

Hazard Mitigation Science and Technology Program for the DoD Chemical and Biological Defense Program (CBDP)

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DoD Chemical and Biological Defense Program Enterprise





Current Chemical and Biological Threat





Current Hazard Mitigation (HM) Paradigm

Immediate

- Individual and operator
- Skin decon; Operator spray-down
- Minimize casualties; save lives
- Limits spread of contamination



Operational

- Crew and unit
- MOPP gear exchange; Operator wash-down
- Limits contamination spread and exposure
- Temporary relief from MOPP

Thorough

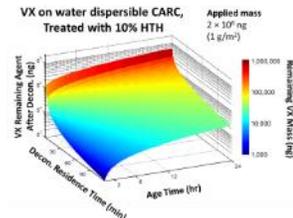
- Specialized units
- Detailed personnel, equipment decon
- **Reduces MOPP level**
- Reconstitutes combat power



Goal: Increase effectiveness earlier in process

More time needed/ Less assets available

Important Considerations:



Time-to-Action



Operational Risk



Material Compatibility



Life-Cycle Management



Protection and Hazard Mitigation Strategy

Mission: Develop technology solutions in full-spectrum CBR physical protection and hazard mitigation, and transition these technologies to the material developer in order to meet the warfighter's needs

Objectives:

- Address hazard mitigation challenges using a system-of-systems approach
- Support the Uniform Integrated Protective Ensemble (UIPE) concept
- Address the full spectrum of threat including NTAs, TICs and biological agents
- Develop the next-generation of CB protective materials
- Improve performance while reducing life-cycle and logistical costs
- Develop test methodologies that are consistent and relevant

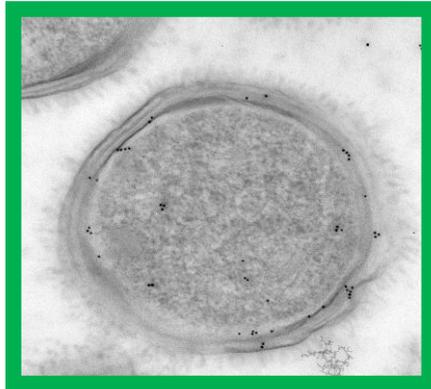
Risks:

- Molecular synthesis, engineering, and scale-up of materials
- Achieving effectiveness at an affordable cost
- New materials that perform well across the environmental spectrum
- Integration of technologies developed by multiple performers



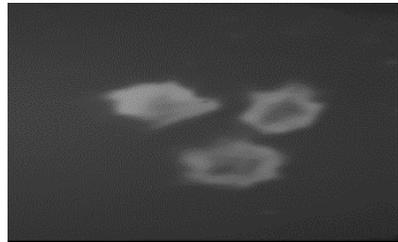
Decontamination Process Alternatives

JBADS



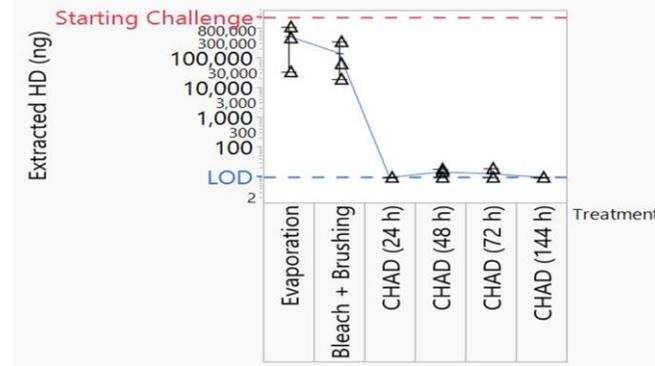
Spore Germination

Agent Disclosure



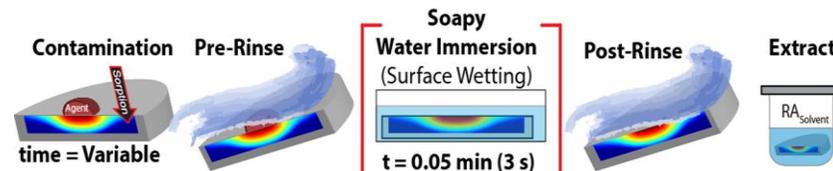
Low Light Formulation Development

Chemical Hot Air Decon



Blister (HD) removal from Pocket Knives

Coatings



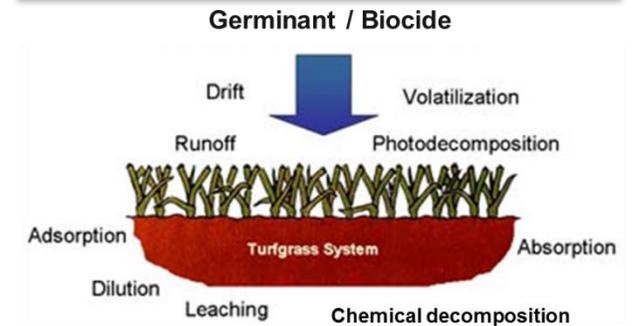
New MIL DTL developed

Sprayable Slurry



Covers Like Paint and 3 log decrease in contamination

Wide-Area Decon



Germinant Approach



JBADS – Spore Germination and Hot Air Treatment

Reduce required times and temperatures required to achieve complete (clearance-level) decontamination

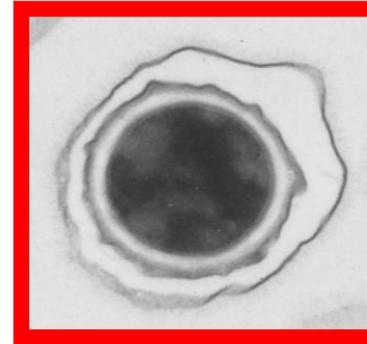
- JBADS Joint Capability Technology Demonstration (JCTD)

- Jan/Feb 2015 in Orlando, Florida
- Clearance Decontamination in 7 days (75-80° C and 70-90% RH)

- S&T Process Improvements

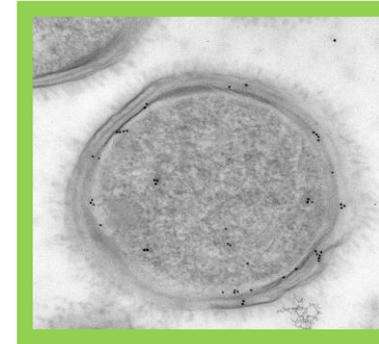
- Two cycle spore germination-heat process achieving efficacy goal in less than 20 hours while exposing aircraft to only two hours of high temperature and humidity (60° C and 90% RH)
- Complete virus inactivation within 13 hours (60° C and 60% RH)
- Complete vegetative bacteria kill within 24 hours (60° C and 90% RH)

UNGERMINATED SPORE

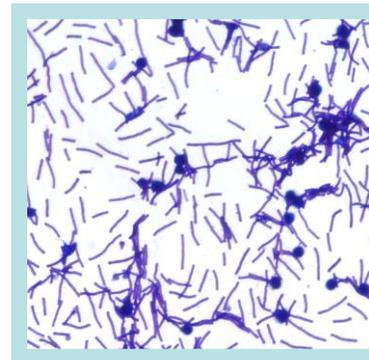


Infectious particle

GERMINATED SPORE



NOT normally infectious

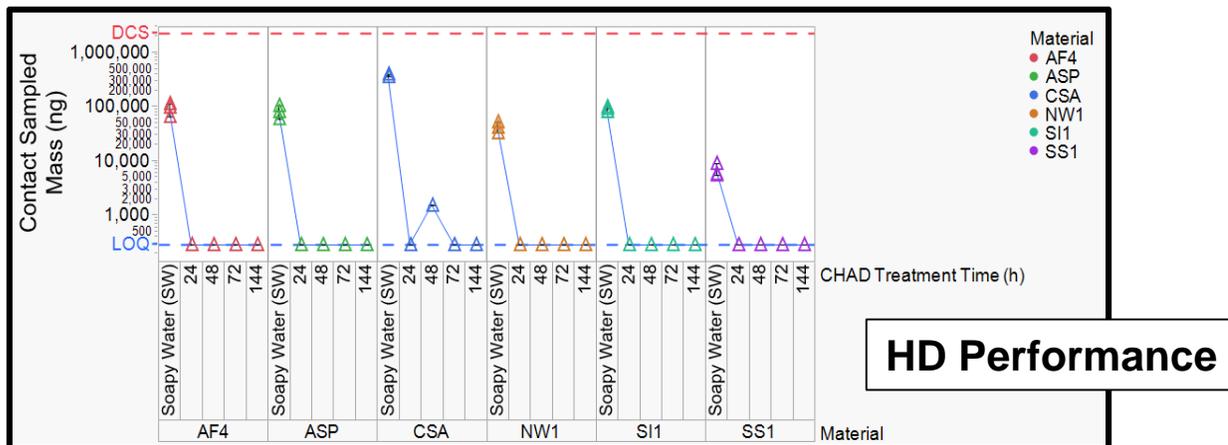
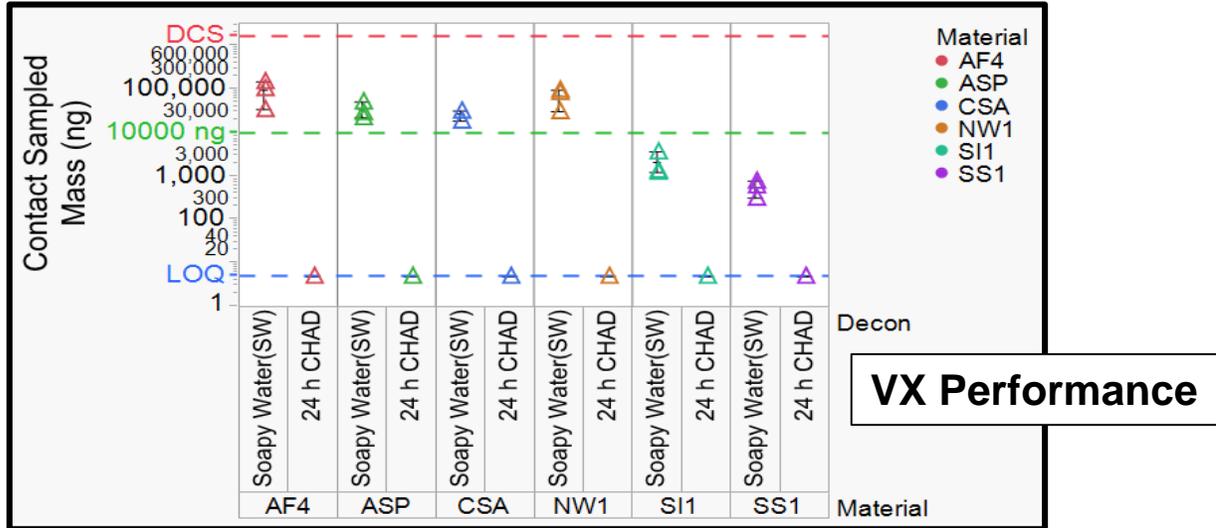


VEGETATIVE REPLICATING BACILLI

Transition: Q1 FY20



Chemical Hot Air Decontamination



- Provides potential for chemical clearance decontamination
- Increased relative humidity is more effective
- Contact efficacy below detection level achieved within 24 hours for HD and VX
- Path Forward/CHAD Process Improvement:
 - Explore process enhancements by adding aerosolized decontaminants or solvents to reduce the amount of remaining agent before CHAD treatment
 - Explore impact of real world (e.g. complex surfaces)



Sprayable Slurry Chemical Decontaminant

Develop a sprayable slurry chemical decontaminant to effectively reduce residual hazard of chemical agents in tactical environments

Goal

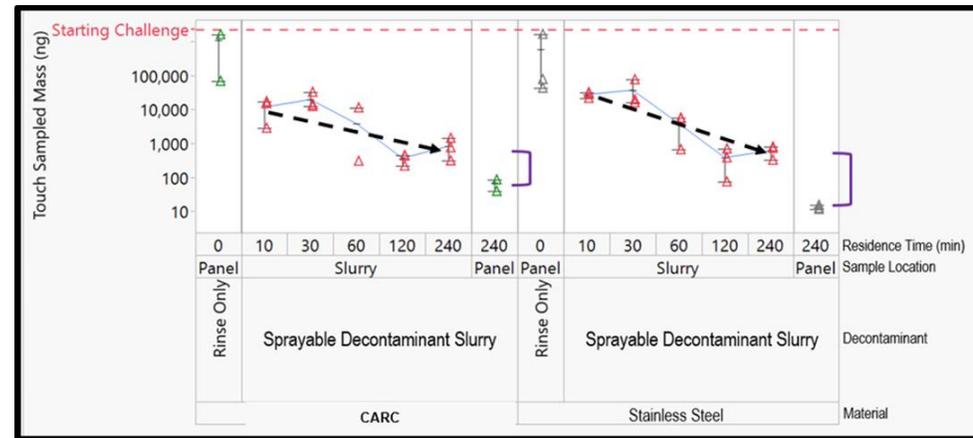
- A non-aqueous, single-step equipment decontaminant
- Applicable to immediate and operation decon (individuals, crews and unit teams)

What is “sprayable slurry”?

- Non-corrosive, paint-like formulation
- Zirconium hydroxide/1,3-dibromo-5,5-dimethylhydantoin active components
- High flash point solvent
- Additives to enhance coating properties



Sprayable Slurry Chemical Decontaminant Covers Like Paint



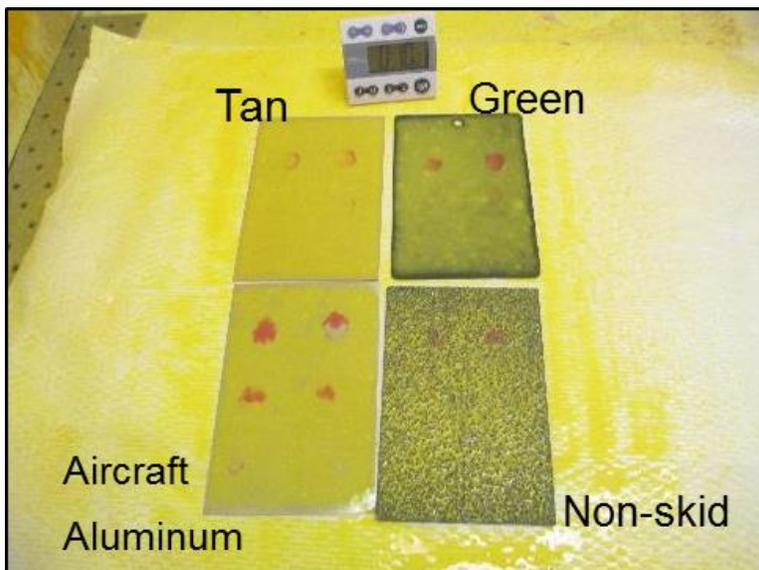
Blister Contact Hazard Reduction over Time

Transition: Q1 FY19

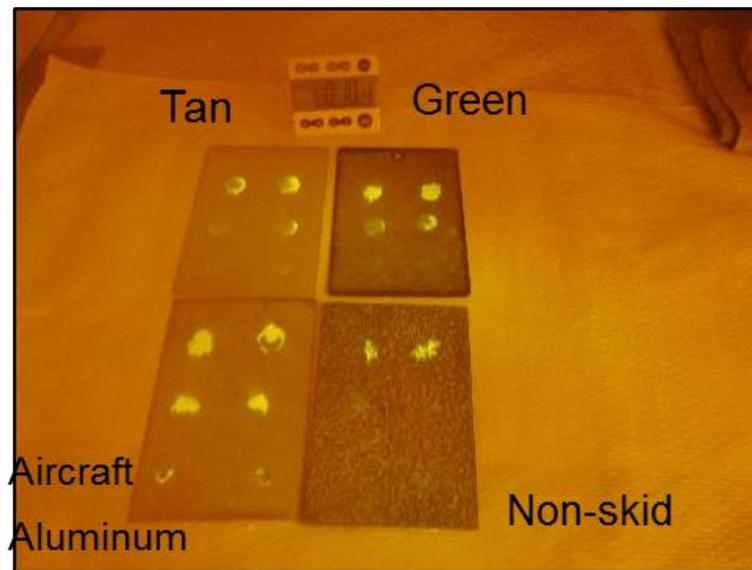


Agent Disclosure

Identify contaminated surfaces under low-light conditions and modify formulation and delivery to reduce waste

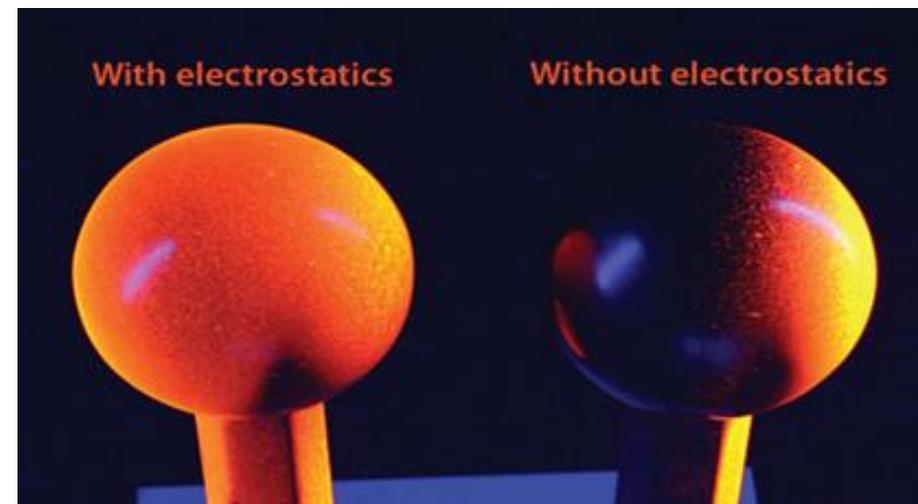


Standard view (visible)



Lowlight (UV Illumination, Orange Filter)

Two views of contamination on surfaces under different lighting conditions



Use of electrostatics to enhance coating of surfaces

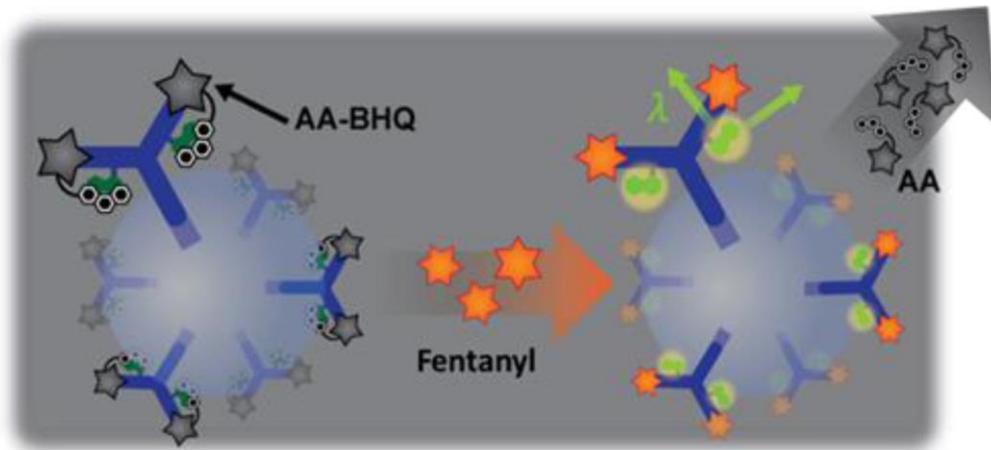
Transition: FY23



Opioid Disclosure Spray

Objective: To formulate low cost, highly specific fentanyl/opioid indicator sprays leveraging mechanism and lessons learned from nerve agent system development

- Examining two approaches simultaneously
 - Immunoassay
 - Receptor-binding assay



KEY



KEY

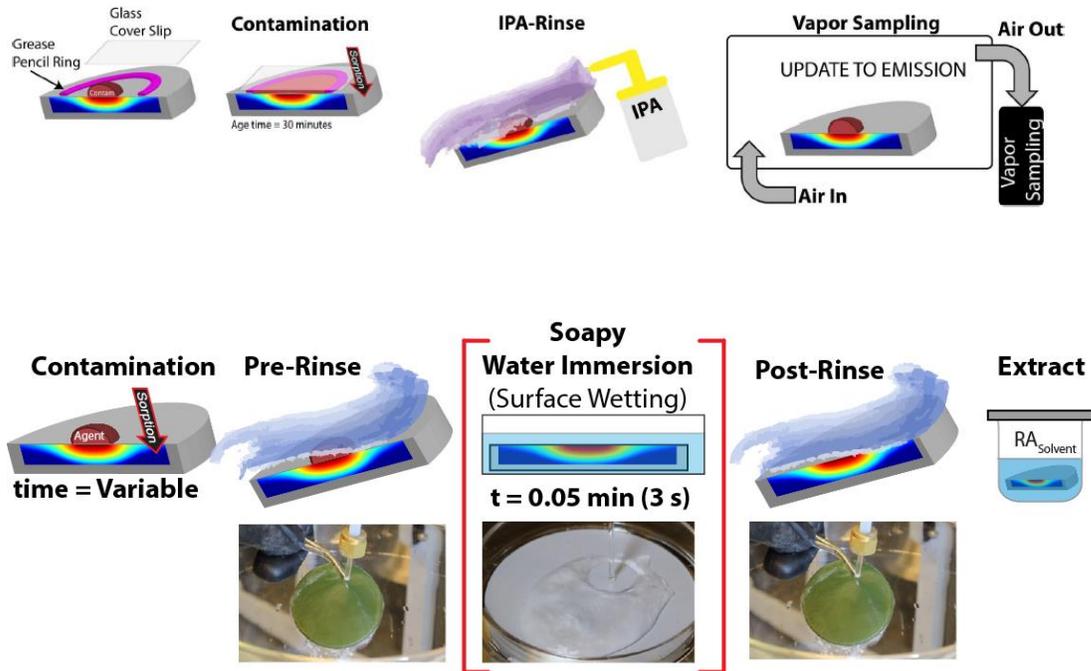


Transition: FY23



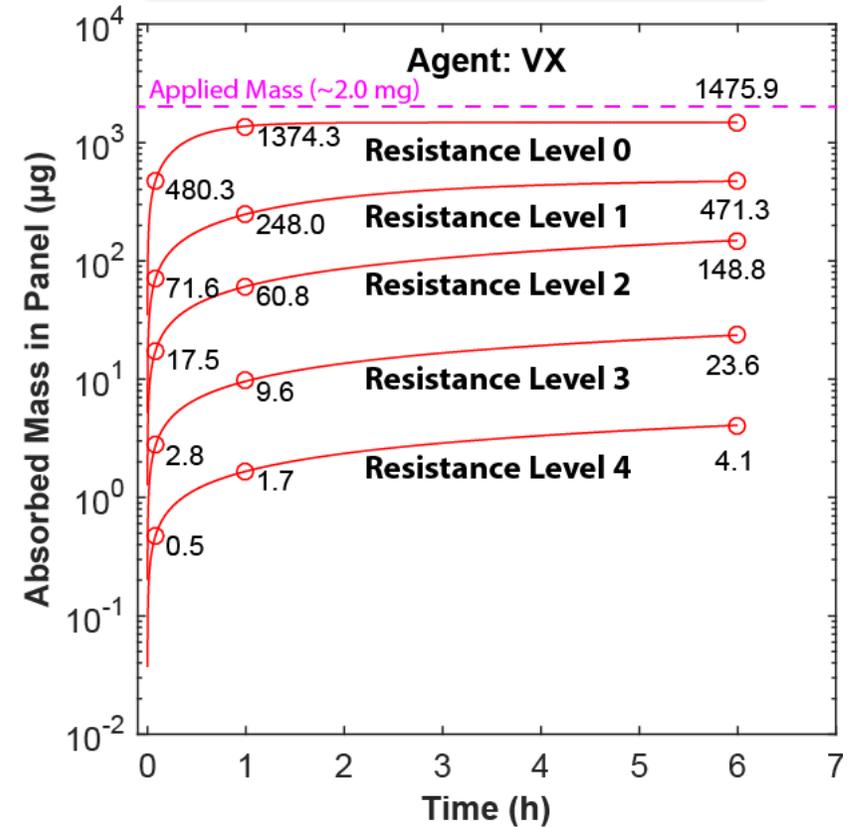
New Chemical Agent Resistance Test Method

Current vs. Updated Method



Agent resistivity for a coating is a measure of retained agent after a mild surface treatment

Agent Resistance Levels for VX



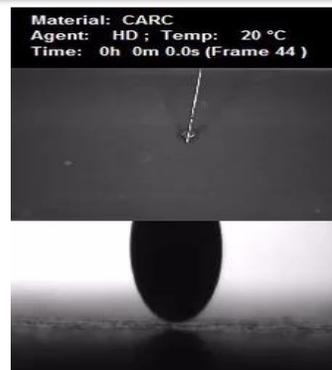
New resistance standard (Level 4) has been developed which allows for, at most, 0.4% absorption of all agents.



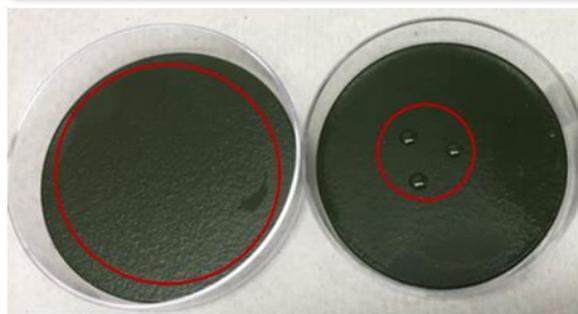
Enhanced Survivability Coatings

Increase chemical agent resistance of CARC to enable more facile decontamination of military assets

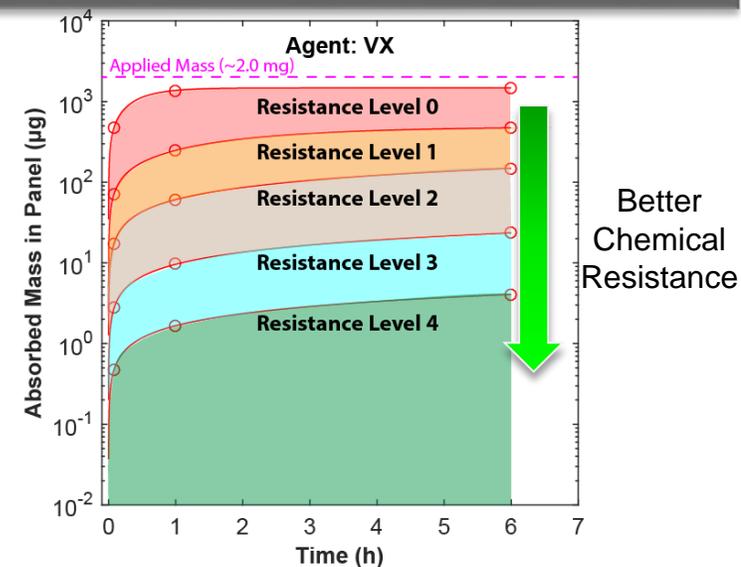
HD on CARC



New coatings could improve chemical agent resistance



Proposed Chemical Agent Resistance Method Levels



Approach:

1. Improve CARC acceptance method
2. Improve performance of existing CARC
3. Uncover underlying contributions to agent absorbance
4. Leverage biomimetic coatings
5. Temporary coatings

Transition: 5-7 years

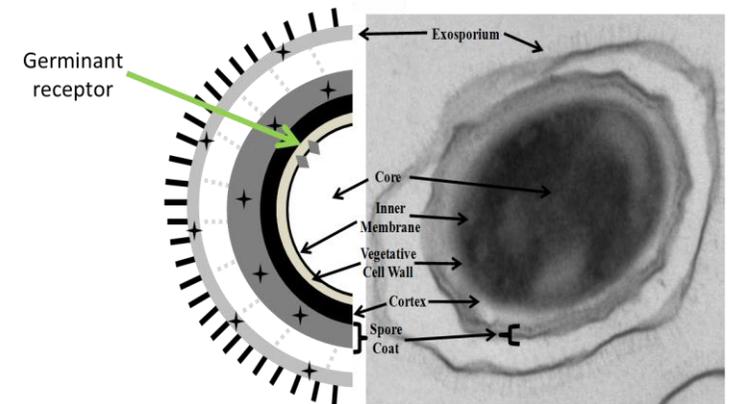


Wide-Area Decontamination Biological

- **Objective:** Develop a low logistics biological decontamination system to rapidly restore use of critical facilities
- **Approach:**
 - Focus first on persistent BWA: *B. anthracis* spore germination w/ follow-on decontaminant; research state-of-the art on agrochemical application methods
- **Metrics:**
 - *Logistics:* 'Green', rapidly deployable, 100X less decon material
 - *Efficacy:* 99.99% spore inactivation on steel, concrete, turf, *etc.*
 - *Cost:* Significantly lower total cleanup costs compared to historic methods
 - *Time:* Remediate within 2 weeks of an attack
- **Timeline:** Demonstrate BWA processes in FY20



Brentwood Postal Facility
\$130M over 2.2 years

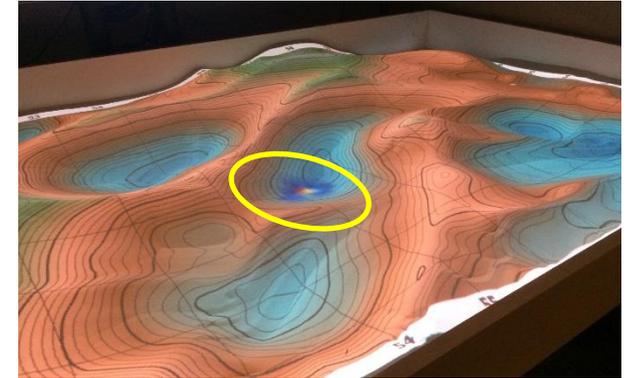


Germinant Approach



Wide-Area Decontamination Chemical

- **Objective:** Develop a low logistics chemical decontamination system to rapidly restore use of critical facilities
- **Approach:**
 - Conduct Scoping Study
 - Literature Review
 - Market Survey
 - SME Consultation
- **Metrics:**
 - *Logistics:* ‘Green’, rapidly deployable, minimize decon material
 - *Efficacy:* 3-4 log reduction on steel, concrete, turf, *etc.*
 - *Cost:* Significantly lower total cleanup costs compared to historic methods
 - *Time:* Remediate within 2 weeks of an attack
- **Timeline:** Produce “Road Map” for program beginning in FY19



Terrain and Surface Considerations



Incheon International Airport, South Korea



Questions ?

