

**FROM SPEC
TO PROTECT**



Mold and Mildew Prevention Through MIL-PRF-24596 Technology Advancements

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SHERWIN-WILLIAMS.

Agenda

- Background
- Regulatory
- Objective
- Mold/Mildewcide



USS Bonhomme Richard (LHD-6)

Commercial Shipping



Flame retardant is “substance added, or a treatment applied, to a material in order to suppress or delay the appearance of a flame and/or reduce the flame-spread rate.”



- Major container ship fires every 60 days
- Supply chain disruption
- Liability, environmental impact, salvage costs

Current MIL-Spec Technology

1. Interior habitability spaces (low flamespread, low smoke density, low toxicity)
2. MIL-DTL-24607C
 - a) Solvent based
 - b) **Chlorinated** alkyd resin
 - c) Contains parachlorobenzotrifluoride (Oxsol 100) exempt solvent
3. MIL-PRF-24596C
 - a) Waterbased
 - b) F25A
 - c) Polyvinylidene **chloride** acrylic emulsion



Regulatory Concerns

1. Perfluoroalkyl Substances (PFAS)
 - a) Fluorinated organic chemicals
 - b) Eliminate Oxsol 100 exempt status?
 - c) EPA (Federal and California) - pending
2. Halogenated Compounds
 - a) Detrimental to human health and the environment
 - b) 2030 Greenhouse Gas Pollution Reduction Act
 - c) 50% reduction in emissions from 2005 levels by 2030
 - d) The US will also reduce non-CO₂ greenhouse gases, including methane, **hydrofluorocarbons** and other potent short-lived climate pollutants

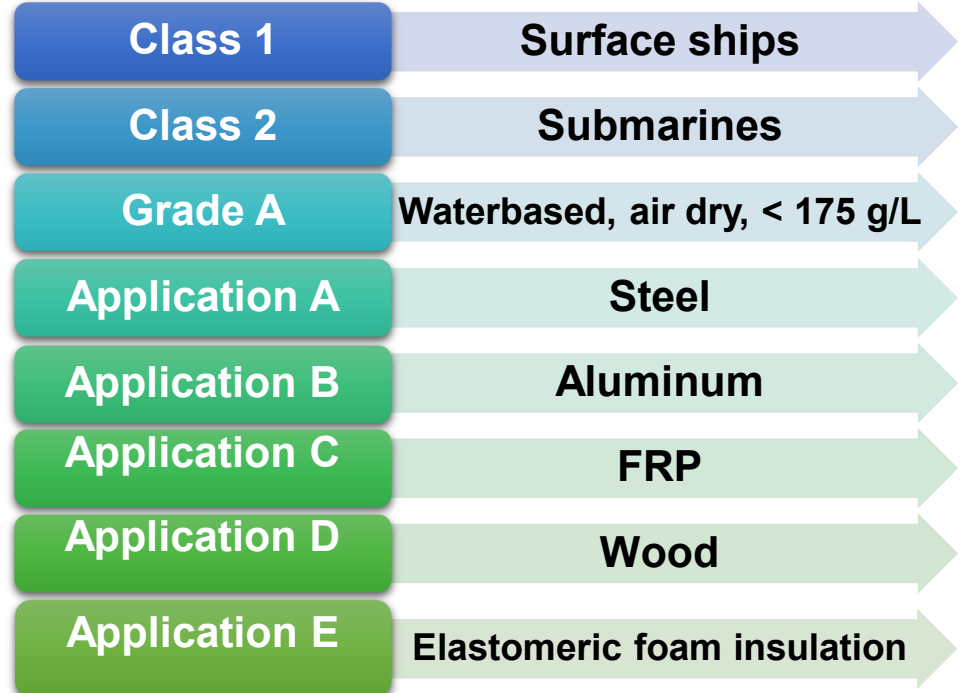
17 VIIA 7A
9 F Fluorine 18.998
17 Cl Chlorine 35.453
35 Br Bromine 79.904

Objective – SeaGuard 2400

GOAL: Enhance interior habitability space coatings

1. Maximize **crew safety**
2. Maximize **ship safety / survivability**
3. Enhance **application and performance properties**
4. Meet **current (and future) environmental and regulatory** concerns
 - a) VOC < 175 g/L
 - b) Non-halogenated
 - c) Oxsol free
 - d) Water clean-up
 - e) Life cycle analysis

Novel Flame Retardant Latex
MIL-PRF-24596



Objective Achieved - SeaGuard 2400

1. **Objective achieved**
2. **MIL-PRF-24596** qualified
3. **Improved** flammability, smoke density, toxicity
 - a) Zero flame spread index
4. **Enhanced** application and performance properties
 - a) **Minimal** yellowing, lower viscosity
 - b) **Improved** shelf stability & flash rust
5. **Non-halogenated (unique to the marketplace)**
6. **Oxsol 100 free, low VOC**
7. **Environmentally sustainable**



What's Next?

By itself, SeaGuard 2400 provides a host of solutions and unique properties

What else can we do with it?

Navy Mold Inhibitive Coatings, Survey, and Demonstration

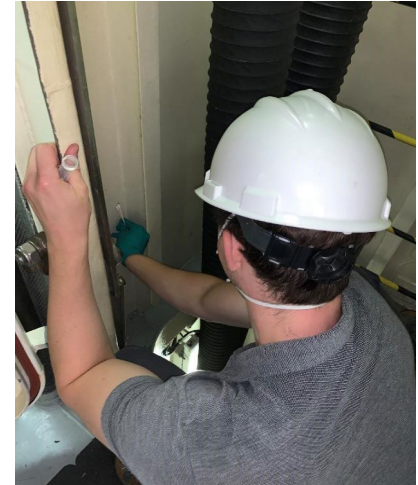


Mold/Mildew Pervasive

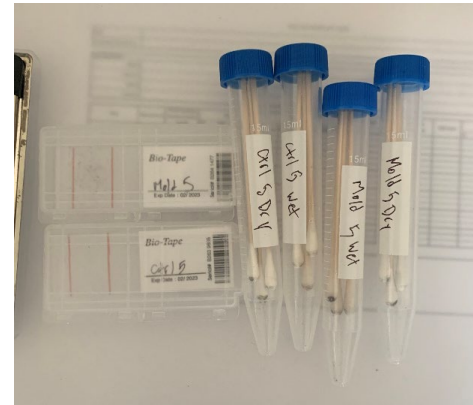


Mold Ship Inspections

Location	CVN	DDG	CG	LCS	LPD	LSD	LHD	Total
San Diego	0	2	1	0	0	1	1	5
Mayport	0	2	0	4	0	0	0	6
Norfolk/NNS	2	4	1	0	1	0	0	8
Everett/Vigor	0	3	2	0	0	0	0	5
Total	2	11	4	4	1	1	1	24

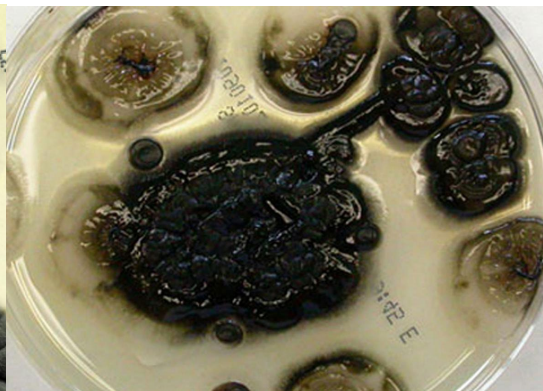
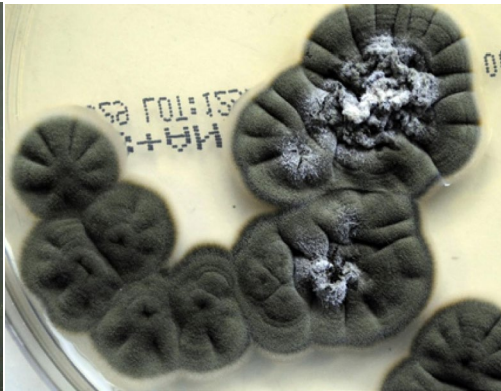
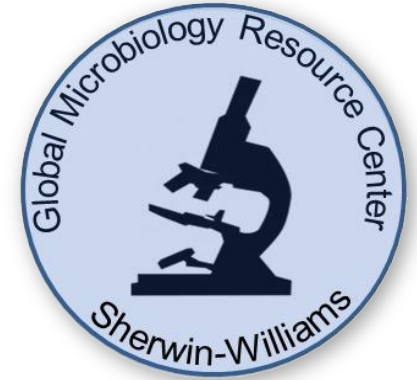


- 113 spaces sampled across 24 ships
- 226 slides and pairs of swabs to be analyzed



Most Common Identified Species

- The four average most abundant fungal species identified were:
 - *Penicillium chrysogenum* (toxigenic)
 - *Cladosporium halotolerans*
 - *Aureobasidium pullulans*
 - *Alternaria botrytis*



Mold Ship Inspection – Conclusions

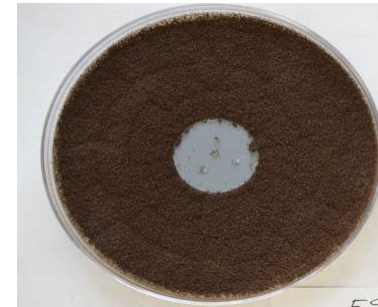
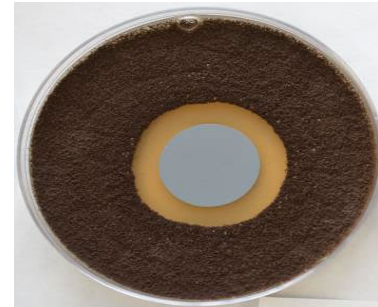
- Mold growth common
 - **Coatings and insulation/lagging**
- No unified fleet wide method to address
- Contractor support for mold remediation - long lead time
- Fleet support
 - **Mold resistant coatings**
 - Improved remediation methods (NavClean)
- Mold is a **health issue**



Coating Development

- SeaGuard 2400 with mold inhibiting additive
- Derived 11 mold inhibiting additive packages for testing
- Coatings with additives tested to ASTM D3273 and ASTM D5590

No.	Topcoat	Biocide Package	Average Rating 1 week	Avg ZOI	Average Rating 2 weeks	Avg ZOI	Average Rating 3 weeks	Avg ZOI	Average Rating 4 weeks	Avg ZOI	Average Rating 5 weeks	Avg ZOI	Average Rating 6 weeks	Avg ZOI
1			2	0	4	0	4	0	4	0	4	0	4	0
2			0	10	0	10	0	10	0	3	0	3	0	3
3			0	13	0	13	0	13	0	4	0	4	0	4
4			0	11.5	0	11.5	0	11.5	0	5	0	5	0	5
5			4	0	4	0	4	0	4	0	4	0	4	0
6			1	0	1.5	0	2.5	0	2.5	0	3.5	0	3.5	0
7			0	1.5	1	0	1	0	1.5	0	2	0	2.5	0
8			0	2.5	0.5	0	0.5	0	0.5	0	1	0	1	0
9			0	9.5	0	9.5	0	9.5	0	1	0	1	0	1
10			0	12	0	12	0	12	0	1	0	1	0	1
11			0	12	0	12	0	12	0	2.5	0	2.5	0	2.5



Ship Demonstrations

- Two ship demonstrations performed in 2023
 - USS Reagan Yokosuka SRF
 - USS Lincoln San Diego



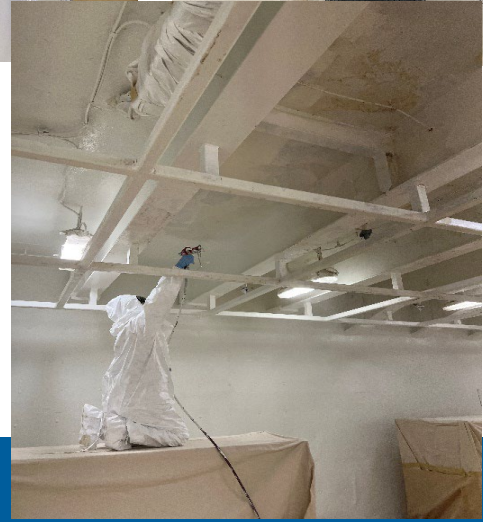
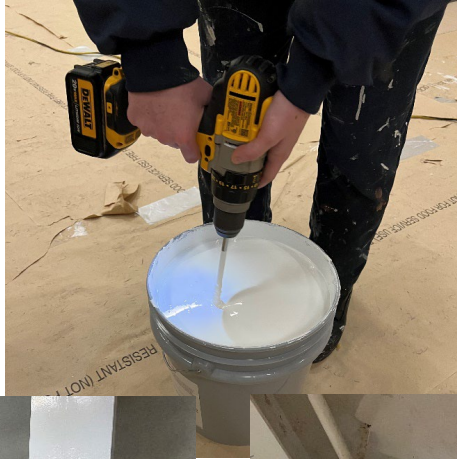
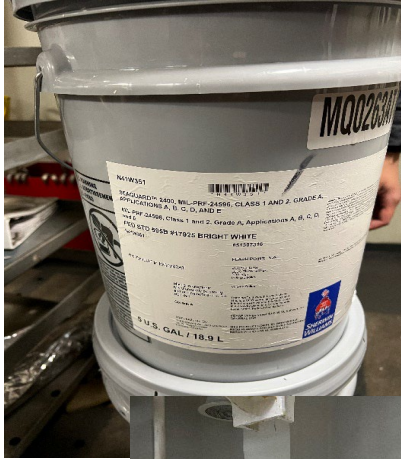
CVN 76 Demonstration Summary

Demo Area	Cleaner	Surface Preparation	Coating System
Space 1	Conventional Cleaning per Standard Ship Practice	Power tool to SSPC SP-3 and roughen tightly adherent coating	Standard 24596 Interior Coating
Space 2	NAV Clean	Power tool to SSPC SP-3 and roughen tightly adherent coating	Standard 24596 Interior Coating
Space 3	NAV Clean	Power tool to SSPC SP-3 and roughen tightly adherent coating	SeaGuard 2400 with mold inhibiting additives

CVN 76 - Condition On Arrival



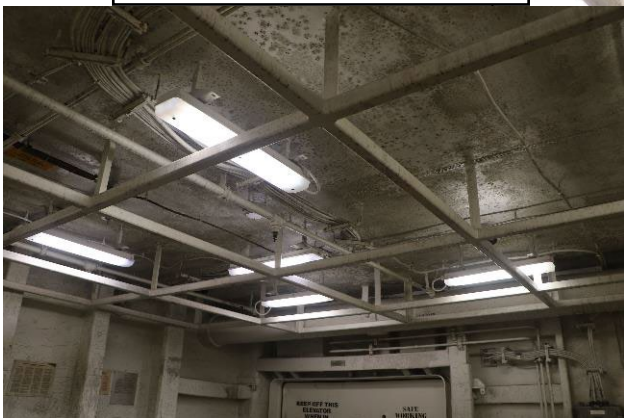
CVN 76 - Coating Application



CVN 76 Four Month In-Service Inspection

- Work completed in all spaces in mid-April 2023
- Ship report from 5/13/2023, prior to deployment:
“The overall appearance is it still looks fresh and clean in the spaces. We have not experienced continuous hot or humid weather and no signs of mold like substance as of today.” – AOC Cody Shaw
- Ship underway with port stops in high humidity locations: Philippines, Vietnam, Bali, Indonesia, Australia
Inspection photos provided by LT Misty Beck on 8/11/2023
“The mold has absolutely come back!” (Control Space #1)
“For Control Space #3, that special paint worked out a lot better!”
- **Ship already requested additional SeaGuard 2400 with mold/mildewcide for future spaces**

CVN 76 Four Month In-Service Inspection



Next Steps

1. Continue to monitor performance
2. Run MIL-PRF-24596 conformance testing
3. Ensure mold/mildewcides no detrimental impact on FST
4. Addition of anti-bacterial agents -
at ESTCP for review



Conclusion

1. **SeaGuard 2400 – MIL-PRF-24596 (today)**
 - a) **Application, performance, and environmental benefits**
2. **Mold pervasive health issue onboard ships**
3. **Mold/mildewcide package – favorable results**
4. **CVN 76 demo trial favorable (to date)**
5. **Update to MIL-PRF-24596?**



FROM SPEC TO PROTECT



Thank You

- NAVSEA 05P2
- NSWCCD, Dr Charles White
- NRL
- SW Global Microbiology Resource Lab
- Elzly Technology
- ESTCP
- SW R&D Team **SHERWIN-WILLIAMS.**