



Sustainable Painting Operations for the Total Army: Miscellaneous Adhesives & Sealants Technology

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Outline

- **Sustainable Painting Operation for the Total Army (SPOTA) Background**
 - **DLSME**
 - **Affected areas**
 - **Exemptions**
- **Miscellaneous Coatings Survey at 14 Army Installations**
- **Adhesives and Sealants Survey including over 90 Army Installations**

DLSME NESHAP – Background

- **Previous NESHAPS for Aerospace and Ship Building.**
- **Late 1990's, proposed NESHAPs for the surface coating of miscellaneous metal and plastic parts, products, and furniture.**
- **Compliance with all NESHAPs would have been nearly impossible for military installations.**

DLSME NESHAP

- EPA exempted surface coating operations from the metal parts, plastic parts, metal furniture coating NESHAPs.
- EPA in process of issuing a special NESHAP for surface coating on military installations (although aerospace and shipbuilding NESHAPs will still apply).
 - Defense Land Systems and Miscellaneous Equipment (DLSME) NESHAP
- DOD is working very closely with EPA and taking an active role in recommending draft rule language.

Areas Affected by DLSME

- **Defense land systems and misc. equipment.**
 - Combat vehicles, tactical vehicles, military personnel items, weapons, armament and engineering, communications, base camp, ground support and launch support equipment, etc.

- **Categories**
 - Paints (CARC and non-CARC)
 - Munition Coatings
 - Rubber-to-Metal Bonding
 - Depainting
 - Solvents and surface preparation processes
 - Miscellenous coatings

DLSME Exemptions

- **Exemptions**
 - **Munitions – covered with no limits**
 - **Aerosols – exempted**
 - **Miscellaneous coatings – exempted (low usage)**
 - **Research**
 - **Unrelated facility maintenance operations**

DLSME Schedule

- **Summer 2005 – Draft MACT standard**
- **January 2006 – Proposed rule**
- **January 2007 – Final rule**
- **January 2010 – Compliance deadline**

Outline

- Sustainable Painting Operation for the Total Army (SPOTA) Background
- **Miscellaneous Coatings Survey at 14 Army Installations**
 - **Focus materials**
 - **Alternatives identification**
 - **GAP analysis**
 - **MEK delisting impact**
- **Adhesives and Sealants Survey including over 90 Army Installations**

Sites Surveyed

- **Surveyed HAP Chemicals at 14 Army Facilities**

- **TYAD**, PBA, RRAD, LEAD, ANAD, LATP, RSA, SAD, RAAP, MCAAP, IAAP, MLAAP, RIA
- **TYAD is largest HAP producer**
- **RRAD has highest HAP concentration**

- **Representative sample of all major Army Operations and Commands**

- **AMCOM, CECOM, JMC, IMA, SBCCOM, TACOM**

Miscellaneous Coatings

Location	Annual Usage (lbs)	Annual HAPs (lbs)	% Total HAPS
TYAD	60137	8029	57.5%
PBA	35778	3648	26.1%
LEAD	3136	1022	7.3%
ANAD	7687	827	5.9%
RSA	609	113	0.8%
SIAD	4578	106	0.8%
CCAD	467	103	0.7%
RAAP	2512	98	0.7%
MCAAP	431	19	0.1%
RIA	227	0	0.0%
MLAAP	73	0	0.0%
IAAP	52	0	0.0%
RRAD	0	0	0.0%
LATP	0	0	0.0%
Total	115687	13963	100%

- **1.157x10⁵ lbs of HAP containing miscellaneous coating materials**

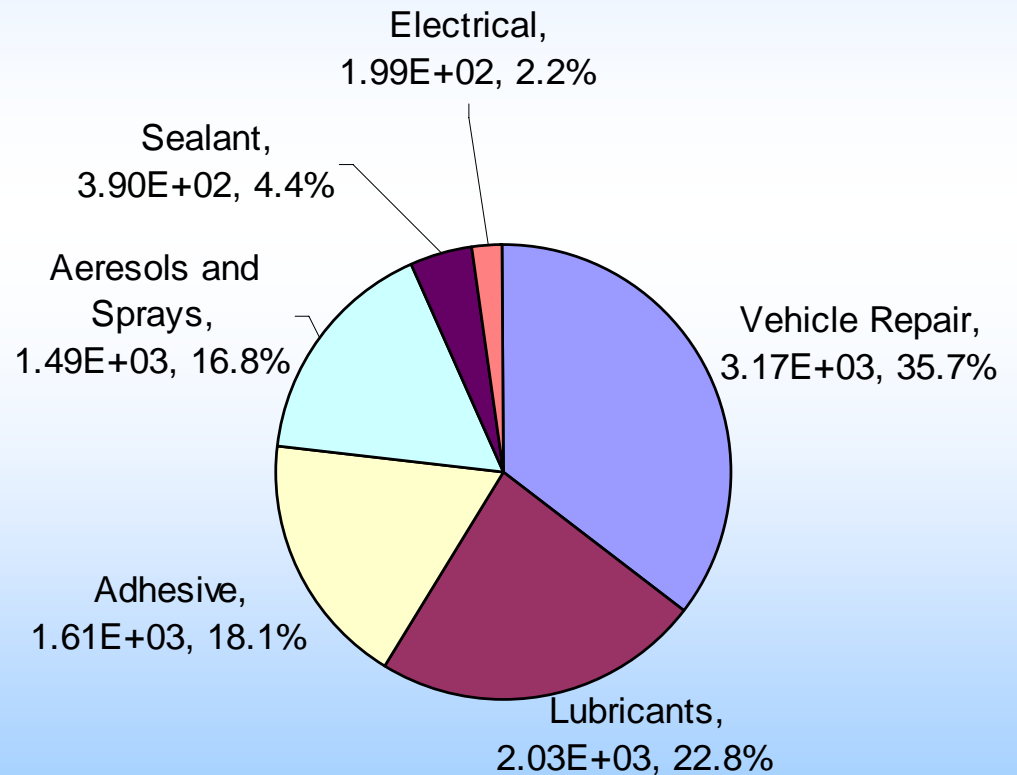
- **1.40x10⁴ lbs total HAP**

Miscellaneous Coatings Splits by Classification

- Thousands of Misc. coatings materials
 - Narrowed down to over 10 gal/yr usage (~400 materials, 64% of total HAPs)

- **Material Classifications**

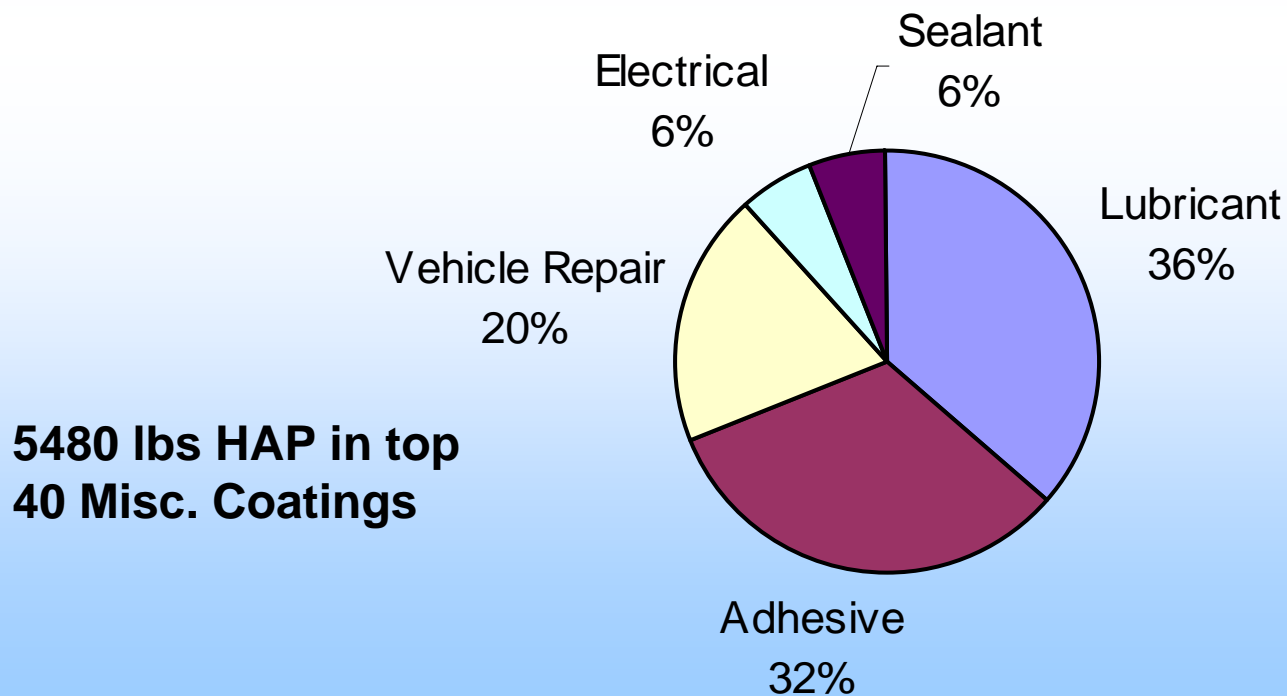
- Adhesives
- Sealants
- Lubricants
- Electrical
- Vehicle Repair
- Aeresols and Sprays
 - Exempt



Focus Materials

- Further narrowed down focus materials
 - In use across multiple Army installations
 - Greater than 30 gal annual usage
 - High HAP content (>20 wt%)

**~40 materials
(39% of total HAPs)**



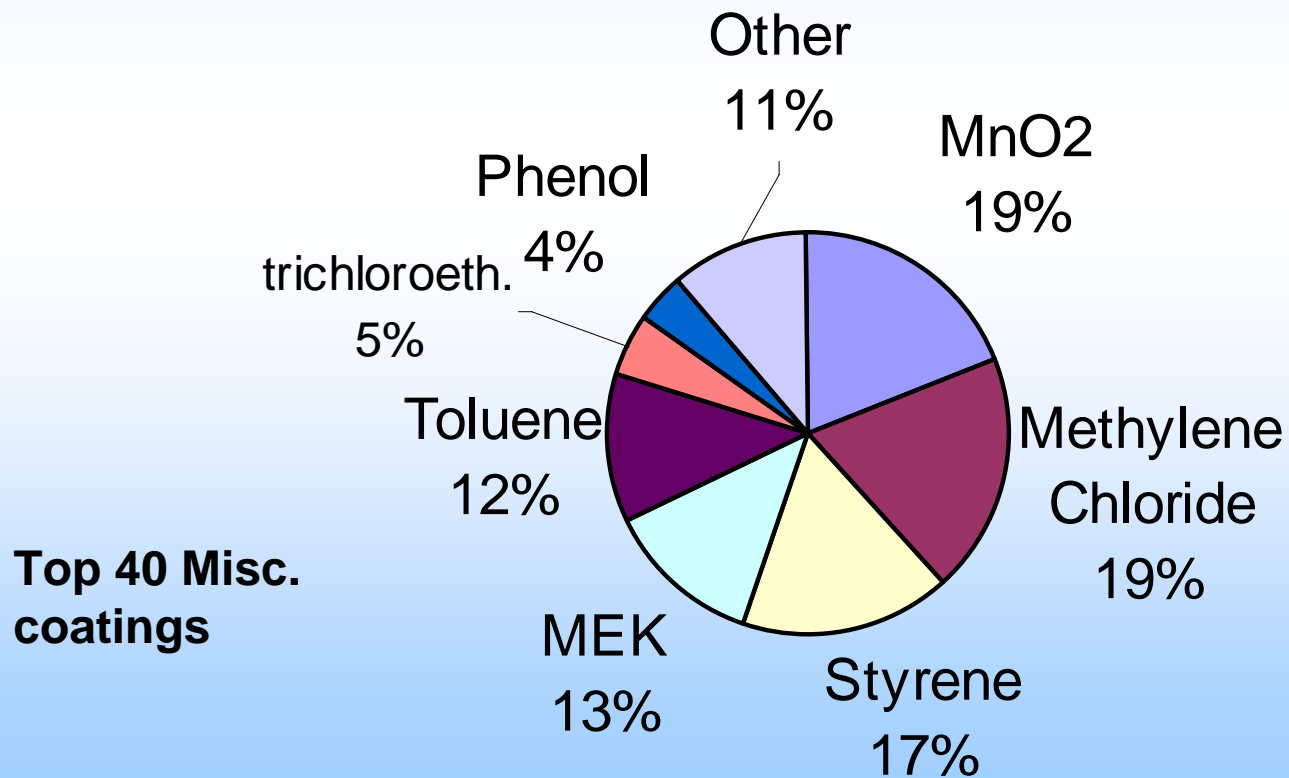
Site Visit

- Over 20 of these materials are used at TYAD
 - NDCEE recently had a site visit to TYAD
 - TYAD amounted to 2784 lbs HAP (51% of 40 focus materials)

Location	Annual HAPs (lbs)	% Total HAPS
TYAD	2784.6	50.8%
ANAD	1296.2	23.7%
RRAD	760.6	13.9%
PBA	381.4	7.0%
LEAD	94.3	1.7%
CCAD	61.9	1.1%
RSA	52.6	1.0%
SIAD	35.7	0.7%
MCAAP	12.7	0.2%
LATP	0	0.0%
RAAP	0	0.0%
IAAP	0	0.0%
MLAAP	0	0.0%
RIA	0	0.0%
Total	5479.3	100%

Major Hazardous Air Pollutants

- MnO_2 , CH_2Cl_2 , Styrene, MEK, and toluene make up 80% of HAP emissions.



Multiple Sites

Material	Material Classification	Location	Annual Usage (lbs)	HAP Content (%)	HAP Content (lbs)
Ecolube 642 (10-008)	Lubricant	ANAD/LEAD	554.0	75.0	415.5
6294 Dent Filler, Component A/Bond	Vehicle Repair	LEAD/TYAD	2470.9	15.0	370.7
MIL-L-46010A; Dry Film Lubricant	Lubricant	ANAD/RIA	486.0	65.0	315.9
PVC Clear Body Cement/Cement, O	Adhesive	MCAAP, PBA	159.0	52.6	83.7
Neoprene rubber contact adhesive/A	Adhesive	LEAD/PBA	144.0	46.3	66.7
3M Super 77 Spray Adhesive	Adhesive	LEAD/RSA	277.0	20.0	55.4
Scotch Seal 800 Industrial Sealant	Sealant	ANAD/LEAD	11.0	57.3	6.3
AC 236 Class B Base	Adhesive	ANAD/LEAD/TYAD	686.6	0.1	0.7
Total =			4788.5	N.A.	1314.7
Average =			598.6	41.4	164.3

- **8 Materials used at multiple sites of 14 Army Installations**

Large Usage (>30 gal)

Material	Material Classification	Location	Annual Usage (lbs)	HAP Content (%)	HAP Content (lbs)
Dry Film Lube (type 36)	Lubricant	RRAD	1492.5	50.0	746.3
STA'-Put SPH Adhesive-cylinder	Adhesive	TYAD	1190.9	60.0	714.5
100889/887 Metal-2-Metal Reinforcement	Vehicle Repair	TYAD	2835.8	24.7	701.3
Ecolube 642 (10-008)	Lubricant	ANAD/LEAD	554.0	75.0	415.5
6294 DENT FILLER, COMPONENT A	Vehicle Repair	TYAD/LEAD	2470.9	15.0	370.7
MIL-L-46010A; Dry Film Lubricant	Lubricant	ANAD/RIA	486.0	67.6	328.8
Drilube #6A	Lubricant	ANAD	513.0	49.0	251.4
Epoxy Hardener, EPON Curing Agent	Adhesive	PBA	10091.4	2.0	201.8
E635-675 #238 Dry Film Lube	Lubricant	ANAD	390.0	35.0	136.5
Adhesive MA-412	Adhesive	TYAD	485.9	20.0	97.2
1201 Red Enamel Glyptal	Electrical	ANAD	271.0	34.5	93.5
FASTBOND 10 Neutral Contact Adhesive	Adhesive	TYAD	247.2	33.0	81.6
77124 Nickel Antisieze Lubricant	Lubricant	ANAD	278.0	21.9	60.9
Plastic Coating Compound, Strippable	Sealant	SIAD	446.2	8.0	35.7
MAGNA-TAC M777 EPOXY PART A AND B	Adhesive	TYAD	317.8	10.0	31.8
Jet-melt Adhesive 3762-AE	Adhesive	RRAD	286.0	5.0	14.3
PR-1440 B-3 Base	Sealant	LEAD	412.5	1.0	4.0
ETHYL CYANOACRYLATE 8040001429193	Adhesive	TYAD	285.7	1.0	2.9
AC-236 Class B Base	Sealant	TYAD	511.8	0.1	0.5
CS 3201 Class A, Black Part A	Sealant	ANAD	384.0	#VALUE!	?
CS 3202 Class B, Black Part A	Sealant	ANAD	314.0	#VALUE!	?
Total =			24264.6	N.A.	4289.1
Average =			1155.5	27.0	225.7

- **21 Materials used at 14 Army Installations have large usage**

High HAP Content (>20 wt%)

Material	Material Classification	Location	Annual Usage (lbs)	HAP Content (%)	HAP Content (lbs)
Electrical grade silicone/2094	Electrical	TYAD	203.3	96.0	195.2
Loctite Adhesive Black Max	Adhesive	PBA	51.6	85.0	43.8
HH-66 Vinyl Cement	Adhesive	TYAD	83.1	73.0	60.7
Hysol PC20M	Electrical	TYAD	53.7	70.0	37.6
Duall 88 All Purpose Cement	Adhesive	TYAD	34.4	67.0	23.0
MMM-A-121/Adhesive MA412	Adhesive	TYAD	352.1	65.1	229.1
STA'-Put SPH Adhesive-cylinder	Adhesive	TYAD	1190.9	60.0	714.5
PR-1750 Manganese Dioxide	Sealant	TYAD	52.5	60.0	31.5
CB 200-40 (component B)	Sealant	TYAD	134.0	57.0	76.4
PR 1440 B2 Accelerator	Sealant	TYAD	286.9	56.3	161.6
Pro Seal 870	Lubricant	CCAD	112.6	55.0	61.9
PVC Clear Body Cement/Cement, C	Adhesive	MCAAP, PBA	159.0	52.6	83.7
So-sure rubber adhesive	Adhesive	LEAD	59.3	47.2	28.0
Neoprene rubber contact adhesive/	Adhesive	LEAD, PBA	144.0	46.3	66.7
3m Super weatherstrip/adhesive	Adhesive	ANAD	24.0	40.0	9.6
88120 copper gasket cement TM-2	Adhesive	LEAD	13.5	39.1	5.3
Bostik Adh 4045	Adhesive	TYAD	49.8	28.0	13.9
M8-110 Grey Epoxy #26622	Adhesive	TYAD	95.0	25.0	23.7
100889/887 Metal-2-Metal Reinforc	Vehicle Repair	TYAD	2835.8	24.7	701.3
Total =			5935.3	N.A.	2567.4
Average =			312.4	55.1	135.1

- **19 Materials used at 14 Army Installations have high HAP content**

Miscellaneous Adhesives and Sealants

- **High priority coatings materials**
 - Used at multiple sites, high usage, high HAP content

Material	Use	Sites	Usage (gal/yr)	HAP % (wt%)	HAPs
Ecolube 642	Lubricant	ANAD/LEAD	60.5	75	Pb, Sb, MEK, MIBK, Tol
MIL-L-46010A; Dry Film Lub	Lubricant	ANAD/RIA	53.2	67	Sb, MEK, Toluene
6294 Dent Filler	Vehicle repair	TYAD/LEAD	151	20	Styrene

- **Lubricant alternatives**

- 099 Waterborne Solid Film Lub, Sandstrom Products
- Tiolube 20/20, Tiodize
- Everlube 9002, Everlube Products
- Lower overall HAPs, but all contain ~10% Sb

- **Vehicle repair**

- Use fatty acid technology to develop low HAP, drop-in, repair resin

Alternatives Identification

- **Focus on HAP-free and low HAP alternatives**
- **Use qualified MIL-Spec products**
- **Recommended replacements by material manufacturer**
- **Literature search for other replacements**

Adhesive Alternatives

Baseline Material	Baseline HAP Content	Material Category	Potential Alternatives	Potential Alternative HAP Content
3M Super 77 Spray Adhesive	Hexane-20%	Adhesive	Spray Mount Artist's Adhesive, Photo Mount, 3M Repositionable 75,	HAP free HAP free HAP free
SPH Spray Adhesive	Methylene Chloride-60%	Adhesive	STA'-Put 2001M	HAP free
3M Super Weatherstrip	MEK 30% Toluene 10%	Adhesive	Scotch-Grip 847 Rubber Gasket Adhesive Brown	HAP free HAP free HAP free
Neoprene Rubber Contact Adhesive	Hexane 50%	Adhesive	Scotch-Grip 847 Rubber Gasket Adhesive Brown	HAP free HAP free HAP free
So Sure Rubber Adhesive	Hexane 36.67%	Adhesive	So Sure Rubber Adhesive (reformulated) Spray Mount Artist's Adhesive, Photo Mount, 3M Repositionable 75,	HAP free HAP free HAP free HAP free
Adhesive MA-412/ MMM-A-122	Toluene 18%; Hexane 37%	Adhesive	Scotch-Grip 847	HAP free

Lubricant Alternatives

Baseline Material	Baseline HAP Content	Material Category	Potential Alternatives	Potential Alternative HAP Content
Ecoalube 642 (10-008)	MEK 25% Toluene 25% MIBK 5%	Lubricant	#099 Waterborne Solid Film Lubricant	Antimony Compounds-10
MIL-L-46010A; Dry Film Lubricant	MEK 20% Toluene 25%	Lubricant	Tiolube 20/20, SFL, Heat Cured	Antimony Compounds-10
Drilube #6A	MEK 7% Toluene 37%	Lubricant	Everlube 9002	Antimony Compounds-10
77124 Nickel Antiseize Lubricant	Nickel 30%	Lubricant	Loctite C5-A	HAP free
Dry Film Lube (Type 36)	Antimony Compound 4%	Lubricant	Poxylube #429	HAP free
LPS White Lithium Grease	1,1,1, Trichlorethane 60%	Lubricant	LPS Laboratories White Lithium Multipurpose White Grease	HAP free

Body Filler/Sealant Alternatives

Baseline Material	Baseline HAP Content	Material Category	Potential Alternatives	Potential Alternative HAP Content
6294 Dent Filler, Component A	Styrene 20%	Body Filler	Transtar Euro UltraV Polyester Filler	12-20% ethyl benzene
PR-1440 B-3 Base and PR-1440 Accelerator	Toluene 55% MnO ₂ 60%	Sealant	Armstrong Products, A-12 Epoxy	HAP free
Pro Seal 870	MnO ₂ 60% Toluene 10% Formaldehyde 1% Phenol 10%	Sealant	AC-665, Advanced Chemistry and Technology, Inc	Strontium Chromate-5 Calcium Chromate- 15

GAP Analysis

- **Adhesives:**
 - EPON Curing Agent V-40 (Epoxy Hardener)
- **Lubricants**
 - E635-675 #238 Dry Film Lubricant
- **Sealants**
 - CS 3201, CS 3202, CB 200-40, PR-1750 Manganese Dioxide
- **Electrical**
 - Hysol PC20M
- **Body Filler**
 - 6294 Dent Filler, 100889/Metal-2 Metal Reinforced
- **ESTCP WP-0617**
 - Replace styrene-based composite resins with environmentally friendly alternatives

Impact of MEK Delisting

- Numerous currently used adhesives will be considered HAP free materials.
- Amounts to 12.5% of HAPs for top 40 Misc. coatings

Material	% by Weight	Material Classification	Total Weight (lbs)	HAP Amount (lbs)
3M Super Weatherstrip	30	Adhesive	24	7.2
Super Weatherstrip Adhesive	27	Adhesive	20	5.4
PVC Clear Body Cement	53	Adhesive	24	12.72
Cement, Oatey Regular Clear PVC	53	Adhesive	135	71.55
HH-66 Vinyl Cement	58	Adhesive	83	48.14
Bostik ADH 4045	28	Adhesive	50	14.0
E635-675 #238 Dry Film Lub.	35	Lubricant	320	112
Hysol PC20M	40	Electrical	6	2.4

- TYAD recently switched to DataKoat Protective Coating (68 wt% toluene)
- Recommend switching back to Hysol PC20M

Outline

- Sustainable Painting Operation for the Total Army (SPOTA) Background
- Miscellaneous Coatings Survey at 14 Army Installations
- **Adhesives and Sealants Survey including over 90 Army Installations**

Expanded Survey of DoD Adhesives

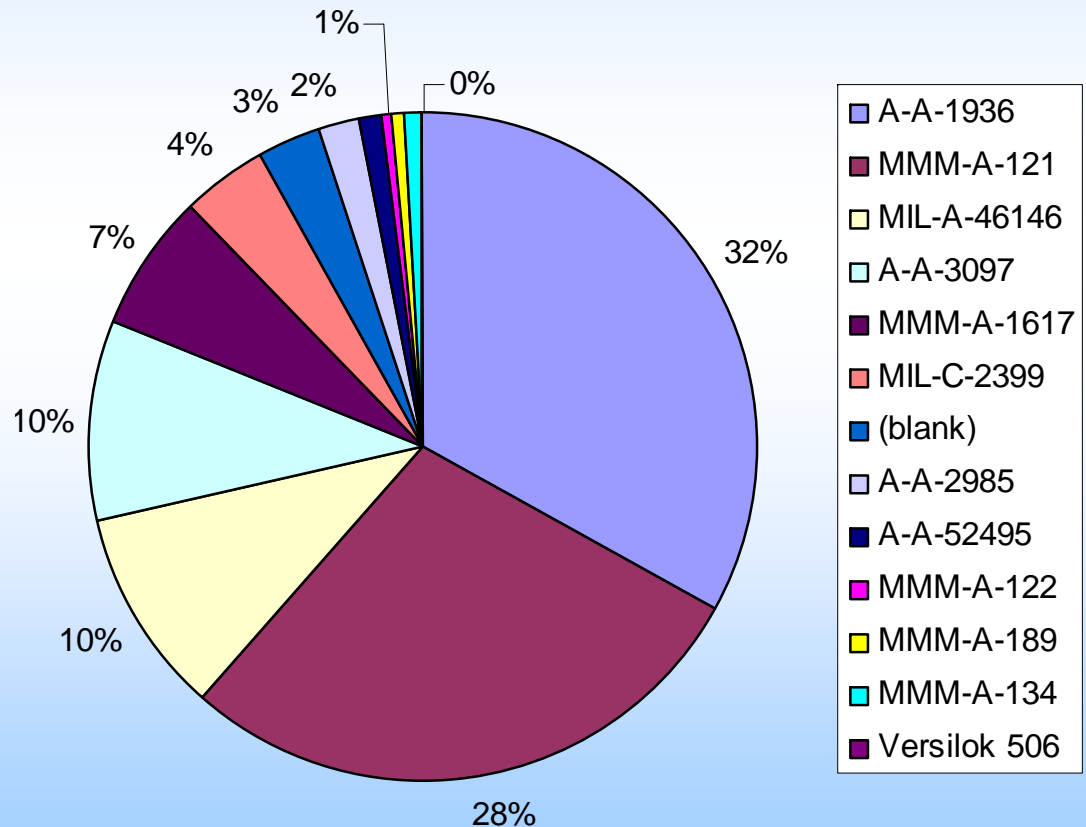
- ~4200 lbs VOHAP/yr
- Top 2 make up 61% of all VOHAPs

Product	Description	Amount	HAP Content	Installations
A-A-1936	Contact cement	1,383	10-78%	>20
MMM-A-121	Solvent-based adhesive	1,197	40-70%	>20
MIL-A-46146	Silicone adhesive	412	0-30%	>20
A-A-3097	Instant adhesive	409	1-88%	5
MMM-A-1617	Neoprene Adhesive	288	4-63%	>20
MIL-C-2399	Tent-patching adhesive	169	0-20%	>20
(blank)		129		
A-A-2985	Silicone resin	83	37-61%	>20
A-A-52495	Sealing compound	40	80%	1
MMM-A-122	Nortech adhesive	30	16-62%	18
MMM-A-189	Plasic adhesive	26	0-14%	>20
MMM-A-134	Epoxy	25	0-54%	0
Versilok 506	Adhesive	5	55-97%	12
Adhesive Total		4,196		

- Most HAPs in TYAD and Fort Rucker

Expanded Survey of DoD Adhesives

- ~4200 lbs VOHAP/yr
- Top 2 make up 61% of all VOHAPs



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A-A-3097	Instant adhesive	409	1-88%	5
MMM-A-1617	Neoprene Adhesive	288	4-63%	>20
MIL-C-2399	Tent-patching adhesive	169	0-20%	>20
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A-A-2985	Silicone resin	83	37-61%	>20
A-A-52495	Sealing compound	40	80%	1
MMM-A-122	Nortech adhesive	30	16-62%	18
MMM-A-189	Plasic adhesive	26	0-14%	>20
MMM-A-134	Epoxy	25	0-54%	0
Versilok 506	Adhesive	5	55-97%	12
Adhesive Total		4,196		

- Most HAPs in TYAD and Fort Rucker

Expanded Survey of DoD Sealants

- ~4700 lbs VOHAP/yr
- Top 2 make up 67% of all VOHAPs

Sum of Lb VOHAP/Yr

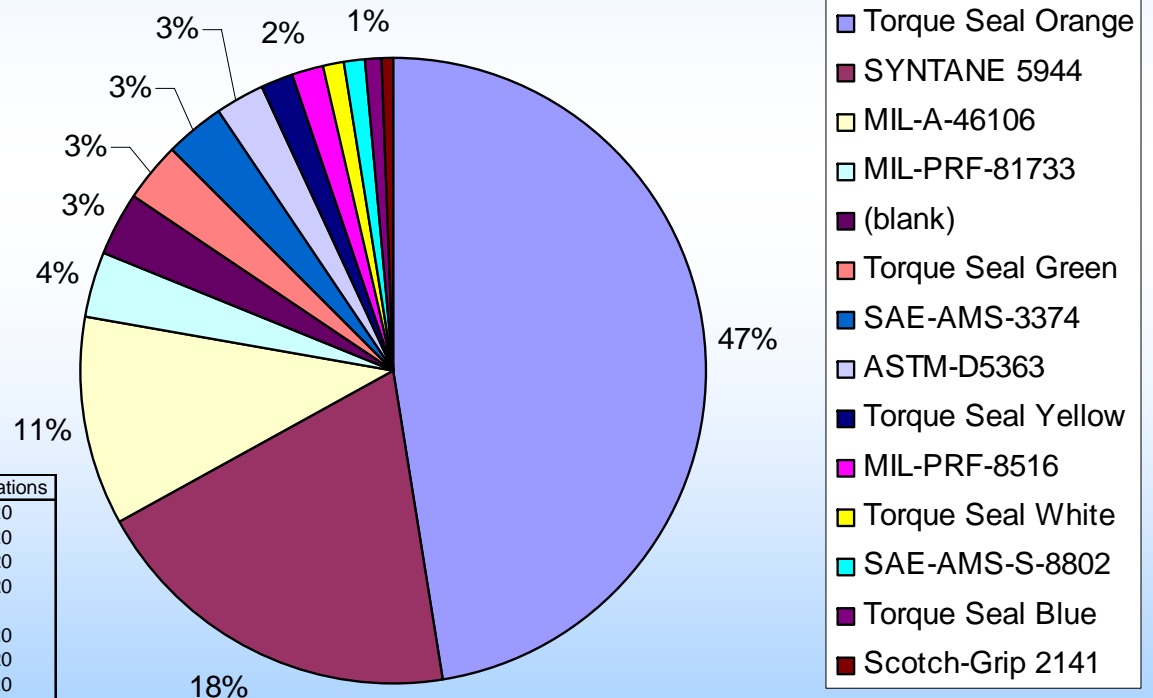
Product	Amount	Amount	HAP Content	Installations
Torque Seal Orange	Torque sealant	2,239	62.80%	>20
SYNTANE 5944	Sealant	916	52.94%	>20
MIL-A-46106	Pipe Joint Compound	507	1-35%	>20
MIL-PRF-81733	Polysulfide sealing cmpd.	167	0-15%	>20
(blank)		157		
Torque Seal Green	Torque sealant	139	62.80%	>20
SAE-AMS-3374	Silicone sealant	138	0-25%	>20
ASTM-D5363	Anerobic sealant	126	0-100%	>20
Torque Seal Yellow	Torque sealant	79	62.80%	20
MIL-PRF-8516	Sealing compound	76	0-80%	>20
Torque Seal White	Torque sealant	54	62.80%	18
SAE-AMS-S-8802	Sealing compound	51	0-25%	>20
Torque Seal Blue	Torque sealant	33	62.80%	>20
Scotch-Grip 2141	Gasket sealant	30	47.02%	1
A-A-59293	Metal to glass sealant	-	0.00%	15
Sealant Total		4,712		

- Most HAPs in TYAD and Fort Rucker

Expanded Survey of DoD Sealants

- ~4700 lbs VOHAP/yr
- Top 2 make up 67% of all VOHAPs

- Most HAPs in TYAD and Fort Rucker

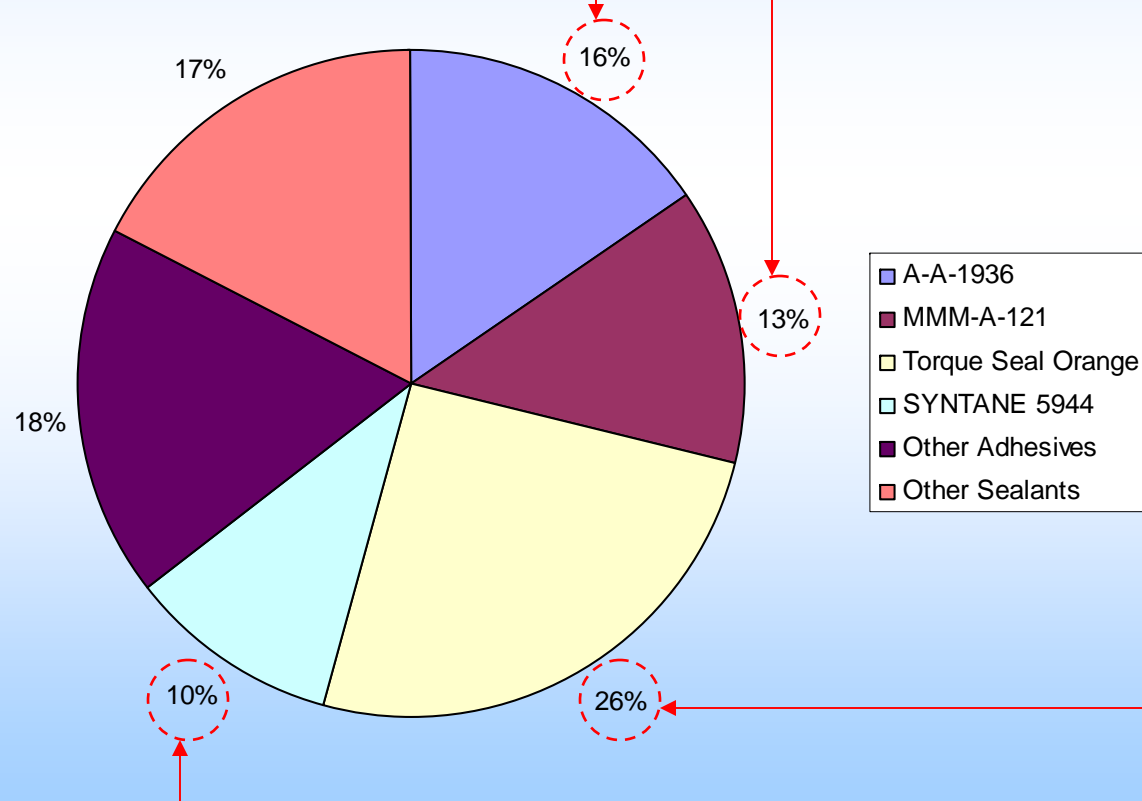


Sum of Lb VOHAP/Yr

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SAE-AMS-S-8802	Sealing compound	51	0-25%	>20
Torque Seal Blue	Torque sealant	33	62.80%	>20
Scotch-Grip 2141	Gasket sealant	30	47.02%	1
A-A-59293	Metal to glass sealant	-	0.00%	15
Sealant Total		4,712		

Sealants and Adhesives

- Top 4 Adhesives and Sealants make up 64% of HAPs



Summary

- **Identified numerous potential HAP-free alternatives for miscellaneous materials used at 14 Army installations**
- **Identified a number of materials with no known low HAP materials**
 - **Vehicle repair**
- **Replacing top 4 adhesives and sealants amounts to 64% of HAPs**

Future Work

- **Full analysis of complete Army survey**
- **Performance Requirements**
- **Materials Evaluation**

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