2023 STUDY REPORTS

Conducted for Pure Maintenance Holdings by Element Lab (Eagan, MN)



ABOUT ELEMENT

Element is one of the world's leading global providers of testing, inspection, and certification services for a diverse range of materials, products, and technologies. They are the premier partner for product developers, manufacturers, and users of antimicrobial pesticides and biocide products.

Element's consultative team of regulatory and scientific experts have a strong track record of more than three decades generating GLP-compliant data that is accepted by global authorities such as the U.S. Environmental Protection Agency (EPA), Health Canada, Australian Therapeutic Goods Administration (TGA), and European Chemicals Agency or individual European Member State agencies.

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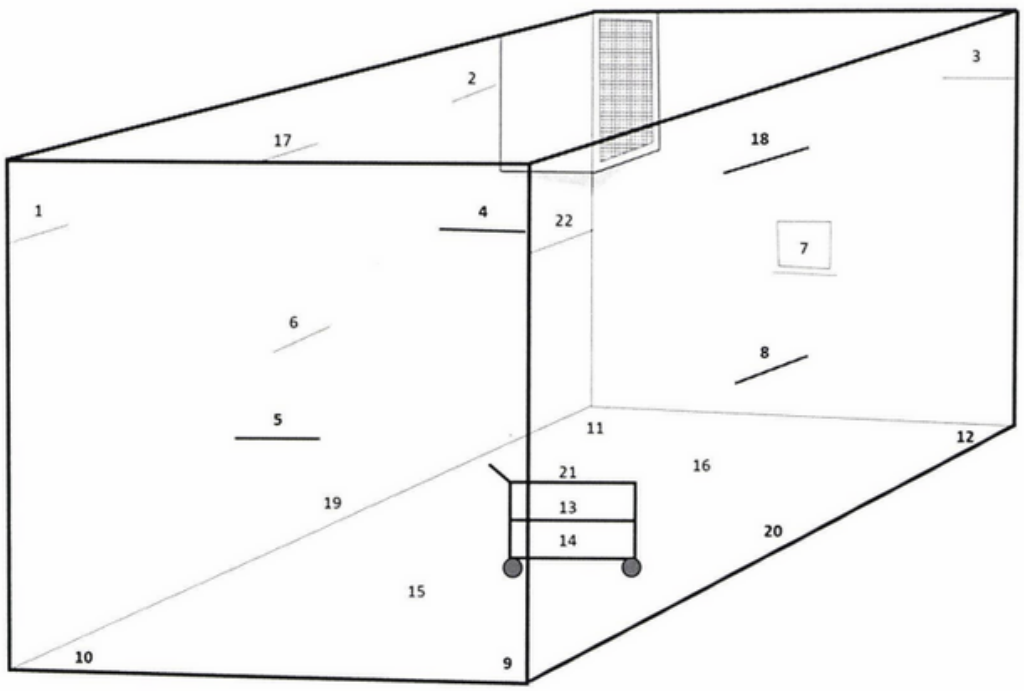
TEST DESIGN

Introduction

When testing the efficacy of any product, process or device against microorganisms, there are three major categories: bioaerosol, porous surfaces, and non-porous surfaces. For the intent of this study, bioaerosol and porous tests were performed after the Pure Maintenance process was performed. Since it is considered more difficult to get a kill on porous surfaces than on non-porous, the surface portion of this study was only tested on porous surfaces, figuring it would reveal effificacy for both types of surfaces

The Testing Room

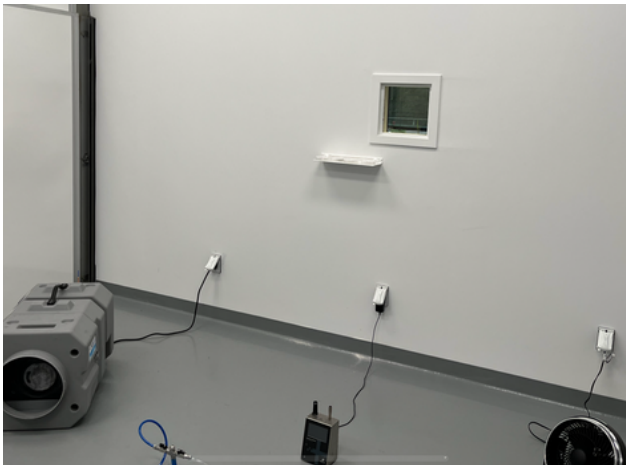
Element Lab expended a large amount of time and resources to create a test room that was large enough to be able to more closely simulate a real world environment for testing devices such as foggers. The dimensions of the test room and control room are 21.5' x 15' x 12'. This one-of-a-kind test room makes it possible to test against airborne and surface pathogens in a unique and pioneering way.



POROUS TESTING

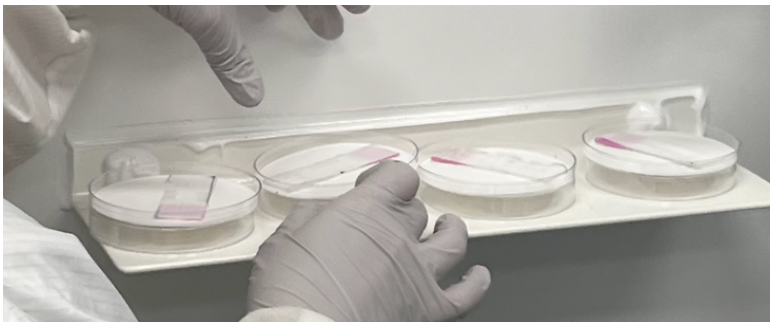
Porous Surface Set Up

For porous surface testing, Element installed shelves at varying heights and locations throughout the test room in order to determine a fumigant's ability to kill microorganisms high and low, and everywhere between. In total, there were 22 locations on which open petri dishes with cotton fabric carriers were placed. These cotton carriers were inoculated with various bacteria and mold. In order to get a kill on porous materials such as cotton, the fumigant must be able to penetrate into fibers of the substrate, making it considerably more difficult.





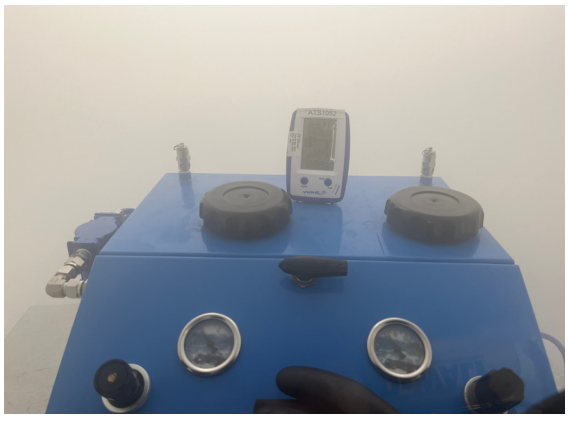




Fogging

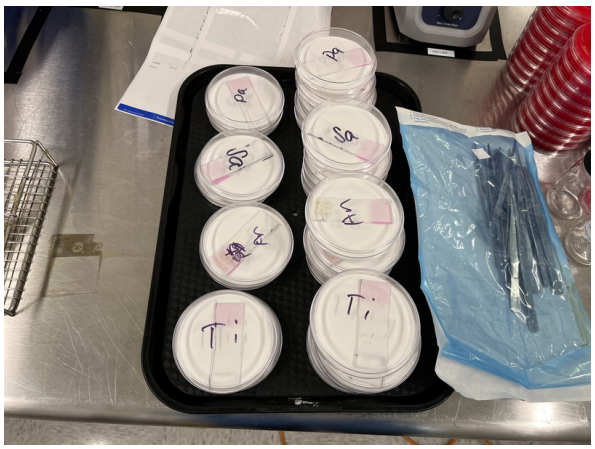
Once the carriers were placed, Pure Maintenance's patented technology was administered via the VaPURE machine. The Pure Maintenance VaPURE machine was allowed to run for 8 minutes and 50 seconds. and then turned off.

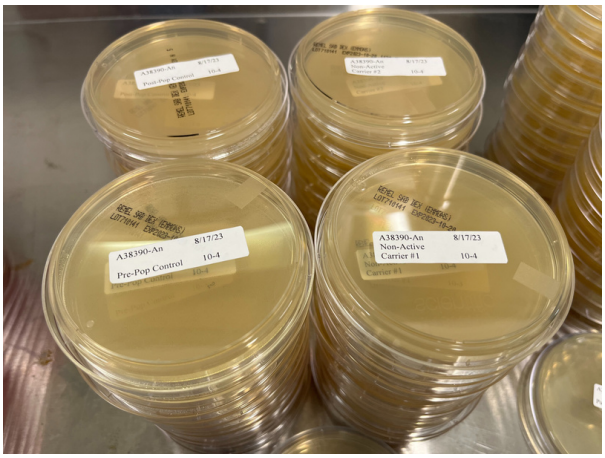




POROUS CONT...

After the Pure Maintenance VaPuRE machine was turned off, the room exhaust system was engaged in order to flush out the peracetic acid from the room. After airing out the room, the microorganisms were removed from the carriers and were transferred to vessels containing neutralizing subculture medium. The subcultures were incubated and assayed for survivors.





TEST RESULTS

As per the EPA's recommendation, 66 cotton carriers were used for the bacteria and 22 for mold. Of the 66 cotton carriers inoculated with Pseudomonas aeruginosa and Staphylococcus aureus, and the 22 carriers inoculated with Trichophyton interdigitale, no survivors were found.

TABLE 5: TEST RESULTS

Test Substance	Test Organism	Sample Dilution	Number of Carriers	
			Exposed	Showing Growth*
VigorOx Liquid Sanitizer and Disinfectant Lot 17622C1420	*Trichophyton interdigitale* (ATCC 9533)	19.2 oz/gallon, defined as 19.2 ounces test substance + 108.8 ounces diluent	22	1°= 0 2°= 0

* Number of carriers showing growth of the test organism.
1°= Primary Neutralizer, 2°= Secondary Neutralizer

TABLE 5: TEST RESULTS

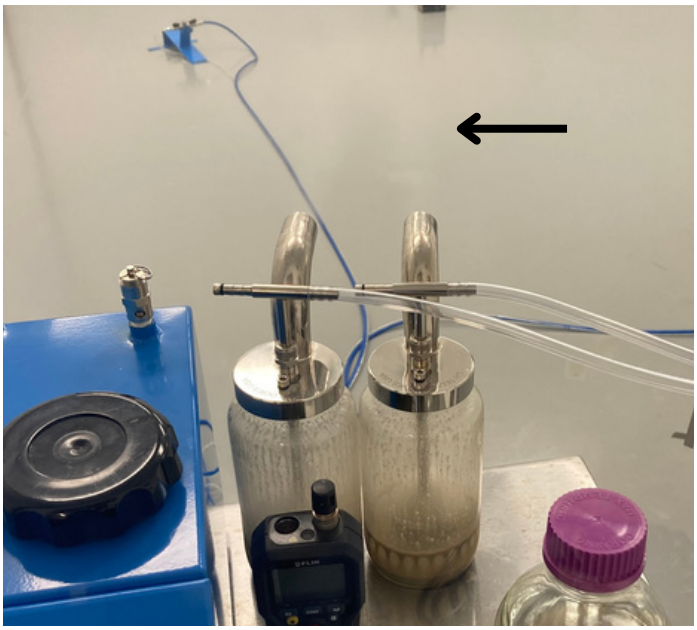
Test Substance	Test Organism	Sample Dilution	Number of Carriers	
			Exposed	Showing Growth*
VigorOx Liquid Sanitizer and Disinfectant Lot 17622C1420	*Pseudomonas aeruginosa* (ATCC 15442)	19.2 oz/gallon, defined as 19.2 ounces test substance + 108.8 ounces diluent	66	0
	Staphylococcus aureus (ATCC 6538)		66	0

* Number of carriers showing growth of the test organism.

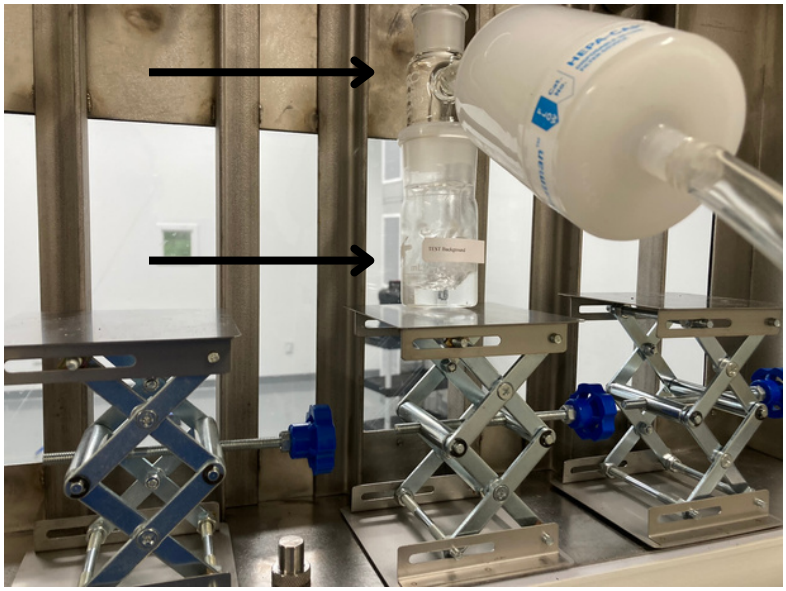
BIOAEROSOL TESTING

Bioaerosol Test Set Up

For the bioaersol testing, the same large room was used. In order to disperse spores into the air of the test room, several million spores were nebulized into the air while the internal ceiling fan was running. This assisted in keeping the spores aloft during treatment and testing.



Again, the Pure Maintenance technology was used allowing the VaPURE machine to run for 8 minutes and 50 seconds at which time it was turned off. One minute and 10 seconds later, at the 10-minute mark from the start of the fog, an impactor that was connected to the test room was deployed. The purpose of the impactor was to pull out the microorganisms that were just infused into the room back out of the room into a solution that was then plated for culturing.



BIOAEROSOL CONT...

The same process of vacuuming the spores into the impactor was employed two more times, once at the 30-minute mark and again at the 45-minute mark from time zero when the fogging started.

Cladosporium Cladosporioides Results

The log reduction was determined to be 3.54 and is based on the spores recovered at the 10-minute mark only. A 3.54 log reduction is equivalent to more than 99.9% of the spores. However, in this case, all Cladosporium spores were rendered dead and so the log reduction represents the limit of detection based on how many spores they were able to recapture.

TABLE 5: TEST RESULTS

Organism	Timepoint	Average CFU/m^3	Average Log/m^3	Log_{10} Reduction vs. Time Zero	Normalized Log_{10} Reduction
Cladosporium cladosporioides (ATCC 16022)	Time Zero	4.15E+05	5.62	N/A	
	10 minutes	* 7.14E+01	1.85	3.76	3.54
	30 minutes	* 7.14E+01	1.85	3.76	2.78
	45 minutes	* 7.14E+01	1.85	3.76	2.01

*No organism recovered. Represents test Limit of Detection.

CONCLUSION

VigorOx Liquid Sanitizer and Disinfectant (17622C1420) diluted 19.2 oz/108.8 oz defined as 19.2 oz of test substance + 108.8 oz sterile deionized water, applied using the V2 Fog Tank demonstrated a 3.54 log_{10} reduction of *Cladosporium cladosporioides* (ATCC 16022) following a 10 minute exposure time when compared to the corresponding baseline result in the presence of a Tri-Part soil organic soil load.

Staphylococcus Aureus Results

The log reduction for Staphylococcus aureus was 4.99. As with the Cladosporium, no live organisms were recovered and thus the log reduction reepresents the limit of detection.

TABLE 5: TEST RESULTS

Organism	Timepoint	Average CFU/m^3	Average Log/m^3	Log_{10} Reduction vs. Time Zero	Normalized Log_{10} Reduction
Staphylococcus aureus (ATCC 6538)	Time Zero	1.16E+08	8.07	N/A	
	10 minutes	*3.20E+02	2.51	5.56	4.99
	30 minutes	*3.20E+02	2.51	5.56	3.12
	45 minutes	*3.20E+02	2.51	5.56	1.93

*No organism recovered. Represents test Limit of Detection.

CONCLUSION

VigorOx Liquid Sanitizer and Disinfectant (17622C1420) diluted 19.2 oz/108.8 oz defined as 19.2 oz of test substance + 108.8 oz sterile deionized water, applied using the V2 Fog Tank demonstrated a 4.99 log_{10} reduction of *Staphylococcus aureus* (ATCC 6538) following a 10 minute exposure time when compared to the corresponding baseline result in the presence of a Tri-Part soil organic soil load.

