



U.S. Army Research, Development and
Engineering Command



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

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

**Environment, Energy,
Security and Sustainability
Symposium 2010**

June 14-17, Denver CO

John V. Kelley
US Army Research Laboratory
410-306-0837
jkelly@arl.army.mil

Wayne Ziegler
US Army Research Laboratory
wziegler@arl.army.mil

Report Documentation Page				Form Approved OMB No. 0704-0188	
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.					
1. REPORT DATE JUN 2010		2. REPORT TYPE		3. DATES COVERED 00-00-2010 to 00-00-2010	
4. TITLE AND SUBTITLE Methylene Chloride Alternative HAP-Free Chemical Paint Strippers at Anniston Army Depot				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) US Army Research Laboratory, 2800 Powder Mill Road, Adelphi, MD, 20783-1197				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 14-17 June 2010 in Denver, CO.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 23	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



Outline



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



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

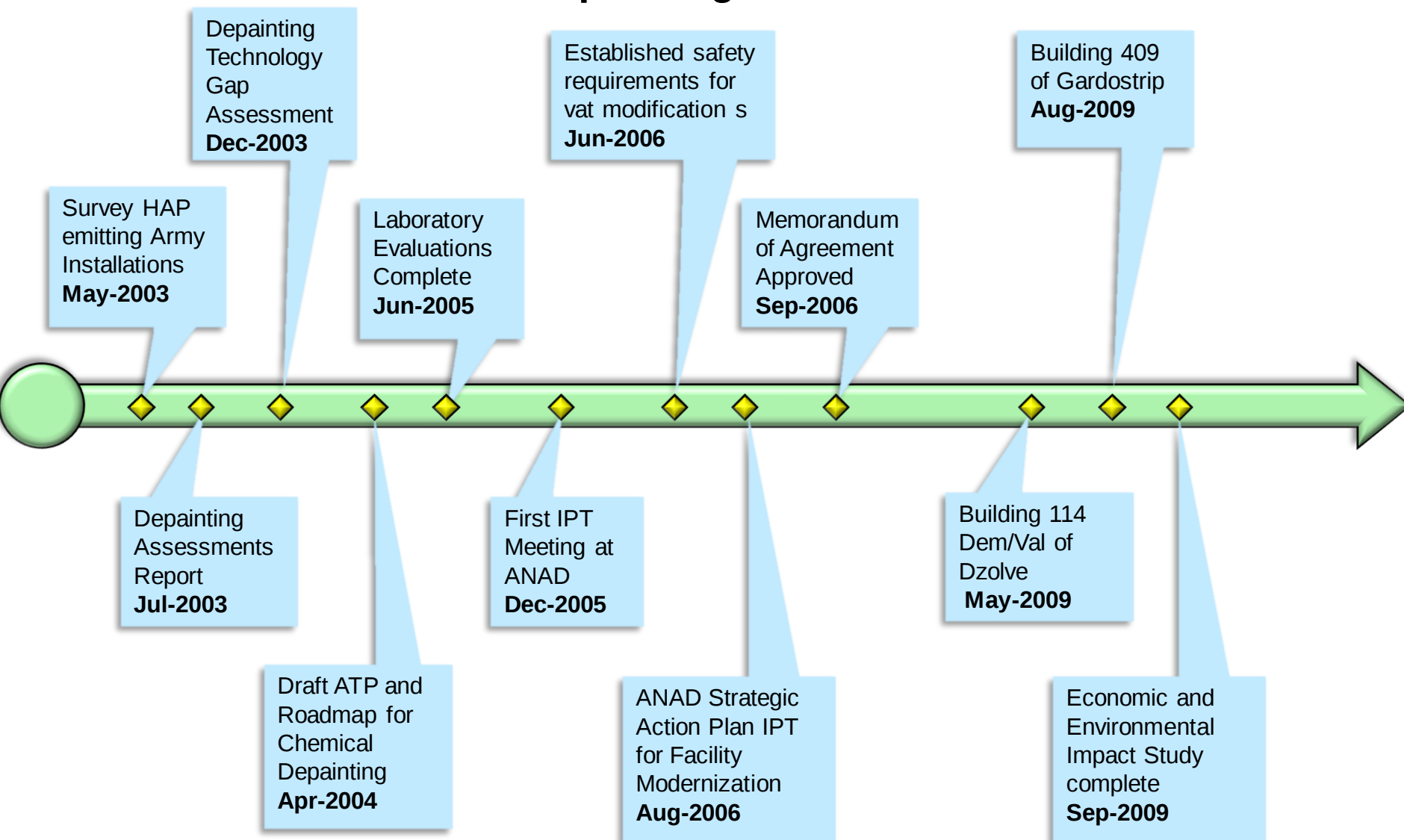
- The ultimate goal of this program is implementation of a HAP-free product for immersion paint stripping.
- Technical Approach: Lab validation and downselect candidates for full scale trials, dem/Val 3 alternatives at ANAD in each major stripping facility, and recommend for implementation most effective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

ARL Evaluated 29 Alternative Paint Strippers

Immersion Tests

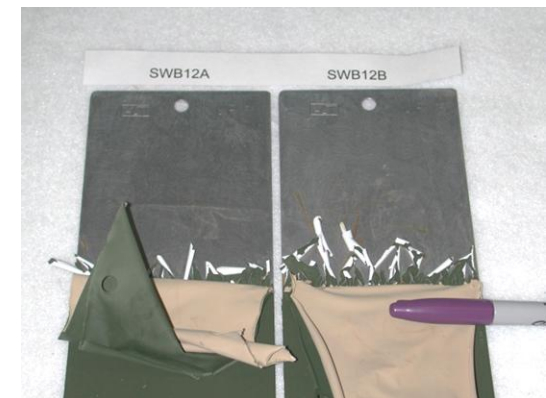
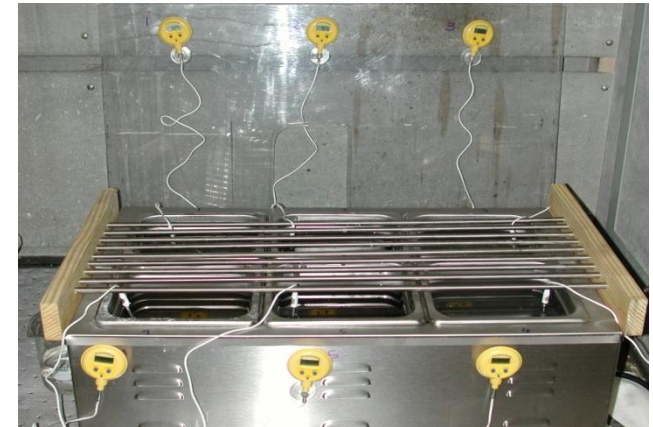
- Heated to 150° F - 170° F
- Test panels immersed for 30 minutes

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





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	

Sample Preparation:

Substrates:

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

Coating System:

Prepared according to ASTM-D6189-97:

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

Also evaluated new products against

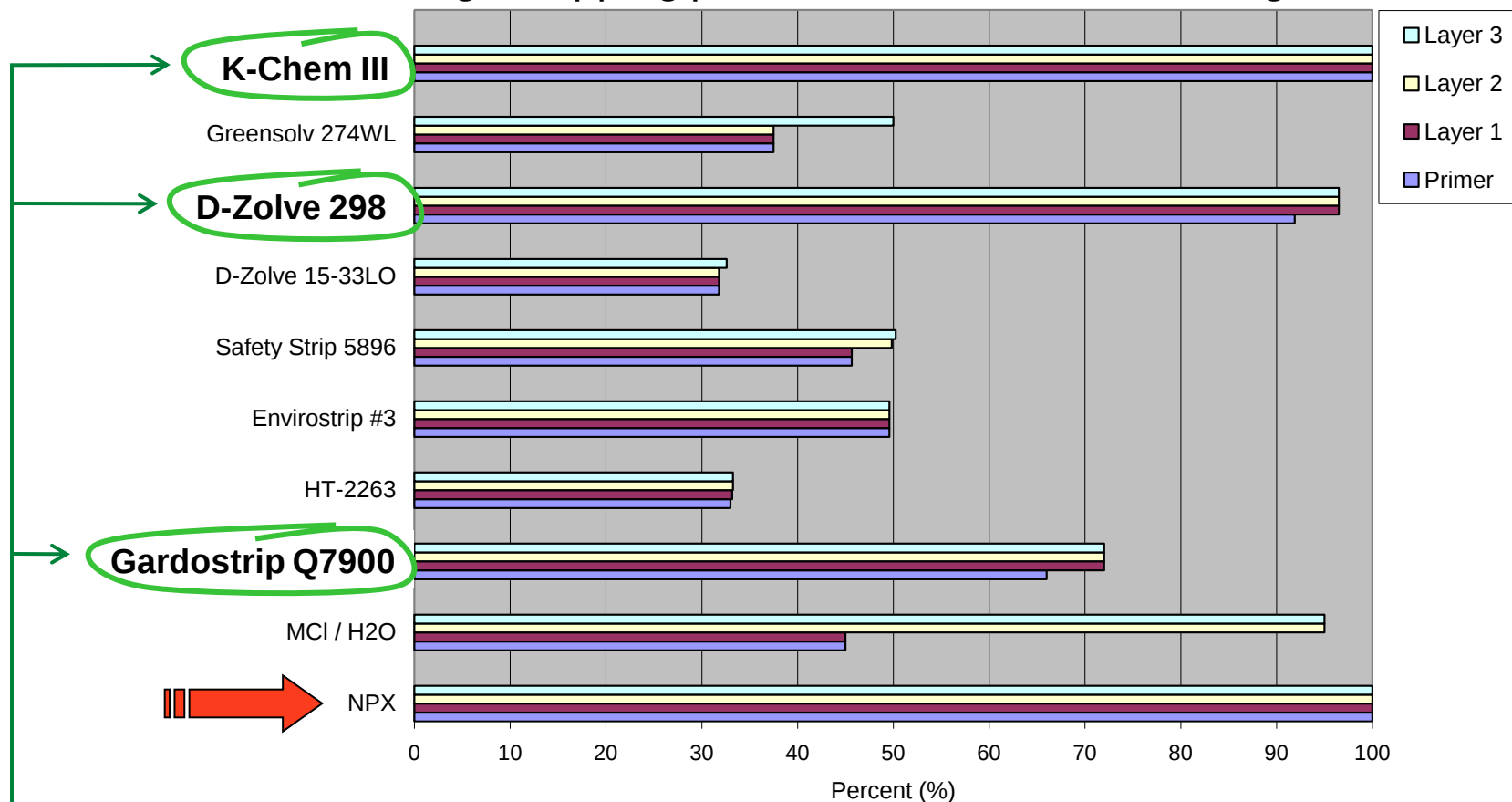
MIL-C-53039



Laboratory Test Results



Average stripping performance of round 1 testing



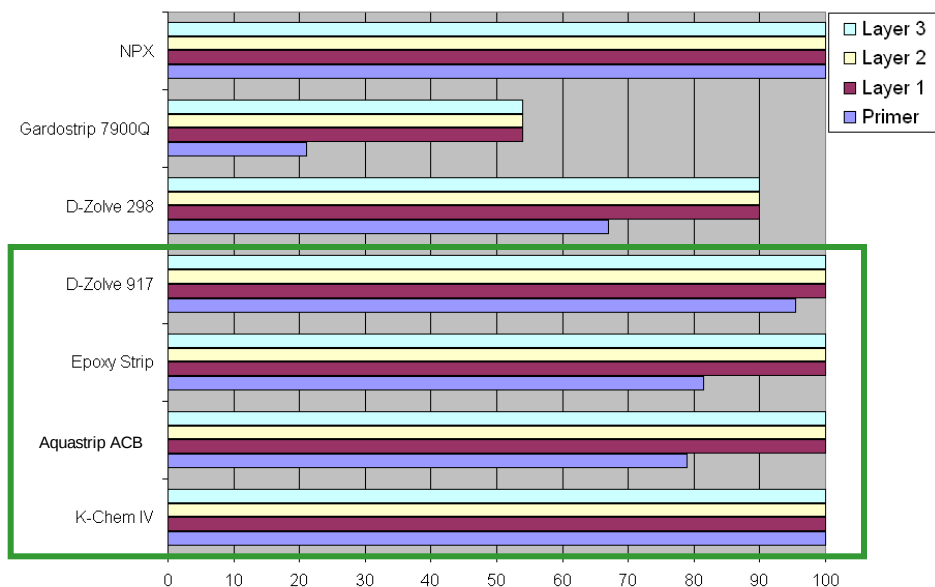
Candidates selected for dem/val consideration

Lab Component Validation

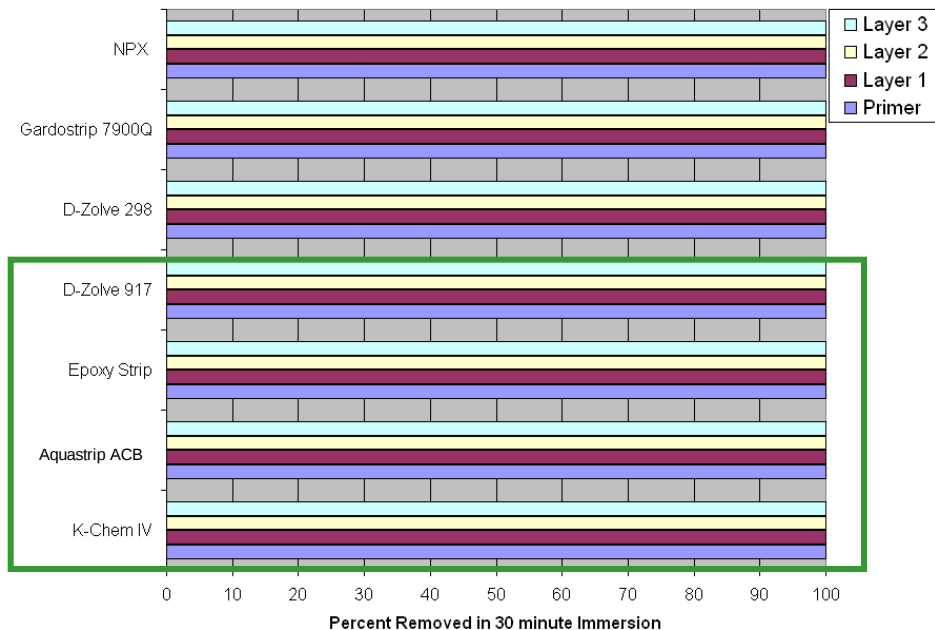




Laboratory Test Results



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



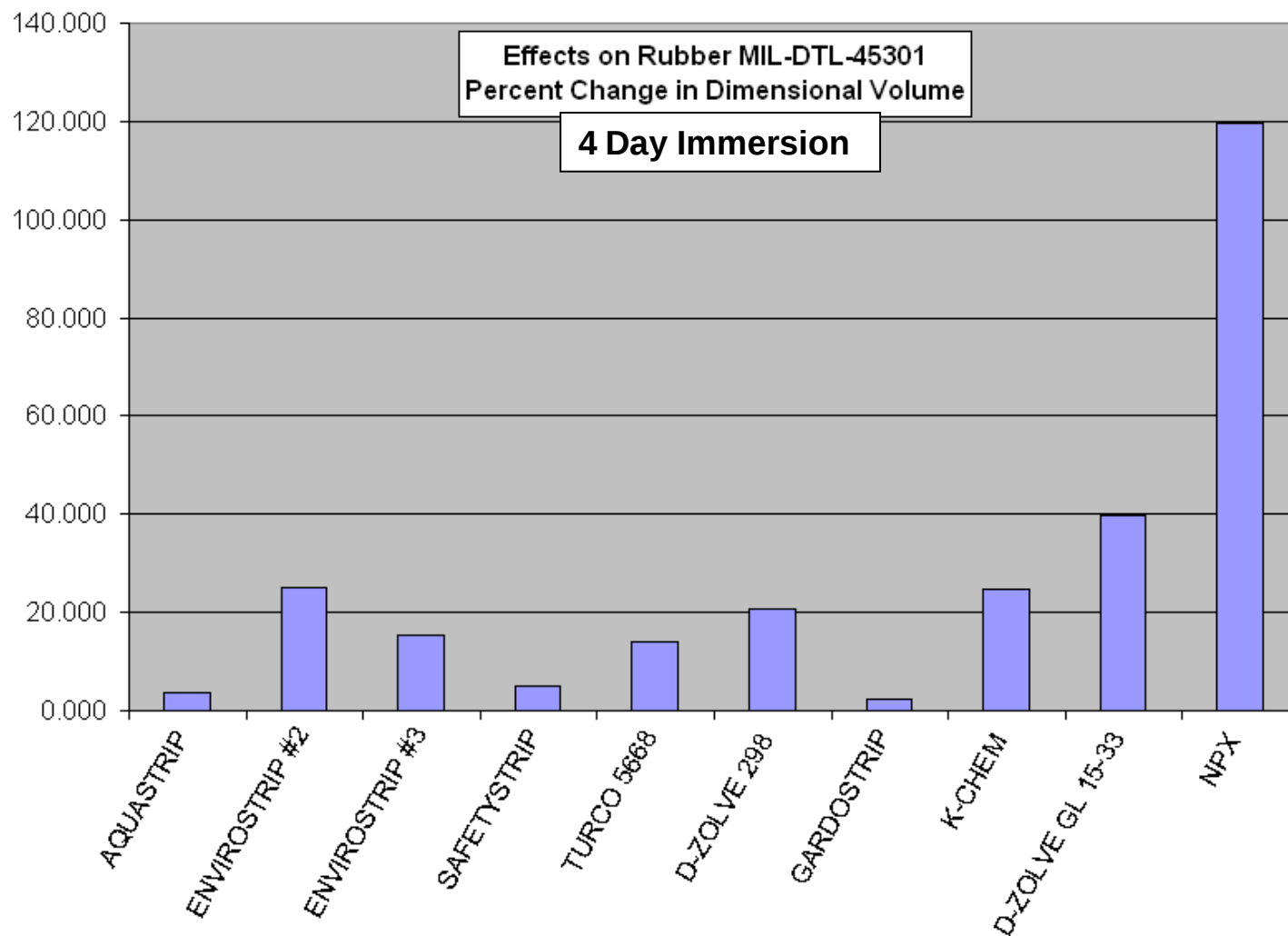
Blank cells = Met

Total Immersion (144 hrs)

[illegible]



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

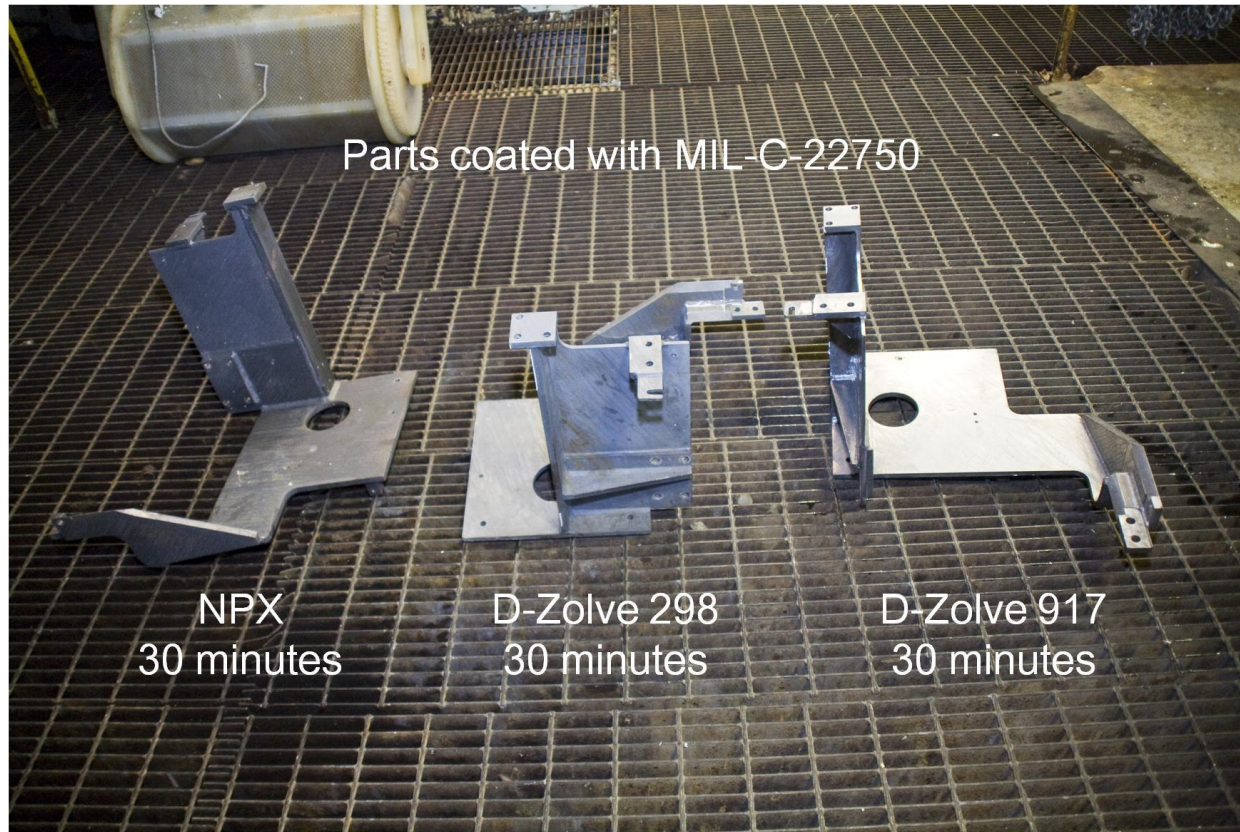
** Exterior CARC: MIL-DTL-64159 (water dispersible) or MIL-DTL-53039 (single component polyurethane)



Demonstration Results



Building 114



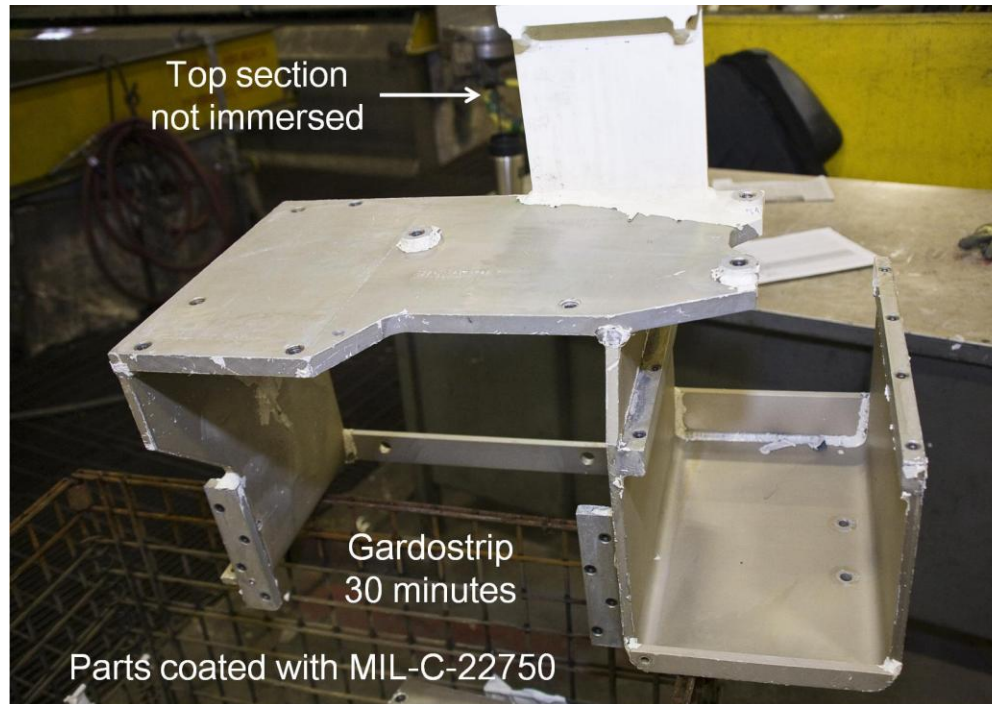
**Randomly selected parts coated with white MIL-C-22750
No noticeable difference in performance**



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

CARC Coated Cupola



30 Minutes NPX



75 Minutes Gardostrip



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

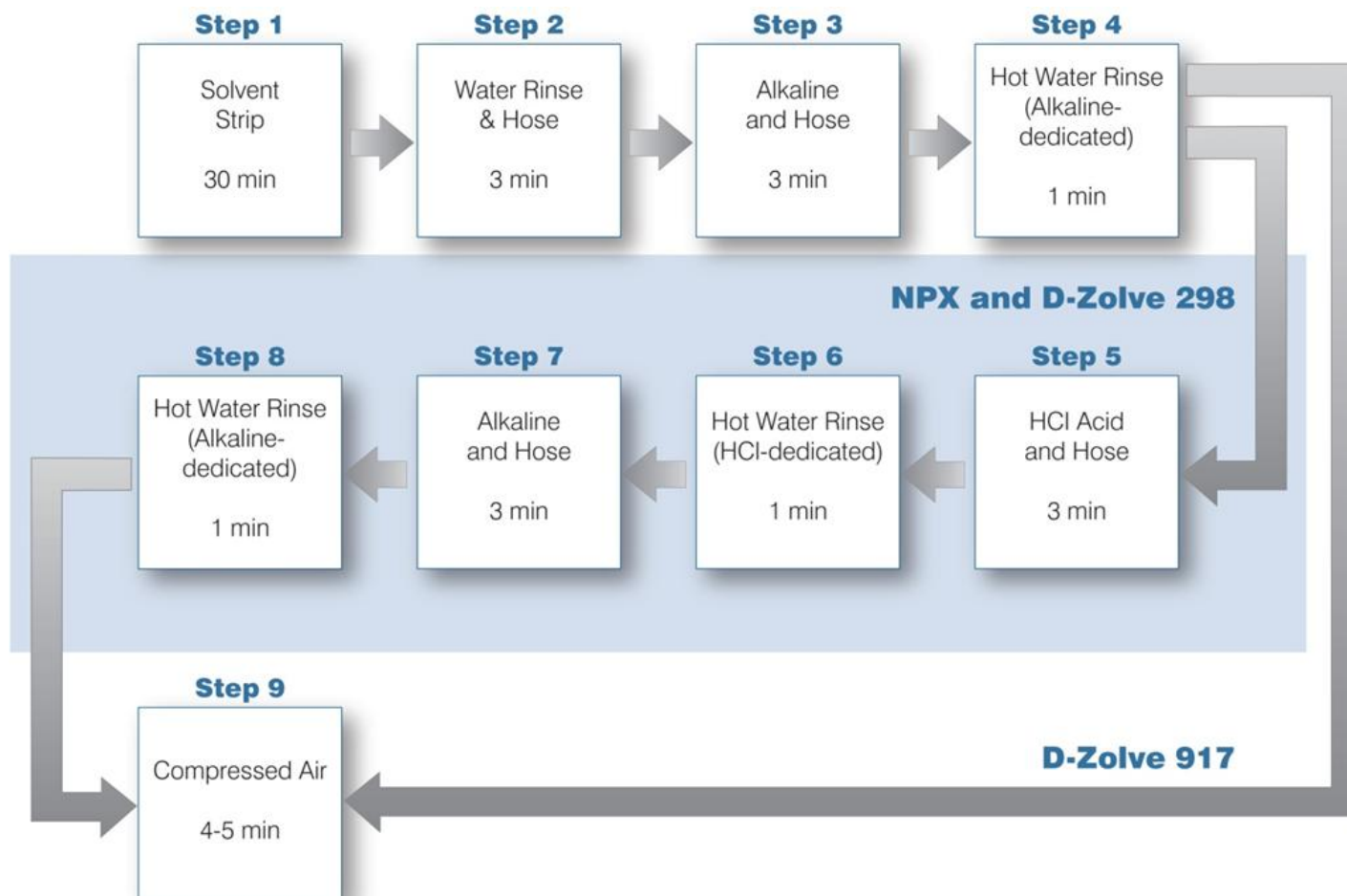
Result: Parts stripped with Gardostrip required additional dwell time



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