Joint Service Solvent Substitution (JS3)
**Report Documentation Page**

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Standard Form 298 (Rev. 8-98)  
Prescribed by ANSI Std Z39-18
Army Cleaning Alternatives

- “Performance Test of ChemFree Enzyme-Based Aqueous Solvent”, Feb 1999
- “Armed Services Test Protocol for Alternative Cleaner Performance Validation” May 1999
NFESC Gun Cleaning Effort

- “USN/USMC Aqueous Weapons Cleaner Test Protocol”, February 2000

Observations & Lessons

Selecting An Alternative Cleaning Process
- Misinformation Abounds and Therefore Education is Critical
- Cleaning Must Be Evaluated as Part of a Process – Not a Stand Alone Operation
- Know Your Process & Define Your Requirements (Not the Performance of Your Current Cleaner)

Evaluating Alternative Cleaning Processes
- Some Criteria Are Difficult to Use in Evaluation or Did Not Allow for a Full Indication of Results
- Procurement of Test Coupons Can Be a Bottleneck
- It Is Difficult to Identify Methods for Evaluating Properties Like Cleanliness and Odor
- There Is a Uncomfortable Balance to Maintain Between Technical Requirements & Economic Realities

2001 P2 Conference:
Charles Sokol

- Microbial Bio-Remediating
- Aqueous Alkaline Cleaner with d-Limonene
- High Pressure Steam Cleaner
• From discussion at Solvent Substitution Workshop → Joint Service Solvent WG
  – Wayne Ziegler (ATC)
  – Andy Del Collo (NAVFAC)
  – Debora Meredith (AFMC)
  – Gerry Mongelli (CTC supporting AFMC)
  – Dr. Katherine Ford (NFESC)
  – Dan Verdonik (representing AAPPSO & DoD NESHAP Subcommittee)

• “largest contribution of HAPs at DoD facilities stems from hand wipe cleaning with solvents”
• Across services 30-35% of P2 needs are related to cleaning applications
• “Increasing compliance requirements causing major impact to manufacturing and maintenance operations” Focus on Cleaning, *Policy and Strategy for Seeking Common Solutions*, Chairman JGPP
• DoD has focused on regulated chemicals, waste management & VOC reductions not HAPs
• 55 DoD Installations are Major HAP Sources
• Multiple NESHAPs may apply to the same system
• Cleaning & depainting technologies have the greatest potential to significantly reduce NESHAP burden
Communication
Collaboration
Coordination
JS3 Tools

- Methodology
- Information Exchanges
- Project Coordination
- Project Database
Implementing Alternatives

Targeted Processes
• Aircraft Maintenance
• Ship Maintenance
• Facility Maintenance
• Etc.

Candidate Solutions
• Aqueous Solvents
• Biobased Solvents
• Ozone
• Etc.

Partners
• NAVSEA
• NAVAIR
• Marine Corps
• Army
• Air Force
• NASA

Joint Services Solvent Substitution Methodology

Screening Methodology
Test Protocol
Lab Testing
Field Testing
Process Approval
Update Manuals
User Awareness
Implementation Support

Processes not requiring extra record keeping & control measures

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
Implementing Alternatives

**Requirement**

**Implementation**

**Targeted Processes**
- Aircraft Maintenance
- Ship Maintenance
- Facility Maintenance
- Etc.

**Candidate Solutions**
- Aqueous Solvents
- Biobased Solvents
- Ozone
- Etc.

**Partners**
- NAVSEA
- NAVAIR
- Marine Corps
- Army
- Air Force
- NASA

**Joint Services Solvent Substitution Methodology**

**Screening Methodology**
- Test Protocol
- Lab Testing
- Field Testing
- Process Approval
- Update Manuals
- User Awareness
- Implementation Support

**Processes not requiring extra record keeping & control measures**

**Technology Driven. Warfighter Focused.**
Basic Concepts

- All cleaning applications are not equivalent
- Define the cleaning process
- Regulations continue to evolve
- Focus on capability and cost
JS3 Methodology

Start

Stakeholders

Develop Implementation Strategy

Process Evaluation

Acceptance Criteria

Approval

Market Research

Approval

Demonstration Plan

Approval

Implementation

Approval

Demonstration Validate

Approval

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
Keys to Success

• Define performance
• Pursue the possible
• Focus on implementation
• Engage the user & understand their perspective
• Grow champions
• Objective: demonstrate the efficacy and validate the economic and process impact of TBAC solvent as alternative
• Norfolk Naval Shipyard
  – T10 thinner alternative for paint gun cleaning
• MCLB Albany
  – Paint thinning, paint clean up and gun flushing
• Corpus Christi
  – Pre-paint tack wipe solvent
• Process Cleaning
  – 2006; Efforts of DoD Services and NASA Towards Green Cleaning Operations
  – 2010; Environmentally Responsible Cleaning Processes for Military Applications

• Handbook on Critical Cleaning
  – Ed. 1 Implementation of Environmentally Preferable Cleaning Processes for Military Applications
  – Vol. 2
• Laboratory screening
• Demonstrations
  – Anniston
  – Corpus Christi
  – Letterkenny
• Small Program Award
Current JS3 Proposals

• SERDP – Cleaning with Ionic Liquids
• ESTCP – nPB Vapor Degreasing full scale demonstration
Summary – JS3

• **Role**
  – Provide tools
  – Expertise
  – Collaboration

• **Clearinghouse for challenges and solutions**
• Engage multiple end users simultaneously
• ARL - research & development, lead
• ATC - test & evaluation
• AMCOM/AMRDEC - aviation
• ECBC - chemical & biological
• ERDC - corp of engineers
• JMC - munitions
• TACOM/TARDEC – ground vehicles
• TACOM/ARDEC - armaments
The Army strategy for addressing issues related to NESHAPs

Army’s #1 Priority under Army Environmental Requirements and Technology Assessments (AERTA)

- Army Environmental Quality Technology (EQT)
- ESO Lead
- Purpose – to ensure continued operations at impacted Army facilities
SPOTA Solvent Plan

1. Site-by-site Assessment – Identify & Quantify
2. Best Practices Survey
3. Technology Gap Assessment
4. Develop Technology Roadmaps
5. Material and Technology Criteria Establishment
6. Laboratory Validation of Material Solutions
7. Demonstration of Material Solutions
8. Implementation of Accepted Solutions
Application and processes identified by SPOTA Assessment and Technology Gap reports. Alternatives for each of the eleven application/process groups will be identified and validated as required.
### Environmental, Safety and Occupational Health, and Chemical Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Environmental Screening</th>
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<tr>
<td>HAPS</td>
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<td>VOC</td>
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<tr>
<td>PEL</td>
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<tr>
<td>Temperature Stability</td>
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<tr>
<td>Temperature Stability</td>
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<td>Specific Gravity</td>
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<td>Low Temp Stability</td>
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<td>Chemical Content Limits</td>
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<tr>
<td>Chemical Property Screening</td>
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<td>Specific Gravity</td>
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<td>Flash Point</td>
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<tr>
<td>Kari-Butanol Value</td>
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<tr>
<td>Vapor Pressure</td>
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<tr>
<td>Chemical Content Limits</td>
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</tbody>
</table>
Material Compatibility Test Types

- Total Immersion
- Effects on Polysulfide Sealants
- Elevated Temp Corrosion
- Effects on Acrylics
- Effects on Unpainted Surfaces
- Effects on Polycarbonate
- Effects on Painted Surfaces
- Effects on SMC
- Effects on Rubber
- Sealant Adhesion
- Adhesive Bonding
- Fluorescent Panertrant
- Hydrogen Embrittlement
- Sandwich Corrosion
- Titanium Stress Corrosion
- Stress Corrosion
- Effects on Polyamide Wire
- Low Embrittling Cadmium Plate Corrosion
- Copper Corrosion
• Visual Inspection
• Wipe Test (White Glove Test)
• Water Break Test
• Soil cleaning per MIL-PRF-680
• ASTM-G 122 Standard Test
• Non-Volatile Residue
# Hand wipe Cleaning Criteria

<table>
<thead>
<tr>
<th>Property/Substrate</th>
<th>Test Name</th>
<th>Test Number</th>
<th>Units</th>
<th>Criteria by Application Group</th>
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<td>Al (AMS-QQ-A-250)</td>
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<td>Al (7075-T6)</td>
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<td>Steel (4340)</td>
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<td>AM-355 CRT</td>
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<td>Cadmium (A-A-51126)</td>
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<td>Effects on Polysulfide Sealants</td>
<td>PRF 61 4.5.13</td>
<td>ShoreA units</td>
<td>no change 5 Shore</td>
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</table>

Total Immersion: ASTM F-483, MIL-PRF-63460D

Notes:
- Effects on Polysulfide Sealants: PRF 61 4.5.13
- ShoreA units
- Criteria by Application Group: no change 5 Shore
Candidate Alternatives

- Candidate alternatives identified by:
  - SPOTA Usage Alternatives Report
  - Army Alternative Cleaner Program Candidates
  - QPLs & Approved Products

- Initial alternative down select
  - Current approvals/QPLs
  - ESOH properties
  - Evaluation of vendor test results
  - Industry experience
  - DOD Aerospace & Shipbuilding NESHAP experience
Implementation Team

- Engage multiple end users groups simultaneously
- Members from:
  - SPOTA team
  - RD&E Centers
  - PEO/PM Offices
  - Site Specific Members
• ASSWG members identifying demo sites base on:
  – Pervasiveness of the application
  – Identify key facilities and individuals who are in a position to champion the alternative cleaners
  – Identify cooperative PM and PEO offices

• Key Issue
  – Workload at key sites
PERFORMANCE SPECIFICATION

CLEANER, GENERAL, FOR MILITARY SYSTEMS, LOW OR EXEMPT VOC, HAP-FREE
Influence Materials Selection

- CAD Drawings (Pro/E)
- MIUL – Bill of Materials
- Material Usage Agreement (MUA)
- Material Selection List
- Material - Chemical Restrictions
- Reports

Diagram shows the flow of Influence Materials Selection, starting from CAD Drawings (Pro/E), followed by MIUL – Bill of Materials, then Material Usage Agreement (MUA), leading to Material Selection List, and finally Material - Chemical Restrictions. The flow ends with Reports.