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AFLCMC
Cd and Cr Replacement/ Elimination Strategy

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AFLCMC/EZP
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Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18
Product Support Engineering

• AFLCMC/EZP: Established to support enterprise efforts to reduce product support costs and improve readiness
  – Cd/Cr is an enterprise issue; to maximize limited resources enterprise approach is required

• Collaborates closely with:
  – CTIO & AFCPO - AFRL
  – ESOH Leads - AFNWC
  – Corrosion Managers - AFSPC
  – Chief Engineers - Lead Commands
  – Depot Community - Other Services (Army, Navy)

• Follows Airworthiness Process for Deploying New or Substitute Materials, Processes, and Product Forms
In Nov 2012, SECAF directed the AF to find innovative solutions to controlling cost without endangering readiness.

OSHA requires “clean as practical” approach to exposure mitigation.
- $67 Mil spent to date on Depot abatement techniques
- Additional Man Hours, Process Time and Training to implement mitigation

Depots contract out Cd plating work.
- Contracting Plating results in extra cost
- Results in impact to 50/50
• Take an enterprise approach to elimination of Cd/Cr on Weapon Systems
• Gain PEO/Program Office buy-in to implement qualified products
• Use Airworthiness (AW) Process for implementation qualified alternative products
• **Purpose**
  - Formalize process for M&P changes is needed for aircraft applications

• **Why to use it**
  - Many new M&P changes are cross-cutting and present unique challenges that must be characterized for the intended service environment, usage, and duration
  - Approval or disapproval should be documented by the appropriate authority, recognized by all AFMC and DLA personnel as a minimum, and implemented in each application

• **Benefits**
  - Ensure M&P changes are fully qualified prior to implementation
  - Encourage implementation of M&P changes when business case is favorable
Notional Framework for Non-Chrome Deployment

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<td>Primer on support equipment and infrastructure</td>
<td>Visible and repairable</td>
<td>Larger source of worker CrVI exposure</td>
<td>Larger source of installation ESOH costs</td>
<td>Green</td>
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<td>Aircraft Outer Mold Line (OML) Primer</td>
<td>Sometimes repairable</td>
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<td>Bare metal surface treatments/Conversion Coatings/&quot;Sealers&quot;</td>
<td>improve performance of outer mold line replacement</td>
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<td>Adhesive bonding primers</td>
<td>Hidden, difficult to inspect or access</td>
<td>Known life cycle structural integrity risk</td>
<td>Limited or no expected worker exposure</td>
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<td>Internal Structural primer</td>
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<td>Known life cycle mishap risk</td>
<td>Limited or no installation ESOH costs</td>
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<td>Fuel tank primers, coatings, and sealants</td>
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Near-term Focus Areas for Implementation:
- Primer on support equipment and infrastructure
- Aircraft Outer Mold Line (OML) Primer
- Bare metal surface treatments/Conversion Coatings/"Sealers"

Some alternatives require more frequent inspection and application.

Sealants

Sealants

Longer-Term Areas
- Adhesive bonding primers
- Internal Structural primer
- Fuel tank primers, coatings, and sealants

Higher life cycle probability of loss of aircraft or of availability.

Example Cad-CrVI Applications
- Life Cycle Corrosion
- Life Cycle Mishap
- DoD Worker Exposure Risk if CrVI Used
- ESOH Life Cycle Cost
- Corrosion Prevention Performance
- Technical Maturity Risk
- Life Cycle Cost
Current chrome alternatives available for near-term Outer Mold Line (OML) implementation
- Update MIL-PRF-32239 to capture top performing systems on QPL
- Document coating application/integration process for non-chrome systems to include repair and characterization
- Implementation strategy critical for success and risk reduction

Current Field Evaluations
- F-16, C-130, HH-60, Ground Support Equipment, ICBM Missile trailers

FY15 Sensors
- Accelerated Corrosion Testing Protocols
- Evaluation of other non-chrome coatings
Cd Elimination Efforts

Components
- LHE Zn-Ni for LG at Hill AFB approved on all organic WS
- Zn-Ni for brush plating repair (on-going ESTCP)

Fasteners
- Zn-Ni for LSS (completed)
- Zn-Ni for HSS (on-going SBIR Phase III)

Connectors
- SEED SERDP
EZP Cd Elimination Current Projects

• Cd-free Alternatives for Brush Plating Repair Operations / Dalistick Project
  – Test and evaluate COTS Zinidal (Zn-Ni) brush plated coating on HSS and LSS for repair applications on WS parts and components
  – Demonstrate COTS brush plating tool Dalistick ™ Station for selective plating, ensuring the safety and cost effectiveness of the novel brush plating technology

• Cd replacement on Low and High Strength Steel Fasteners
  – Validate and qualify LHE Zn-Ni coating with non-hex Cr conversion coating for applications on HSS and LSS threaded and unthreaded fasteners
Brush Repair - Dalistick Station

- Practical and environment-friendly solution for brush plating technology
- Zinidal Zn-Ni as Cd replacement
- Recovers brush plating electrolyte at the point of contact and recycles it for reuse in a closed-loop process:
  - solution life/use is extended
  - hazardous solid waste is reduced

Can be used for coating/rust removal, activation, and deposition of thin metallic layers on curved, horizontal or vertical surfaces and edges either in the field or at Depots
Cd Alternatives Strategy: Fasteners

• Enterprise focus on outer mold line fasteners
  – Approved aerospace alternatives exist (F-35, KC-46)

• Utilizing supply chain management approach to quickly implement alternatives
  – Thousands of TOs, drawings, and specs call out Cd
  – AFSC/LG mining FLIS for Cd fastener data

• Working with AFSC/AFLCMC/DLA for approval process for alternative NSNs for fasteners
  – Cd NSN would be linked to approved alternative to ensure Cd fasteners no longer purchased
  – Working with Joint Group on Environmental Attributes team for DoD solution
Future Projects Through WS-STEP and Enterprise Approach

- Cr-free conversion coating (dip-tank process)
- Non-Cr fuel tank coating
- High-flexibility non-Cr primer
- Complete Cr-free coating system for LHE Zn-Ni and Cr-free anodize seals
- Non-Cr coating systems field evaluations
- Implementation of Non-Cr surface adhesion promoter (PreKote™)
- Cr-free alternatives for OML additional testing:
  - Process compatibility testing
  - Material compatibility testing
  - Weapon system requirements testing
- Planned evaluations:
  - Field testing on multiple WS (C-5, A-10, KC-135, B-1, E-3)
Summary

• Primary focus has been on Cr alternative for OML application due to Risk Assessment

• Secondary focus is on Cd alternatives for fasteners and repair operations

• Developed Cr/Cd elimination strategy linked with Airworthiness Process and Enterprise Approach for deployment of qualified alternatives