

Viability Study of 1K Oxsol (PCBTF) Free MIL-PRF-24635F Type V Comp 1 Coatings in OE Shipyards

July 2026

Elzly, NCP Coatings, HII-Newport News, and BAE Jacksonville



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Background

- New environmental restrictions prevent some paint facilities from spraying coatings containing oxsol.
 - Commercialization of Parachlorobenzotrifluoride (PCBTF)/Oxsol 100-free polysiloxane topcoats began around 2018 when California banned the solvent.
 - Some manufacturers changed single component (1K) coating formulations to omit oxsol.
 - NCP has since developed a 1K Oxsol-free polysiloxane for MIL-PRF-24635 Type V Class 2 Grade B Composition 1 in Color 26270 Haze Gray for topside applications.
- The benefits of 1K topcoats include:
 - Minimizes onset coating failures such as cracking and flexibility issues due to mixing errors that can occur with two component (2K) systems.
 - Reduced waste and disposal costs since 1K systems can be resealed and reused.
- Concerns about the corrosion protection of thinner oxsol-free 1K topcoats need to be investigated.

Scope of Work

- Identify gaps in knowledge of Navy 1K oxsol-free polysiloxane topside coatings meeting MIL-PRF-24635F Type V, Comp. 1 requirements and traditional 2K polysiloxane coating systems.
- Compare 1K and 2K polysiloxane systems production rates, reduction in material waste, and coating performance focused on corrosion and UV protection, adhesion, flexibility, and impact resistance.

Project Goals and Objectives:

- Assess overall system coating performance.
- Determine coating failure rates and quantify impact on rework.
- Benchmark overall production benefits (mixing/application).
- Track waste stream benefits where possible.
- Identify/share best practices among shipyard coating experts.

Tasks

- Task 1: Identify testing requirements, environmental monitoring metrics, and demonstration goals
 - Work with stakeholders/Navy technical advisors to identify requirements and tests
 - In-process
- Task 2: 1K vs. 2K evaluation - lab testing and environmental impact study
 - Execute laboratory testing on coating performance
 - Evaluate environmental impacts of coating material waste
- Task 3: Shipyard Demonstration
 - Partner yard demo(s) to gather production (paint and QC) feedback
 - Monitor production rates, waste, and coating performance
 - Planned September – December 2026
- Task 4: Final Report
 - Compile data, information, and results into final report (February 2027)

Previous Work

Qualification and Demonstration of PCBTF-Free and Low-VOC Topcoats for Surface Ships and Submarines, Naval Research Laboratory/ESTCP (2025)

- A multi-year effort funded by ESTCP and performed by Naval Research Laboratory (NRL) on this topcoat recently concluded in 2025 with favorable results. Through the NRL study it was determined that the Oxsol-free 1K variant performed similarly to existing 1K MIL-PRF-24635 polysiloxane in terms of application and exhibited excellent color and gloss retention, corrosion resistance, adhesion, and durability during laboratory testing and field demonstrations even when applied at thinner film thicknesses. Numerous field conditions were tested:
 - Airless-spray applied over 23236 Ty VI epoxy + 1K polysiloxane (2 demos).
 - Roll-applied over aged 2K polysiloxane topcoat that was abraded with power tools and over aged silicone alkyd topcoat that was abraded by hand-sanding.
- Ultimately, the 1K oxsol-free exhibited durability and weatherability and was found to be more user-friendly than the 2K coating.

Previous Work – pt 2

FCS MK 99 Antenna Reflector/KAS Problems and Recommended Corrective Actions – Tim Tenopir, NSWCCD Port Hueneme Division (2023)

- Other recent work investigated concerns about brittleness and cracking of polysiloxanes particularly on (non-metallic) substrates typically associated with weapons systems. Testing done to support Navy weapons systems and NSWCCD Port Hueneme have shown that a 1K product has improved flexibility and elongation compared to 2K polysiloxane.

Task 1: Identify testing requirements, environmental monitoring metrics, and demonstration goals (in-process)

- Initial test plan draft delivered focus on requirements outlined in 009-32 table 2 Lines 1, 1A and 2. Focus on SP-10 surface preparation. Updates following testing plan meeting to be adjudicated and submitted for approval
- Testing Candidates:
 - Primers
 - MIL-PRF-23236 Type V or VI, Class 5 or 7 (5 to 8 mils)
 - MIL-DTL-24441 Type III Formula 159 (3 to 5 mils)
 - Topcoats
 - NCP Siloxoshield 1K – 2 to 3 mils
 - NCP Siloxoshield II 1K (Oxsol-Free) – 2 to 3 mils
 - NCP Siloxoshield II 1K (Oxsol-Free High Build) – 4 to 6 mils
 - NCP Siloxoshield 2K – 5 to 8 mils

Task 1: Identify testing requirements, environmental monitoring metrics, and demonstration goals (in-process)

- Proposed Testing Procedures

- Production and Waste Evaluation

- Comparisons in mix time, time/sqft coverage, and quantity of wasted coating after completion of application

- ASTM D5894 Cyclic Corrosion and UV exposure

- ASTM D610 Rust Through, ASTM D714 Blistering, ASTM D1654 Scribe Cutback, and ASTM D4541/6677 Adhesion Testing

- ASTM D522 Conical Bend Test (Flexibility)

- ASTM D2794 Impact Testing

Path Forward

- Finalize Test Plan for lab studies (coating performance)
- Draft plan for production assessment (environmental/waste, productivity)
- Begin discussions for yard demonstration

