Impact Assessment and Road Map for Chromium

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Task Background

- Awarded January 2018
- Kick off meeting February 2018
- Build on and leverage existing SERD / ESTCP Tasks
  - 5-Year Strategy and Road Map
  - Depot level assessments (3)
- Goal
  - Go beyond current SERDP/ESTCP projects
Task Elements and Evaluation Process

- Look at where we are and where we need to be
- Build a roadmap (tool) to get there using different policy options
- Recognize the difficulties to implement the new TWA-TLV and STEL
  - More than just additional supplied air respirators
  - Leverage Services’ assessments
- Some technologies flip paradigm
  - Do not mitigate the chrome, but rather mitigate the performance risks and human exposures
Old and New Drivers for Chrome

- RCRA
- CAA
- CWA
- USD(AL&T) memo “Minimizing the Use of Hexavalent Chromium.”
- RoHS
- REACH
  - Increasing application restrictions
  - Sunset dates
  - Potential work place restrictions

ACGIH

- New TLV-TWA for chrome(III) and chrome(VI)
- New STEL for chrome(VI)

Hex Chrome Removal Navy (2004) FA-18
Hex Chrome as an Emerging Contaminant (EC)

- **2006** Identified as an EC
- **2007** Phase I Impact Assessment
- **2008** Phase II Impact Assessment
- **2009** USD(AL&T) Minimization Memo
- **2009** DFARS Clause
- **2010** Services Report
- **2016** 5-Year Depot Level Strategy
- **2018** Impact Assessment and Roadmap
### ACGIH 2018 Adopted Changes for Chromium

<table>
<thead>
<tr>
<th>Chromium Compound</th>
<th>OSHA* Permissible Exposure Limit, 8-hour Time-Weighted Average (TWA)</th>
<th>Old ACGIH TLV,** 8-hour TWA</th>
<th>New ACGIH TLV, 8-hour TWA (Inhalable)</th>
<th>Health Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium (metal)</td>
<td>1.0 mg/m³</td>
<td>0.1 mg/m³</td>
<td>0.5 mg/m³</td>
<td>- Respiratory tract irritation</td>
</tr>
<tr>
<td>Chromium^3</td>
<td>0.5 mg/m³</td>
<td>0.1 mg/m³</td>
<td>0.003 mg/m³</td>
<td>- Skin &amp; respiratory sensitization (water soluble compounds)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Respiratory tract irritation</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Asthma</td>
</tr>
<tr>
<td>Chromium^6</td>
<td>0.005 mg/m³ (0.0025 mg/m³ AL)</td>
<td>0.05 mg/m³ (water soluble)</td>
<td>0.0002 mg/m³</td>
<td>- Skin &amp; respiratory sensitization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.01 mg/m³ (insoluble)</td>
<td>0.0005 mg/m³ (STEL***)</td>
<td>- Skin &amp; nasal septum ulcers and septum perforation</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Confirmed carcinogen</td>
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<td></td>
<td></td>
<td></td>
<td>- Sinonasal cancer</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Lung cancer</td>
</tr>
</tbody>
</table>

*OSHA = Occupational Safety and Health Administration  
**ACGIH = American Conference of Governmental Industrial Hygienists Threshold Limit Value  
***STEL = 15-minute Short-Term Exposure Limit
Uses of Chrome\textsuperscript{6+}

75+% of Cr\textsuperscript{6+} usage is chromate primers...have to replace chromated primers to meet strategic reduction goals.

Top Usage of Cr\textsuperscript{6+}
- Chromated Primers
- Adhesives and Sealants
- Chrome Plating

Source: [link]
Possible Impacts of ACGIH TLV-TWA Changes

- **Exposure Sampling Requirements**
  - “Total” vs “Inhalable”—sampling method modification
  - Determine if inhalable sampling is OSHA compliant

- **Medical Surveillance**
  - Increase in enrolled personnel along with increased costs?
  - Only required when exposed greater than OSHA Action Level (AL) > 30 days
  - OSHA AL (2.5 µg/m³) vs. ACGIH TLV (0.2 µg/m³)

- **Additional Requirements for Exposure Controls**
  - Engineering (ventilation)
  - Administrative (training, restricted access, housekeeping)
  - Respiratory protection

- **Hazard Communication**
  - collaboration with HR, supervisors, bargaining units (labor unions)
Possible Impacts - Other Operational Issues

- Confusing message to workers
  - Exposures are above the ACGIH TLV-TWA but less than OSHA compliance levels

- Designation of “Regulated” Areas
  - Only required when Cr$_{6+}$ concentrations are > OSHA (5 µg/m$^3$)
Identification of DoD Cr$^{6+}$ Processes and Alternatives

Based on Figure ES-1 and Table 5 of the %-Year Strategy Roadmap, Ver 2.2
Depots Included in Roadmap Tool

1. Implementation Plan developed for the depot during either Phase I or Phase II of the Strategy effort
2. Have recent HAZMAT data or information that appears trustworthy
4. Past visits
Roadmap (Conceptual Design)

### Process by Depot

<table>
<thead>
<tr>
<th>Process</th>
<th>Depot 1</th>
<th>Depot 2</th>
<th>Depot 3</th>
<th>Depot 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC-ALC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OO-ALC</td>
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</tbody>
</table>

### Weapons System by Depot

<table>
<thead>
<tr>
<th>System</th>
<th>Depot 1</th>
<th>Depot 2</th>
<th>Depot 3</th>
<th>Depot 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC-ALC</td>
<td>KC-135</td>
<td>B-1</td>
<td>KC-10</td>
<td></td>
</tr>
<tr>
<td>OO-ALC</td>
<td>F-16</td>
<td>A-10</td>
<td>F-22</td>
<td></td>
</tr>
</tbody>
</table>

### Potential Alternative by Process, Depot, and Weapons System

- Paint Stripping (Chemical)
- OC-ALC
- KC-135

Laser Depaint

**Relational database sortable by process, depot, weapons system, and alternative**
## Proposed Depot Visits

<table>
<thead>
<tr>
<th>Depot</th>
<th>Location</th>
<th>Notes</th>
<th>Timeline</th>
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</thead>
<tbody>
<tr>
<td>Anniston Army Depot (ANAD)</td>
<td>Anniston, AL</td>
<td>• HAZMAT data are possibly underreported</td>
<td>Sept/Oct</td>
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<tr>
<td></td>
<td></td>
<td>• Several processes use hexavalent chromium (plating, sealing, conversion coatings)</td>
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<tr>
<td></td>
<td></td>
<td>• Depot is looking at trivalent chromium as alternatives</td>
<td></td>
</tr>
<tr>
<td>Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS/IMF)</td>
<td>Bremerton, WA</td>
<td>• Limited HAZMAT data</td>
<td>Sept/Oct</td>
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<td></td>
<td></td>
<td>• Largest user of Cr⁶⁺ in NAVSEA</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Limited processes/environment information</td>
<td></td>
</tr>
<tr>
<td>Fleet Readiness Center Southwest (FRC-SW)</td>
<td>San Diego, CA</td>
<td>• HAZMAT data for 2017</td>
<td>Oct/Nov</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Similar processes to FRC-E and FRC-SE</td>
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<td></td>
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<td>• Degree of maintaining tanks and processes is unknown</td>
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<td></td>
<td></td>
<td>• Alternatives implementation is unclear</td>
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<td>• Largest user of both chrome plating materials and chromated paint strippers in the Air Force</td>
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<tr>
<td></td>
<td></td>
<td>• Only depot to maintain a completely chrome-free OML plane (F-15)</td>
<td></td>
</tr>
</tbody>
</table>
Depot Descriptions and Associated Weapons Platforms

- Anniston Army Depot (ANAD)
  - ANAD is the designated center for tracked and wheeled ground combat vehicles (minus Bradley), towed and self-propelled artillery, assault bridging systems, individual and crew served small caliber weapons and locomotives, rail equipment and non-tactical generators.
  - ANAD performs depot level maintenance on vehicle systems such as the M1 Abrams tank, M88 Recovery Vehicle, Stryker, M113 M9 Ace Combat Earthmover and the Assault Breacher Vehicle. Major components of each vehicle are also overhauled and returned to stock.

- Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS/IMF)
  - Fleet maintenance, modernization, recycling, and support

- Fleet Readiness Center Southwest (FRC-SW)

- Warner Robins Air Logistics Complex (WR-ALC)
  - WR-ALC provides depot maintenance, engineering support and software development to major weapon systems (F-15, C-5, C-130, C-17 and SOF aircraft).
Conclusion

- Implementation of the new ACGIH TLV-TWA presents logistical challenges
- ACGIH TLV-TW is most recent in a long line of actions driving DoD to reduce or eliminate Chrome\(^6\+)
- Roadmap tool will enable cross service examination of process, alternative process, depot, and weapon system

Disclaimer:

The views express are those of the author and do not present the conclusions, findings, statements, or policies of the Department of Defense of the United States Army Corps of Engineers

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Identified Service POCs

The following were identified in May 2018 as OSD and Service leads for this task:

- Mr. David Asiello, ODASD(EI&E)
- Dr. Robin Nissan, ODASD(EI&E) SERDP/ESTCP
- Mr. Ken Dormer for Mr. Forbes SAF/AQRE
- Ms. Poppy Harrover, OASA(EI&E)
- Ms. Glenn Williams, AMCOM G4
- Ms. Michelle Davis, TACOM
- Ms. Kristen Furman, MARCORSYSCOM
- Mr. Jim Rudroff, ODASN(EI&E)

- Mr. James Jennings, Naval Surface Warfare Center Philadelphia Division, identified for chrome conversion coated steel fasteners and chrome passivated stainless steel fasteners.