BI-ANNUAL DOD JOINT COMMITTEE ON TACTICAL SHELTERS (JOCOTAS) MEETING & OUTDOOR EXHIBITION WITH THE SOFT & RIGID WALL SHELTER

May 2-4, 2005

Reactive Coatings as a Protective Shelter Liner Against CB Agents

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Report Documentation Page

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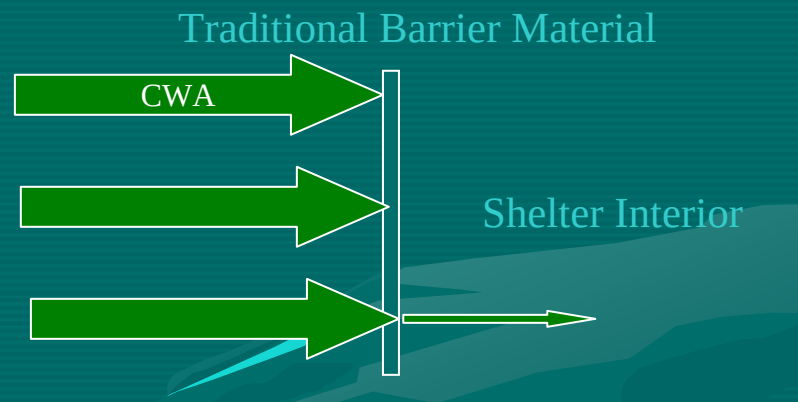
Order of Operation

- Introduction
- Theory
- Criteria for Success
- Background
- Coating Comparison
- Summary and Conclusions
- Questions

Reactive Treatments/Coatings for Collective & Individual Protection

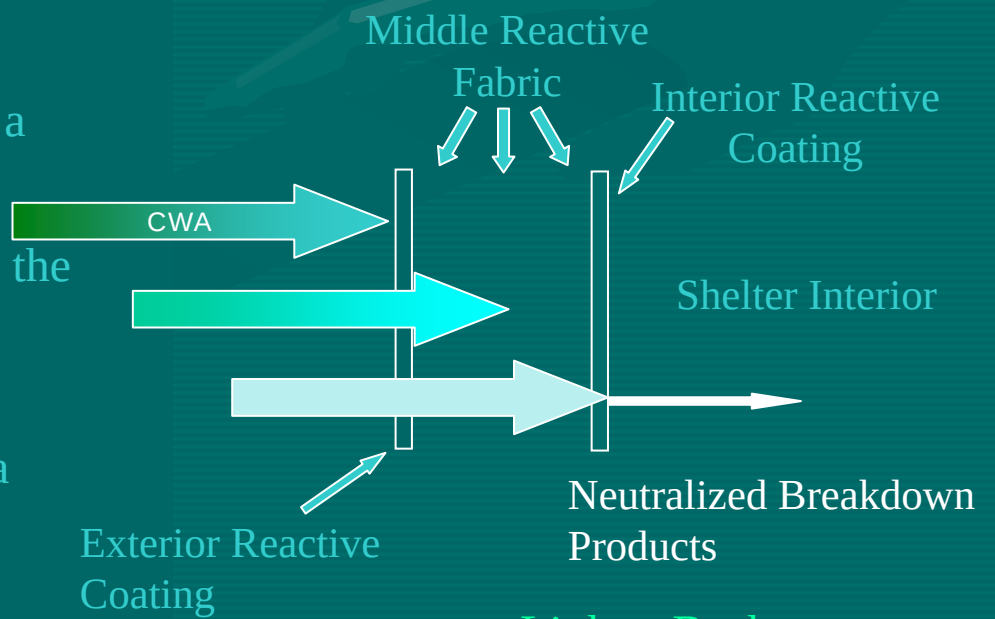
Conventional Barrier Materials

- All present barrier materials will fail over time
- Better barrier materials => to higher costs



Reactive/Barrier Materials

- Neutralization products at the surface act as a prophylactic
- Only neutralized products permeate through the reactive barrier component
- Shelter materials can be used to make less expensive barrier materials augmented with a reactive coating



Link to Back-ups

Criteria for Success

- Reactive system chemically active to the target C/BWA
- Reactive system compatible with proposed polymer system w\o significant loss of chemical reactivity
- Products considerably less toxic than CWA targets
- Favorable stoichiometry of reactive system vs CWA target
- Permeation kinetics must be slower than reaction kinetics
- Ideally catalytic or capable to regenerate

How Neutralization Occurs

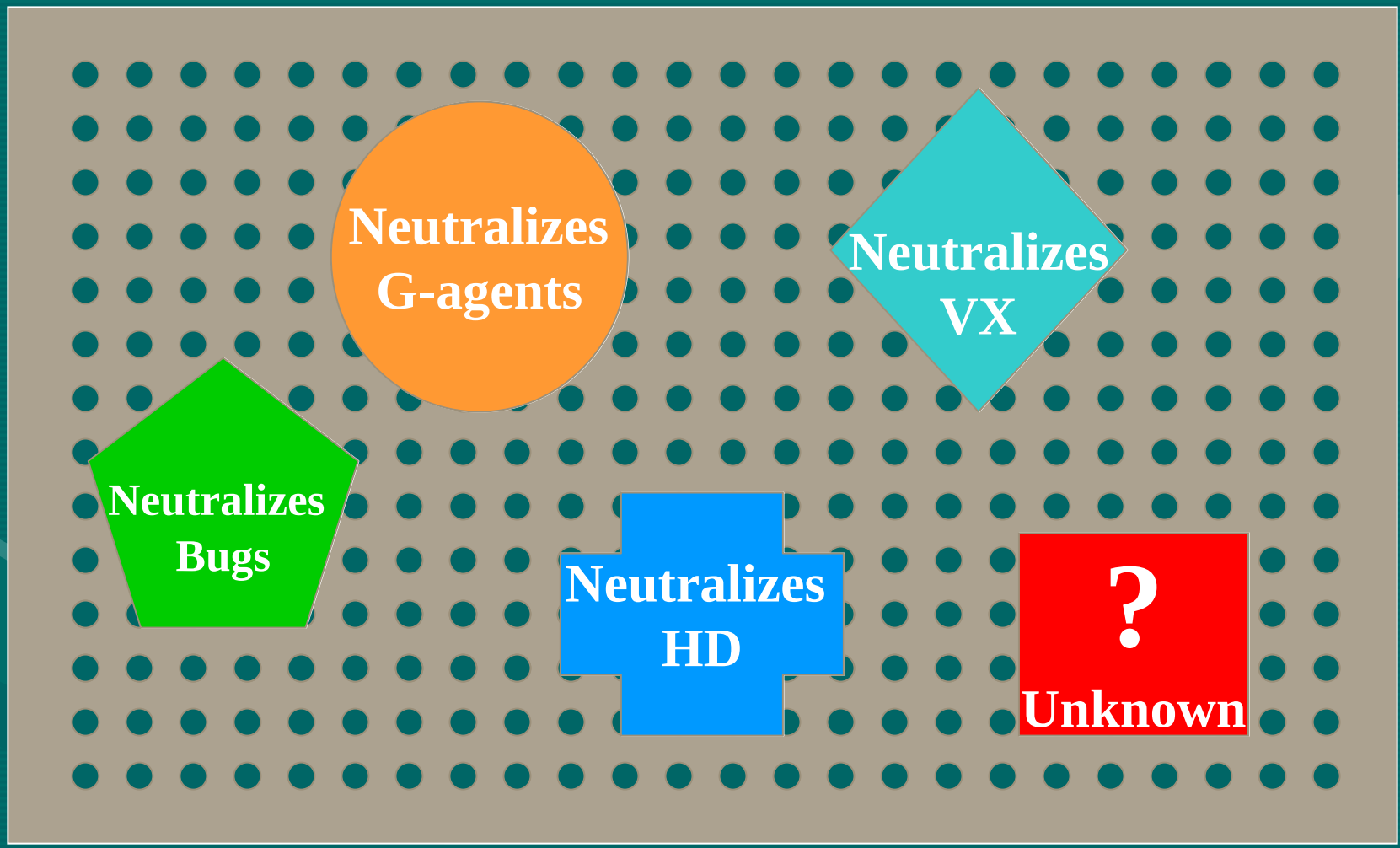
- cell toxicity
- membrane disruption
- oxidation

- oxidation
- hydrolysis
- nucleophilic attack

- hydrolysis
- nucleophilic attack

- oxidation
- hydrolysis

What We Want


Neutralizes G-agents
Neutralizes VX
Neutralizes Bugs
Neutralizes HD
?
Unknown

Technical Approach

Weak oxidizers within a band of reactivity that targets specific functional groups

Chloramides

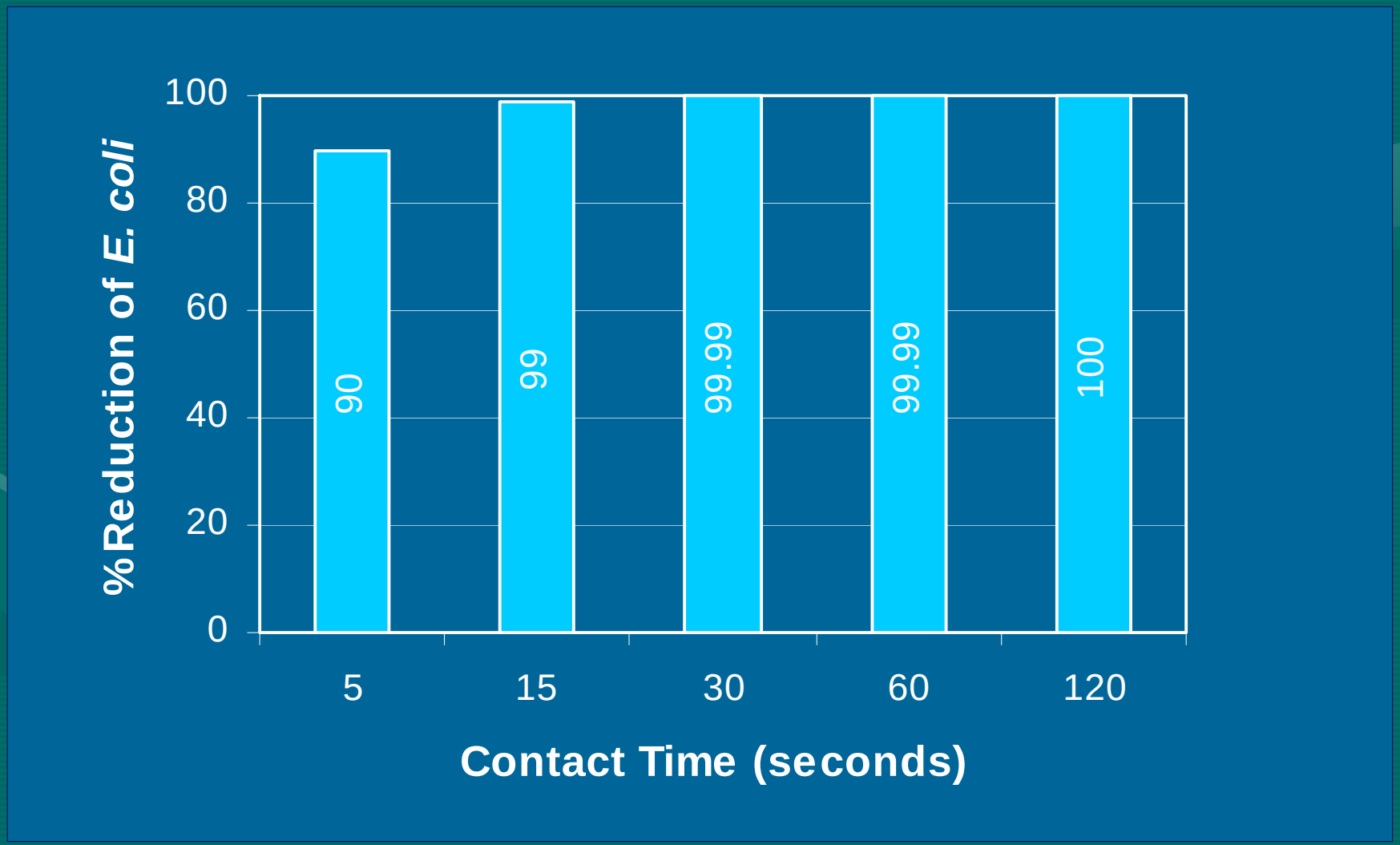
Why Chloramides?

- CWA decontaminant
- Antibiotic
  - nonspecific
  - acts on contact
  - broad-spectrum
- Benign

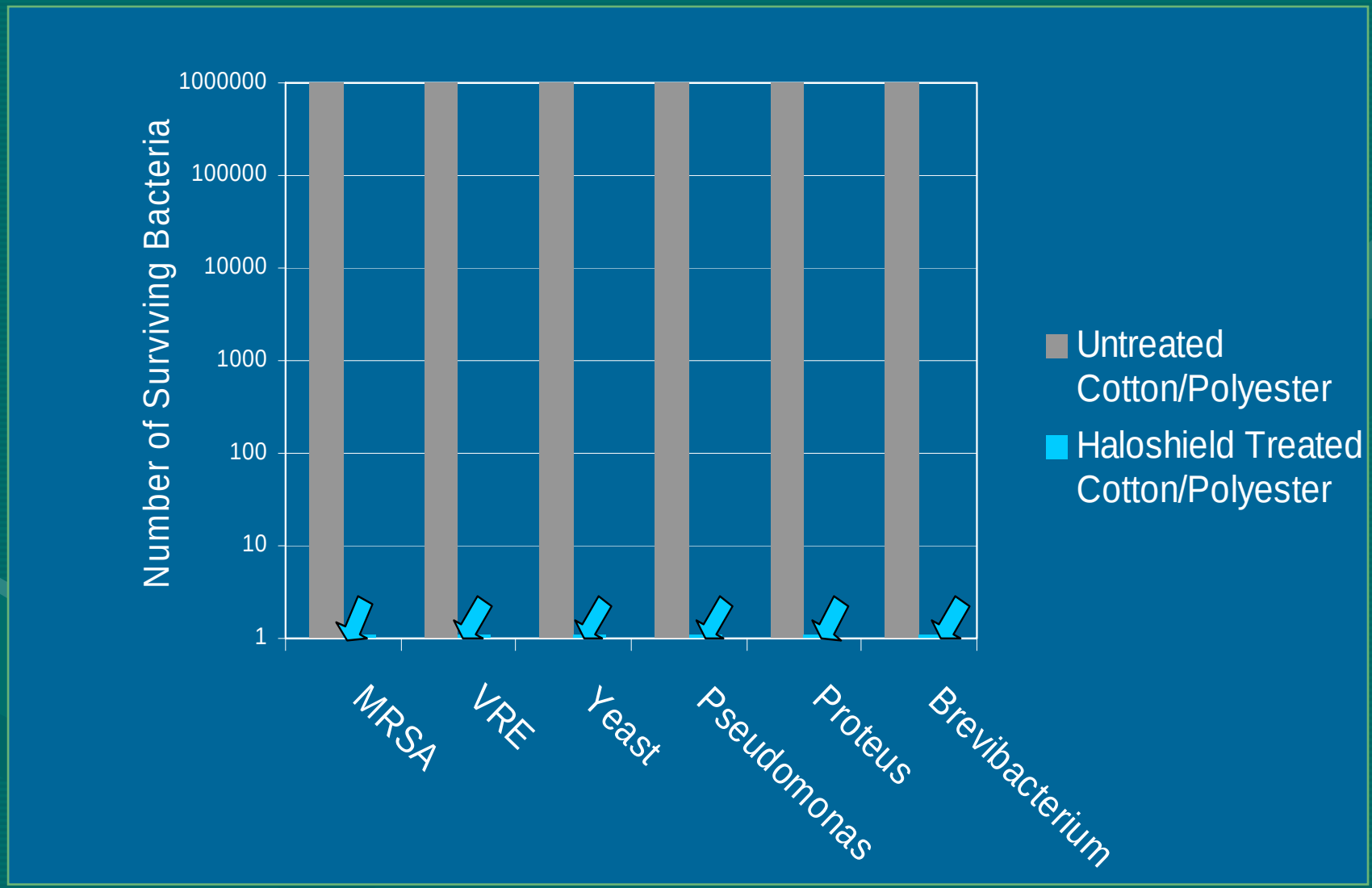
Progressive Approach to Reactive Barrier

- Establish Biocidal Efficacy
- Challenge Broad Spectrum of Organisms
- Challenge Spores
- Challenge Chemical Simulants
- Incorporate into Coatings

Chloramides: Fast Acting Biocides



Chloramides: Broad Spectrum Biocide



After two minutes exposure

Chloramides Challenging Spores

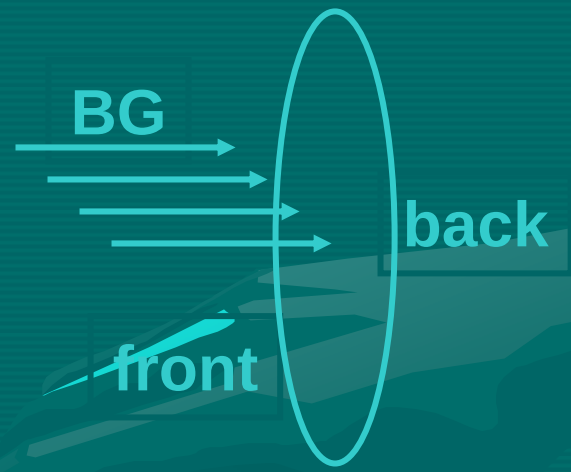
(Compliments of Natick)

AEROSOL CHALLENGE TEST

BG Spores, 10 min flow

525-675K Spores, 1 hr Incubation

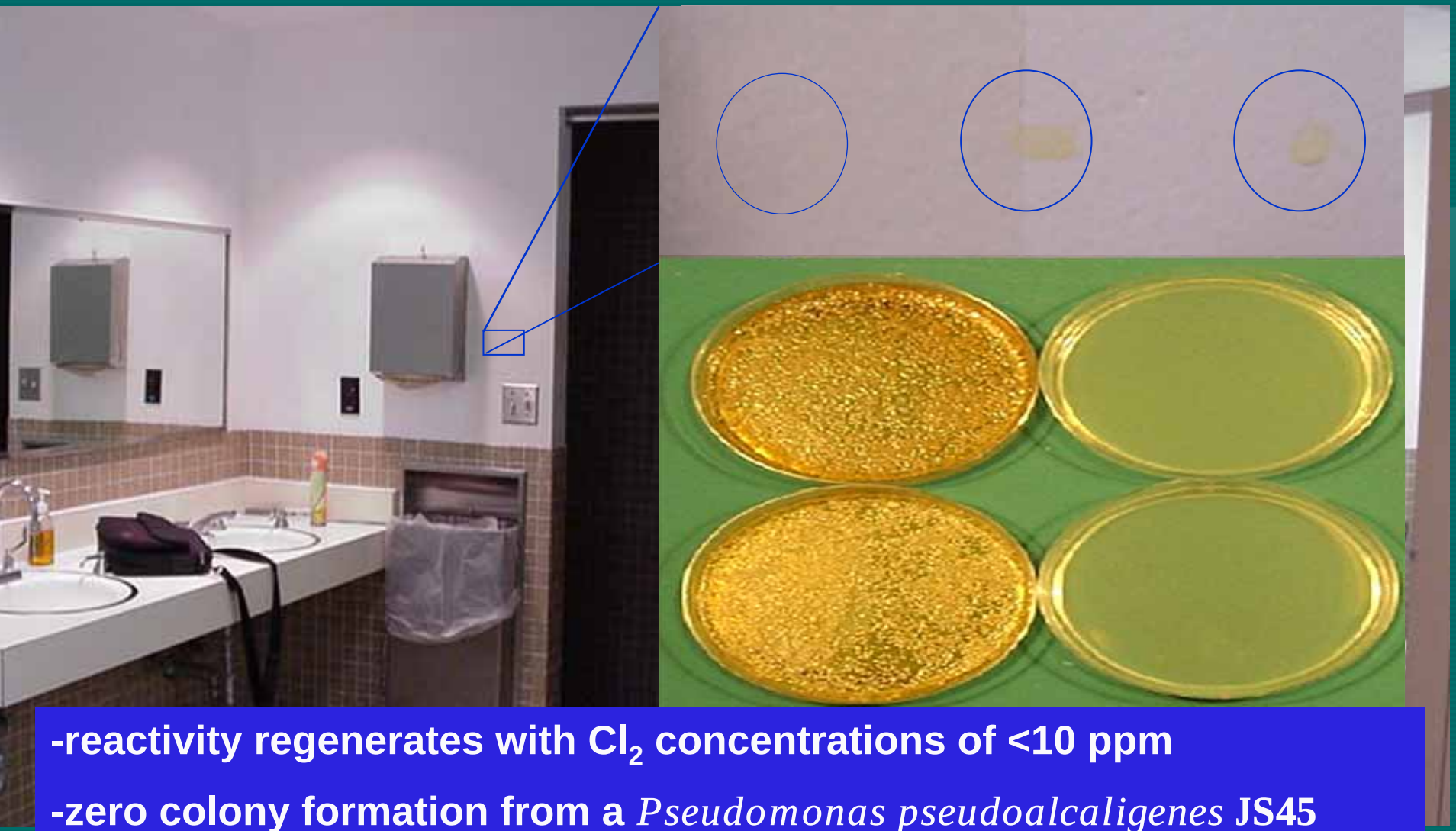
Plate Back Surfaces and Count



RESULTS

SAMPLE	Penetration (%)	Front (counts)	Back (counts)
Shell/Espun	3.0	36,000	1,150
Shell/Espun/Chloramine	2.7	29,000	720
Shell/Coated/Chloramine	9.6	1,610	0

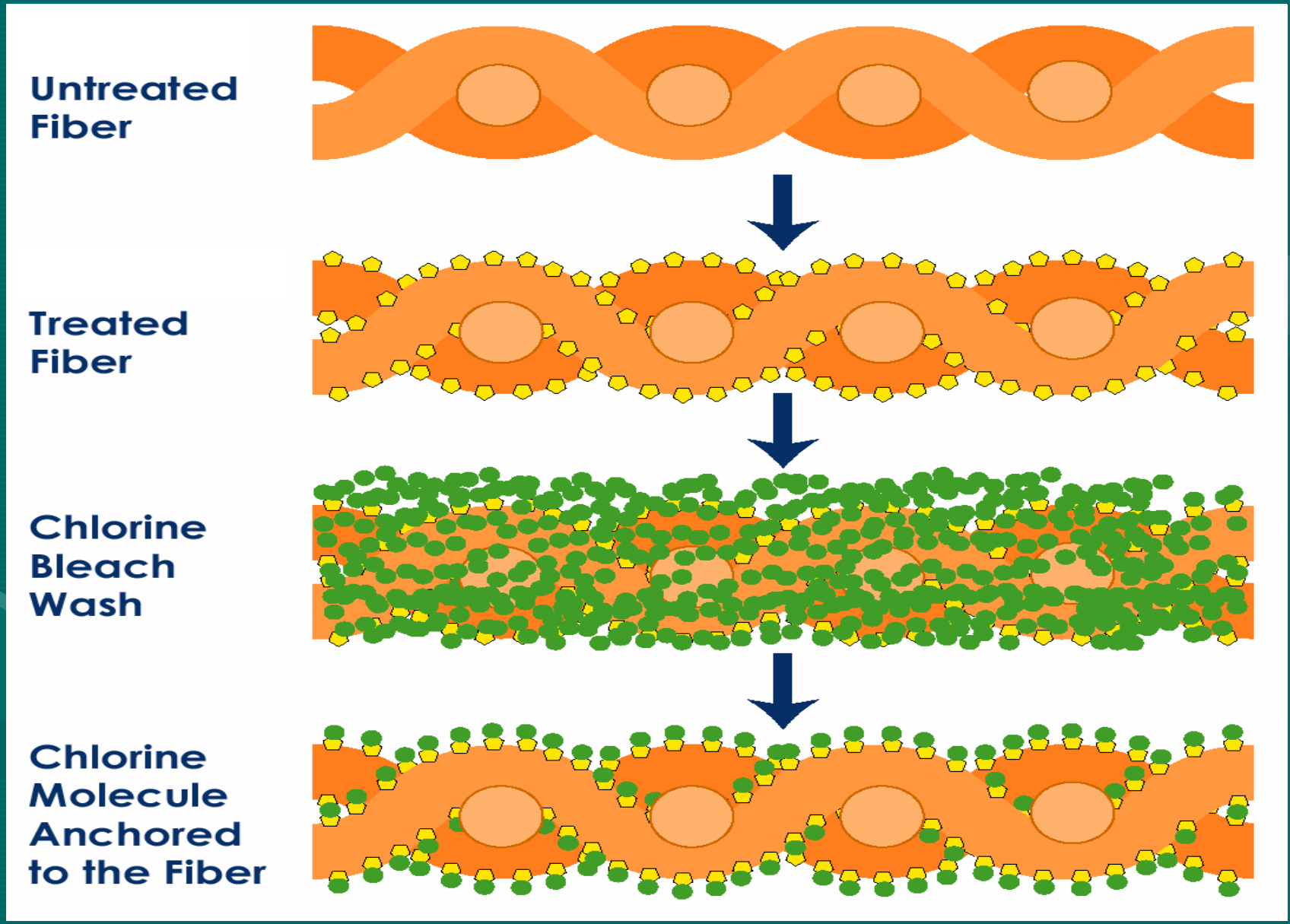
Chloramides: Practical Environment



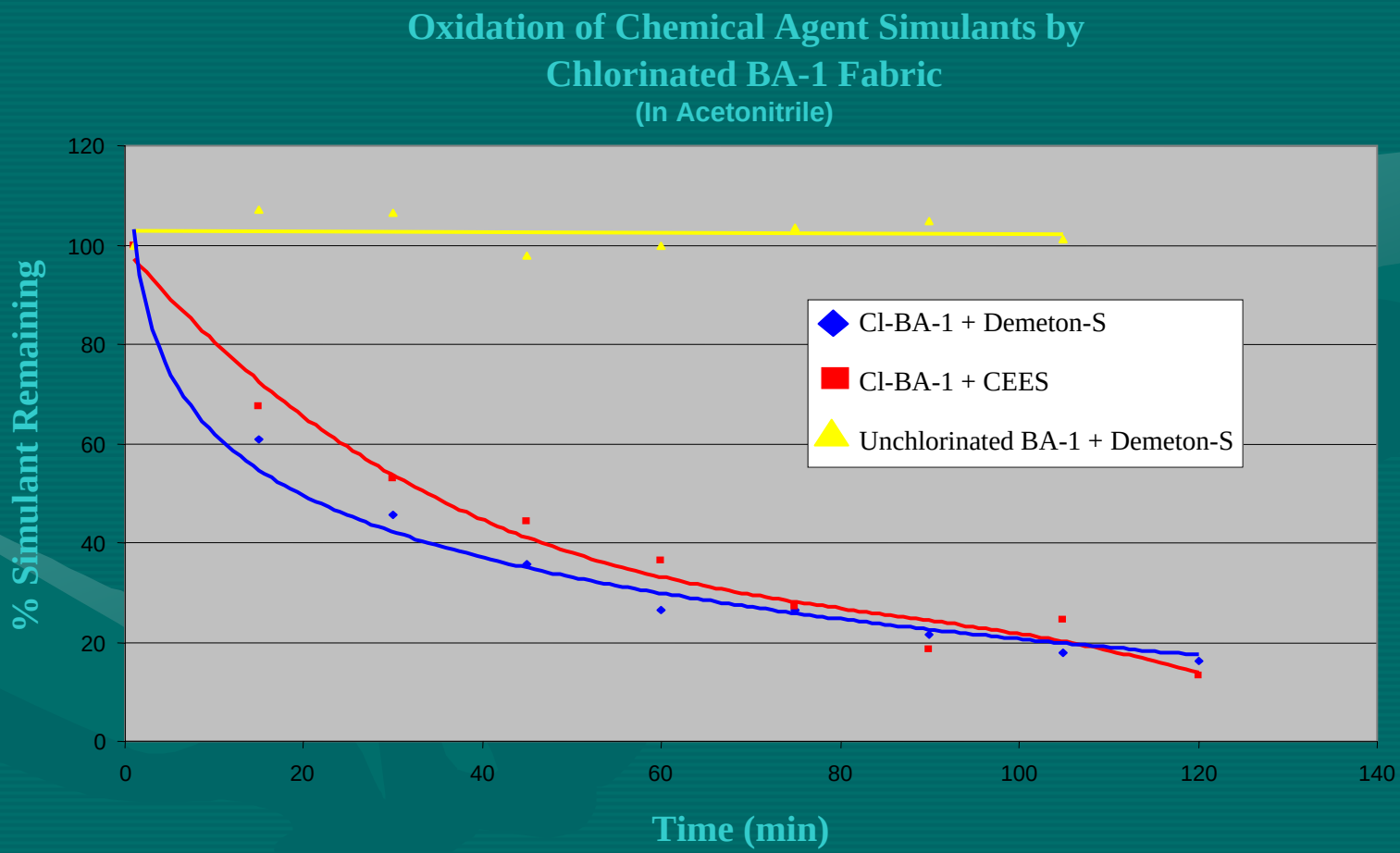
-reactivity regenerates with Cl_2 concentrations of <10 ppm

-zero colony formation from a *Pseudomonas pseudoalcaligenes* JS45 challenge after three, six, nine and twelve months w/o recharging

Grafting/Activating Reactive Sites to Cellulose Fibers



Chloramide Reactivity to CEES: Agent Simulant



The Reactive Coating System

•Fabric- 600 threat count, 100% cotton sateen
Manufacturer: Hotel Fine Linens

•Silicone Coating- Ultra Guard 5500®, single component silicone elastomer
Manufacturer: General Coatings, Inc.

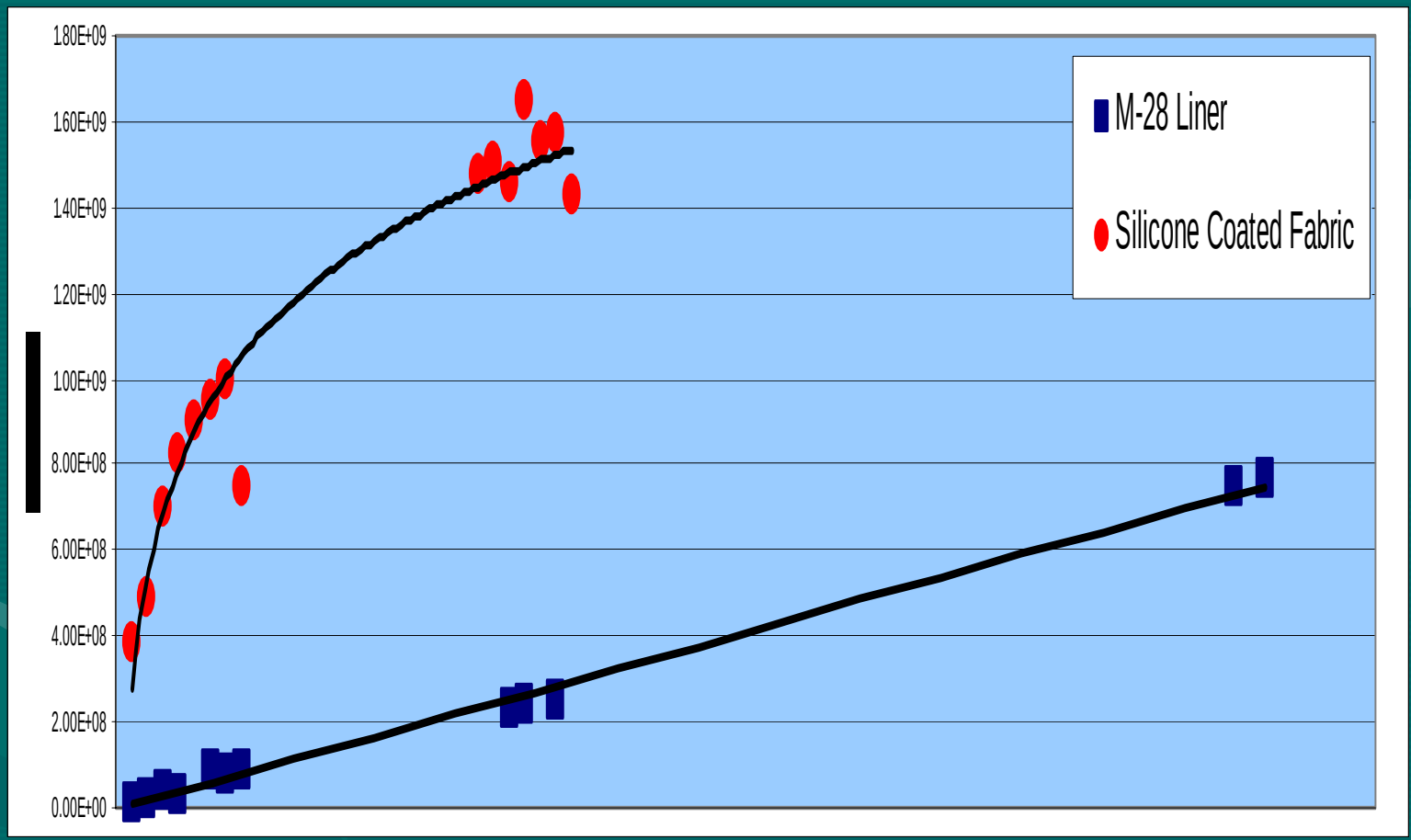
•Fluorinated Silicone Coating- Dow Corning® 94-003, single component fluorinated silicone elastomer
Manufacturer: Dow Corning

•Experimental chloramine monomers: DC, MC, BA-1, poly-TTDD
Synthesized by: Auburn University

•Reactive System = Silicone coating with Chloramine (10% wt/wt) coated onto chloramine treated 600 count cotton fabric

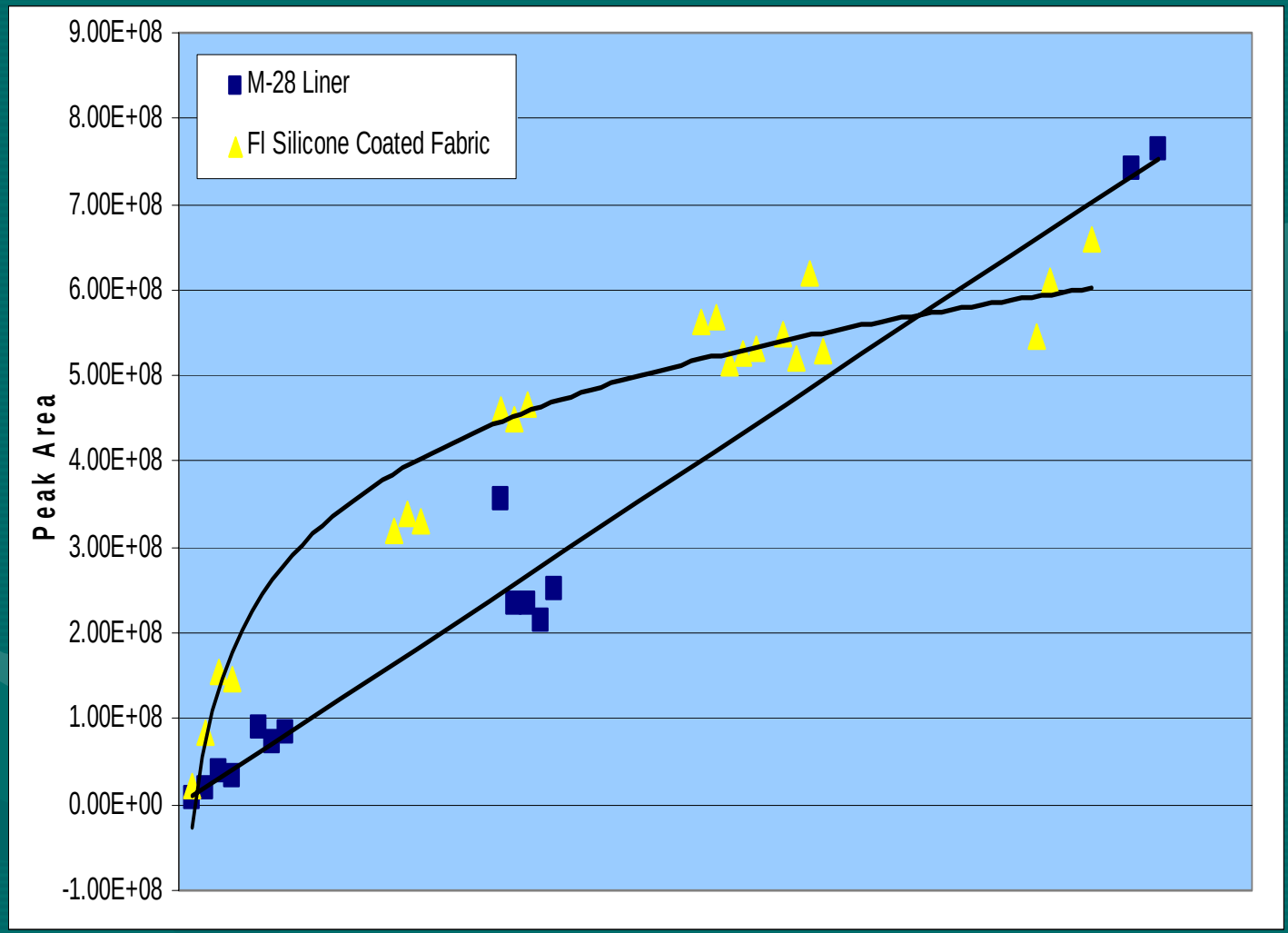
M-28 Liner vs Silicone Coated Fabric: CEES

20g/m² Challenge



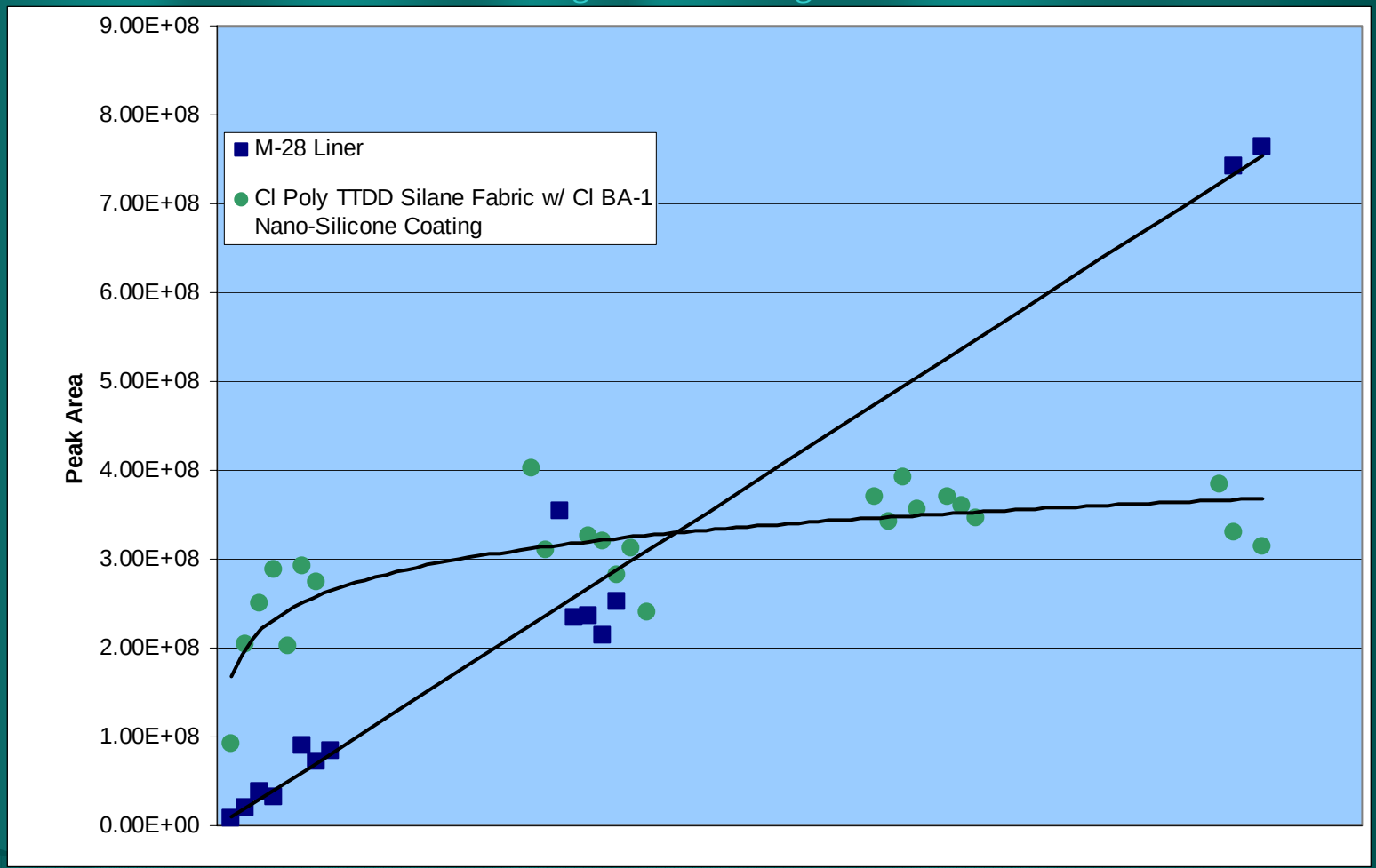
M-28 Liner vs Fl Silicone Coated Fabric: CEES

20g/m^2 Challenge



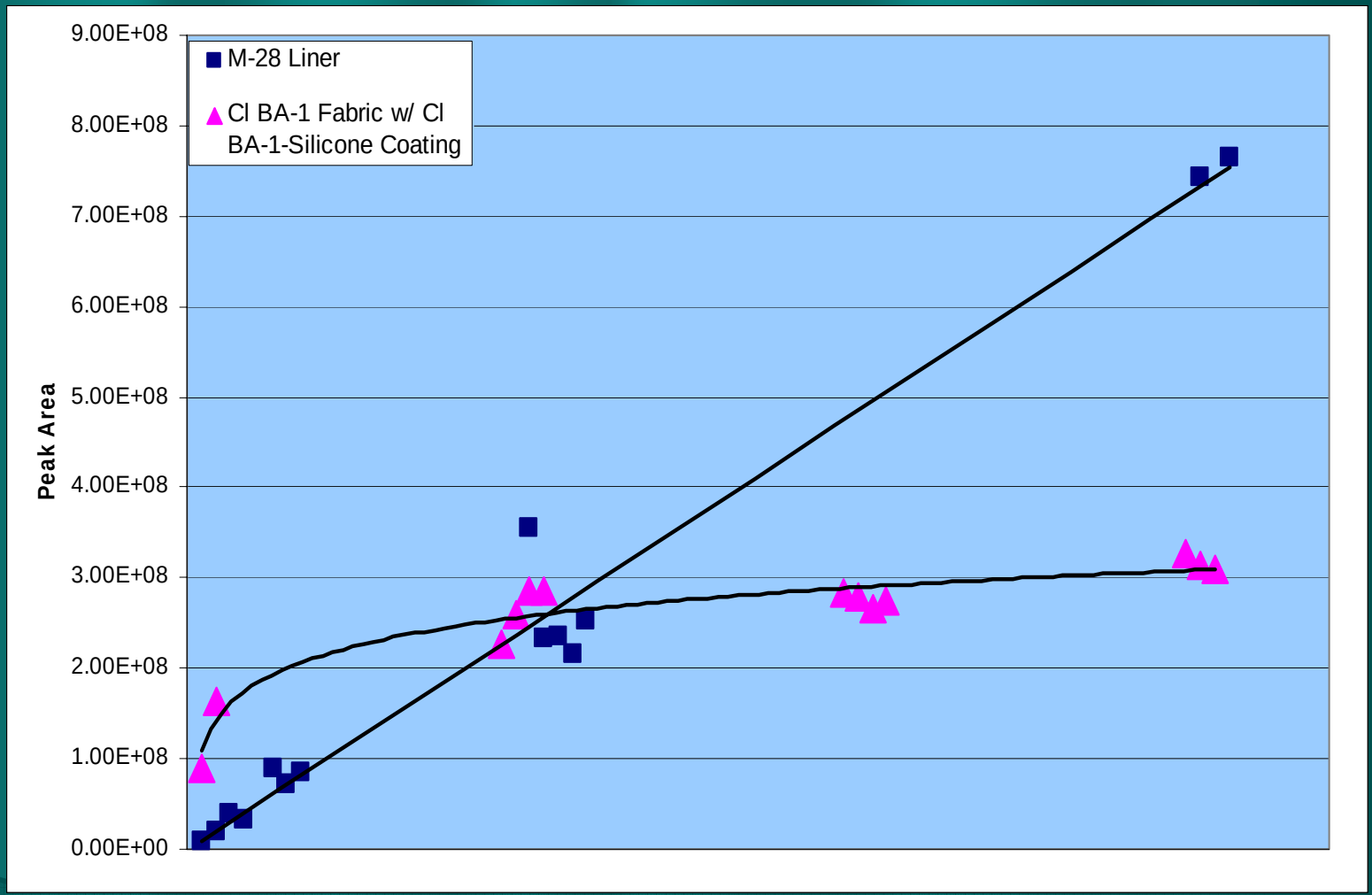
M-28 Liner vs Cl Poly TTDD Silane Fabric w/ Cl BA-1 Nano-Silicone Coating: CEES

20g/m^2 Challenge



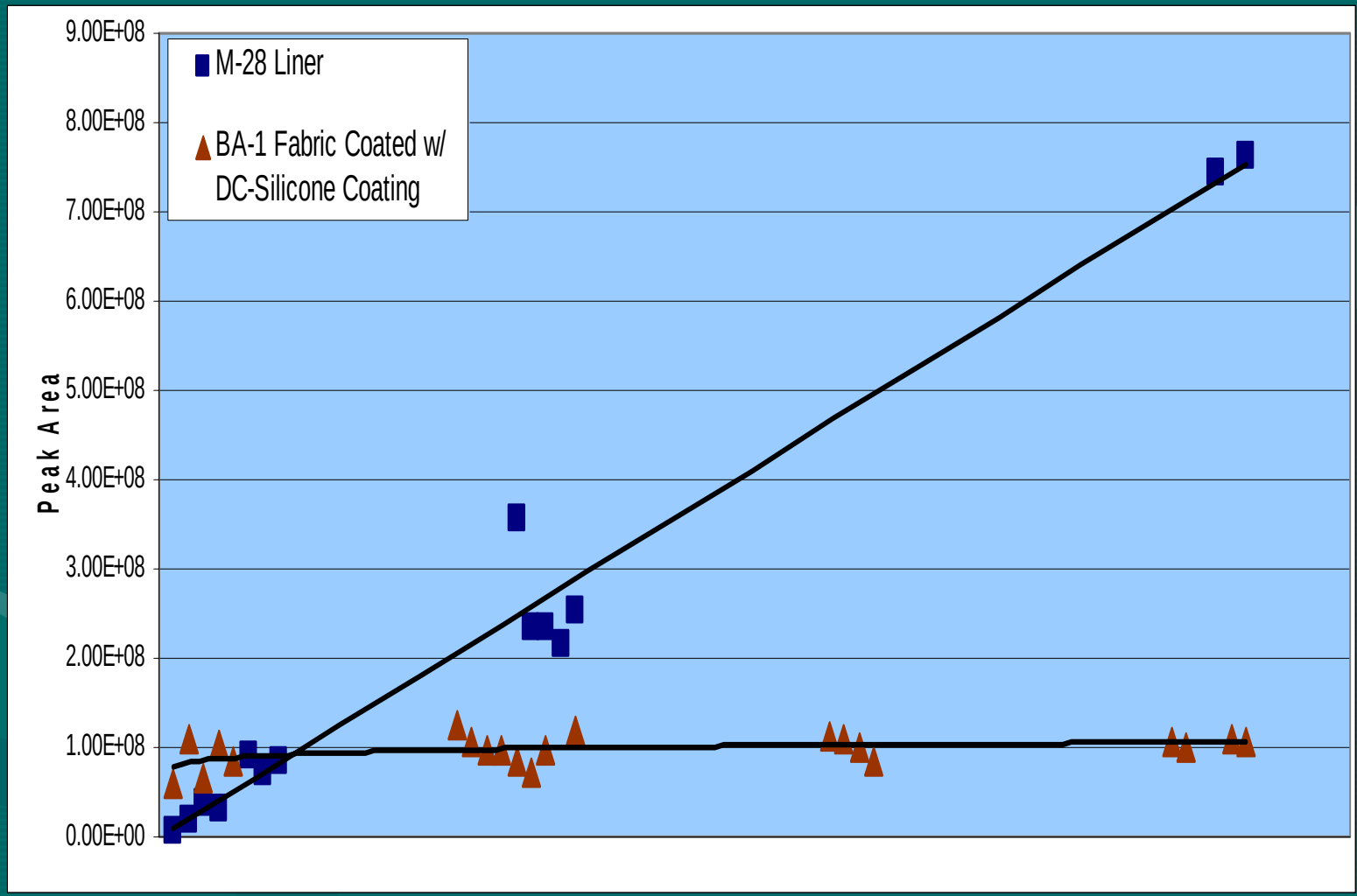
M-28 Liner vs Cl BA-1 Fabric w/ Cl BA-1 Silicone Coating: CEES

20g/m^2 Challenge

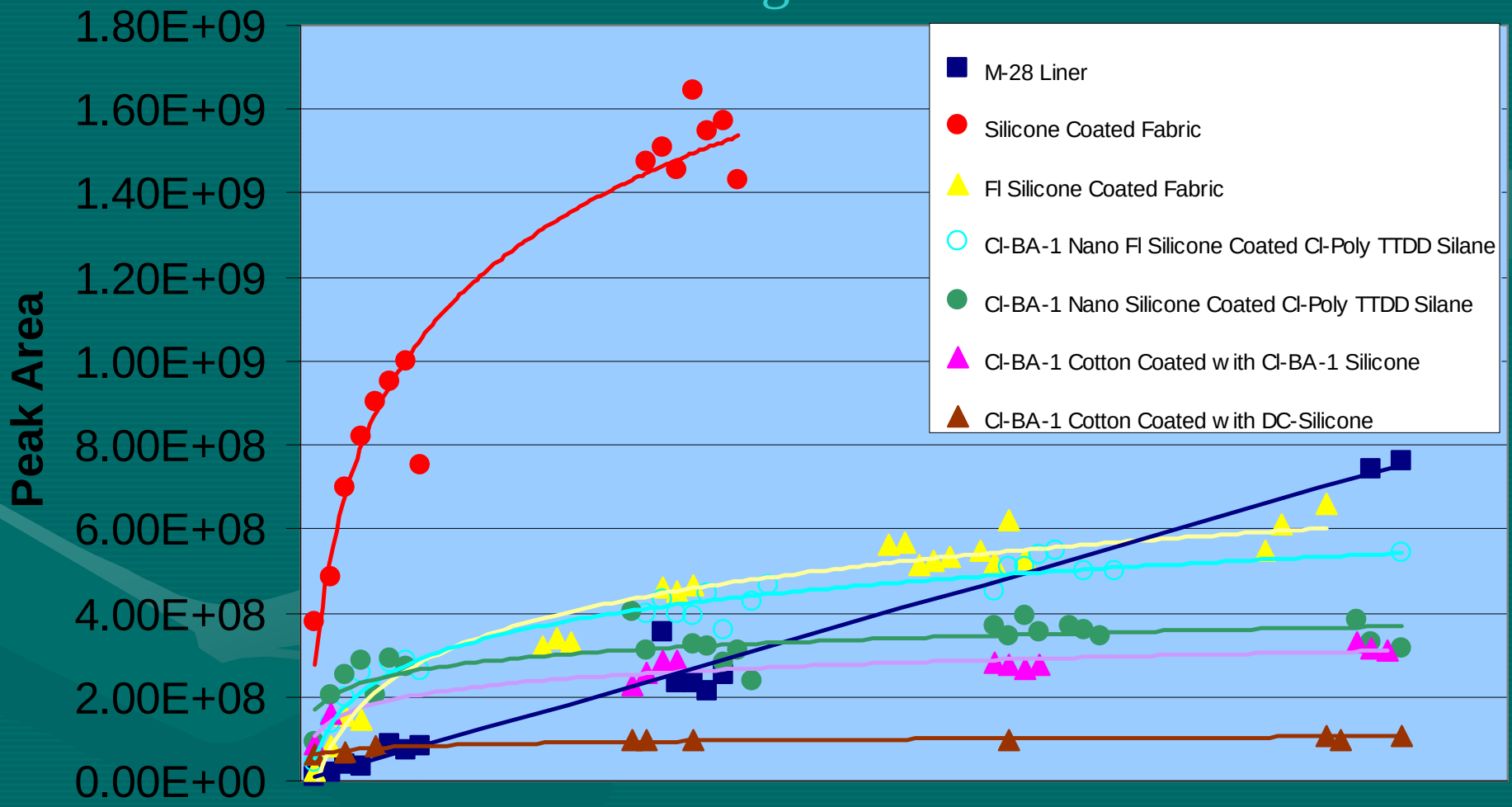


M-28 Liner vs BA-1 Fabric Coated w/ DC-Silicone Coating: CEES

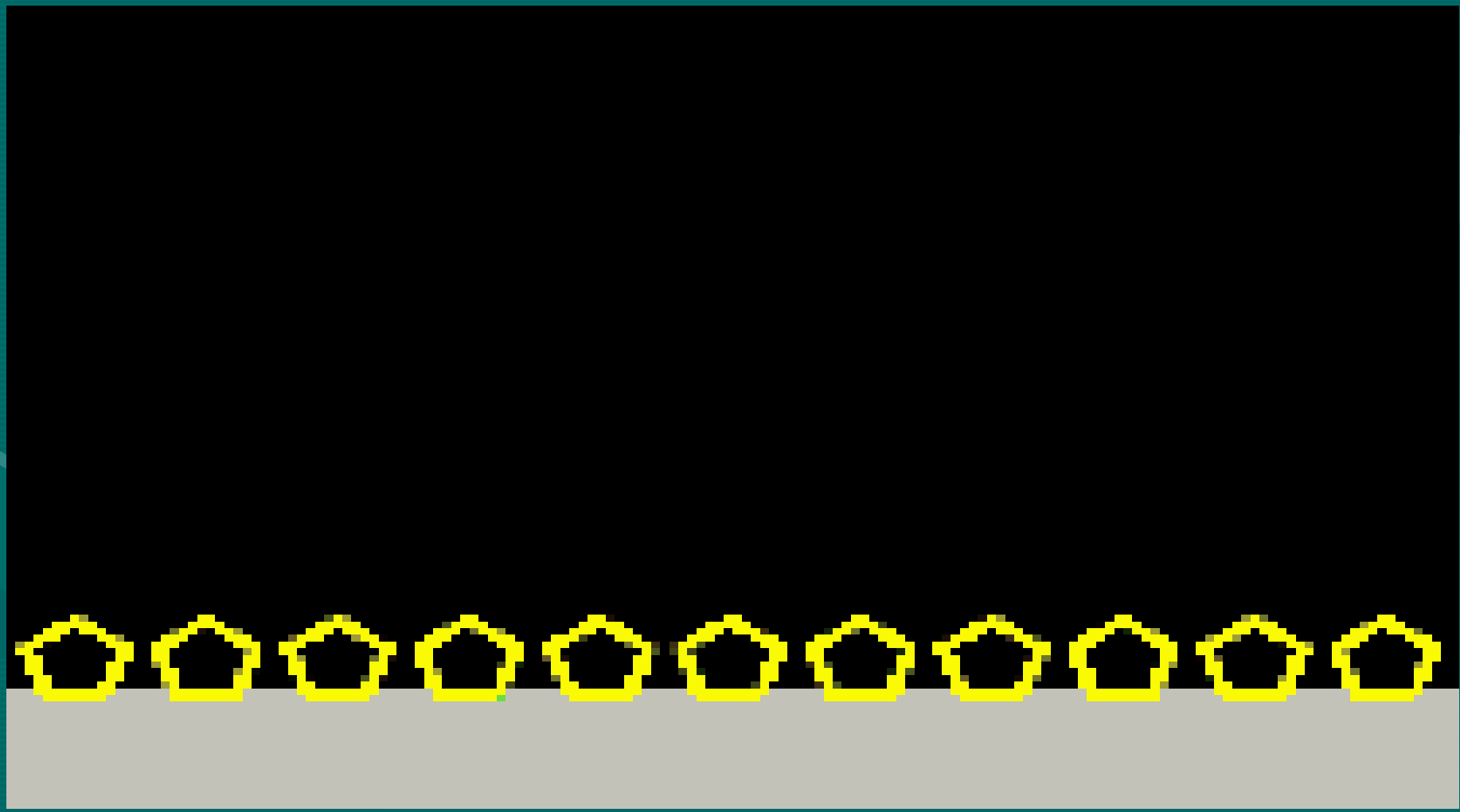
20g/m² Challenge



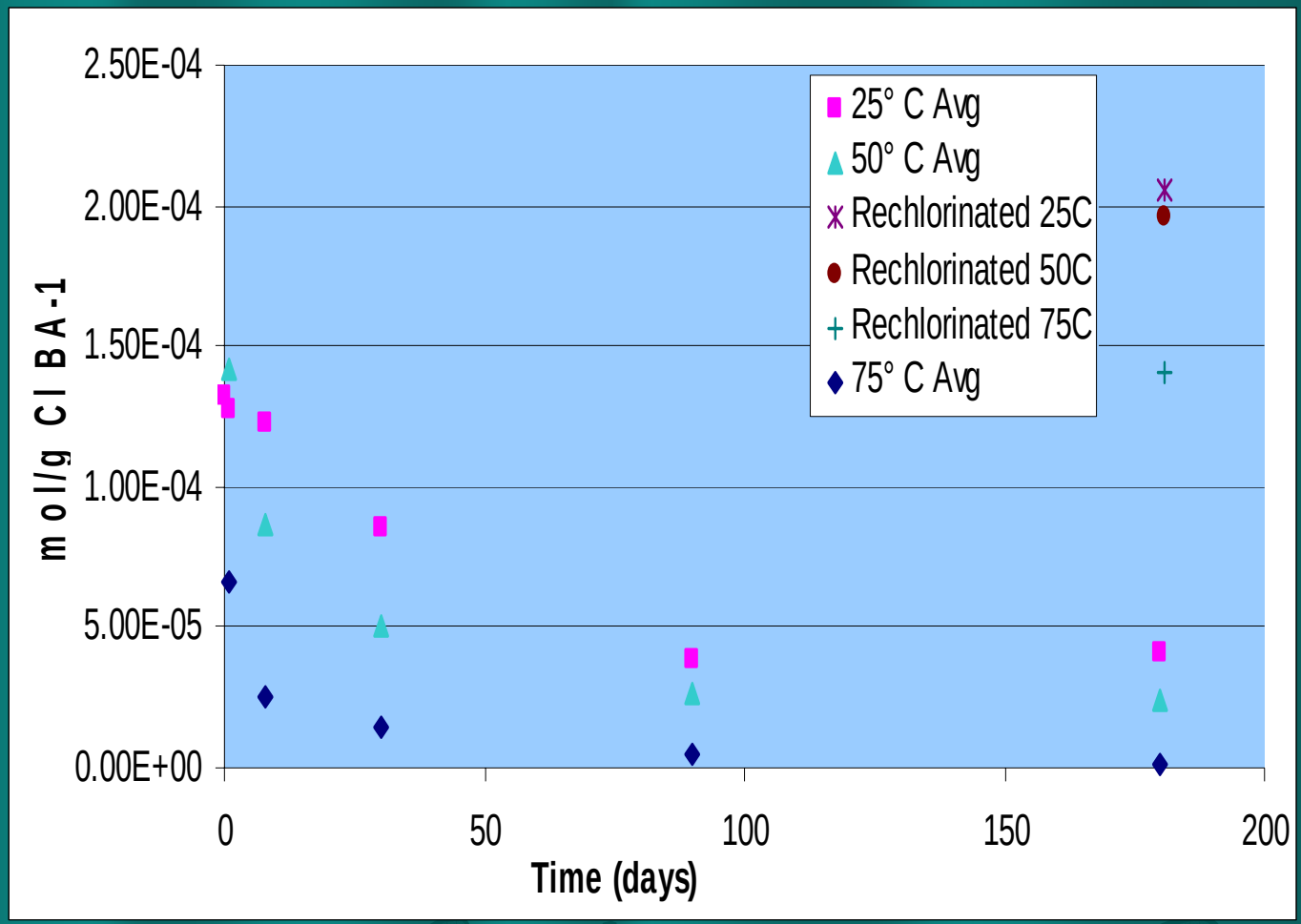
Liner Materials Challenged with CEES 20g/m^2



Chloramides of the World…
Regenerate!



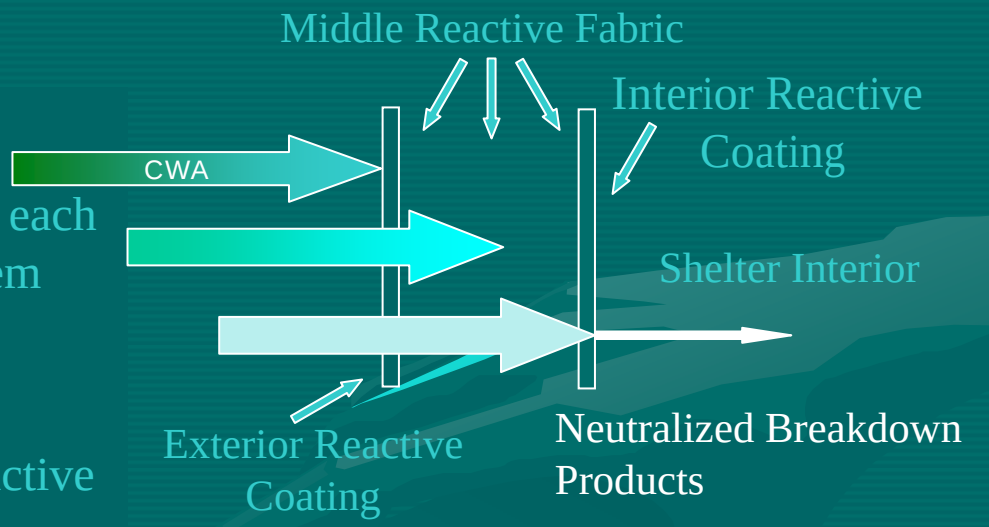
Temperature / Regeneration Study



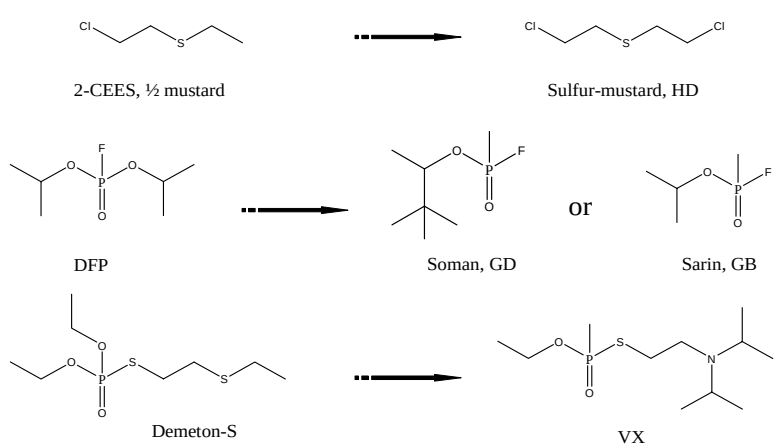
Summary and Conclusions

Reactive/Barrier Materials

- The defined Criteria For Success were met for each target CWA, therefore the reactive barrier system will outperform conventional barrier materials
- Shelter materials can now be made using less expensive barrier materials augmented with reactive coatings to provide increased protection
- Potential for expedient field-applied system to non-CB hardened structures
- Further simulant and agent testing is required



Simulant/CWA Comparison



Questions?