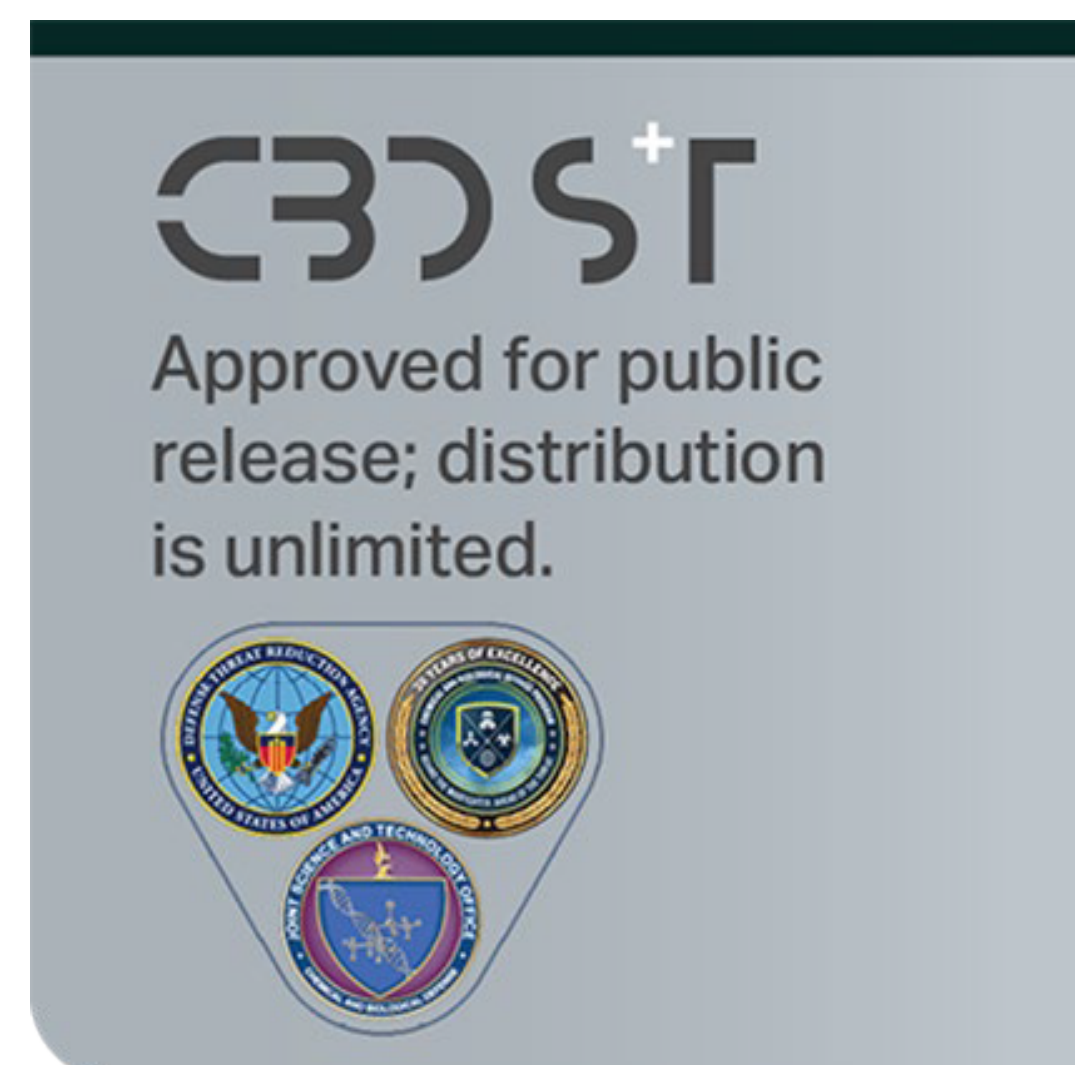




# Chemical Hot Air Decontamination (CHAD) of Complex Features and Realistic Items

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## ABSTRACT

Chemical Hot Air Decontamination (CHAD) Is a method of decontamination which uses heat and humidification to remove/detoxify the contaminants from assets without the need for harsh chemicals, such as bleach or caustic. CHAD requires contaminated items to be placed inside an enclosure that can be heated and humidified, which has air flowing through to allow any evaporated contaminants to be removed.

The Decontamination Sciences Branch (DSB) of US Army Combat Capabilities Development Command (DEVCOM) Chemical Biological Center (CBC) has utilized CHAD in small-scale laboratory studies as a method of removing contamination from absorptive surfaces, complex features, and realistic small items. Humidification up to 95% RH at 170°F (~243 g water/m<sup>3</sup> air) have been evaluated. CHAD has been shown to remove a significant amount of contamination from materials within 8 h.

## CHEMICAL HOT AIR DECONTAMINATION

Chemical Hot Air Decontamination (CHAD) Is a method of decontamination which uses heat and humidification to remove/detoxify the contaminants from assets. CHAD requires contaminated items to be placed inside an enclosure that can be heated and humidified, which has a slow air flowing through (2 air change/h) to allow any evaporated contaminants to be removed.



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## DECONTAMINATION CHALLENGES

**Time** is an important factor for decontamination of assets when contaminants have been shown to absorb into materials (paints, polymers, etc.).

Beginning a decontamination process quickly after contamination limits absorption of the contaminant into the substrate and ensures that the contaminant can be accessed by surface decontamination techniques.

However, in the real-world applications, the rapid decontamination of assets may not be possible. The CHAD project utilized a 24 h contaminant aging time for laboratory studies:

- Maximizes the absorption of contaminant
- Provides a difficult, more-realistic decontamination scenario

Decontamination of complex features is a difficult challenge because of the presence of screws, grooves, capillary features and multi-material interfaces.

## CHAD APPLICATION



- Thermotron Chamber (model # S-1.0-8200) is used inside a laboratory fume hood to ensure operator safety.
- Computer control, ability to control temperature and humidity ramping (eliminate possibility of condensation → mold)

## TEST SUBSTRATES



**Picatinny Rail:** mounting platform that is widely used in the firearms industry to attach accessories such as scopes, lasers, and bipods to firearms.



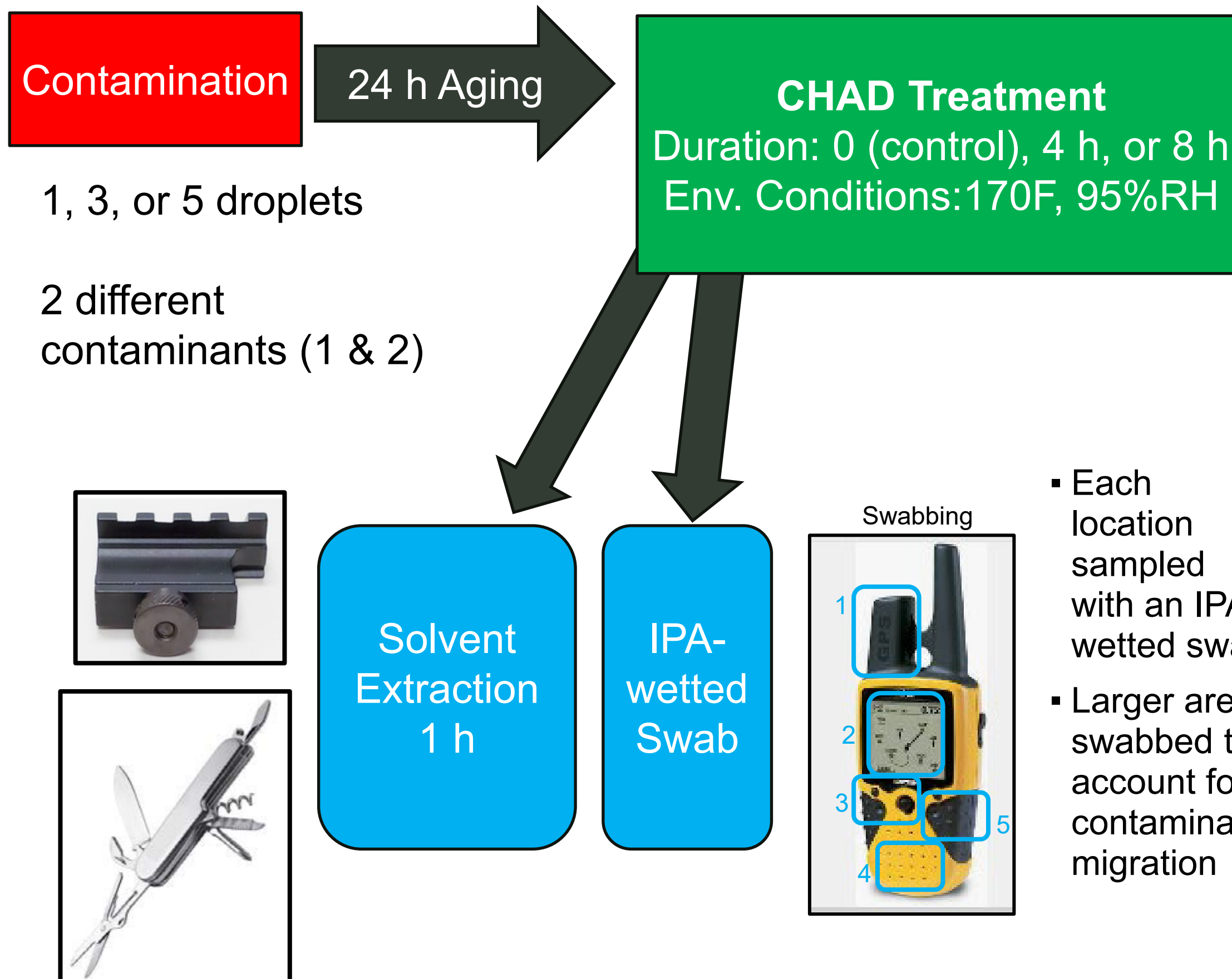
**Pocket Knife:** Multitool containing screwdriver, scissors, corkscrew, can opener, etc. contains complex features, multi-material interfaces, and lubricant



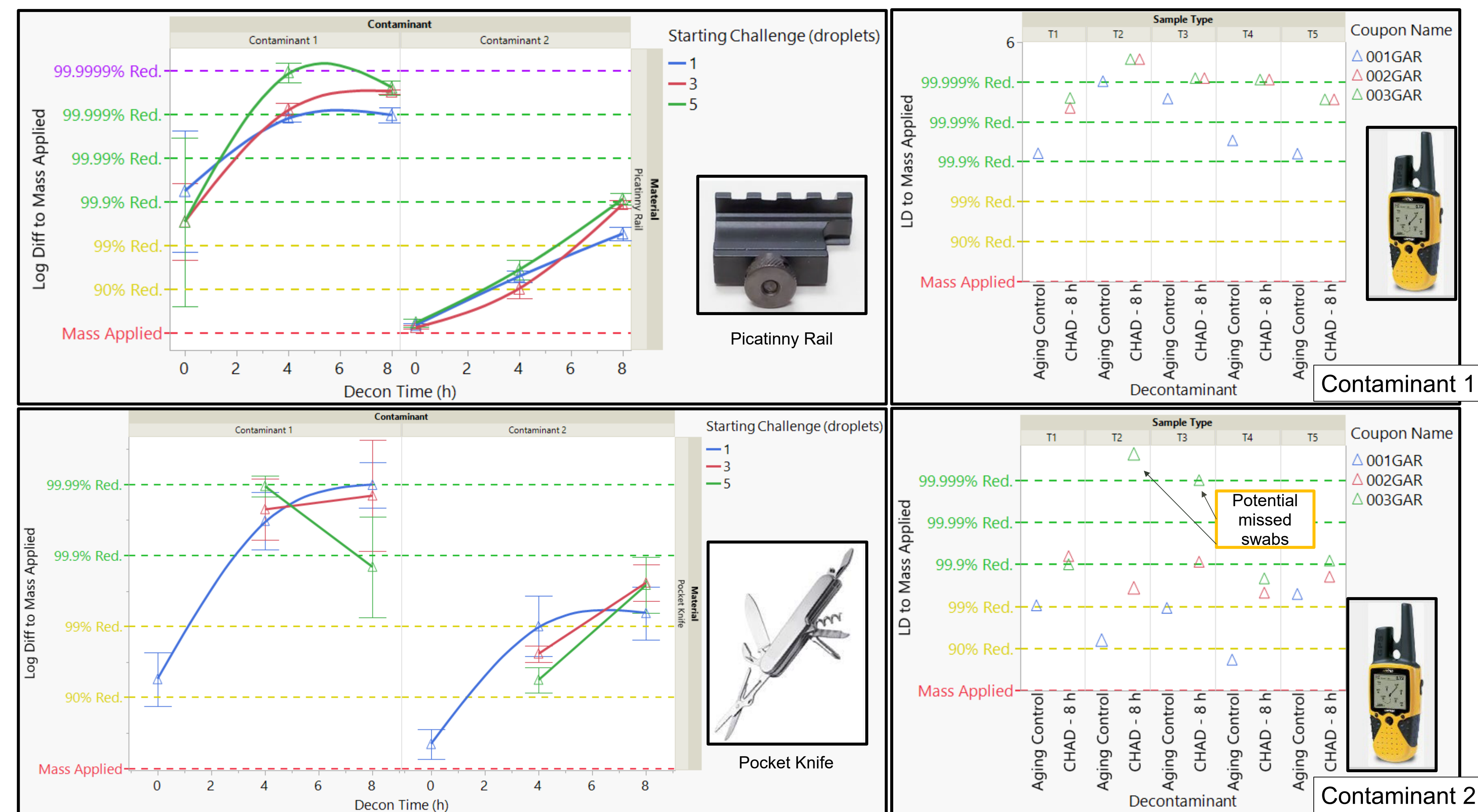
**Garmin Rino 110 2-way GPS Radio:** Realistic small item with electronic components. Composed of capillary features and multi-material interfaces. Body material made from ABS plastic with a rubber antenna.

*This is a realistic surrogate for Sensitive Electronic Equipment*

## STUDY PARAMETERS



## RESULTS



## CONCLUSIONS

- Contaminant 1 (moderate volatility) was removed more readily than Contaminant 2 (low volatility) from Picatinny Rail and Pocket Knife substrates, suggesting that the primary mechanism of decontamination was evaporation of the contaminants.
- Swab sampling of the Hand Radios produces higher variability than extraction-based analysis techniques (used for Picatinny Rail and Pocket Knife substrates)
- CHAD demonstrated the ability to remove high percentages (>99%) of two different contaminants from several realistic items as compared to control conditions in as little as 4 h of treatment. These results included the decontamination of items which contained complex geometries, multi-material interfaces, and capillary features.
- CHAD was effective at removing a range of starting challenges (multiple droplets) from the items, covering a range of complex features

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