboratory has withdrawn approval for MIL-C-46168—a solvent-based, plural-component coating. Approval for MIL-DTL-53039C, Types I and II (solvent-based, single-component coatings that use silica-based flattening agents), may also be withdrawn.

CARC topcoats are routinely applied at Army depots and maintenance facilities as part of a repair procedure or to change color. Depending on deployment camouflage requirements, tan or green topcoat coloring is applied to weapon systems. The green camouflage color system consists of black, green, and brown, with green as the base. Chalk is used to add the camouflage pattern to the base as stipulated by Army regulations for each weapon system. Each camouflage color section is labeled with a 1 (black), 2 (green), or 3 (brown); and sections are coated as needed.

Fort Benning and Fort Stewart, Georgia; Anniston Army Depot, Alabama; and Fort Wainwright, Alaska, were aided in their transitions to new CARC topcoats without an adverse impact on their production schedules. These facilities share attributes with other Army depots and maintenance facilities; however, none of the facilities are identical. Factors such as climate, type of equipment serviced, throughputs, and personnel experience make each site unique.

NDCEE/USAEC assistance was provided primarily through demonstrations. They—

- Determined the CARC formulation that was best-suited for operations at each installation. Operational field conditions were replicated to the maximum extent feasible, thus providing painters with the most realistic basis from which to evaluate the performance of the CARC alternatives and ancillary equipment.
- Helped installation personnel smoothly integrate the new coating and ancillary equipment into ongoing painting operations. Although alternative CARC formulations serve as "drop in" replacements, the implementation of new material always involves a learning curve. Hands-on demonstrations with the new coatings and auxiliary paint equipment addressed installation painters' issues and concerns.

The NDCEE/USAEC demonstrations were also designed to address the unique needs of each site with reference to enhancing overall paint/depaint operations. To achieve this secondary goal, the site demonstrations involved one or both of the following objectives:

- Provide coatings applicator training. Except for a few minor adjustments, the new CARC formulations serve as drop-in replacements for the older formulations; therefore, personnel who were experienced in applying

CARCs required little or no training in applying a new CARC topcoat. Demonstrations at Fort Stewart and Fort Wainwright featured Spray Technique Analysis and Research for Defense training, which offered strategies and techniques that enabled painters to use less coating and improve finish quality. Fort Benning and Georgia National Guard personnel also attended the training at Fort Stewart.

- Determine the coating removal technologies that are best-suited for operations at each installation. All demonstrations featured a water-blasting technology. Other technologies demonstrated included a vacuum-sanding system (Fort Benning and Fort Stewart) and corn hybrid polymer blasting (Fort Wainwright).

Inherent to these objectives is an understanding that the primary challenge for many Army painting operations is the requirement to maintain a high level of vehicle and equipment throughput. Application methods, ease of operation, and maintenance requirements are other challenges that must be addressed. While these secondary challenges may not be as critical for installations with high throughput requirements, they factor into the overall determination of CARC transition effectiveness and, therefore, must be incorporated into the decisionmaking process for all installations.

Following the demonstrations and consumption of current CARC supplies, all host sites reported the ability to efficiently switch to alternative CARC topcoats. Fort Benning, Fort Stewart, and Fort Wainwright switched to the MIL-DTL-64159, Type II, CARC; while Anniston Army Depot switched to the MIL-DTL-53039C, Type III, CARC. Fort Wainwright also elected to have a quantity of MIL-DTL-53039C, Type III, CARC on hand for jobs requiring a quicker-than-normal turnaround time.

In summary, the NDCEE and USAEC succeeded in their goal of helping four Army installations successfully transition to the use of low VOC/no-HAP CARC topcoats. Installation painters can now apply and remove CARCs with more ease, more accuracy, and less time. Vehicle finish quality has improved, and overspray wastes have decreased. Furthermore, the CARC transition supports installation and Army sustainability goals and objectives targeted toward reducing the use of hazmat, increasing environmental compliance, improving worker safety, and reducing greenhouse gas emissions to improve overall regional air quality.

CARC formulation comparison

Silica-based CARCs	Polymeric bead-based CARCs
• MIL-DTL-64159, Type I ▪ Plural component ▪ WD ▪ Up to 1.8 pounds of VOC per gallon	• MIL-DTL-64159, Type II ▪ Plural component ▪ WD ▪ Up to 1.8 pounds of VOC per gallon
• MIL-DTL-53039C, Types I and II ▪ Single component ▪ Solvent-based ▪ 1.5 pounds of VOC per gallon	• MIL-DTL-53039C, Types III–VI and VIII ▪ Single component ▪ Solvent-based ▪ Under 1.5 pounds of VOC per gallon

CARC demonstration at Fort Wainwright

Endnotes:

[1]The NDCEE, which was established in 1991, conducts research on and demonstrates and supports the fielding of viable, mission-driven solutions that reduce total ownership costs and fulfill environmental, safety, occupational health, and sustainability requirements. It is operated by Concurrent Technologies Corporation (CTC), a nonprofit organization. The Office of the Assistant Secretary of the Army (Installations and Environment) is the executive agent for the NDCEE. For more information, visit *<http://www.ndcee.ctc.com>*.

[2]The USAEC leads and executes environmental programs and provides environmental expertise that enables Army training, operations, acquisition, and sustainable military communities. The USAEC locates and fields new and innovative technologies to help installations complete their environmental missions faster, easier, and more cost efficiently. For more information, visit *<http://aec.army.mil>*.

[3]MIL-DTL-53072C, *Chemical Agent Resistant Coating System Application Procedures and Quality Control Inspection*, 6 June 2003.

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