Aeronautical Systems Center

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U.S. AIR FORCE

Hexavalent Chromium Substitution Projects

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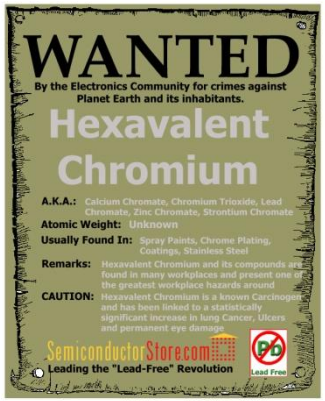
Overview of Presentation

- Background
- Scope of WNV Efforts
- Current and Past Projects
- Pending Projects
- Lessons Learned
- Recommendations/Conclusions

Background

- **RoHS – EU regulations on electronics products (MCV 0.1%)**
- **REACH – EU legislation is imposing restrictions on Cr^{6+} use**
- **OSHA PEL reduction to 5 µg/m^3 (Feb 2006)**
- **Aerospace Industry Exemption to 25 µg/m^3**

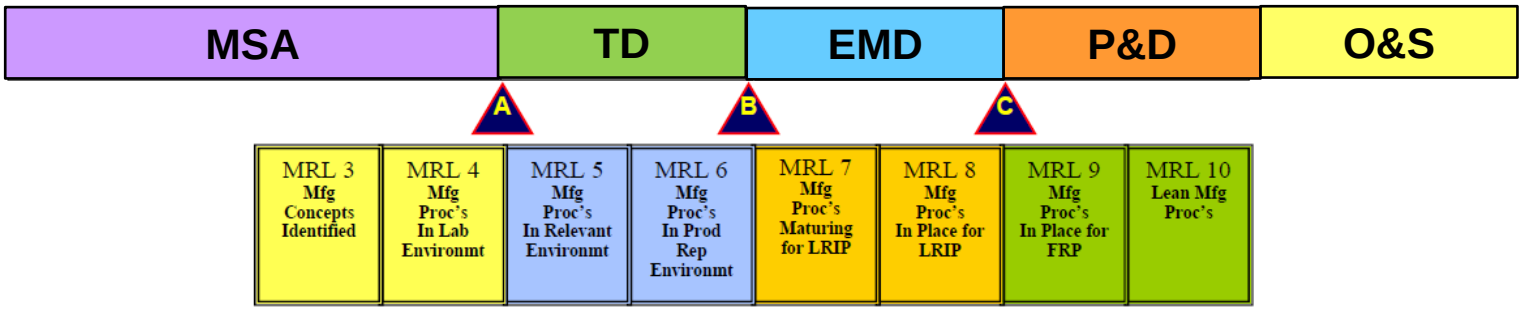


USD(AT&L) Memorandum

- **Cr^{6+} has international restrictions, which will increase LCC & decrease Cr^{6+} availability**
- **Approve the use of alternatives when they perform adequately**
- **Document Cr^{6+} risks & alternative efforts in PESHE**
- **PEO will certify Cr^{6+} on new systems & legacy system modifications/updated maintenance procedures if no alt. exists**

PEO Certification Details

- Cost effectiveness of alternatives vs. Cr^{6+}
- Technical feasibility of alternatives
- ESOH Risk of alternatives vs. Cr^{6+}
- MRL of at least 8 for alternatives
- Materiel availability of alternatives vs. Cr^{6+}
- Corrosion performance differences as defined by service SMEs (AFCPCO & CTIO)



AF Policy

- **AFI 63-101 "*Acquisition Sustainment Lifecycle Management*" Paragraphs 3.49.8 and 3.68.3**
- **Paragraph 3.49.8 Incorporate in PESHE, the following:**
  - **ID system specific applications of Cr^{6+}**
  - **Include Cr^{6+} associated use risk**
  - **Document efforts to quantify less toxic alternatives**
  - **Status of PEO or ALC/CC approval for cont'd Cr^{6+} use**
  - **AOA should address cost/schedule risk and LC Cost**
    - » **Including material handling and disposal costs**
    - » **Any increase in system overhaul due to diminished corrosion protection**

AFI 63-101 Paragraph 3.68.3

- **PM shall incorporate DOD ban on Cr^{6+} in long term corrosion planning (Applies to all ACATs or Life Cycle Phases)**
- **PM shall obtain PEO or ALC/CC approval for all new or continued uses of Cr^{6+}**
- **PM will acquire AF CCPE concurrence prior to PEO or ALC/CC approval**

AFI 63-101 Paragraph 3.68.3 Cont'd

- **To enable PEO or ALC/CC cert., PM must demonstrate the following:**
  - **Cont'd Cr^{6+} availability for period of approval**
  - **One or more of the following:**
    - **Unacceptable LCC cost using the alternative(s)**
    - **Alternative(s) are technically not feasible**
    - **Serious or High ESOH Risk as defined by MIL-STD 882D for the alternative(s)**
    - **MRL of 7 or less for alternative(s)**
    - **Lack of assured availability of the alternative(s)**
    - **Unacceptable corrosion performance**

DFAR Clause

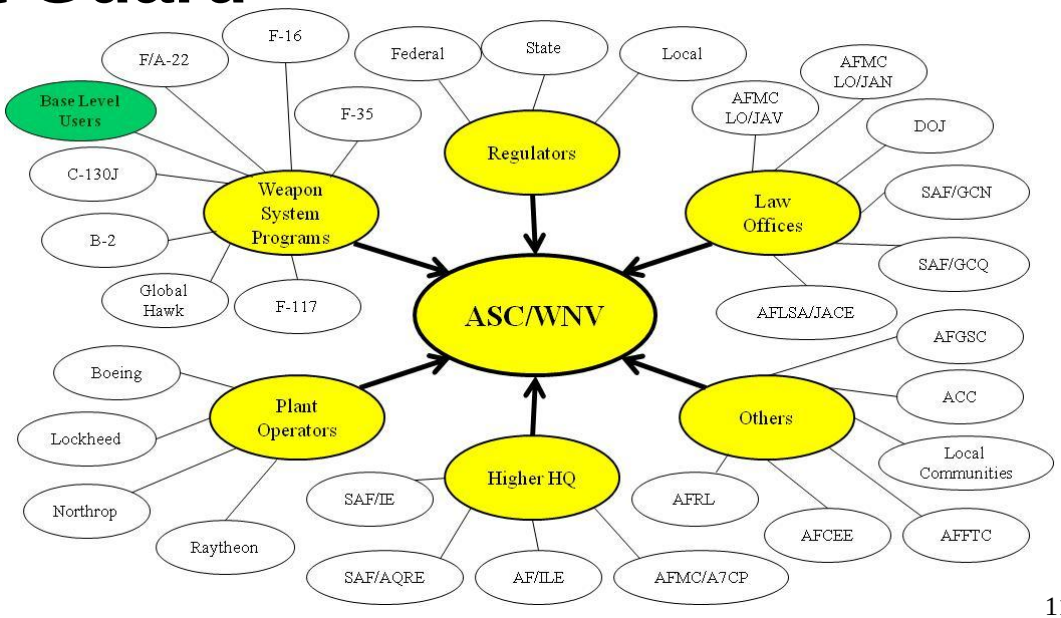
- **DFAR 252.223.7300 - 252.223.7306 (5 May 11)**
  - **Actual contract clause is 252.223.7308**
- **Exception for Legacy Systems**
  - **Any program which is past Milestone A (as of 5May11)**
  - **Does not apply to upgrades/modifications to the legacy system past Milestone A**
- **Exception for critical defense applications assuming no realistic substitute can be found**
  - **Not cost effective or technical feasible**
  - **ESOH risks associated with use of alternative**
  - **MRL of < 8**
  - **Alternative not available over the life of the program**
  - **Poor corrosion performance**
  - **Exception approved by PEO**

Scope of WNV Cr^{6+} Efforts

- **3010/3020 Funding – directly support the production of aircraft and missiles**
  - **Qualification and Validation of COTS**
- **Our Cr^{6+} efforts are on:**
  - **Corrosion Control of aircraft surfaces (Pretreatments, Primers and Coatings)**
  - **Corrosion Control of fasteners**
  - **Fuel tanks**
  - **Sealants**

Other Cr^{6+} Alternatives Efforts

- AFRL/RXSSO (CTIO)
- ALCs and AFCPCO, Robins AFB
- PEWG, Tinker AFB
- Other services such as NAVAIR, Army Aviation and Coast Guard
- Industry
- Academia



Status of Cr^{6+} on Some of the USAF Legacy Systems

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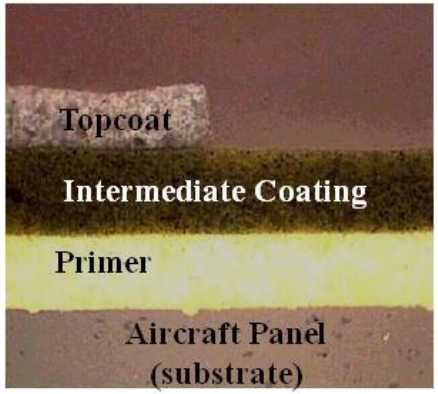
- **Non-Cr Surface Treatments and Non-Cr Primer**
  - **AETC (T-38)**
  - **WR-ALC (F-15)**
  - **ACC (F-16) Plan Mg Rich Primer & Non-Cr pre-treatment**
  - **F-35**
- **Non-Cr Surface Treatment (Prekote) and Cr Primer**
  - **OO-ALC (C-130, F-16, A-10)**
  - **AETC (T-6, T-38 and T1A)**
- **Both Cr Primers & Non-Cr primers as well as Cr Surface Treatment**
  - **F-22**

Non-Chrome Tie-coat
& touch-up primer

Current and Past WNV Cr^{6+} Efforts

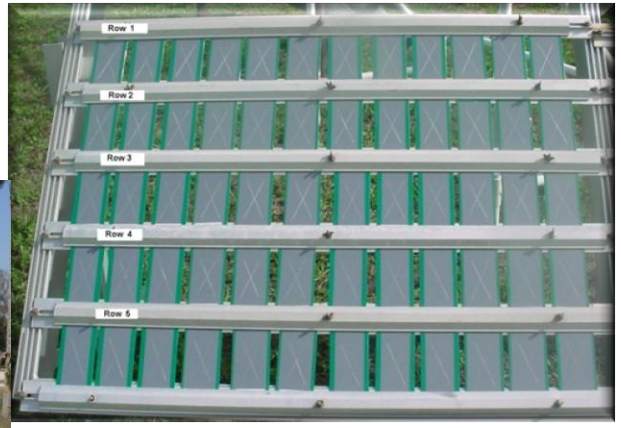
- Low-Cr Conversion Coating and NC Primer for C-130J OML
- Non-chrome primer – C130J IML
- Mg-Rich Treatment
- Non-chrome, Low VOC Fuel Tank Coating (Mil Spec AMS-C-27725)
- ~~Barrier coat for F-35~~



Barrier coat encapsulates chrome primer
Chrome primer application on F-16

More WNV Cr^{6+} Projects

- Non-chrome conversion coating (Touch-up)
- Non-chrome conversion coating (Immersion)
- Total Non-chrome stack-up C-130J OML
- TCP Alternative for Anodized Seal
- Non-Threaded Dry Fastener for wet sealant Corrosion Protection
- ~~Next Gen Mg-Rich Treatment~~



Test Panels at FMRF
Static A/C (F-106) at FANG

Lessons Learned

- **Projects based on P2 needs from GOCO facilities & ASC Program Offices**
- **Projects benefit is on production**
  - **may impacts ACLs**
- **Projects must have environmental compliance (ESOH driver)**
- **Each weapon system requires Dem/Val of the alternative on their system**
- **OEM "process" change required Qual Testing & OEM Spec changes**

Lessons Learned Cont'd

- **Need to insert all Cr^{6+} related projects into DoD ASETSdefense database**
  - **WNVV has provide summaries of Cr^{6+} projects**
- **Depend on AFRL, Academia & Commercial entities to mature technologies (TRL 7)**
  - **Use ASETSdefense for DoD and Commercial applications**
  - **DTIC for DoD-related efforts**

ASETSdefense.org

Recommendations/Conclusions

- **Need to collaborate with others (e.g., AFRL, OEMs and depots) for future projects to avoid duplication of effort**
- **Some Cr^{6+} will be continued to be used:**
  - **Unless the alternatives are equal in corrosion control, have less LCC, are available and have less ESOH risk (as defined by MIL-STD 882D)**
  - **Unless Cr^{6+} becomes no longer available due to increasing international & US regulations**

ASETSdefense Report

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Project Summary

Project Title:	Low-Chrome Conversion Coating and Non-Chrome Primer Finish System Qualification for C-130 OML		
Performing organizations:	77 AESW/EEV		
POC(s):	Gene McKinley		
Phone:	(937) 255-2903		
e-mail:	gene.mckinley@wpafb.af.mil		
Funding organization:	AFMC	**Project #:**	**ACFL04PV15**
Completion:	2009		
Link to project information:			
Purpose:	**Lockheed-Martin qualify reduced chrome finishes on C-130J Outer Mold Line**		
Materials, systems:	24 different stack-ups on exterior of C-130J OML (14 NC and 10 partial or low chrome) vs. chromated control		
Tests:	surface appearance, salt spray, wet tape & cross hatch adhesion, filiform corrosion, Xenon Arc & QUV-B weather resistance, low temp & impact flexibility, humid, heat, solvent & heat		
Alternative to:	Chromate primers	[Click arrow to choose from drop-down list]	[Click arrow to choose from drop-down list]

Notes:

At the request of the USAF corrosion control office, galvanic corrosion testing was conducted as a supplement to the Phase II effort. Galvanic corrosion results were considered in the conclusions and outcome of this project.

Contract Solicitations

Aeronautical Systems Center Guide to
Integrating Environment, Safety, and Occupational Health
Criteria into System Contract Solicitation Documents

Table of Contents

Section 1

1. Purpose and Background

This guide describes certain contract solicitation documents and provides examples and descriptions for program offices that manage system acquisitions to use when developing Environment, Safety, and Occupational Health (ESOH) performance criteria for inclusion in the solicitation documents.

System acquisitions are diverse–large and small dollar value, developmental and commercial derivatives and commercial off-the-shelf, new systems and system modifications–and each one can follow a different business strategy, driving the use of different types of acquisition documents. This is a relatively lengthy guide as it provides a "menu" of examples illustrating ESOH considerations for various types of acquisition documents. The examples provide a starting point and **must be tailored to meet specific program needs**. **If desired, contact ASC/WNVV for support in tailoring these examples for your program!**

Statement of Objectives

- **Engineering Objectives:**
  - **Design a system which:**
    - **Meets the performance requirements specified in …**
    - ***Effectively and efficiently limit and control ESOH hazards for operators and maintainers***
    - ***Does not rely on use of ozone depleting substances or hexavalent chromium***
    - **Has life cycle support costs that …**

System Requirements Document

- **Hazardous Material: Hazardous Materials (HAZMAT) and Ozone Depleting Substances (ODS): (Note: this example is from a commercial derivative system.)**
  - **No new ODS or hexavalent chromium shall be added to the aircraft or delivered in the performance of this contract (THRESHOLD).**

CDRL

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE
C018	HAZARDOUS MATERIALS MANAGEMENT PROGRAM (HMMP) REPORT	

4. AUTHORITY (Data Acquisition Document No.)	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
DI-MISC-81397A/T	2.4.2.3	TBD

7. DD 250 REQ	9. DIST STATEMENT	10. FREQUENCY	12. Date of First Submission
LT	D	BLK16	BLK16
8.APP CODE		11. AS OF DATE	13. Date of Subsequent Submission BLK16
A			

16. REMARKS

Blk 4: This DID is tailored as follows:
a. Contractor format is acceptable.
b. The SYSTEM HMMP will follow the requirements of National Aerospace Standard 411, paragraph 4.4, with, but not limited to, the following specific items included: (1) Identification of the Hazardous Materials either imbedded in the system or used for system Operation & Maintenance (O&M), (2) reasonably expected hazardous waste occurring during O&M and during situations such as emergencies and mishaps, and (3) all listings by specific data element/part number on the aircraft with the quantities used or generated.
c. Information delivered shall include:
1) Identification of the hazardous materials (HAZMAT) imbedded in the system and used and generated during O&M by specific data elements/part number on aircraft and quantities (those used during manufacturing do not apply)
2) Description of the reasonably anticipated hazardous waste(s) generated during normal O&M and emergency/mishap situations.
3) A Material Safety Data Sheet shall be provided for each material included in the hazard tracking system.
d. If Hexavalent Chromium (Cr^{6+}) is planned to be used, or will be required for maintenance operations, provide the following information for each application and alternative:
1) Cost effectiveness of alternative materials or processes over weapon systems life cycle.
2) Technical feasibility of alternative materials or processes.
3) Environment, Safety, and Occupational Health Hazard Risks calculated using MIL-STD-882D process for Cr^{6+} or substitute material uses in each specific location.
4) Achieving a Manufacturing Readiness Level of at least 8 for any qualified alternative.
5) Material availability of Cr^{6+} and the proposed alternate over the projected life cycle of the system.
6) Corrosion performance difference of alternative materials processes compared with Cr^{6+}.

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