Hexavalent Chromium Reduction in the Army: Success Stories and the Path Forward

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Toxic Metals Reduction in Surface Finishing on Army Weapon Systems

- Army Environmental Requirements and Technology Assessments (AERTA) PP-2-02-03
- Reduce use of carcinogenic substances in metal plating, including
  - Hexavalent chromium (Cr(VI))
  - Cadmium (Cd)
  - Beryllium and its alloys
- Currently #2 overall Army environmental requirement
- Pollution Prevention Technology Team (P2TT) built Toxic Metal Reduction (TMR) Program to address AERTA
- TMR funded via Army Environmental Quality Technology (EQT) Program and additional leveraged programs
Initiated TMR Program & Technology Survey

PEO Close Combat Systems Endorsement

P2TT Approves TMR

TMR Briefed to EQT Leadership

TMR Submitted to POM FY12-17

PEO Combat Support and Combat Service Support Endorsement

TMR Briefed to Weapon System Review

Initiate seed project funding

TMR Phase I

TMR Phase II

TMR Program Timeline
Toxic Metal Reductions in Surface Finishing

**Phase I:**

**Funding:** BA2-BA4, BA6  
**Timeframe:** FY08-17  
**Thrust Areas:**  
- Alternatives to Cr(VI) in Metal Plating  
- Cr(VI) Reduction in Pretreatment and Surface Finishing  
- Alternatives to Cd in Plating and Finishing

**Phase II:**

**Funding:** BA2-BA3  
**Timeframe:** FY15-17+  
**Thrust Areas:**  
- All other Cr(VI) and Cd-based processes that require further R&D  
- Beryllium  
- Other toxic metals
TMR Phase I Overview

- **Scope of Program**
  - All major Army industrial installations use Cr(VI) and/or Cd in production & maintenance processes and field maintenance / touch-up operations
    - Plating
    - Conversion Coatings
    - Stripping
  - PMs specify these materials due to lack of validated alternatives on many systems
    - Ground vehicle systems
    - Communications
    - Support equipment
    - Anodizing
    - Sealing
    - Wash Primer
    - Aviation
    - Armaments
    - Electronics

- **Objectives**
  - Develop & field technologies to reduce
    - Cr(VI) used in electroplating by 75%
    - Cd used with Cr(VI) finishes by 75%
    - Cr(VI) in pretreatments and surface finishes by 100%
  - Meet or exceed all operational performance requirements

ESOH costs (per depot): $2M+/yr
Transition all technologies to users at Technology Readiness Level 7 (prototype demo) and some at TRL 8 (full system demo)
Objectives:
- Eliminate Cr(VI) in manufacture of medium caliber bore coatings
- Extend medium caliber gun barrel life

Technical Approach:
- Benet Laboratories explosively cladding tantalum-tungsten (Ta-W) alloy coatings on the bore

Successes:
- Test fired Ta-W clad barrel side-by-side with current Cr(VI) barrel with 3x increase in barrel life

Follow-On:
- Transition to Army MANTECH Program
- Leverage technology in large caliber systems
Objective:
- Eliminate Cr(VI) strippers for inorganic surface finishes during the overhaul & repair of Army Aviation assets

Technical Approach:
- Test COTS solutions on highest use processes and substrates at Corpus Christi Army Depot (CCAD)

Successes:
- Developed baseline data for Cr(VI)-based strippers to establish Army Aviation requirements for IGA/EGP and Weight Loss

Follow-On:
- Conduct IGA/EGP and Weight Loss tests for alternative processes
Additional EQT Efforts to Reduce Cr(VI)

Sustainable Painting Operations for the Total Army (SPOTA)

- Handheld Laser Depainting for Aviation
- Non-Chromate Conversion Coating for Zinc-Plated Steel
- Flashjet Depainting for Rotor Blades
- HAP-Free, Non-Cr(VI) Wash Primer
- Ordnance Environmental Program
  - Perchlorate- and Cr(VI)-Free Delays for Handheld Signals
2003: Initiated by AMCOM G-4 with NAVAIR and ARL

2005: Demo CH-47 coated by 1109th Aviation Classification Repair Activity Depot (AVCRAD) in Groton
- Expanded use to CH-47, UH-60, OH-58, AH-64, UH-1
- No significant difference between the Cr(VI)-free and standard coating systems

2010: 1108th AVCRAD transitioned to the MIL-PRF 85582 Class N primers and working towards implementation of the MIL-DTL-81706 Type II conversion coatings

2011 & Beyond:
- AMCOM G-4 coordinating with Ft. Rucker and CCAD to implement the Cr(VI)-free technologies coating system
- G-4 coordinating with 1107th AVCRAD, Springfield, MO and 1106th AVCRAD, Fresno, CA to begin implementation of the new coating system
Non-EQT Army Efforts
Past Success: Aviation Cr(VI) Free Conversion Coatings and Epoxy Primers

Conversion Coating Application

Conversion Coat Completed
Pre-primer Application

CARC Top-coat Applied – Stencil Application In-progress

Aircraft Primed
Cr(VI) Free Coatings for Missile Weapon Systems
- Demonstrate use of a total Cr(VI)-free coating system on missile weapon systems/support equipment assemblies (mixed metal) with NAVAIR & ARL

Tagnite Coated Magnesium Components
- Dem/Val of processing Tagnite coated magnesium housings (NDCEE)
- Nondestructive Inspection (NDI) testing of magnesium transmission housings for aviation systems (AMRDEC and NDI Center of Excellence)
- Cr(VI) free coating system for magnesium housings on aircraft (AMRDEC)
Defense Federal Acquisition Regulation Supplement (DFARS); Minimizing Use of Hexavalent Chromium

- Proposed DFARS clause published in FR 8 April 2010
- Comments from industry incorporated into public draft
- Army drafted Army Acquisition Policy – Awaiting final DFARS Clause

Army Goals for Toxic Chemical Reduction

- 1 Mar 10 Memo outlines Army Hazardous Material Management Plan to reduce Army use of three chemicals
- Includes Cr(VI) containing epoxy primers – used primarily in aviation corrosion control
- Goal: 9% reduction from 2010-2013 (base year CY2007)
Questions?

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