Cadmium Alternatives for Fasteners
Status and Way Forward

James Jennings

Naval Surface Warfare Center Philadelphia
james.c.jennings@navy.mil
215-897-7869, DSN 443-7869
FAX 215-897-8450, DSN 443-8450
**Report Documentation Page**

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

<table>
<thead>
<tr>
<th>1. REPORT DATE</th>
<th>JAN 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. REPORT TYPE</td>
<td></td>
</tr>
<tr>
<td>3. DATES COVERED</td>
<td>00-00-2007 to 00-00-2007</td>
</tr>
<tr>
<td>4. TITLE AND SUBTITLE</td>
<td>Cadmium Alternatives for Fasteners. Status and Way Forward</td>
</tr>
<tr>
<td>5a. CONTRACT NUMBER</td>
<td></td>
</tr>
<tr>
<td>5b. GRANT NUMBER</td>
<td></td>
</tr>
<tr>
<td>5c. PROGRAM ELEMENT NUMBER</td>
<td></td>
</tr>
<tr>
<td>5d. PROJECT NUMBER</td>
<td></td>
</tr>
<tr>
<td>5e. TASK NUMBER</td>
<td></td>
</tr>
<tr>
<td>5f. WORK UNIT NUMBER</td>
<td></td>
</tr>
<tr>
<td>6. AUTHOR(S)</td>
<td></td>
</tr>
<tr>
<td>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</td>
<td>Naval Surface Warfare Center Philadelphia, Carderock Division-Ship Systems Engineering Station, 5001 South Broad Street, Philadelphia, PA, 19112-1403</td>
</tr>
<tr>
<td>8. PERFORMING ORGANIZATION REPORT NUMBER</td>
<td></td>
</tr>
<tr>
<td>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</td>
<td></td>
</tr>
<tr>
<td>10. SPONSOR/MONITOR’S ACRONYM(S)</td>
<td></td>
</tr>
<tr>
<td>11. SPONSOR/MONITOR’S REPORT NUMBER(S)</td>
<td></td>
</tr>
<tr>
<td>12. DISTRIBUTION/AVAILABILITY STATEMENT</td>
<td>Approved for public release; distribution unlimited</td>
</tr>
<tr>
<td>14. ABSTRACT</td>
<td></td>
</tr>
<tr>
<td>15. SUBJECT TERMS</td>
<td></td>
</tr>
<tr>
<td>16. SECURITY CLASSIFICATION OF:</td>
<td></td>
</tr>
<tr>
<td>a. REPORT</td>
<td>unclassified</td>
</tr>
<tr>
<td>b. ABSTRACT</td>
<td>unclassified</td>
</tr>
<tr>
<td>c. THIS PAGE</td>
<td>unclassified</td>
</tr>
<tr>
<td>17. LIMITATION OF ABSTRACT</td>
<td>Same as Report (SAR)</td>
</tr>
<tr>
<td>18. NUMBER OF PAGES</td>
<td>18</td>
</tr>
<tr>
<td>19a. NAME OF RESPONSIBLE PERSON</td>
<td></td>
</tr>
</tbody>
</table>

Standard Form 298 (Rev. 8-98)  Preprinted by ANSI Std Z39-18
Introduction

• Where We Have Been
• Where We Are
• A Way Forward
Where We Have Been

• Cadmium is a Hazardous Material
  – US OSH Regulated
  – US EPA Regulated
  – Not a Prohibited Material In US
  – Not a Prohibited Material In DoD
Where We Have Been

• ESTCP/SERDP/JG-PP Sponsored Work
  – JG-PP: Alternatives to Electrodeposited Cadmium for Corrosion Protection and Threaded Part Lubricity Applications (Project Number: J-95-MF-006)
  – JG-PP: Cadmium Replacements for Department of Defense (DoD) and National Aeronautics and Space Administration (NASA) Applications (Project Number: J-00-MF-024)
    • Structural Cadmium
    • Fastener Cadmium Coating Alternatives
    • Connector Cadmium Alternatives
Where We Have Been

• Other DoD Sponsored Work
  – Army
    • Independently Evaluated Alternatives
    • Implemented Alternatives
    • No Cadmium in FCS
  – Air Force
    • Independently Evaluated Alternatives
    • Implemented Alternatives
    • No Cadmium in JSF
  – Navy
    • No Independent Alternative Evaluation
    • No Implementation
Where We Are

• Cadmium Not The Only Problem
  – Hexavalent Chromium in Chromate Coatings
    • US OSHA reduced PEL in 2006
    • US OSHA may further lower PEL
• US National Regulations Not Only Source
  – Europe
    • End-of-Life Directive
    • Restriction of use of Hazardous Substances (RoHS)
  – US States
    • May adopt European style restrictions
Where We Are

- Cadmium is Not Only Problem
  - Hexavalent Chromium in Chromate Coatings
    - US OSHA dropped PEL in Feb. 2006
    - US OSHA may further lower PEL
- US National Regulations Not Only Source
  - Europe
    - End-of-Life Directive
    - Restriction of use of Hazardous Substances (RoHS)
  - US States
    - May adopt European style restrictions
Where We Are

• Industry Moved Faster than DoD
  – Auto and Ground Vehicle Industry
    • No Cadmium
    • No Hexavalent Chromium
  – Electronics Industry
    • No Cadmium
    • No Hexavalent Chromium
  – Commercial Aviation Industry
    • No Cadmium
    • No Hexavalent Chromium
Where We Are

• Industry Moved Faster than DoD (Cont.)
  – Diminishing supply sources
    • Cadmium plating more expensive
    • Hexavalent Chromium more expensive
  – Are we getting what we expect?
Where We Are

• ESTCP/SERDP/JG-PP
  – Aware of Need
    • 2006 Metal Finishing Workshop
    • 2006 Partners In Environmental Technology Technical Symposium and Workshop
  – SERDP
    • 2008 Solicitation
      • WPSON-08-01 "ENVIRONMENTALLY BENIGN, HIGH-STRENGTH FASTENERS FOR WEAPONS SYSTEMS"
  – ESTCP
    • 2008 Solicitation
      • Topic 4 "WEAPONS SYSTEMS & PLATFORMS (WP)"
  – JG-PP
    • Joint Cadmium Alternatives Team (JCAT)
A Way Forward

Where Do We Go From Here?
• Needs
  – Cadmium and Hexavalent Chromium Free Alternatives
    • Identify
    • Evaluate
  – Test Protocol
  – Design Guidance
  – Implement Alternatives
A Way Forward

- New High Strength Steel Fastener Cadmium (and Hexavalent Chromium) Alternatives
  - Coordinated Efforts
  - Diverse Team
    - Industry
    - DoD
  - Information Sharing
  - Submit Proposals To ESTCP/SERDP As Appropriate
A Way Forward

• Proposed ESTCP/JG-PP Program
  – Year 1
    • Joint Test Protocol
    • Potential Alternatives Report
    • Correlate Existing Data
    • Test Program
  – Years 2 & 3
    • Testing
    • Identify Additional Work
    • Communicate
• Proposed ESTCP Program (Cont.)
  – Year 4
    • Test Report
    • Design Guidance
    • Implementation
  – Follow-On
    • Implementation
      – Specifications
      – Design Documentation
      – Stock System
I Need Your Help!
• I Need Your Help!
  – Stakeholders and Interested Parties
  – Test Data
  – Participation in Work
  – Ideas
Interested?

Please Contact Me

James Jennings

james.c.jennings@navy.mil

215-897-7869