





Reducing Microbial Contamination in a Corporate Environment

Problem

Following a recent solutions installation in California, R-Zero conducted tests to determine the effectiveness of the R-Zero disinfection ecosystem. Creating and maintaining healthy indoor environments is a growing concern for organizations of all sizes across the U.S. and around the world. Without adequate maintenance and operation of shared spaces, employees can become exposed to indoor microbial contaminants. R-Zero's UV-C disinfection ecosystem enables terminal and continuous disinfection of air and surfaces. This suite of solutions can lead to a dramatic reduction in microbial counts while enabling safer indoor environments where employees can thrive and enjoy peace of mind.

Test Location	Site Location	Test Devices	Occupancy
 Corporate campus, 2 buildings	 California	 R-Zero's UV-based disinfection ecosystem	 Limited, workplace open with restrictions

Methodology

This testing examined the field safety and efficacy of R-Zero's air and surface disinfection solutions in reducing the number of potentially harmful microorganisms in the environment. Environmental assessments, irradiance measurements, and bioaerosol exposure calculations allowed the study team to evaluate the real-world effectiveness of R-Zero devices - Arc for terminal disinfection, and Beam for upper room UVGI - in occupied spaces. This study following the installation in this busy office environment also examined germicidal dose delivery, device safety, and microbial load modeling.

The testing protocol employed for this facility collected the following information:

- Indoor air quality assessments: measurement of room temperature, carbon dioxide, carbon monoxide, and microbiological measurements of terminal room disinfection
- Irradiance measurements: dose validation and eye safety checks for upper room UVGI devices and Far-UVC devices to validate device compliance with threshold limit values (TLV) for UV-C exposure levels recommended by the American Conference of Governmental Industrial Hygienists (ACGIH)
- Microbial load computation: use of bioaerosol exposure calculation and germicidal dose model to compute SARS-CoV-2 variant B.1.1.529 (Omicron) microbial load in the disinfected space

Indoor environmental conditions at each sampling location were collected using a Q-Trak Indoor Air Quality Monitor Model 7575. The sampling probe was held away from air supply vents near R-Zero devices and allowed to stabilize, with relevant details such as temperature, relative humidity, and carbon dioxide levels being noted. Representative surface samples were collected using 3M Quick Swabs and then plated on 3M Rapid Aerobic Count Plates. They were then analyzed for enumeration of total bacterial colony-forming units (CFUs) using the 3M Petrifilm Plate Reader Advanced.

For upper room UVGI (Beam) devices, irradiance measurements utilized an International Light Technologies (ILT) ILT2400 Optical Meter fitted with a UVGI Filtered Detector with a 240–310nm wavelength spectral response calibrated to a 268nm wavelength.

UV-C doses were calculated by multiplying the irradiance by the exposed time(s) and reported as mJ/cm². In addition, photochromic indicators (dosimeter cards) were used to validate dose delivery. Eye level safety measures were taken for the upper room UVGI (Beam) fixtures with the same apparatus used for irradiance measurements but with adaptations to mimic the structure of the human eye.

Risk modeling for the test locations assumed well-mixed air and a default HVAC ACH of 3. It also took into account human behavior in the spaces and how the spaces are utilized as well as occupancy levels and immunity to microorganism risks through vaccines and natural immunity.

Results

Arc: surface sampling results in the kitchen area at RingCentral showed 95 and 18 CFUs on the microwave and beverage refrigerator handles prior to the test. After Arc treatment in the space, no bacterial CFUs were detected in those areas.

Beam: when measuring for eye safety, all installed Beam fixtures in 7 different areas met the eye level safety guidelines (TLV limits) set out by ACGIH. All devices in all areas delivered a UV-C dose that exceeded the 3.7 mJ/cm² required to inactivate 99.9% of SARS-CoV-2 in just one minute.

The R-Zero ecosystem resulted in an overall 2.1x microorganism reduction and an increase of 5.3 eACH (+2.3 eACH above baseline).

Conclusions

Based on the experiments conducted in the study, the testing team concluded that the R-Zero devices tested exceeded performance expectations and are highly effective in decreasing microbial load at the office site. The devices tested met safety guidelines (TLV limits) while exceeding the UV dose required to inactivate microorganisms, resulting in an overall 2.1x microorganism reduction and an increase of 5.3 eACH.

ABOUT R-ZERO

R-Zero is the first technology company dedicated to helping indoor corporate environments become clinically clean. Our disinfection ecosystem goes beyond typical UV-C, continually evaluating risk while enhancing layered prevention protocols that help protect your employees and staff in the spaces they share. R-Zero's suite of thoughtfully designed technologies and science-backed protocols reduce the microorganism load. Through the use of sustainable UV-C disinfection, we enable safer indoor environments and healthier shared spaces with significant economic benefits. Our connected devices and device dashboard create an auditable trail of activity to make the traditionally invisible disinfection process visible. For more information, visit www.rzero.com/workplace.

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