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

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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

2005

PEO Close Combat Systems Endorsement

2006

P2TT Approves TMR

2007

TMR Briefed to EQT Leadership

2008

TMR Submitted to POM FY12-17

2009

PEO Combat Support and Combat Service Support Endorsement

2010

TMR Briefed to Weapon System Review

2011

Initiate seed project funding

TMR Phase I

2012

TMR Phase II

2017
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
**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
TMR Phase I Project Break-Out

TMR Technology Demonstration/Validation Efforts

Proposed Funding Allocation

- Alternatives to Cr(VI) Metal Plating
- Alternatives to Cd in Plating and Finishing
- Cr(VI)-Free Pretreatments, Finishes and Conversion Coatings

Transition all technologies to users at Technology Readiness Level 7 (prototype demo) and some at TRL 8 (full system demo)
TMR Funded Project: Cr(VI) Elimination in Medium Caliber Guns

- **Objectives:**
  - Eliminate of 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
- Flashjet Depainting for Rotor Blades
- HAP-Free, Non-Cr(VI) Wash Primer
- Non-Chromate Conversion Coating for Zinc-Plated Steel

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
**AMCOM Ongoing Projects**

- **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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