U.S. Army Research, Development and Engineering Command

Methylene Chloride Alternative HAP-Free Chemical Paint Strippers at Anniston Army Depot

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

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Outline

- Background
- Technical Approach
  - Laboratory Test Methodology
  - Lab Results and Downselection
  - Demonstration Results
- Current Status
- Summary

Background

Impact Statement

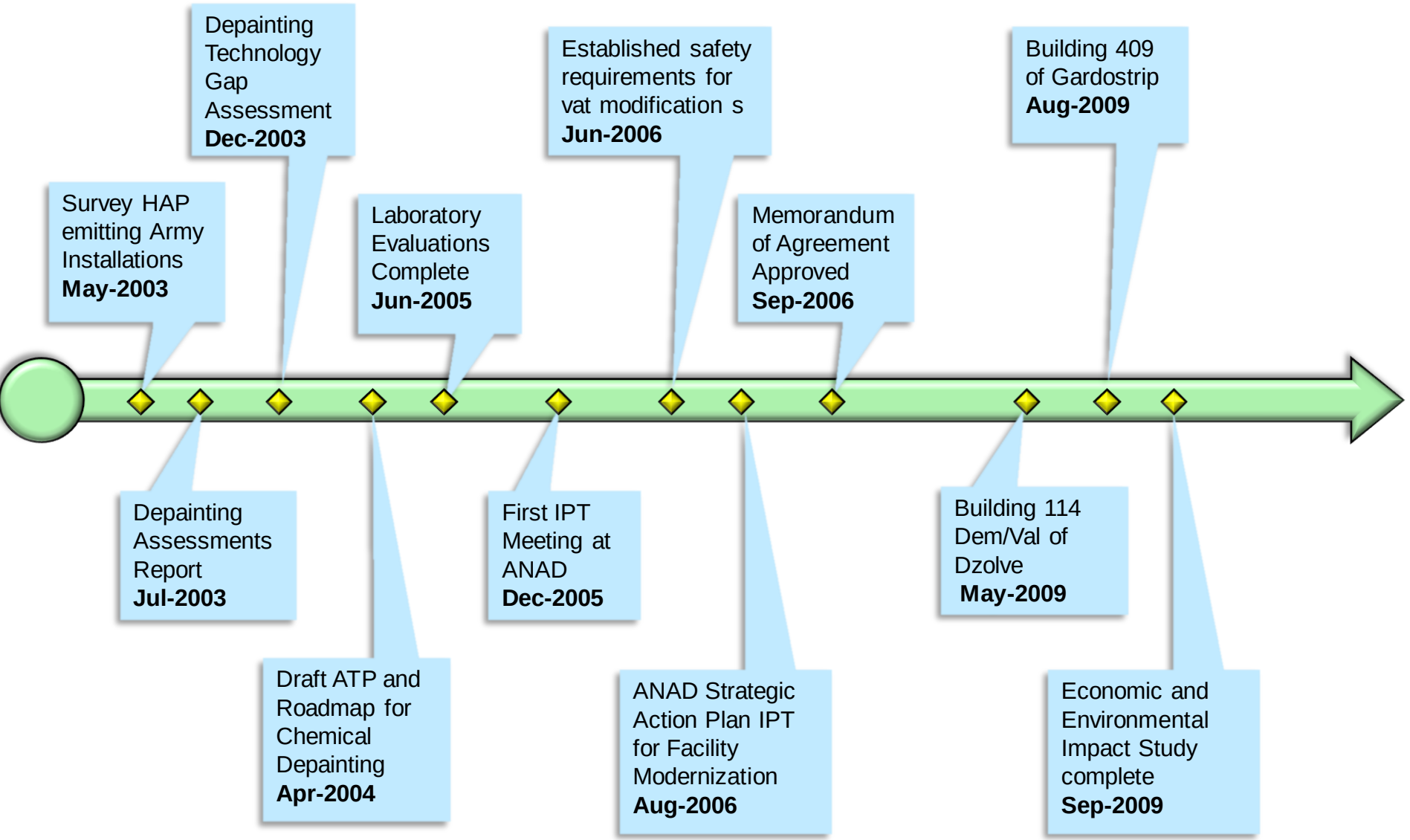
- The DLSME NESHAP is expected to regulate organic finishing processes and will likely require the modification of process lines to meet the new compliance limits.
- ANAD's current process utilizes Pen-Strip® NPX, an acid-activated paint remover containing approximately 70% methylene chloride and accounts for approx 92 of the 173 tons (53%) of the HAP generated by ANAD annually
- Elimination of Methylene Chloride in the immersion paint stripping process at ANAD?

Description

- The ultimate goal of this program is implementation of a HAP-free product for immersion paint stripping.
- Technical Approach: Lab validation and downselect candidates for full scale trials, dem/Val 3 alternatives at ANAD in each major stripping facility, and recommend for implementation most effective product.
- Targeted platforms are Army land based systems serviced at ANAD

Background

Depainting Timeline



Technical Approach

- Conduct Lab validation of HAP-free chemical paint strippers to replace MCL
  - Performance evaluations
  - Substrate repaintability
  - Materials compatibility
  - Toxicity clearances
  - Downselect top 3 candidates for full scale trials

- ANAD Demonstrations Buildings 114 and 409
  - Modify vats
  - Conduct demonstration
  - Perform Economic and Environmental Impact Study
  - Select product for implementation

- ANAD Demonstrations Building 474
  - Modify vat(s)
  - Conduct demonstration
  - Select product for implementation

Laboratory Test Methodology

Laboratory Validation

ARL Evaluated 29 Alternative Paint Strippers

Immersion Tests

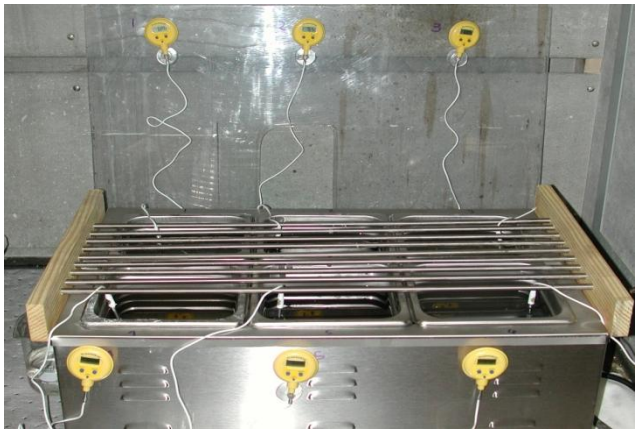
- Heated to 150° F - 170°F
- Test panels immersed for 30 minutes

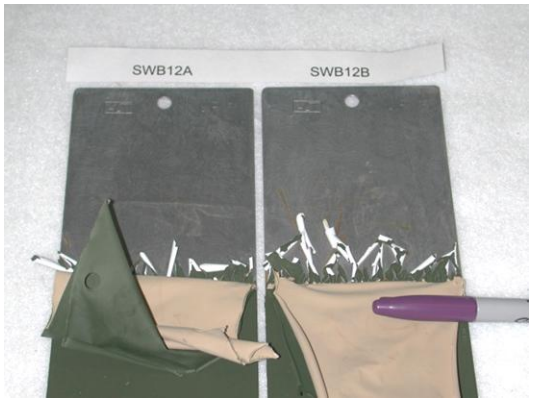
CARC paint systems

- MIL-DTL-46168 (53022 epoxy primer)
- MIL-DTL-64159 (53030 epoxy primer)
- MIL-DTL-53039 (53022 epoxy primer)

Substrates

- Chromated Al
- Phosphated Steel





Laboratory Test Methodology

Test Panel Schematic

CARC SB MIL-C-46168	(3)
CARC SB MIL-C-46168	(2)
CARC SB MIL-C-46168	(1)
Epoxy Primer SB MIL-P-53022B	(P)
Chromated Aluminum or Zinc Phosphated Steel	

CARC WB MIL-C-64159 Type I	(3)
CARC WB MIL-C-64159 Type I	(2)
CARC WB MIL-C-64159 Type I	(1)
Epoxy Primer WB MIL-P-53030	(P)
Chromated Aluminum or Zinc Phosphated Steel	

Also evaluated <u>new</u> products against MIL-C-53039

<u>Sample Preparation:</u>

Substrates:

- •Alodine Chromate pretreated 2024 aluminum
- •Zinc Phosphated cold rolled steel

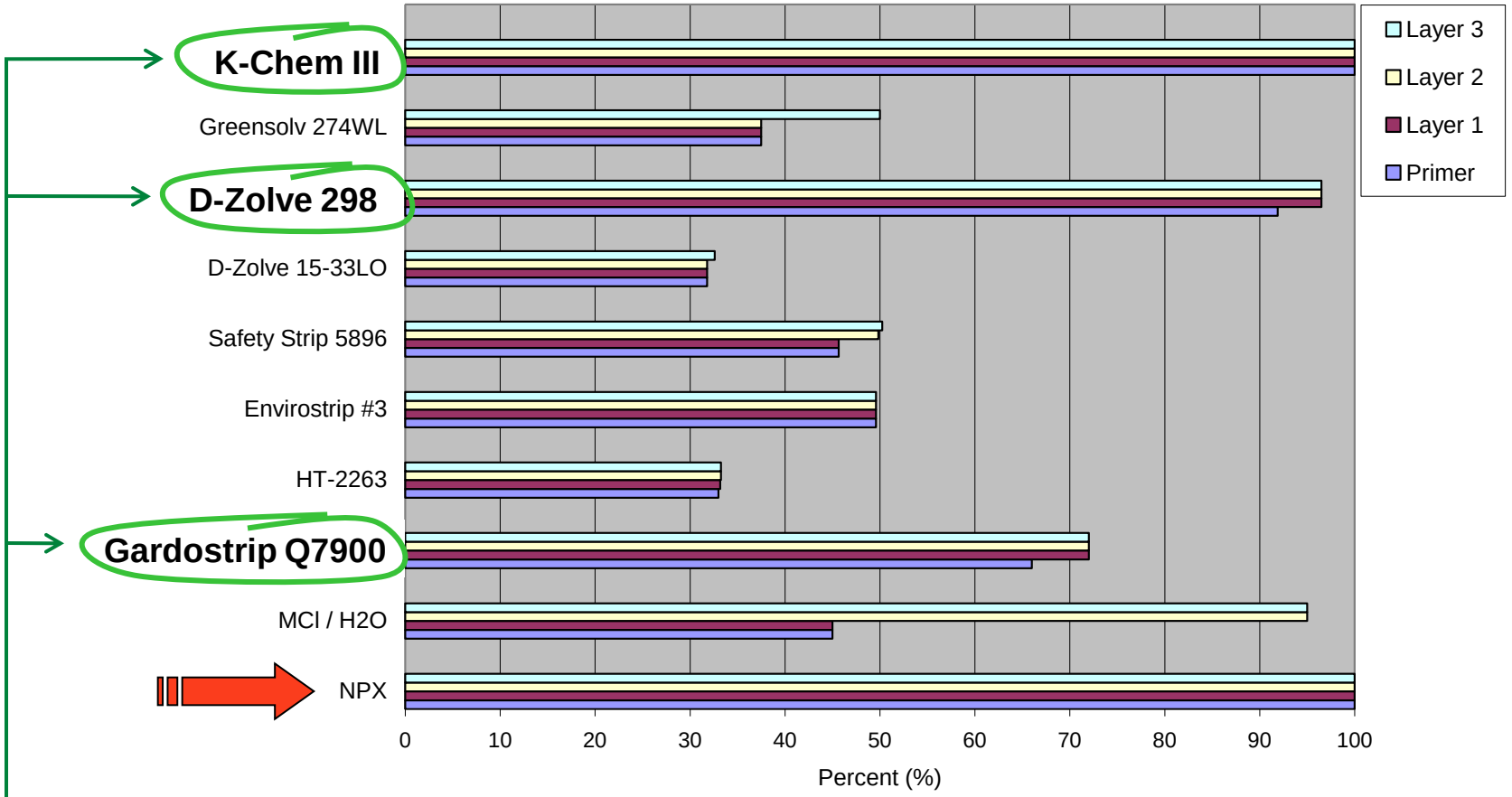
<u>Coating System:</u>

Prepared according to ASTM-D6189-97:

- •Applied primer plus 3 layers of topcoat
- •Alternated colors for easier stripping evaluation and ID

Laboratory Test Results

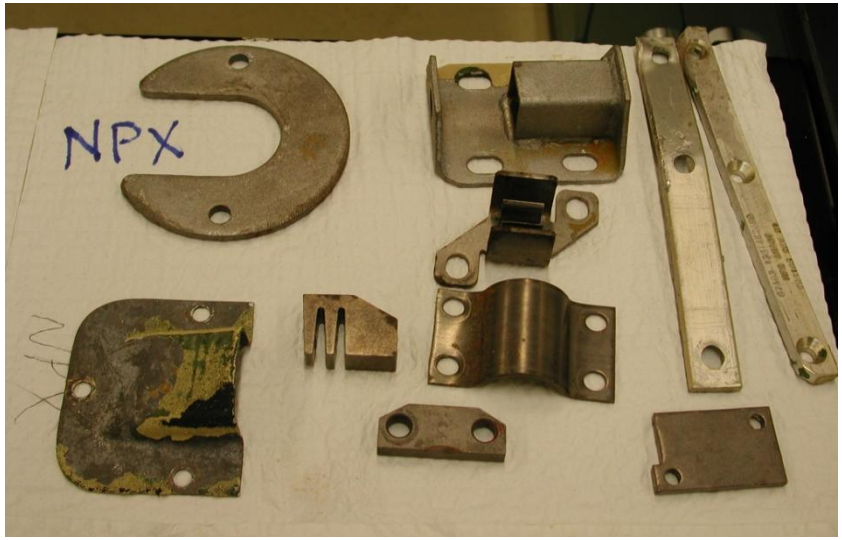
Average stripping performance of round 1 testing

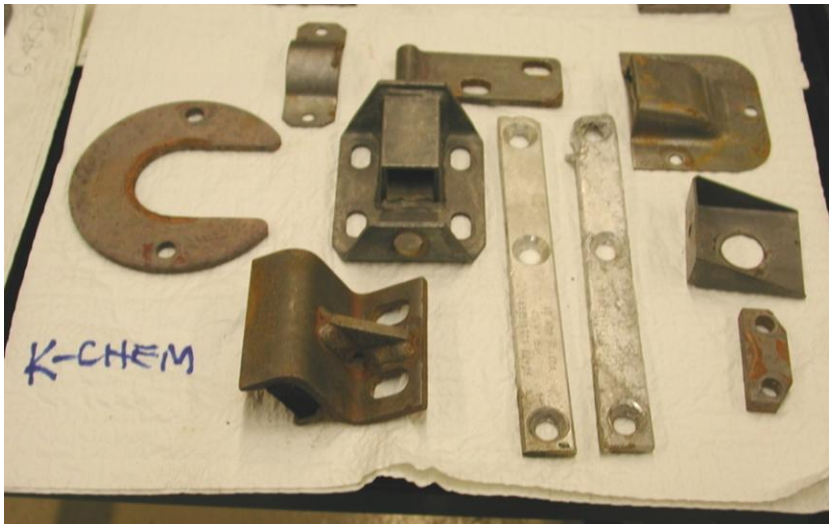


Candidates selected for dem/val consideration

Laboratory Test Results

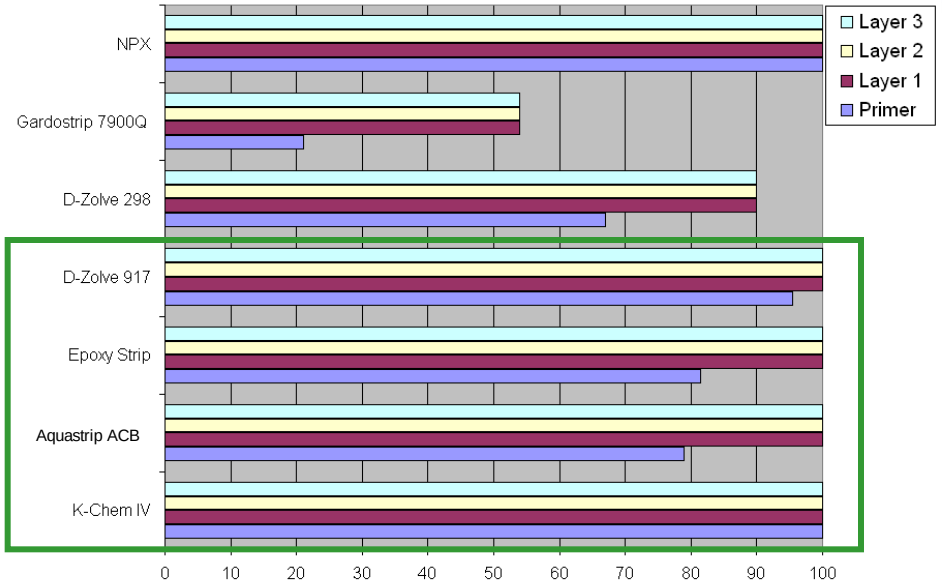
Lab Component Validation



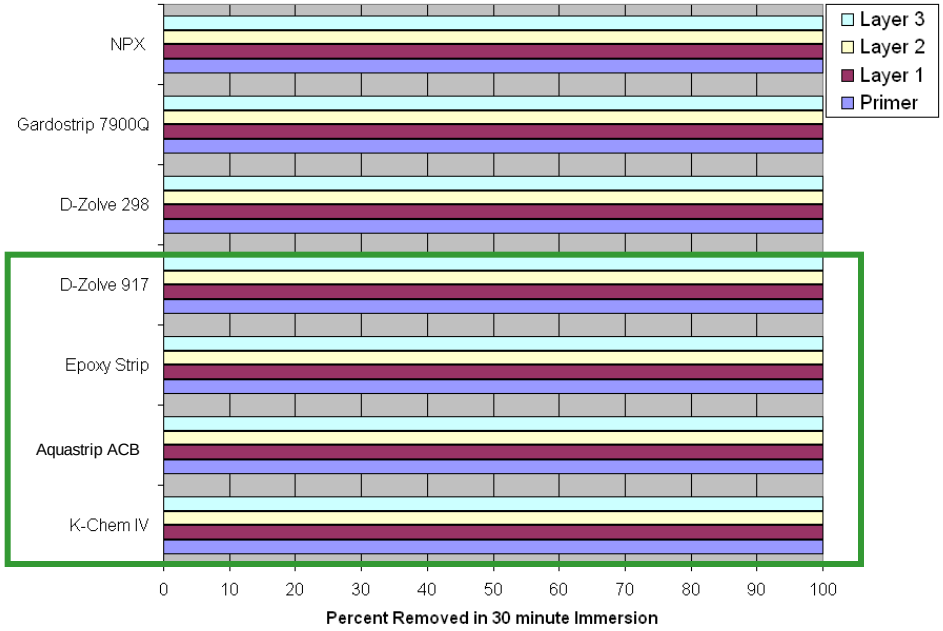


App ED.

Laboratory Test Results



CARC
53022B/53039



CARC
53030/64159
Type II

Relevant Properties

HAP-free Candidate Paint Removers

Product	Active Ingredients	PEL	Concentration	pH	Product soluble in H2O?	Flashpoint (F)
Aquastrip ACB	Benzyl Alcohol Proprietary	n/e n/e	45 - 55%	2.0 - 2.5	yes	>212
D-Zolve 298	Benzyl Alcohol Formic Acid	n/e 5ppm	10%	2.1	yes	>212
D-Zolve 917	Benzyl Alcohol Glycolic Acid	n/e n/e		2.4	yes	>200
Epoxy Strip	Glycolic Acid	n/e	<5%	2 - 4	yes	none
Gardostrip 7900Q	Proprietary	n/e		2 - 3	yes	>212
K-Chem III	Benzyl Alcohol Formic Acid Carbon Monoxide	n/e 5ppm 25ppm	<65% 1-2%	2.0	no	none
K-Chem IV	Benzyl Alcohol Formic Acid Carbon Monoxide	 25ppm	<25% 1-2%	2.0	no	>200

Materials Compatibility Tests

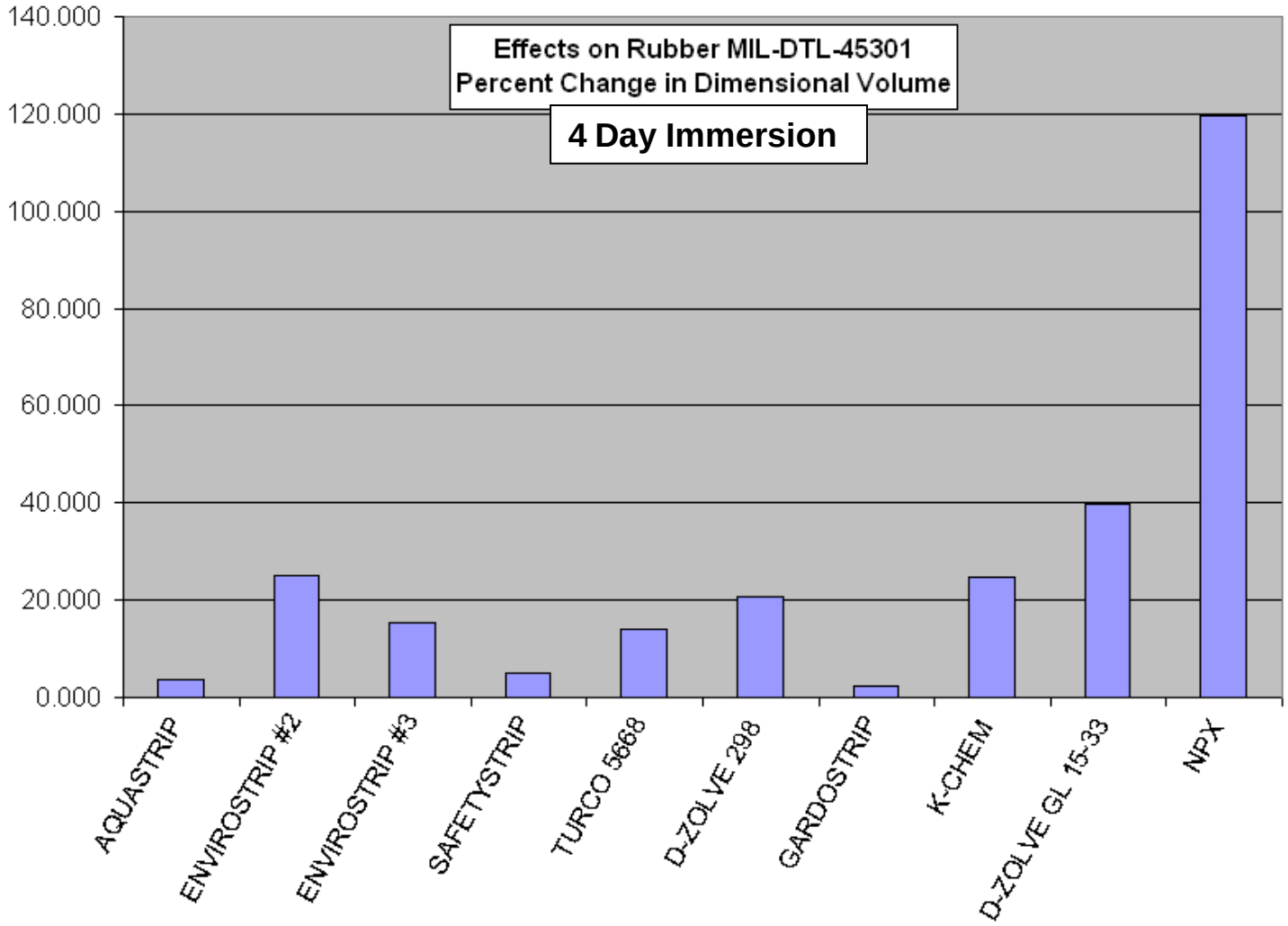
US ARMY RDECOM

X = Corrosion
X = Weight Loss
X = Staining
Blank cells = Met

Total Immersion (144 hrs)

	TITANIUM	ZINC	MAGNESIUM	STEEL 4340	CADMIUM	BRASS	STAINLESS 13-8	MARAGING C 250	AM 355	STEEL A36	ALUMINUM 7075	ALUMINUM 5083	HIGH HARD STEEL
Aquastrip ACB		X	XX	X	XX	X		X		XX	X		XX
Envirostrip #2		XX	X	X	X	X		X		X	X	X	X
Envirostrip #3		XX			X	X							X
Safetystrip 5896B				X									X
Turco 5668		XX	X		X	X							
D-Zolve 298		XX	XX	XX	XX	X	X	X		XX	XX	XX	XX
Gardostrip Q7900A		XX	XX	X	XX	X		X		XX		X	XX
K-Chem CARC Stripper III		X	XX	XX	X	XX		XX		XX	X	XX	XX
D-Zolve 917		XX	XX	XX	XX	X	X	X		XX	XX	X	XX

Materials Compatibility Tests



Demonstration Results

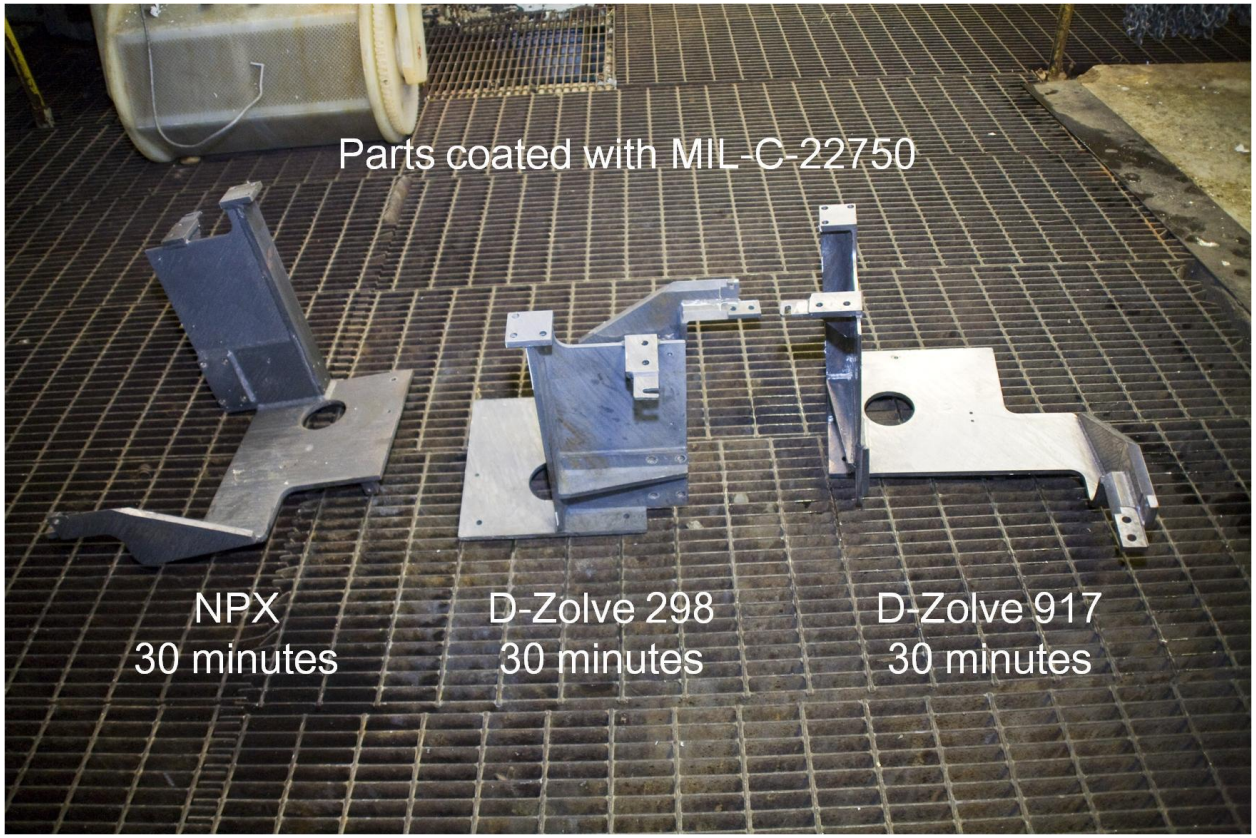
Overall Performance

	White Interior* (85% of workload)	Exterior CARC** (15% of workload)
Technology	**Performance vs. NPX**	
D-Zolve 917	Comparable	Required longer dwell times
D-Zolve 298	Equivalent	Slightly slower
Gardostrip Q7900A	Equivalent	Slightly slower

* White Interior Topcoat: MIL-C-22750
** Exterior CARC: MIL-DTL-64159 (water dispersible) or MIL-DTL-53039 (single component polyurethane)

Demonstration Results

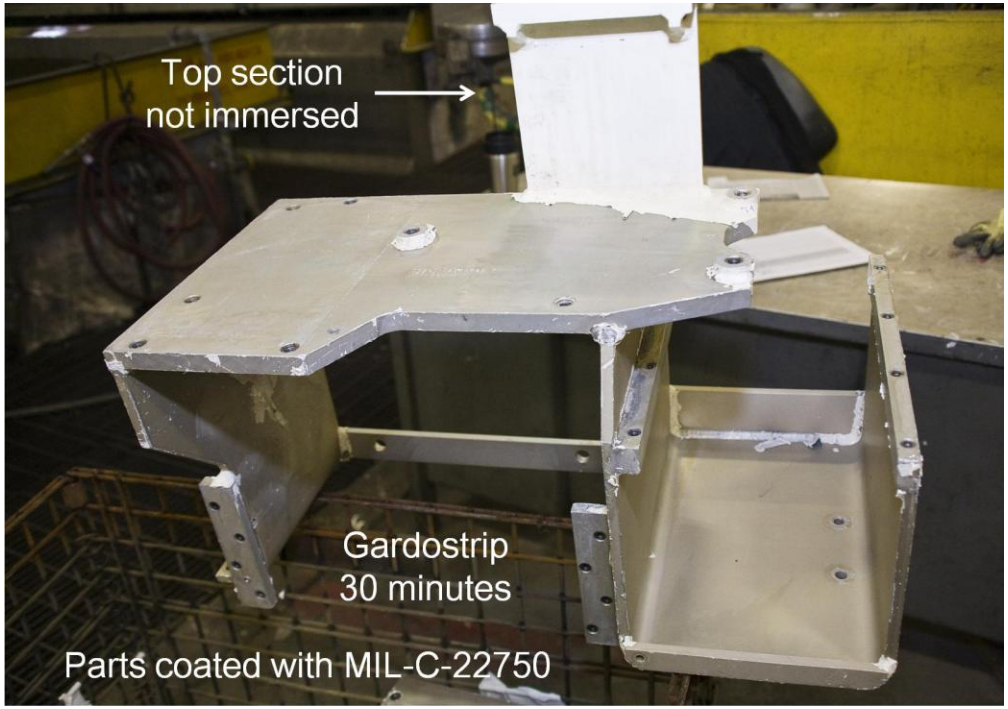
Building 114



Randomly selected parts coated with white MIL-C-22750
No noticeable difference in performance

Demonstration Results

Building 409 Gardostrip

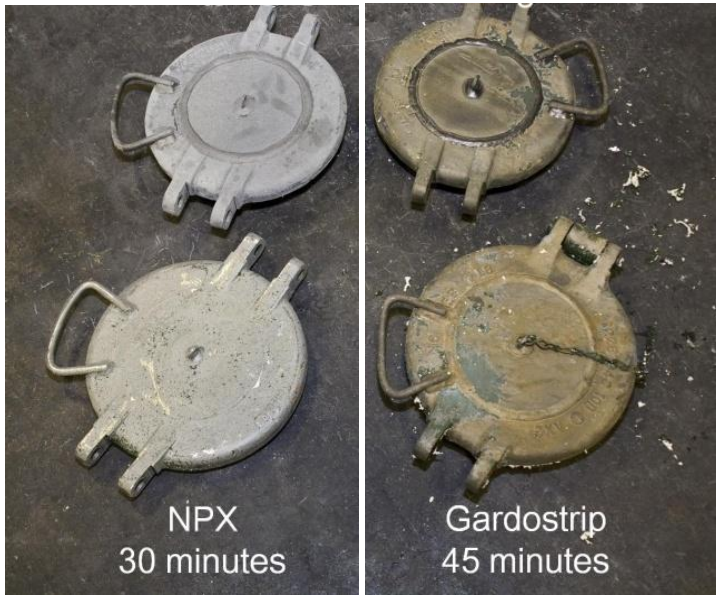


Electronic components rack coated with MIL-C-22750 (white interior coating)

Result: Equivalent performance

Demonstration Results

Building 409 NPX vs. Gardostrip



Filler opening caps coated with MIL-DTL-64159 or 53039 (tan/green exterior CARC)

Result: Parts stripped with Gardostrip required additional dwell time

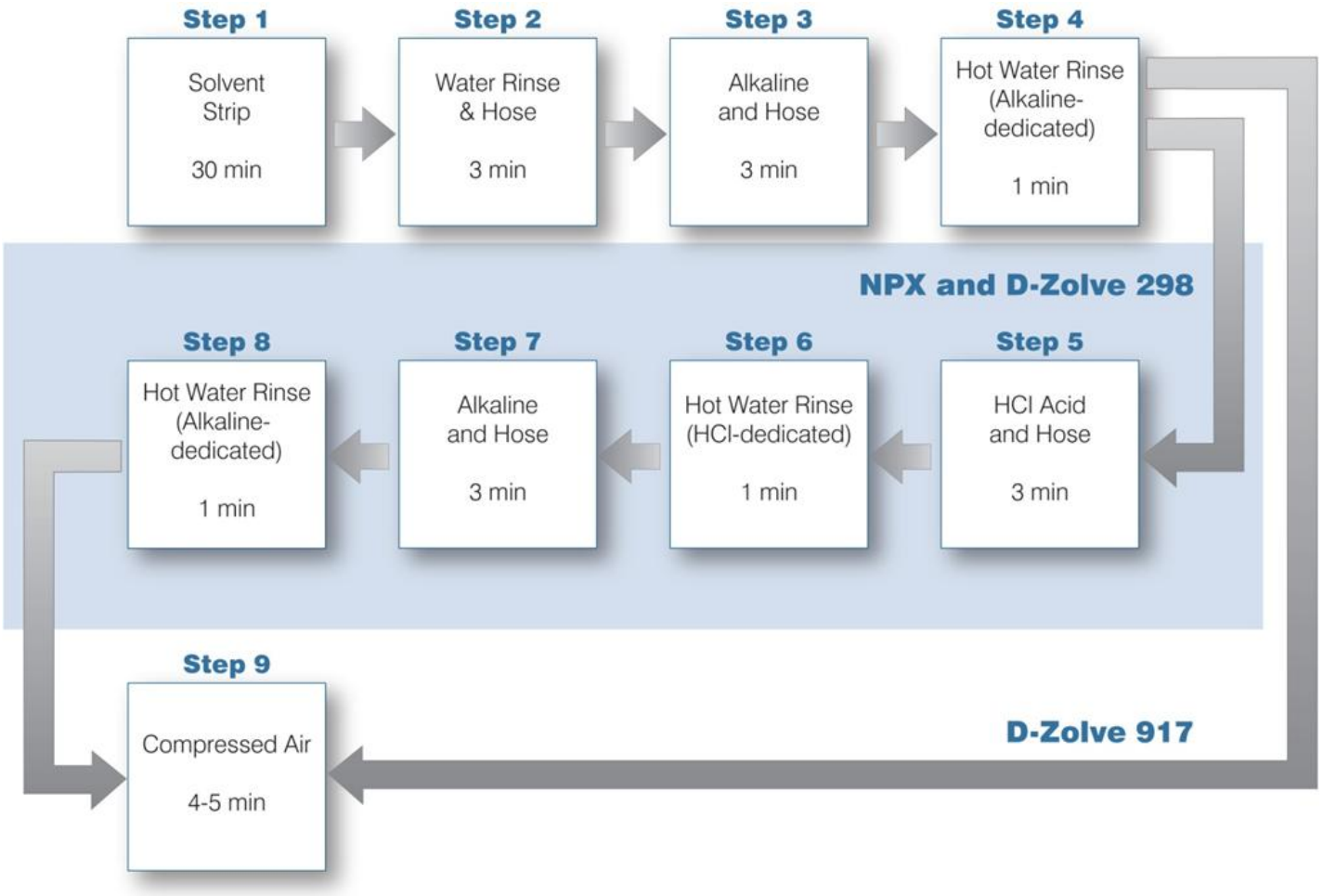
CARC Coated Cupola

30 Minutes NPX

75 Minutes Gardostrip

Demonstration Results

Process Flow for Steel Parts in B114



Demonstration Results

Summary of Costs for NPX and Alternative Processes

Technology	Capital Costs	Annual O&M Costs
Baseline NPX	$0	$1,926,112
NPX with Pollution Controls	$1,913,647	$2,453,047
D-Zolve 917	$277,164	**$1,292,556**
D-Zolve 298	$277,164	$1,293,919
Gardostrip Q7900A	$277,164	$1,506,095

Demonstration Results

HAP and VOC Emissions Summary

Solvent	HAP Emissions			VOC Emissions		
	lbs/yr	tons/yr	% Reduced	lbs/yr	tons/yr	% Reduced
NPX	250,993	125.5	0	107,568.25	53.78	--
D-Zolve 917	0	0	100	12,134.07	6.07	89%
D-Zolve 298	0	0	100	17,813.38	8.91	83%
Gardostrip Q7900A	0	0	100	26,813.73	13.41	75%

Current Status of Ongoing Dem/Val

- Dzolve 917 was selected alternative for both B114 and B409
- One HAP-free vat currently in use in B114
- Two Vats Modified in B409:
  - One vat of currently in regular use
  - Currently evaluating a new filtering system on second vat
  - When filtering system is selected, it will be installed on both vats
- Vat modifications ongoing for power train facility in B474

SPOTA Depainting Technical Review Summary

- Successfully demonstrated three MCL alternatives in 2 ANAD facilities
- All HAP-free chemical strippers were more cost effective than current NPX
- Lowest cost option proved to be Dzolve 917 with payback for initial investment less than 6 months
- Obtaining National Stock Number (NSN) for Dzolve 917
  - 55 gallon drum: NSN 8010015790893
  - 205 gallon tote: NSN 8010015790894
- ANAD has allocated additional funds in FY10 to start transitioning to a HAP-free alternative
  - At least 4 HAP-free vats expected to be in full use by the end of this CY 2010.

Questions