

Acquisition and Logistics Heavy Metals Working Group: Creating an Army Future Free of Hexavalent Chromium







2023 Secretary of the Army Environmental Awards Environmental Excellence in Weapon System Acquisition

INTRODUCTION

In 2018, the Army created a Heavy Metals Working Group (HMWG) to address long standing life cycle issues related to heavy metals associated with equipment, parts, and repair processes. In January 2021, as a response to specific acquisition hexavalent chromium (Cr6+) issues identified by the Army HMWG, the ASA(ALT) Environmental Support Office (ESO) established an Acquisition and Logistics Heavy Metals Sub-Working Group (HMWG A&L). Since then, this diverse group has come together to resolve a wide range of Cr6+ problems plaguing the Army, many for over 20 years. The team even went beyond the original charter with many additional short- and long-term Cr6+ reduction projects. This package highlights the health, safety, and cost issues with Cr6+ and all the exceptional work done by the HMWG A&L team to make a greener, safer Army.

HMWG A&L Team Makeup	
ASA(ALT)/ASA(IE&E)	PEO Aviation
HQDA DCS G-4	PEO Ground Combat System (GCS)
AMCOM G-4	HQ DEVCOM Safer Alternatives for Readiness (SAFR) Program
Defense Logistics Agency (DLA)	DEVCOM Ground Vehicle System Center (GVSC)
Corpus Christi Army Depot (CCAD)	DEVCOM Army Research Lab (ARL)
MEDCOM Army Public Health Command (APHC)/Defense Health Agency (DHA)	DEVCOM U.S. Combat Capabilities Development Center (CCDC) Aviation and Missile Center (AvMC)

Judging Criteria

	Program Management		Technical Merit		Orientation to Mission
	Stakeholder Interaction		Transferability		Impact and Outcomes

BACKGROUND

Industry, Department of Defense (DoD), and the United States Army have a history of incorporating Cr6+ into weapon systems and associated repair processes due to its excellent corrosion resistance properties. Extensive research has identified Cr6+ as an excellent corrosion inhibitor that increased the life expectancy of the platforms under the harshest environmental conditions. In particular, paints, primers, sealants, and fasteners were impregnated or coated with Cr6+ and other heavy metals to enhance the corrosion prevention properties of the products in order to protect the system substrates from deterioration as a result of corrosion. It worked very well in this application and has extended the serviceability of many platforms beyond the original life expectancy. Therefore, many of the legacy weapon systems in the Army inventory designed in the 1960s and 1970s still contain Cr6+ and due to the complex and costly nature of finding suitable alternatives, new weapon systems have continued to incorporate Cr6+ into their design.



Vehicle chassis
with corrosion

The challenges associated with the long-term use of Cr6+ center around the toxicity of the substance to humans and the environment. Cr6+ is a known human carcinogen and can cause numerous cancers if not properly handled, managed, and controlled. Its utilization, management, and disposal are closely watched by regulatory agencies such as the Environmental Protective Agency (EPA) and the Occupational Safety and Health Administration (OSHA). Failure to adhere to the proper protocols for the management and control of Cr6+ can have severe consequences both in terms of human health and fiscal liability. Workers exposed to Cr6+ can develop serious diseases and illness and organizations that fail to protect their workforce and the environment can face penalties for negligence and remediation requirements. Willful disregard of the requirements can result in fines of over \$80,000 per day and facility clean-up can cost hundreds of thousands of dollars that must come from operational funding. For example, hangar decontamination from floor level to just 15 feet above the floor, not including any rafters or high-level structures, cost Fort Drum, NY \$250,000. At Corpus Christi Army Depot (CCAD), process control and mitigation equipment such as personal protective equipment (PPE), grinders with vacuums, HEPA vacuums, and needle scalers exceeded \$1.78 million (M), and installation of compressor systems & follow-on air sampling exceeded \$1.42M for a total of more than \$3.2M.



Guidelines for worker safety are disseminated by both OSHA and the American Conference of Governmental Industrial Hygienists (ACGIH). Over time the exposure guidelines for safe working environments have been drastically reduced as more is learned about the toxicity of Cr6+. Workers subjected to Cr6+ exposure are enrolled in expensive medical surveillance programs based on these guidelines. In 2006, OSHA changed the Occupation Safety and Health Permissible Inhalation Exposure Limit from 52 to 5 ug/m³. Then, in 2018, ACGIH reduced their recommended Airborne Occupational Exposure Limit to 0.2 ug/m³. This continuous downward trend in exposure limitations amplifies the need to find suitable replacements for Cr6+ that will meet performance specifications yet be less toxic to workers and the environment.

HMWG A&L CHARTER and TEAM ACCOMPLISHMENTS

The HMWG A&L was extremely driven to make progress on their six charter tasks to help reduce Cr6+ usage and exposure to Army civilians and soldiers. The team worked tirelessly, often meeting bi-weekly to review progress and coordinate with outside subject matter experts, Installations, and Defense Logistics Agency (DLA) to ensure all possible solutions were investigated. In addition, many members of the team as well as invited guests provided information sharing presentations on research and development efforts, DLA processes, and contracting mechanisms that allow DoD organizations to partner with industry.



The following outlines the HMWG A&L's successes and struggles with the six charter tasks.

1

The first charter task was to review two level maintenance policies to expand the definition of field level to include damage repair and corrosion preservation maintenance. This included a goal of revising Army Regulation (AR) 750-1 to require special coding of components in the supply system that have Cr6+ paints and primers or that contain Cr6+. To address this issue, DCS G-4 team members spearheaded the update of AR 750-1, Army Material Maintenance Policy, to expand the definition of field level maintenance to include damage repair and corrosion prevention to ensure Cr6+ and other heavy metals policies are applicable to all maintenance activities from depot to field level. Currently AR 750-1 is in the final stages of approval prior to publication. In addition, G-4 Maintenance Directorate (DA G-44) transferred guidance for painting systems at the field level to applicable DA Pamphlets (PAMs). These efforts ensure potential Cr6+ worker exposure is clearly documented throughout the depot repair process.



2

The second charter task was to open a Federal Acquisition Regulation (FAR) case to revise the Defense Federal Acquisition Regulation Supplement (DFARS) Subpart 223.73, "Minimizing the Use of Materials Containing Hexavalent Chromium," to incorporate current policies and remove/clarify references to use in legacy systems. The effort emphasizes the prodigious goals of this team to try to not only reduce Cr6+ usage within the Army, but also affect policies throughout the DoD. Although there was concerted effort to make this happen, the Office of the Secretary of Defense (OSD) ultimately elected not to support this request based on input from other Services. Although the team did not achieve this goal, it was value added to bring this issue to the entire DoD to start a Cr6+ elimination conversation.



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3

The third task was to review current Army acquisition policies and create new policy to reduce and/or eliminate the use of Cr6+ in weapon systems. The team accomplished this through the creation of the Elimination of Hexavalent Chromium in Army Acquisition and Sustainment policy, signed by the Assistant Secretary of the Army for Acquisition, Logistics, and Technology (ASA(ALT)) in March of 2022. This policy leads the way for a methodical Cr6+ elimination process in new system acquisition and system modifications. Because it is expected that not all parts will have a qualified alternative by the elimination dates, the policy has a structured waiver application process. All waivers must be coordinated through Life Cycle Management Command (LCMC) before being routed for approval through the appropriate acquisition offices for sustainment community awareness. This was done to ensure sustainment processes with Cr6+ continue to keep environmental compliance and health protection procedures in place to protect field and depot soldiers and civilians.

The policy team then developed a waiver tracking library for Cr6+ waivers in the Department of Defense Environmental, Safety, and Occupational Health Network and Information (DENIX) system. DENIX provides definitive tracking of remaining Cr6+ usage within Army systems until qualified alternatives are identified. This tracking can help target and justify any necessary research and development funding as well as any safety, occupational health, and environmental controls. The DENIX library also offers the benefit of having security settings to restrict documents with CUI to only approved users but can also be shared with approved personnel across DoD for collaborative benefits.

Although it will take some time for full implementation, the policy memo and elimination dates will eventually save the Army millions of dollars in future sustainment costs through cost avoidance. Savings include worker safety engineering controls, protective equipment, occupational health monitoring, special facilities for daily worker decontamination, hazardous waste disposal costs, environmental permitting, possible fines, and periodic site cleaning to remove heavy metal dust.

Cr6+ Elimination Item/Process	Elimination Date
Paint primers	30 Sep 23
Surface pretreatments (conversion coatings & wash primers)	30 Sep 24
Coatings, plating, and post treatments/sealers on ground system fasteners	30 Sep 24
Electrical connector mating surfaces	30 Sep 26
Adhesives, sealants, and other specialty coatings	30 Sep 28
All other plating, anodizing, and post treatments/sealers	30 Sep 30
Missile thermal batteries and igniters	30 Sep 30



4

Task four was to ensure system and spare parts have unique national stock number (NSN) designations for non-heavy metal and heavy metal-containing items. DCS G-4 in coordination with Tank-automotive and Armaments Command (TACOM) reviewed technical manuals and updated Tech Manual 43-0242 to support this task. DLA team members took a deep dive into Federal Logistics Information System (FLIS) data and educated the group

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on a way to mark all new NSN requests with a “QD” Environmental Attribute Code (ENAC) which will ensure NSNs have appropriate, searchable data to identify Cr6+ within an NSN. In addition, DLA team members found that each Service can request specialized wording be added in the NSN description to further document Cr6+ or Cr6+-free component characteristics. Although the team made good strides to address this issue, the task has more opportunity for continued improvement.

5

The fifth task was to ensure Cr6+ and Cr6+-free products with the same military specifications do not share the same NSN. An NSN in and of itself does not discriminate between chromated and non-chromated parts. Because installations order products through DLA using NSNs, NSNs that include both Cr6+ and Cr6+-free products prevent installations from being able to order only Cr6+-free products. AMCOM and DEVCOM team members identified NSNs that included both Cr6+ and Cr6+-free products and then worked closely with DLA personnel to create separate NSNs for Cr6+-free products. Team members also worked to create procedures to ensure future Cr6+-free, qualified products would be given a separate NSN to ensure green products could be easily ordered at the installation level.

6

The final task was to support research to identify alternatives to heavy metal containing items such as coatings, adhesives, primer, and pre-treatment, and share successes and setbacks across the Army. As discussed, Cr6+ use during system acquisition affects the entire life cycle of a weapon system. The following are examples of some of the recent outstanding program management, investigation, research and development (R&D), and product qualification efforts being made to reduce Cr6+ usage on existing weapon systems. These efforts will support Cr6+ reduction on future Army platforms.

➤ US Army Combat Capabilities Development Command (DEVCOM) Ground Vehicle Systems Center (GVSC) is combining forces with Program Executive Office (PEO) Combat Support and Combat Support Services (CS&CSS) to put strong acquisition practices in place to implement the “Elimination of Cr6+ in Army Acquisition and Sustainment” policy. PEO Ground Combat Systems (GCS) is also implementing this policy and setting goals to execute elimination dates ahead of schedule. This stricter enforcement of Cr6+ prohibitions is forcing contractors to use qualified greener, safer alternatives during system design.

➤ GVSC and Aviation and Missile Center (AvMC) have identified a Cr6+-free wash primer that has completely replaced Cr6+ primers at ANAD and Red River Army Depot (RRAD). Replacement of the Cr6+ primers is currently ongoing at Letterkenny Army Depot (LEAD).

➤ PEO GCS has identified Cr6+-free plating solutions and worked to update multiple Military Standards (MS), National Aerospace Standards (NAS), and Society of Automotive Engineers (SAE) specifications to accommodate new MIL-PRF-32647 zinc-nickel (ZiNi) plating specification. This is another effort that will set up future acquisition and material replacement for success to provide safer coatings for soldiers and civilians and a product that is better for the environment.

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- PEO GCS Abatement Team, in coordination with BAE Systems conducted successful research and validation testing in coordination with Yuma Proving Ground and five major installations was conducted on ZINi fasteners. These will replace current ground system fasteners containing Cr6+. To date, they have conducted comparison testing



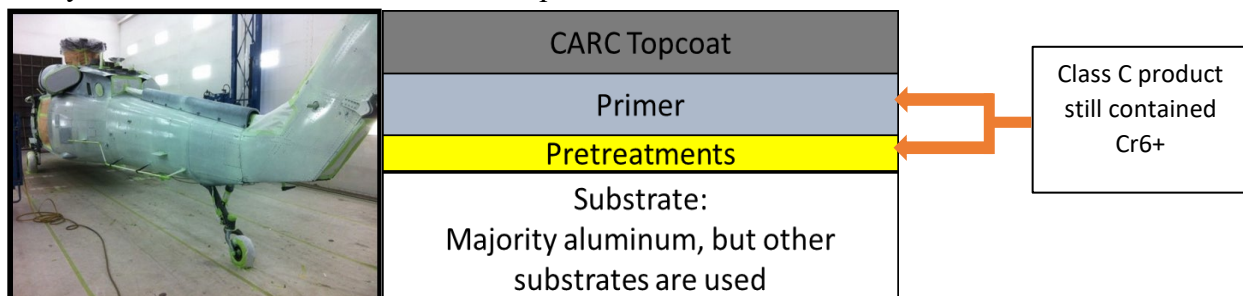
between 1300 Cr6+ and ZINi fasteners such as Grade 8 Cap screws, hardened washers, and locking nuts using live fire testing and driving equipment over 1,000 miles on Yuma courses. With the exception of one fastener, torque testing found no rotation/ loosening. Testing is underway for cracking, stretching, and hardness.

DEVCOM Safer Alternatives for Readiness (SAFR) program has funded numerous projects to develop and demonstrate alternatives to Cr6+ in dozens of applications through its comprehensive research, development, test and evaluation (RDTE) program for Toxic Metal Reduction (TMR). This includes alternatives to wash primer, aluminum anodizing, conversion coatings, hard chrome plating, sealers, cadmium plating, copper/silver plating, chemical stripping and magnesium anodizing. SAFR has multiple sealers projects for hard anodize, Ion Vapor Deposition (IVD) Aluminum, zinc plating, black oxide and zinc magnesium phosphate. Demonstrations are being done in coordination with Corpus Christi Army Depot (CCAD) and Anniston Army Depot (ANAD).

- SAFR is also doing extensive research to identify Cr6+-free electrical connectors and circuit board options that will work when connected to exiting systems. Identifying an alternative finish for electrical connectors has lagged behind fasteners due to corrosion issues that arise when connecting dissimilar metals between new and legacy parts and systems.



- Aviation and Missile Command (AMCOM) team members worked with installations to identify, test, and qualify Cr6+-free alternatives for MIL-PRF-23377 and MIL-PRF-85582 primers, working through initial ordering roadblocks and then publishing Aviation Maintenance Action Message (AMAM) GEN-21-AMAM-06. This now creates a primer system free of heavy metals, providing a safer process for soldiers and civilians that conduct repairs as well as reducing environmental contamination. AMCOM is now taking this a step further, by implementing a Cr6+-free pretreatment which will render the entire coating system on aviation airframes and components free of Cr6+.



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- AMCOM continues to conduct testing and implementation of processes at CCAD to remove Cr6+. For example, AMCOM identified available MIL-PRF-81733 and AMS-S-8802 Cr6+-free sealants already available and have mandated these through an AMAM for a quick win. Cr6+-free stainless-steel passivation, Class N primers, sealers for black oxide and Tagnite (Cr6+ free pretreatment for magnesium) have all been implemented. Demonstrations for IVD aluminum post treatment



sealers and Cr6+ stripping for copper plating are in work.

Laboratory testing for Cr6+ free aluminum anodizing, hard chrome plating and cadmium with post treatment Cr6+ sealers are ongoing. Another effort in the sealants arena is a project to implement a Cr6+- free version of Cho-Shield, a Cr6+-free conductive coating.



Zirconium Pretreatment
Replaces Chromated
Conversion Coatings
(immersion and spray-on)

IN CLOSING

Since early 2021 this diverse Working Group, made up of exceptional members of the Acquisition, Logistics, and Sustainment communities, came together to create targeted policies and implement projects that are directly supporting the reduction of hexavalent chromium (Cr6+) in weapon system life cycles. These efforts are improving the safety to our civilian artisans and soldiers, the environment, and long-term mission success. Examples of this included updating the AR-750-1 Army Material Maintenance Policy, creating of an Elimination of Cr6+ in Army Acquisition and Sustainment Policy, publishing maintenance memorandums that prohibit Cr6+ paints and primers on most aviation platforms, PEO GCS and PEO CS&CSS working to implement the “Elimination of Cr6+ in Army Acquisition and Sustainment” policy, and astounding research and development efforts that continue to find and implement qualified, safer chemicals and processes.

These efforts have resulted in an immediate reduction of Army civilian and soldier exposure to Cr6+ at depot and field level repair, as well as set the stage for full elimination of Cr6+ in all Army weapon systems in the future. These efforts are not only exceptional because of the reduced exposure and cancer risk to our civilians and soldiers performing repair work on systems, but also because it is a start to reduction and elimination of all heavy metals which will improve efficiency and reduce costs.

This team’s accomplishments and planning have laid the groundwork for Cr6+ elimination plans, policies, and processes that have been unattainable for over 20 years. While complete removal of Cr6+ from our Army weapon systems and spares will still take many years, these efforts and achievements have been instrumental in taking the first step to a greener, safer, and more resilient Army.