

EPA Office of Research and Development

HOMELAND SECURITY RESEARCH



EPA ORD's Corsi-Rosenthal Box Bioaerosol Testing Results

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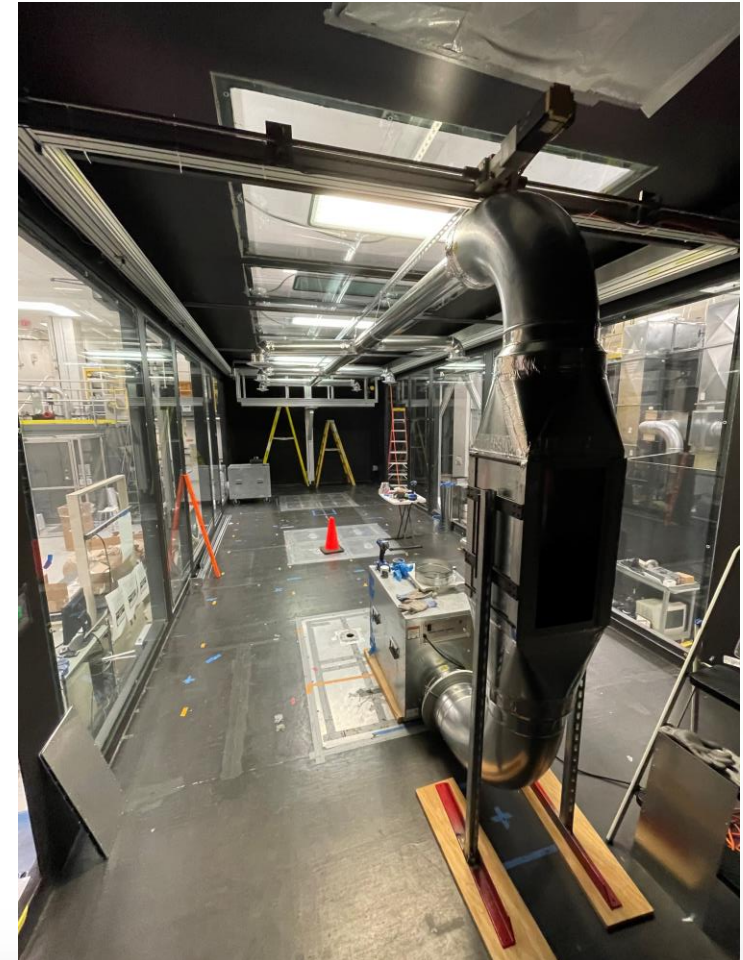
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ORD's Center for Environmental Solutions and Emergency Response

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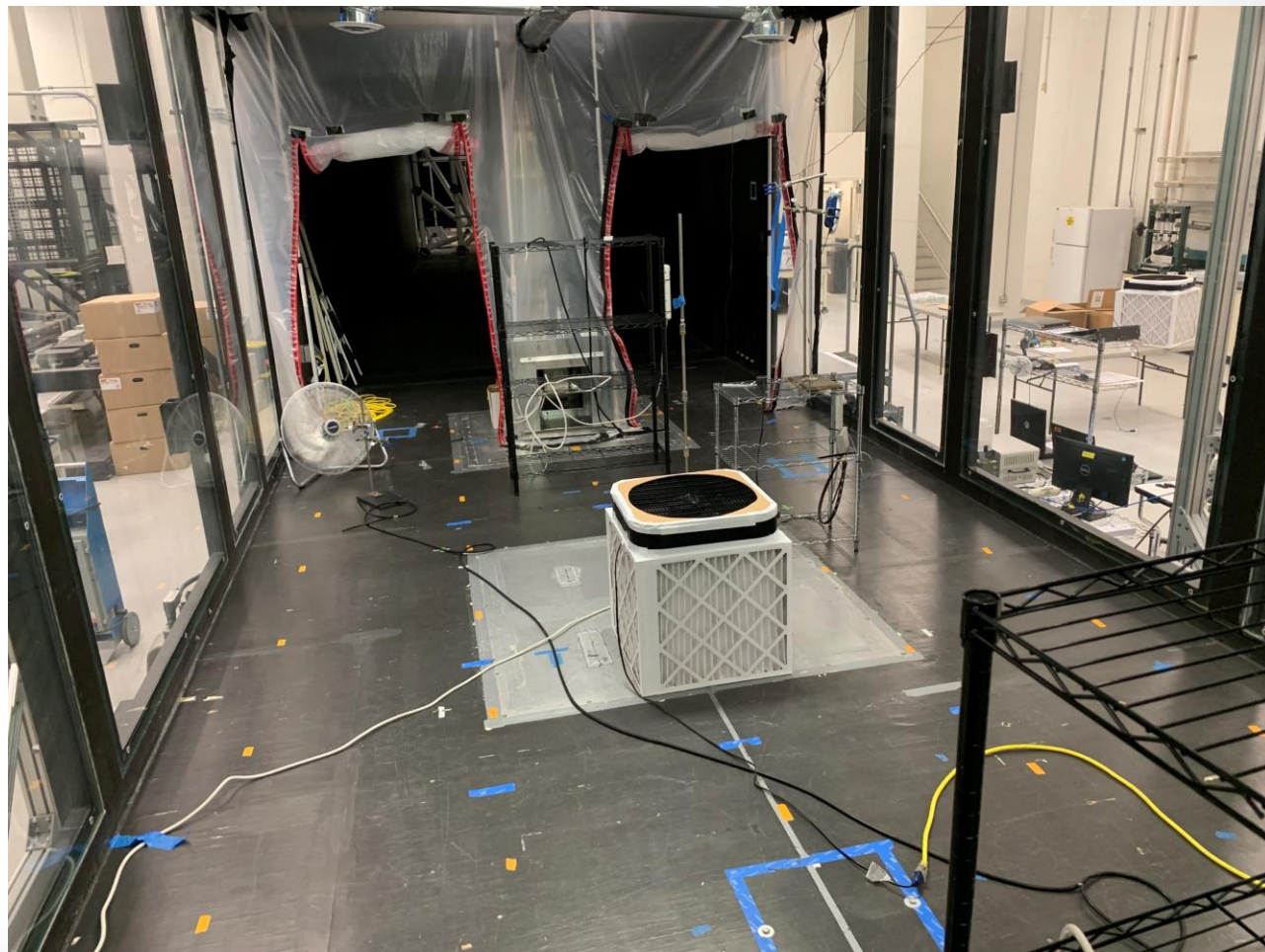
Data presented herein did not undergo a formal quality assurance review as outlined in "U.S. EPA Office of Research and Development's Quality Management Plan for Scientific Research". If these data are included in future EPA reports or other publications, they will be subjected to this review.

- Utilizing large EPA test chamber (3000 ft³) with mock HVAC system and temperature/humidity control
- Aerosolize non-pathogenic virus (bacteriophage MS2) in simulated saliva before turning on technology
- Take air samples from breathing zone in test chamber during test period; use plaque assay to determine concentration of infectious virus in the air
- Conduct replicate tests with and without technologies operating (to account for natural decay and settling)
- Particle size & concentration measurements during testing





(Left) Owl Force One, built by 5th grade class in Connecticut. (Right) EPA-assembled Corsi-Rosenthal (CR) Box, constructed from 20x20x2 inch MERV-13 filters. A new CR Box was used for each test.





Efficacy Calculations

- How can we quantify technology efficacy against infectious bioaerosols?
 - **Log Reduction (LR):** compare bioaerosol samples from tests with technologies active to time-matched positive control (technology off) samples

LR = mean \log_{10} recovery (positive control samples) – mean \log_{10} recovery (test samples)

- **Clean Air Delivery Rate (CADR) = $V (L_{on} - L_{off})$**

V = volume of test chamber; L_{on} and L_{off} are first-order virus loss rates for technology on/off conditions

following Stephens et al. (2022) “Interpreting Air Cleaner Performance Data.” *ASHRAE Journal* 64.3: 20-30.

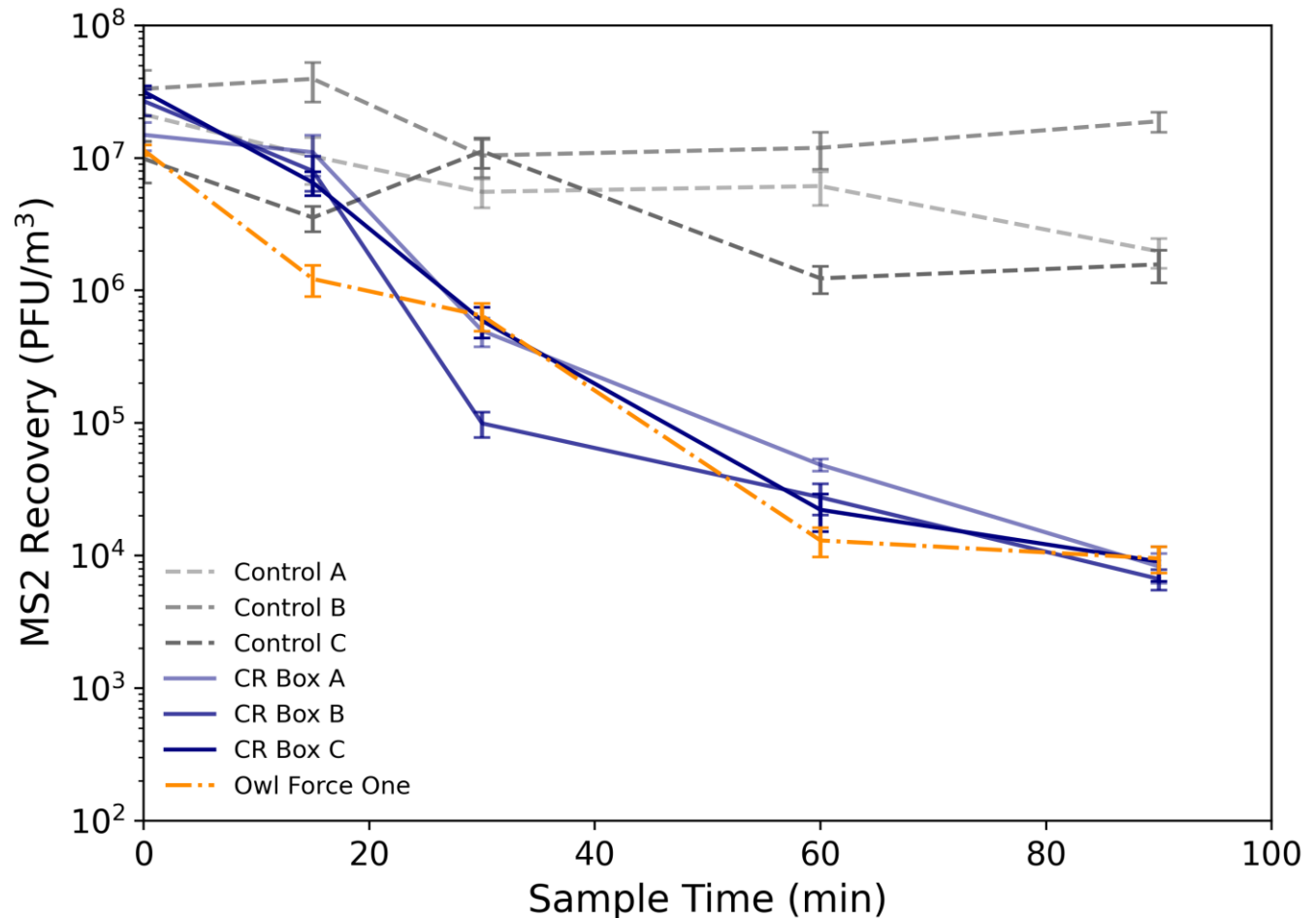


Bioaerosol Results

Owl Force One was tested at the lowest fan speed setting (378 CFM).

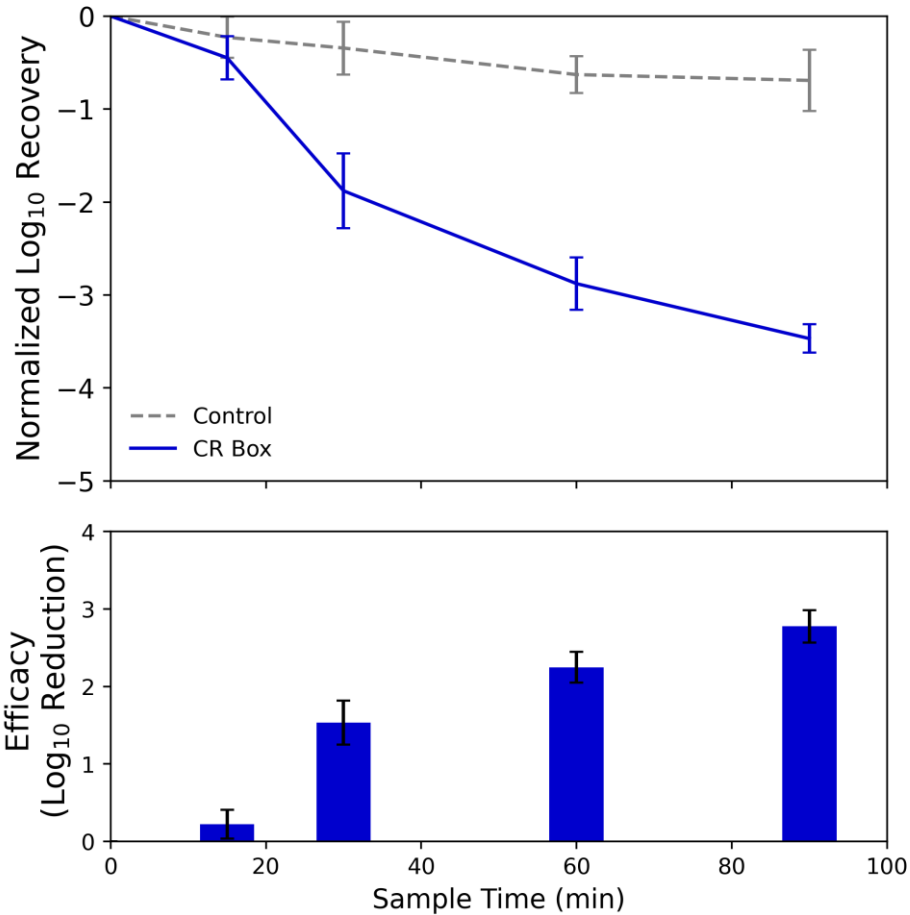
EPA-assembled CR Boxes were tested at the highest fan speed setting (560-605 CFM).

Control tests are bioaerosol tests with no CR Box operating (to quantify natural decay of infectious aerosol without intervention)





Bioaerosol Results

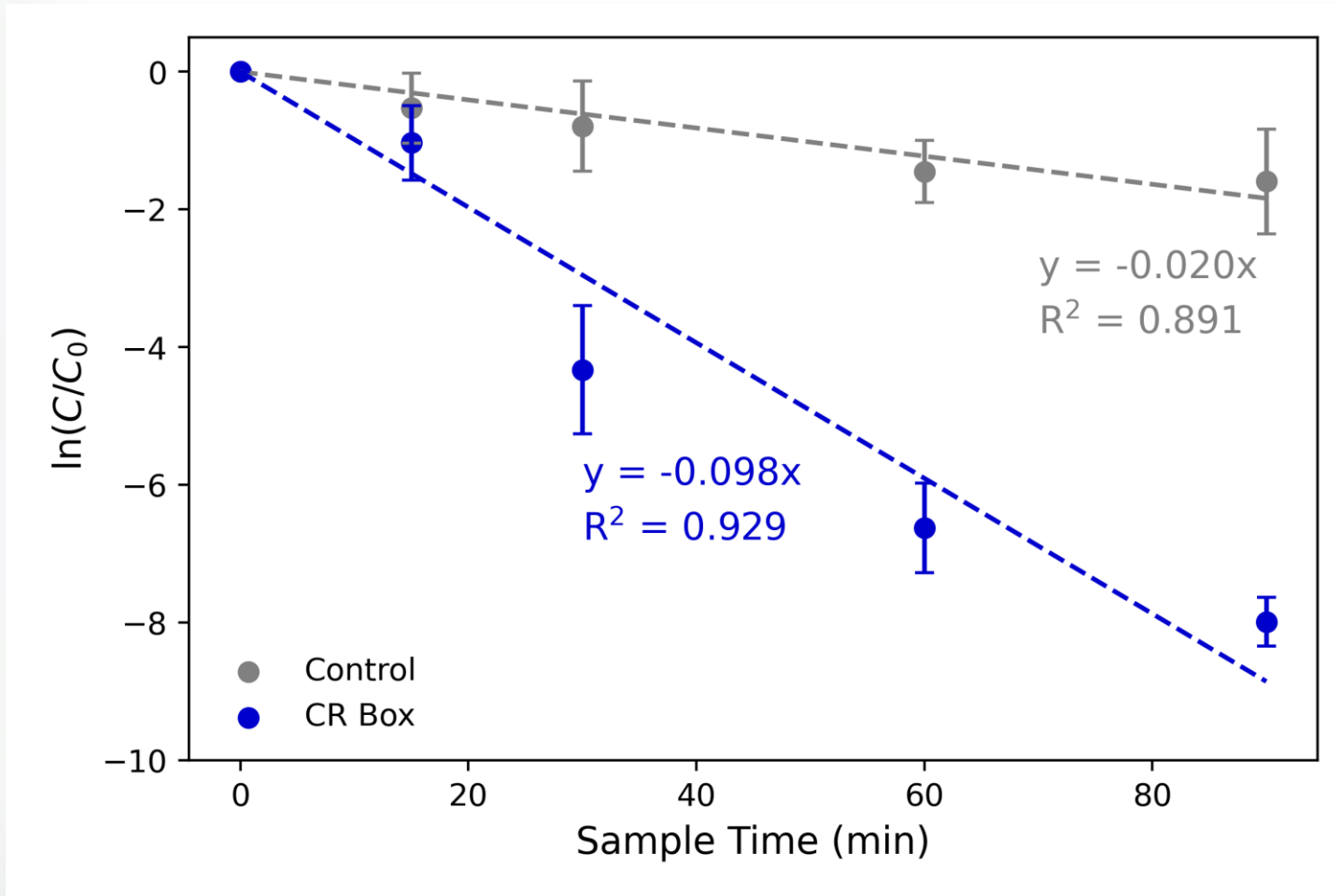


Reductions calculated by averaging results of three control test replicates and three EPA CR Box test replicates.

Sample Time (min)	Log ₁₀ Reduction	Percent Reduction
15	0.2	40%
30	1.5	97%
60	2.2	99.4%
90	2.8	99.8%



Bioaerosol Results



**Infectious Aerosol
CADR = 234 CFM**



Particle Results

Normalized particle concentration measured by a Scanning Mobility Particle Sizer (particles $0.01\ \mu\text{m}$ – $0.6\ \mu\text{m}$, including the most penetrating particle size of $0.3\ \mu\text{m}$)

