



**Idaho
National
Engineering
Laboratory**

Alternative Chemical Paint Strippers

Third Annual International Workshop on Solvent Substitution

ALAN PROP. 208-526-07

December 10, 1992

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Project Objective

The objective of this project is to evaluate low toxicity, environmentally compliant solvents for paint stripping operations at DOE and DOD facilities. Evaluation includes rigorous performance testing of selected solvents on a series of paint systems widely used in the aerospace industry, by DOD, and by DOE after initial screening to eliminate unsuccessful materials.

Hazardous Constituents of Current Formulations

- Methylene chloride
- Phenol
- Formic acid

Typical Active Constituents in Alternative Solvents

- Ethanolamine and derivatives
- N-methylpyrrolidone
- Glycol phenyl ethers
- Cyclic amines
- Terpene hydrocarbons
- Benzyl alcohol
- Benzene sulfonic acid derivatives
- Naphthenic distillate
- p-toluene sulfonamide derivatives
- Potassium hydroxide

Test Sequence for Product Evaluation

- Paint stripping efficiency screening test
- Paint stripping efficiency test
- Immersion corrosion test
- Process enhancement tests
- Extended performance test
- Rinsability/refinishing properties test
- Hydrogen embrittlement test
- Field evaluation studies

Summary of Results of Product Evaluation

- 48 immersion strippers evaluated
 - 12 passed screening
 - 11 passed immersion corrosion test
- 20 brush-on strippers screened
 - None passed
 - Screening criteria too restrictive
 - Products will be re-evaluated

Coating Systems Classified by Topcoat/Primer

- Epoxy
 - Epoxy
 - Epoxy polyamide
- Urethane
 - Elastomeric polysulfide
 - Water-thinned epoxy
 - Epoxy primer for use in high erosion areas
 - Epoxy polyamide/polysulfide sealant/epoxy polyamide
 - Koroflex
- Lacquer
 - Zinc chromate

Paint Strippers Classified by Main Ingredient

- Ethanolamine/amine

- Hotstrip 420*

- CM-3707*

- SP-800

- SP-828

- FO 606*

- CEE BEE A-477*

- Benzyl alcohol

- CEE BEE A-245*

- N-methylpyrrolidone (NMP)

- M-Pyrol*

- PSS 600

Paint Strippers Classified by Main Ingredient (cont'd)

- Benzene sulfonic acid/glycol phenyl ethers
 - Clepo Envirostrip 222
- NMP/ethanolamine/other
 - T-5668
- Controls
 - CEE BEE A-227D
 - CEE BEE A-458
 - CEE BEE J-59
 - T-5351
- Most effective products

Summary of Results for Most Effective Products

Hotstrip 420

- General
 - Generally effective on all coating systems
- Epoxy
 - Effective but slow on selected systems
- Urethane
 - Effective but relatively slow on polysulfide coats
- Lacquer
 - Very effective

Summary of Results for Most Effective Products (cont'd)

CM-3707

• General

- Less effective than FO 606

• Epoxy

- Effective; selected systems strip slowly from carbon steel

• Urethane

- Slow to remove most urethane coatings
- Polysulfide undercoat not removed from carbon steel

• Lacquer

- Very effective

Summary of Results for Most Effective Products (cont'd)

FO 606

- General
 - Not completely effective on coatings applied to anodized substrates
 - Less effective on some systems than CEE BEE A-477
 - Selected systems resist stripping from carbon steel substrates
- Epoxy
 - Not effective on selected systems
- Urethane
 - Effective on some urethane systems; slow starting
 - Polysulfide coats are difficult to impossible to strip depending on substrate
- Lacquer
 - Effective

Summary of Results for Most Effective Products (cont'd)

CEE BEE A-477

- General
 - Most effective product tested
 - Most paint systems completely stripped in 1 h or less

- Epoxy
- Urethane
- Lacquer

Summary of Results for Most Effective Products (cont'd)

CEE BEE A-245

- General
 - Stripping of some systems from carbon steel substrates is very slow to only minimal
 - Approximately the same efficiency as CM-3707 on most coating systems; less effective on selected epoxy systems
- Epoxy
 - Not effective on some systems
- Urethane
 - Slow to remove some topcoats and undercoats
 - Not effective on polysulfide undercoats
- Lacquer
 - Very effective on topcoat; primer removed more slowly

Summary of Results for Most Effective Products (cont'd)

M-Pyrol

- General
 - Generally effective on all coating systems
- Epoxy
 - Effective; selected systems required 2 h or longer to strip
- Urethane
 - Effective but slower acting than on epoxies
 - Polysulfide undercoats and Koroflex are slow to strip
- Lacquer
 - Effective on topcoat
 - Mixed results on primer

Conclusions

- Stripping efficiency depends not only on product composition and coating system used, but also on substrate
- The controls were not completely effective on all coating systems; action of most effective products tested is comparable to that of controls
- No brush-on strippers passed the screening; revised test procedures required
- For products evaluated, temperature has a significant effect on performance

Conclusions (cont'd)

- Corrosion rates for products tested are comparable to or lower than controls for the same metallurgy
- The current generation of products still contains components with some levels of hazard
- The paint systems being used in these studies contain hazardous components, including chromium