WELLAIR
It's that important

Laboratory & Clinical Research Summary

In independent laboratory studies WellAir products, powered by NanoStrike™ technology or bipolar ionization technolgy, have been shown to safely and effectively reduce bacteria, mold spores, viruses, allergens, volatile organic compounds, and particulate matter.

In clinical settings, both the WellAir portable devices and WellAir's Plasma Air HVAC in-duct devices have been have been demonstrated to reduce airborne pathogens and odors.

Contents

NanoStrike™

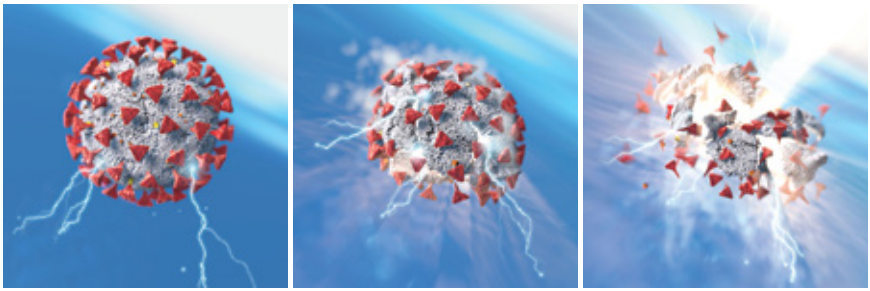
The First Line of Protection Against Airborne Viruses and Bacteria

NanoStrike™ technology is the unique, patented technology at the core of all WellAir portable air cleaning devices. This nanotechnology inactivates airborne microorganisms on contact providing the first line of protection against viruses and bacteria.

- Patented technology harnessing multiple pathogen inactivation processes in one powerful strike
- Inactivates at the DNA level in a sub-second time frame
- Uniquely bursts the pathogen cell, preventing self-healing
- Multiple inactivation processes helps to prevent future antimicrobial resistance
- Low total cost of ownership
- Powerful but gentle for 24/7 use
- Independently tested and proven

Developed by the WellAir team of scientists and engineers, NanoStrike technology harnesses a range of physical concurrent pathogen inactivation processes to safely clean and disinfect the air.

NanoStrike coils provide a powerful strike that works to burst airborne pathogen cells, rapidly inactivating them, ensuring they are no longer a threat of infection.



NanoStrike effect on SARS-CoV-2 virus

Escherichia coli (E. coli) Inactivation

Laboratory Name:	NASA Ames Research Center
Laboratory Location:	Moffett Field, Mountain View, CA
Date:	February 12, 2016
Device Tested:	Protect 200
Space Treated:	18 ft^3

Objective

To explore the modification of the cell structure of aerosolized *Escherichia coli (E. coli)* treated with NanoStrike technology.

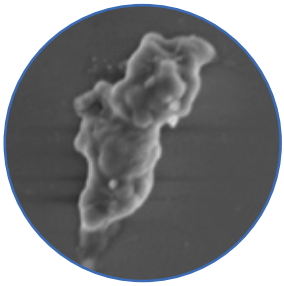
Methodology

The Protect 200 air disinfection device was placed inside a biosafety cabinet, and a compressor nebulizer was attached to the input of the system in order to aerosolize the bacterial particles for testing.

Summary of Results

The bacteria underwent physical distortion to varying degrees, resulting in deformation of the bacterial structure. The electromagnetic field around the NanoStrike coil caused severe damage to the cell structure, possibly resulting in leakage of vital cellular materials. The bacterial reculture experiments confirm inactivation of airborne *E. coli* upon treating with NanoStrike technology.

Healthy bacteria



Bacteria after NanoStrike treatment

Staphylococcus epidermidis and *Aspergillus niger* Inactivation

Laboratory Name:	NASA Ames Research Center
Laboratory Location:	Moffett Field, Mountain View, CA
Date:	July 5, 2017
Device Tested:	Protect 200
Space Treated:	18 ft^3

Objective

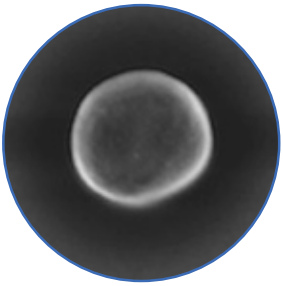
To explore the efficacy of the atmospheric pressure from NanoStrike technology on inactivating airborne pathogens, specifically *Staphylococcus epidermidis*, a surrogate for methicillin-resistant *Staphylococcus aureus* (MRSA), and *Aspergillus niger*.

Methodology

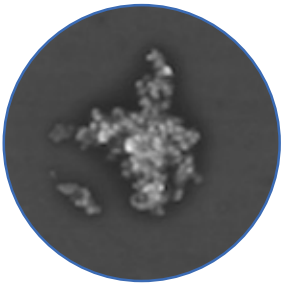
The Protect 200 air disinfection device was placed inside a biosafety cabinet, and a nebulizer was attached to the input of the system in order to aerosolize the bacterial particles for testing. All the system vents, except the top one, were sealed to prevent any undesired microorganism from getting into the system.

Summary of Results

It is concluded that the NanoStrike technology caused severe size and shape change of the cell structure, possibly resulting in destruction of cellular components and eventually to cell death. A similar effect was also found on the fungal spores, indicating the versatility of the equipment toward a range of microorganisms.



Healthy bacteria



Bacteria after NanoStrike treatment

Mycobacterium tuberculosis Inactivation

Laboratory Name:	Qualilife Diagnostics
Laboratory Location:	Mumbai, India
Date:	December 10, 2016
Device Tested:	Protect 200
Space Treated:	18 gal

Objective

To evaluate the efficacy of the Protect 200 air disinfection device on reducing *Mycobacterium tuberculosis*.

Methodology

The Protect 200 device was placed inside a 18 gallon plastic enclosure. The plastic enclosure and test set up was placed inside a biosafety cabinet. Clinical isolate of *Mycobacterium tuberculosis* was aseptically transferred into a sterile mycobacteria growth indicator tube (MGIT) and Lowenstein-Jensen (LJ) medium.

Summary of Results

The air sample collected from the test after being exposed to the Protect 200 showed no growth of *Mycobacterium tuberculosis*. This shows that the device has effectively rendered all airborne *Mycobacterium tuberculosis* non-viable.

SARS-CoV-2 Reduction

Laboratory Name:	Innovative Bioanalysis, Inc.
Laboratory Location:	Costa Mesa, CA
Date:	April 6, 2021
Device Tested:	Defend 1050
Space Treated:	1,280 ft^3

Objective

To evaluate the efficacy of the FDA cleared Defend 1050 air cleaning system at reducing live SARS-CoV-2, the virus causing COVID-19.

Methodology

The challenge pathogen, SARS-CoV-2 USA-CA1/2020, was used for testing the efficacy of the Defend 1050. The bioaerosol efficacy challenge was completed in three distinct trials with the active pathogen to create a baseline of data. The Defend 1050 was placed in the same position for each viral challenge and operated in the same manner. Two control tests were conducted without the Defend 1050 in a testing chamber of 1,280 ft^3. The control tests were used for the comparative baseline to assess the viral reduction when the Defend 1050 was operated in the challenge trials, to enable net reduction calculations to be made. The device was run at maximum speed (5).

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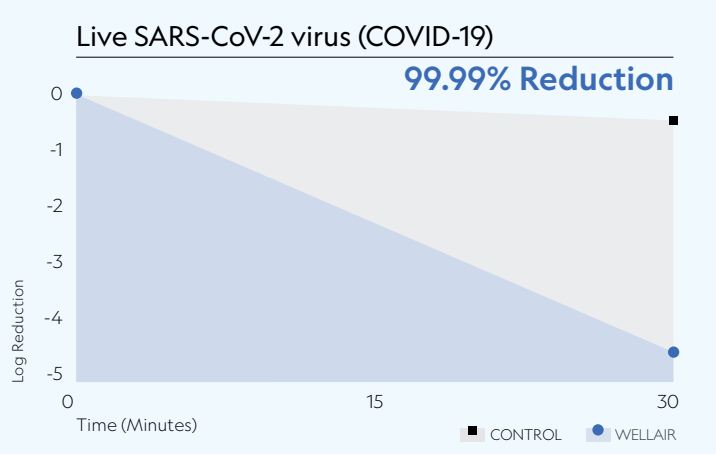
Summary of Results

The Defend 1050 achieved a 4.53 log10 reduction, which equates to a 99.997% percentage reduction, in 30 minutes. The live SARS-CoV-2 virus was not detectable after 30 minutes. The Defend 1050 performed to manufacturer specifications and demonstrated a dramatic reduction of active virus after 30 minutes of exposure in aerosol form. Every effort was made to simulate a real-life environment in the chamber while taking into consideration the special precautions needed when working with a Biosafety Level 3 Pathogen. Overall, the Defend 1050 device showed substantial efficacy in the removal of SARS-CoV-2 USA-CA1/2020 out of the breathable air.



SARS-CoV-2 Reduction

Laboratory Name:	Innovative Bioanalysis, Inc.
Laboratory Location:	Costa Mesa, CA
Date:	April 6, 2021
Device Tested:	Defend 400
Space Treated:	1,280 ft^3

Objective

To evaluate the efficacy of FDA cleared Defend 400 air cleaning system at reducing SARS-CoV-2, the virus causing COVID-19.

Methodology

The test was conducted in a 20' × 8' × 8' (36m^3) chamber that complied with BSL-3 standards. The temperature during all test runs was approximately 76 ±2°F (24.4 ±1.1°C), with a relative humidity of 33%. A 6.32 × 106 TCID50/mL of SARS CoV-2 in viral suspension media was nebulized into the room with mixing fans before collection. Air sample collections occurred at 0, 15, and 45 minutes of device operation.

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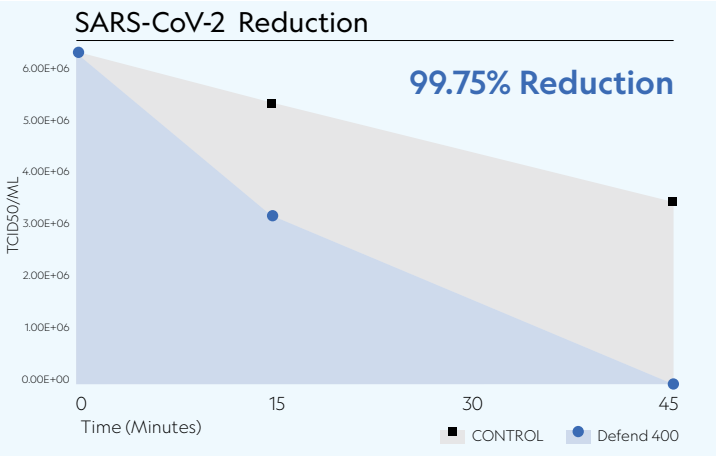
Results

The test results displayed a more rapid reduction in viral concentration than the natural viability loss rates observed. After 15 minutes of operation, the viral concentration decreased from a starting value of 6.32 × 106 TCID50/mL to 3.45 × 106, 3.19 × 106, and 3.00 × 106 TCID50/mL, averaging to approximately 3.21 × 106 TCID50/mL, a 49.20% reduction. With the device operating for 45 minutes, collectable SARS-CoV-2 decreased to an average of 8.76 × 103 TCID50/mL, a 99.86% reduction.

Conclusion

The Defend 400 demonstrated the ability to reduce the concentration of active SARS-CoV-2 from the air at a more rapid rate with an average of 49.20% reduction after 15 minutes and 99.86% after 45 minutes. A net reduction of 99.75% was achieved with the device operating for a total of the 45 minutes time point.



SARS-CoV-2 Reduction

Laboratory Name:	Aerosol Research and Engineering Laboratories,
Laboratory Location:	Olathe, Kansas
Date:	August 17, 2021
Device Tested:	Protect 200
Space Treated:	35.3ft³ (1m³)

Objective

To evaluate the efficacy of the Protect 200 air disinfection device at reducing aerosolized MS2 bacteriophage, a surrogate for SARS-CoV-2, the disease causing COVID-19.

Methodology

The effectiveness of the system was assessed in a 1m³ bioaerosol chamber for a single (1) RNA based virus, MS2. Testing was conducted in triplicate trials plus a control trial to demonstrate the capability of reducing viable bioaerosol concentrations. There were a total of four (4) independent trials in this study.

MS2 bacteriophage was aerosolized into a sealed 1m³ environmental chamber containing the Protect 200 device. Impinger samples were collected at set time points throughout each trial. All impinger samples were serially diluted, plated, and enumerated in triplicate to yield viable bioaerosol concentration at each sampling point and time. Chamber control trial data was subtracted from Protect 200 trial data to yield net LOG reduction in the chamber for viable bioaerosol and concentrations. Three trials were conducted to evaluate the Protect 200's efficacy at removing viable MS2 bacteriophage from the air in the test chamber.

Summary of Results

The Protect 200 device performed well, in the 1m³ test enclosure, achieving a bioaerosol reduction of 4.07 ±0.13 net LOG of viable airborne MS2 concentration within a 180-minute period.

The Protect 200 was shown to reduce aerosolized MS2 bacteriophage by 99.991% in 180 minutes.

MS2 Bacteriophage Reduction – a surrogate for influenza, norovirus and coronaviruses

Laboratory Name:	Aerosol Research and Engineering Laboratories
Laboratory Location:	Olathe, Kansas
Date:	April 2020
Device Tested:	Defend 1050
Space Treated:	562 ft^3

Objective

To evaluate the efficacy of the FDA cleared Defend 1050 air cleaning system at reducing aerosolized MS2 bacteriophage virus, a surrogate for SARS-CoV-2, the virus causing COVID-19.

Methodology

MS2 bacteriophage was aerosolized into a 562 ft^3, sealed environmental bioaerosol chamber containing the Defend 1050. AGI impingers were used to sample the chamber bioaerosol concentrations. Chamber control trial data was subtracted from the Defend 1050 trial data to yield net LOG reduction in the chamber for the bioaerosol challenges.

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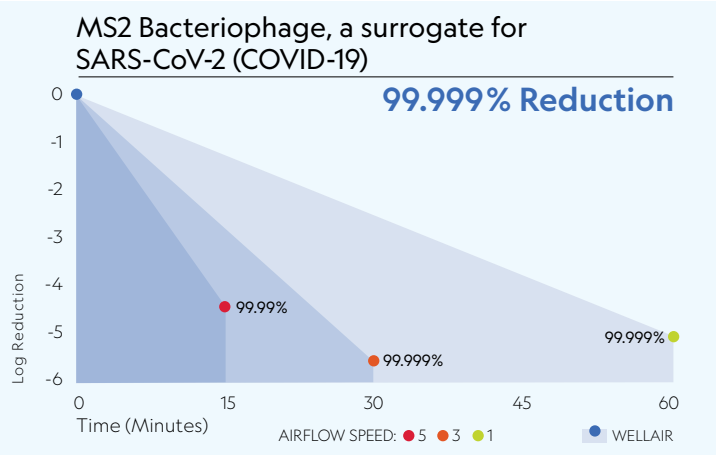
Summary of Results

When tested on the speed 5 setting, the Defend 1050 showed an average 4.41 net LOG reduction of MS2 bacteriophage virus which equates to over a 99.99% reduction, in 15 minutes.

When tested on the speed 3 setting, the Defend 1050 showed an average 5.53 net LOG reduction of MS2 bacteriophage virus which equates to over a 99.999% reduction, in 30 minutes.

When tested on the speed 1 setting, the Defend 1050 showed an average 5.1 net LOG reduction of MS2 bacteriophage virus which equates to over a 99.999% reduction, in 60 minutes.



MS2 Bacteriophage Reduction

Laboratory Name:	Aerosol Research and Engineering Laboratories
Laboratory Location:	Kansas, USA
Date:	October 4, 2020
Device Tested:	Defend 400
Space Treated:	562 ft^3

Objective

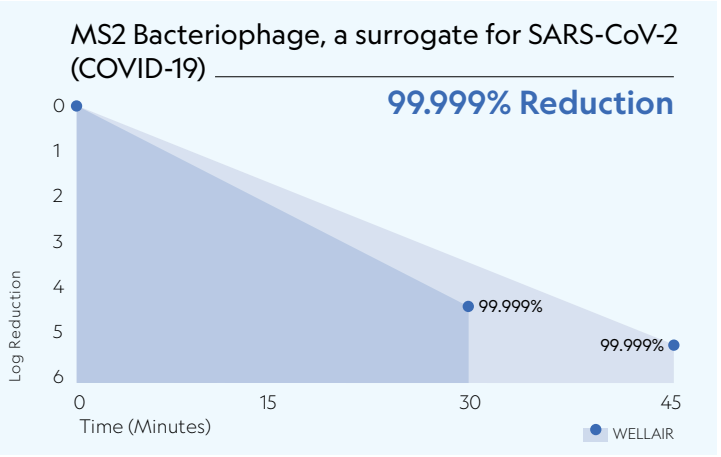
To evaluate the efficacy of the FDA cleared Defend 400 air cleaning system at reducing aerosolized MS2 bacteriophage virus, a surrogate for SARS-CoV-2, the virus causing COVID-19.

Methodology

MS2 bacteriophage was aerosolized into a 562 ft^3 sealed environmental bioaerosol chamber containing the Defend 400. AGI impingers were used to sample the chamber bioaerosol concentrations. All impinger samples were serially diluted, plated and enumerated in triplicate to yield viable bioaerosol concentration at each sampling point and time. Samples were taken at 0, 15, 30, 45 and 60 minutes in order to quantify the reduction speed and capabilities of the Defend 400. Chamber control trial data was subtracted from the Defend 400 trial data to yield net LOG reduction in the chamber for the bioaerosol challenges.

Summary of Results

The Defend 400 achieved a net LOG reduction of MS2 bacteriophage virus after 45 minutes of 5.31 which is equivalent to a net percent reduction of 99.9995%.



MS2 Bacteriophage Reduction

Laboratory Name:	Aerosol Research and Engineering Laboratories
Laboratory Location:	Olathe, Kansas
Date:	December 7, 2016
Device Tested:	Protect 900
Space Treated:	563 ft^3

Objective

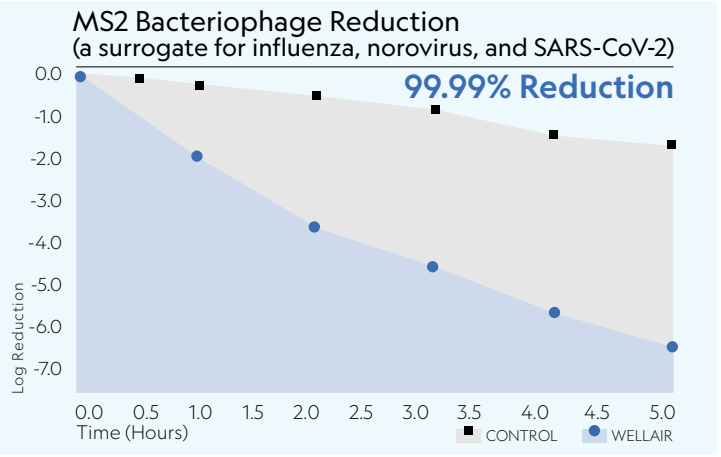
To evaluate the efficacy of the Protect 900 air disinfection device on neutralizing MS2 bacteriophage (a surrogate for influenza, norovirus and coronaviruses).

Methodology

A large sealed aerosol test chamber was used to replicate a potentially contaminated room environment and to contain any potential release of aerosols into the surrounding environment.

Summary of Results

Test results show the Protect 900 device was extremely effective at reducing viability of MS2 bacteriophage by 99.99%.



Human parainfluenza type 3 (HPIV3) Reduction – Measles surrogate

Laboratory Name:	Airmid Health Group Ltd.
Laboratory Location:	Dublin, Ireland
Date:	October 30, 2019
Device Tested:	Defend 1050
Space Treated:	1,006 ft³

Objective

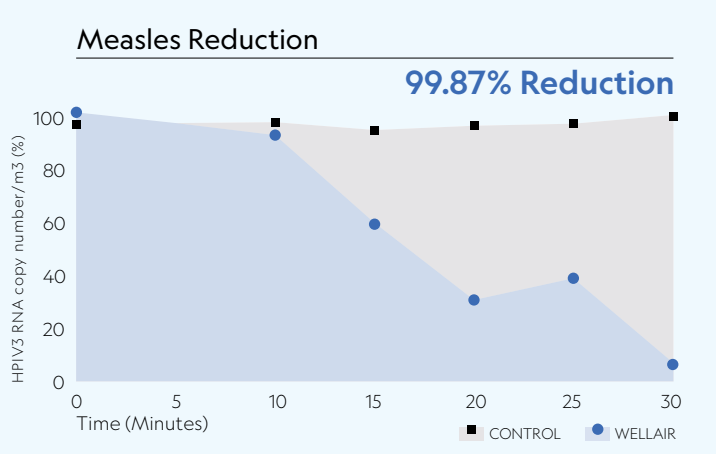
To assess the performance of the FDA cleared Defend 1050 air cleaning system in removing aerosolised Human parainfluenza type 3 (HPIV3) (renamed human respirovirus 3), a surrogate for Measles virus.

Methodology

The impact of Defend 1050 on aerosolised HPIV3 (strain MK-3) was conducted in a 1,006 ft³ environmental testing chamber. The test chamber was preconditioned to 65 °F and 55 ±5% relative humidity. During testing, the chamber air handling unit was shut down, which reduces the number of air changes to as close to zero as possible.

Summary of Results

The results achieved during the testing show that the Defend 1050 was able to reduce the concentration of HPIV3 by 99.87% in 20 - 30 minutes.



Influenza A Reduction

Laboratory Name:	Airmid Health Group Ltd.
Laboratory Location:	Dublin, Ireland
Date:	April 25, 2018
Device Tested:	Defend 1050
Space Treated:	1,006 ft³

Objective

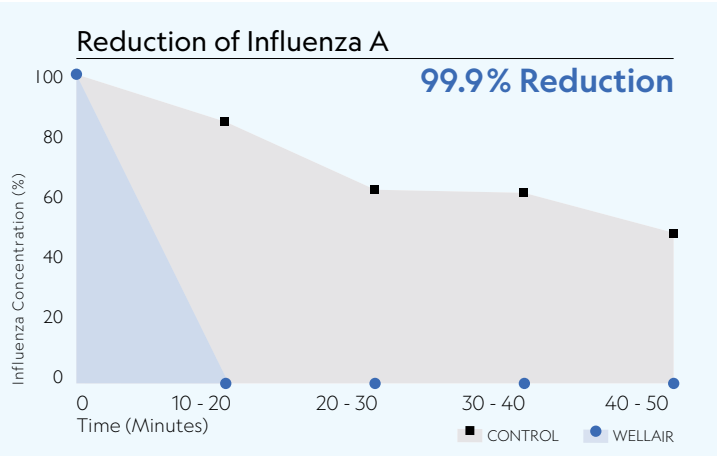
To evaluate the efficacy of the FDA cleared Defend 1050 air cleaning system on removing Influenza A.

Methodology

Testing of the Defend 1050 was conducted in a 1,006 ft³ environmental test chamber. The chamber was preconditioned to 68 °F and 50 ±10% relative humidity prior to commencement of the tests. For the test runs, the Defend 1050 was placed on the floor in the center of the chamber.

Summary of Results

The Defend 1050 was effective in reducing airborne Influenza A aerosols in the test chamber, reaching 99.9% airborne virus reduction within the first 10 – 20 minutes of operation at maximum speed.



Phi X 174 Reduction

Laboratory Name:	Korea Testing Laboratory
Laboratory Location:	Jinju, South Korea
Date:	October 22, 2019
Device Tested:	Defend 1050
Space Treated:	2,119 ft^3

Objective

To assess the performance of the FDA cleared Defend 1050 air cleaning system in reducing Phi X 174 virus.

Methodology

Test Method: KOUVA AS02: 2019

Virus: Phi X 174 (ATCC 13706-B1)

Temperature: (77) °F

Humidity: (50 ±5) % R.H.

Test time: 30 minutes

Test chamber: 60 m^3 = 2,119 ft^3

Air flow: Maximum

Summary of Results

The Defend 1050 achieved a 98.8% reduction of Phi X 174 virus in 30 minutes in a 2,119 ft^3 chamber.

Methicillin-resistant *Staphylococcus aureus* (MRSA) Reduction

Laboratory Name:	Microbac Laboratories, Inc.
Laboratory Location:	Wilson, NC
Date:	May 19, 2016
Device Tested:	Protect 900
Space Treated:	35 ft^3

Objective

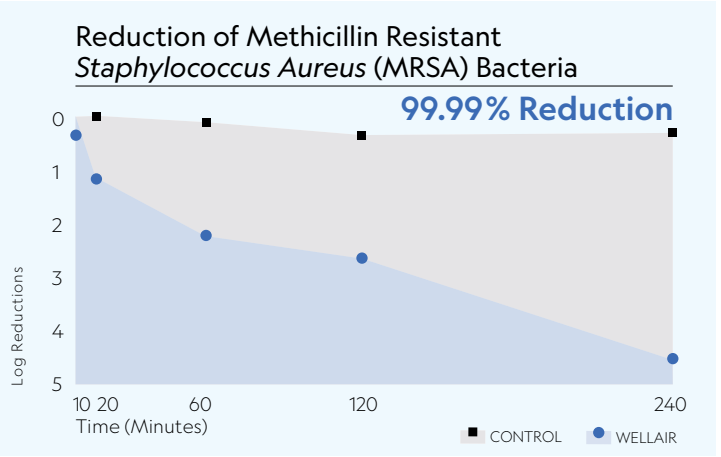
To evaluate the efficacy of the Protect 900 air disinfection device in reducing methicillin-resistant *Staphylococcus aureus* (MRSA).

Methodology

The challenge bacteria were aerosolized using a six-jet collision nebulizer under high pressure air and introduced into the chamber with the Protect 900 device.

Summary of Results

The Protect 900 reduced 99.99% of methicillin-resistant *Staphylococcus aureus* (MRSA) bacteria over the course of four hours.



Staphylococcus epidermidis Reduction – a surrogate for methicillin-resistant *Staphylococcus aureus* (MRSA)

Laboratory Name:	Aerosol Research and Engineering Laboratories
Laboratory Location:	Olathe, Kansas
Date:	December 7, 2016
Device Tested:	Protect 900
Space Treated:	563 ft^3

Objective

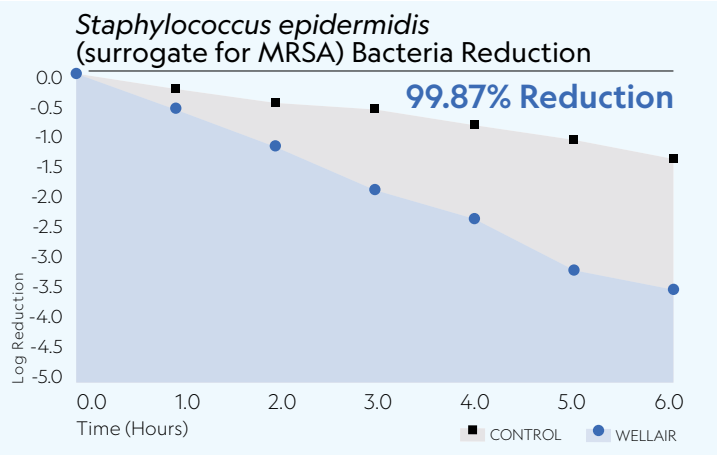
To evaluate the efficacy of the Protect 900 air disinfection device on neutralizing aerosolized biological *Staphylococcus epidermidis* (a surrogate for methicillin-resistant *Staphylococcus aureus* (MRSA).

Methodology

A large sealed aerosol test chamber was used to replicate a potentially contaminated room environment and to contain any potential release of aerosols into the surrounding environment.

Summary of Results

Test results show the Protect 900 was extremely effective at reducing viability *Staphylococcus epidermidis* by 99.87%.



Staphylococcus epidermidis Reduction – Methicillin-resistant *Staphylococcus aureus* (MRSA) surrogate

Laboratory Name:	Novaerus Research and Development Labs
Laboratory Location:	Dublin, Ireland
Date:	June 27, 2018
Device Tested:	Defend 1050
Space Treated:	1,059 ft^3

Objective

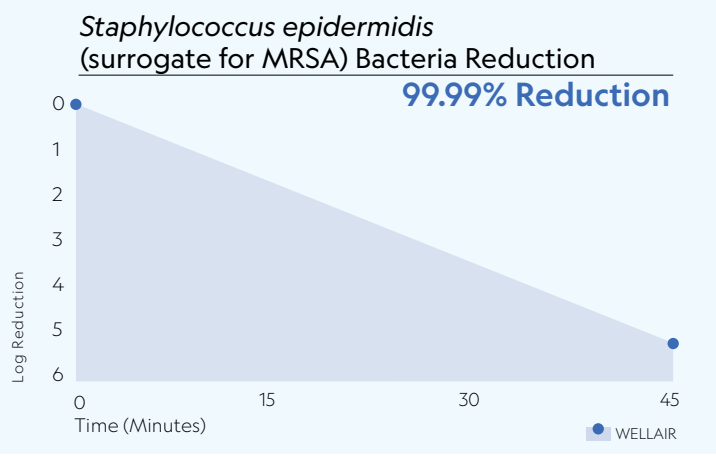
To evaluate the efficacy of the FDA cleared Defend 1050 air cleaning system in reducing airborne *Staphylococcus epidermidis* bacteria, a surrogate for methicillin-resistant *Staphylococcus aureus* (MRSA).

Methodology

The test environment was a 1,059 ft^3 test chamber, located in the WellAir microbiology laboratory. During the testing, the Defend 1050 was tested at maximum airflow, speed setting 5, and placed inside the chamber at the center, with the air inlet facing towards the door of the chamber.

Summary of Results

The Defend 1050 achieved a microbial cell reduction of 99.94% of *Staphylococcus epidermidis*, a surrogate for methicillin-resistant *Staphylococcus aureus* (MRSA), within 15 minutes of operation.



Staphylococcus epidermidis Bacteria Reduction

Laboratory Name:	Korea Testing Laboratory
Laboratory Location:	Jinju, South Korea
Date:	October 11, 2019
Device Tested:	Defend 1050
Space Treated:	2,119 ft^3

Objective

To assess the performance of the FDA cleared Defend 1050 air cleaning system in reducing *Staphylococcus epidermidis* bacteria.

Methodology

Test Method: KOUVA AS02: 2019

Bacteria: *Staphylococcus epidermidis* (ATCC 12228)

Temperature: (77) °F

Humidity: (50 ±5) % R.H.

Test time: 1 hour

Test chamber: 60 m^3 = 2,119 ft^3

Air flow: Maximum

Summary of Results

The Defend 1050 achieved a 99.9% reduction of *Staphylococcus epidermidis* bacteria in 60 minutes in a 2,119 ft^3 chamber.

Staphylococcus epidermidis Bacteria Reduction

Laboratory Name:	WellAir Research & Development Laboratory
Laboratory Location:	DCU ALPHA, Dublin, Ireland
Date:	December 12, 2020
Device Tested:	Defend 400
Space Treated:	1,059 ft^3

Objective

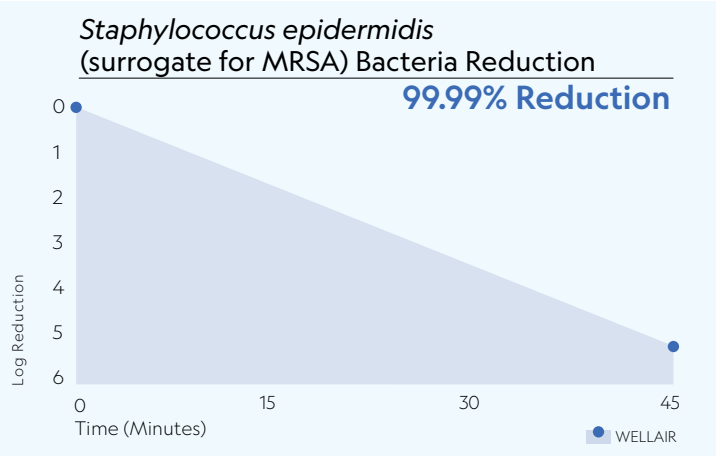
To evaluate the efficacy of the FDA cleared Defend 400 air cleaning system at reducing aerosolized *Staphylococcus epidermidis*, a surrogate for *Staphylococcus aureus*, MRSA and *Micrococcus luteus*.

Methodology

The environmental chamber used for this study was 1,059 ft^3 in size and designed to replicate a room setting. The bioaerosol was generated using a 24-jet Collison nebuliser operated with a purified filtered air supply. The bioaerosol samples were collected at 15-minute intervals in sterile SKC BioSampler impingers to determine the chamber concentration.

Summary of Results

The Defend 400 achieved greater than a log-4 reduction (>99.99%) of *Staphylococcus epidermidis* after 45 minutes.



Staphylococcus epidermidis Reduction – Methicillin-resistant *Staphylococcus aureus* (MRSA) Surrogate

Laboratory Name:	University of Huddersfield
Laboratory Location:	Huddersfield, England
Date:	May 27, 2014
Device Tested:	Protect 900
Space Treated:	35 ft^3

Objective

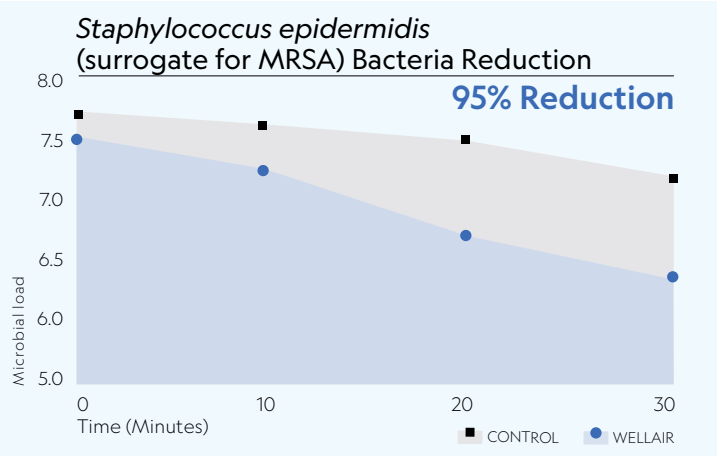
To evaluate the efficacy of the Protect 900 air disinfection device in reducing *Staphylococcus epidermidis* aerosols, a surrogate for methicillin-resistant *Staphylococcus aureus* (MRSA).

Methodology

A 35 ft^3 air tight chamber was fitted with an internal fan to maintain mixing, sampling and injection ports, and the Protect 900 device. The fan and the Protect 900 were activated from outside of the chamber as required.

Summary of Results

In over 30 minutes of sampling, the Protect 900 reduced 95% of *Staphylococcus epidermidis* aerosols, a surrogate for methicillin-resistant *Staphylococcus aureus* (MRSA). Both the rate of removal and the final log reduction were greater in the presence of the Protect 900.



Bacillus Subtilis Endospores Reduction

Laboratory Name:	Aerosol Research and Engineering Laboratories
Laboratory Location:	Olathe, Kansas
Date:	December 7, 2016
Device Tested:	Protect 900
Space Treated:	563 ft^3

Objective

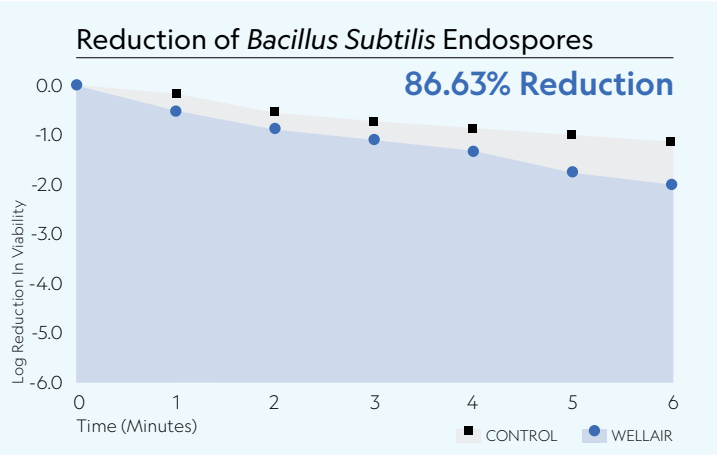
To evaluate the efficacy of the Protect 900 air disinfection device on neutralizing aerosolized biological *Bacillus Subtilis* endospores.

Methodology

A large sealed aerosol test chamber was used to replicate a potentially contaminated room environment and to contain any potential release of aerosols into the surrounding environment.

Summary of Results

Test results show the Protect 900 device reduced viability of *Bacillus subtilis* bacteria spore by 86.63%.



Bacillus Globigii Endospores Reduction – *Bacillus Anthraxis* surrogate

Laboratory Name:	Aerosol Research and Engineering Laboratories
Laboratory Location:	Olathe, Kansas
Date:	May 12, 2020
Device Tested:	Defend 1050
Space Treated:	563 ft^3

Objective

This in vitro study characterized the efficacy of the FDA cleared Defend 1050 air cleaning system at removing aerosolized *Bacillus Globigii* Endospores, a surrogate for Anthrax, a biological warfare agent.

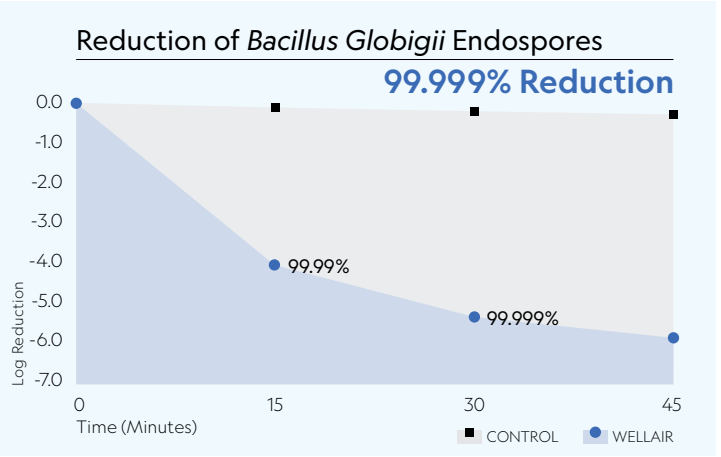
Methodology

Bacillus Globigii was aerosolized into a sealed environmental bioaerosol chamber containing the Defend 1050. AGI Impinger samples were taken at 0, 7.5, 15, 22.5, 30 and 45 minutes from the chamber in order to quantify the reduction speed and capabilities of the Defend 1050.

Summary of Results

The Defend 1050 showed an average 4 net LOG reduction of *Bacillus Globigii* endospores which equates to over a 99.99% reduction, in 15 minutes.

The Defend 1050 showed an average 5.11 net LOG reduction of *Bacillus Globigii* endospores which equates to over a 99.999% reduction, in 30 minutes.



Bacillus Globigii Endospores Reduction

Laboratory Name:	Aerosol Research and Engineering Laboratories
Laboratory Location:	Kansas, USA
Date:	October 4, 2020
Device Tested:	Defend 400
Space Treated:	562 ft^3

Objective

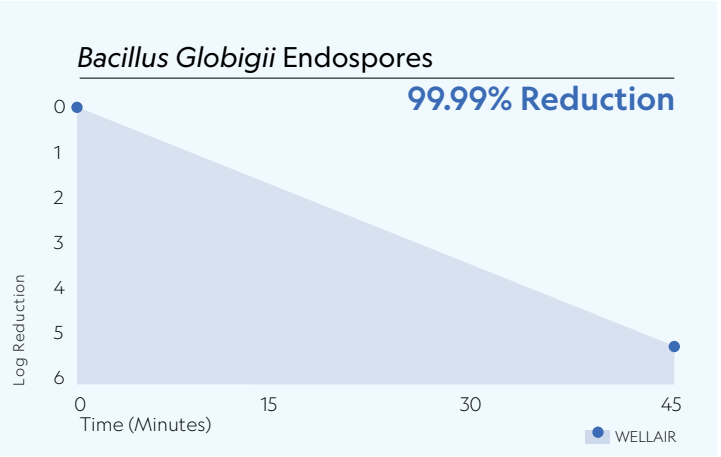
To evaluate the efficacy of the FDA cleared Defend 400 air cleaning system at reducing aerosolized *Bacillus Globigii* bacterial endospores, a commonly used surrogate for *Bacillus Anthraxis*.

Methodology

Bacillus Globigii was aerosolized into a 562 ft^3 sealed environmental bioaerosol chamber containing the Defend 400. AGI impingers were used to sample the chamber bioaerosol concentrations. All impinger samples were serially diluted, plated and enumerated in triplicate to yield viable bioaerosol concentration at each sampling point and time. Samples were taken at 0, 15, 30, 45 and 60 minutes in order to quantify the reduction speed and capabilities of the Defend 400. Chamber control trial data was subtracted from the Defend 400 trial data to yield net LOG reduction in the chamber for the bioaerosol challenges.

Summary of Results

The Defend 400 achieved a net LOG reduction of *Bacillus Globigii* endospores after 45 minutes of 4.55 which is equivalent to a net percent reduction of 99.9969%.



Mycobacterium smegmatis Reduction – *Mycobacterium tuberculosis* surrogate

Laboratory Name:	Airmid Health Group Ltd.
Laboratory Location:	Dublin, Ireland
Date:	July 6, 2018
Device Tested:	Defend 1050
Space Treated:	1,059 ft^3

Objective

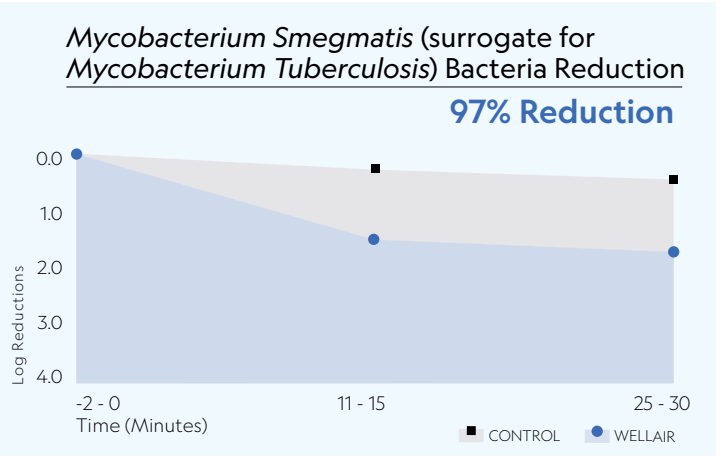
To assess the performance of the FDA cleared Defend 1050 air cleaning system in removing aerosolised *Mycobacterium smegmatis*, a surrogate for *Mycobacterium tuberculosis*.

Methodology

The impact of the Defend on aerosolised *M. smegmatis* was conducted in a 1,059 ft^3 environmental testing chamber. The test chamber was preconditioned to 68 °F and 55 ±5% relative humidity. These conditions were maintained throughout the test and control runs. Prior to each run, the test chamber was decontaminated by scrubbing the walls and surfaces.

Summary of Results

The results achieved during the testing show that the Defend 1050 was able to reduce the concentration of *M. smegmatis*, a surrogate for *Mycobacterium tuberculosis*, artificially aerosolised by 95% within the first 15 minutes and this rose to 97% after 30 minutes of A/C operation.



Clostridium difficile Bacteria Spore Reduction

Laboratory Name:	Airmid Health Group Ltd.
Laboratory Location:	Dublin, Ireland
Date:	February 8, 2019
Device Tested:	Defend 1050
Space Treated:	1,006 ft^3

Objective

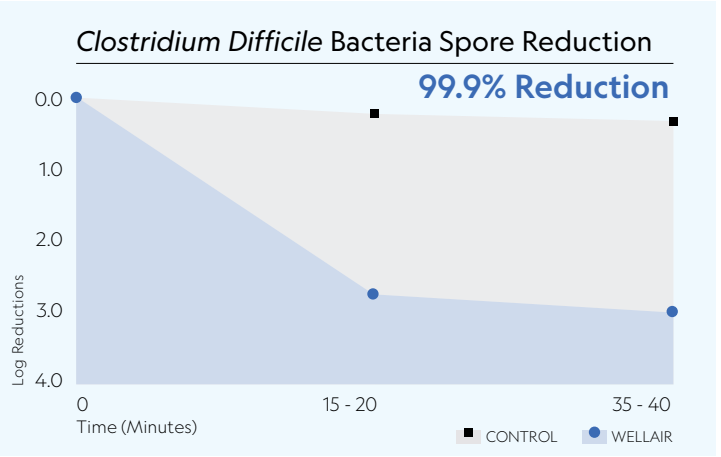
To assess the performance of the FDA cleared Defend 1050 air cleaning system in removing aerosolized *Clostridium difficile* spores.

Methodology

A 1,006 ft^3 environmental test chamber was preconditioned to 68 °F and 55 ±5% relative humidity. During the test runs the Defend 1050 was placed in the center of the test chamber and operated at maximum fan speed mode. During the control runs the Defend 1050 was switched off. The *C. difficile* spores were nebulised into the chamber for a fixed time and mixed with a ceiling fan.

Summary of Results

The Defend 1050 demonstrated to be effective in reducing the airborne *C. difficile* by 99.6% within the first 20 minutes and this increased to > 99.9% after 40 minutes.



Airborne Bacteria Reduction

Laboratory Name:	Urgent Care Outpatient Facility
Laboratory Location:	New Jersey
Date:	November 2021
Device Tested:	Defend 400
Space Treated:	96 to 896 ft^3

Objective

The objective was to determine whether the FDA cleared Defend 400 air cleaning system could reduce airborne bacterial counts as compared to the control (no Defend 400 device) in an urgent care outpatient facility running under normal conditions (occupied by doctors, nurses, staff and patients).

Methodology

Enumeration and identification of airborne bacterial species from air samples. The samples were collected using an impaction air sampler, MAS-100 Eco Microbiological Air Sampler (MBV AG, Switzerland). Bacterial counts and bacterial species identification was performed by EMSL Analytical Inc (NJ, USA).

Air samples were taken during two phases: control and test.

- The control phase, without the Defend 400, consisted of air samples taken at each environment for five consecutive days. The control phase established a baseline for the air samples colony counts.
- The test phase, with the use of a Defend 400 in each environment, was carried out in a similar fashion on same five consecutive days of the week. During test phase the Defend 400 was set to speed 3, 108 Cubic Feet per Minute (CFM) [184 m^3/hour]. Note that the device was always ON during the test phase.

Both, control, and test phase conditions reported comparable overall number of visitors (303 v 306) to the clinic, with same average and median number of visitors per hour (5).

Continued...

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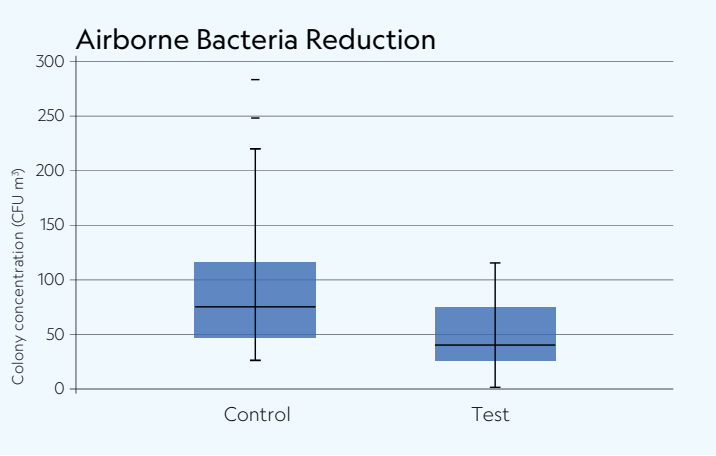
Summary of Results

Compared to the control, the Defend 400:

- In each room, the reduction ranged from 11-72%
- Significantly ($P<0.05$) reduced airborne bacteria in the combined four rooms by 52%
- Overall, there was a 60% reduction in opportunistic pathogens (2980 to 1180 CFU)

  The most numerous species reduced consisted of *Micrococcus luteus* and *Micrococcus lylae*, which have been associated with a variety of illnesses including meningitis, septic arthritis, endocarditis, chronic cutaneous infections and catheter infections.
- Overall, there was a 43% reduction in pathogenic bacteria (70 to 40 CFU)



Aspergillus niger Spore Reduction

Laboratory Name:	Aerosol Research and Engineering Laboratories
Laboratory Location:	Olathe, Kansas
Date:	May 28, 2018
Device Tested:	Defend 1050
Space Treated:	562 ft^3

Objective

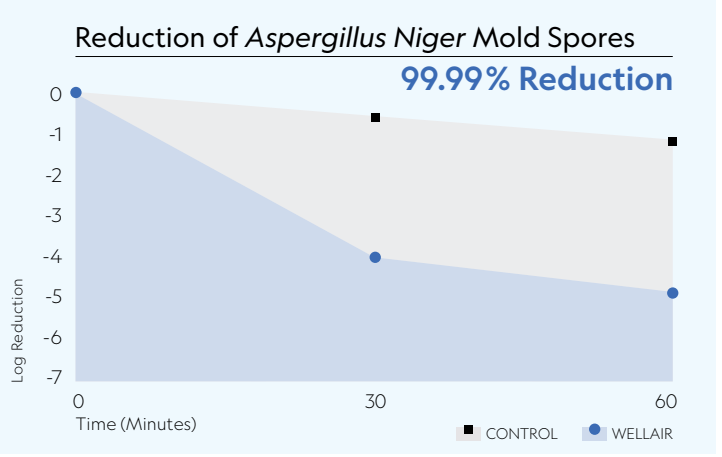
To evaluate the efficacy of the FDA cleared Defend 1050 air cleaning system against aerosolized *Aspergillus niger* spores.

Methodology

A. niger spores were aerosolized into a sealed bioaerosol chamber using a dry powder disseminator. AGI impingers were used to capture chamber bioaerosol concentrations.

Summary of Results

The average net LOG reduction of the Defend 1050 at 30 minutes showed a 4.10 LOG. The net LOG reduction at 60 minutes showed a 4.28 LOG due to reaching detection limit. The actual LOG reduction is theoretically much higher at 60 minutes in a small room environment.



Aspergillus niger Spore Reduction

Laboratory Name:	Aerosol Research and Engineering Laboratories
Laboratory Location:	Olathe, Kansas
Date:	December 7, 2016
Device Tested:	Protect 900
Space Treated:	563 ft^3

Objective

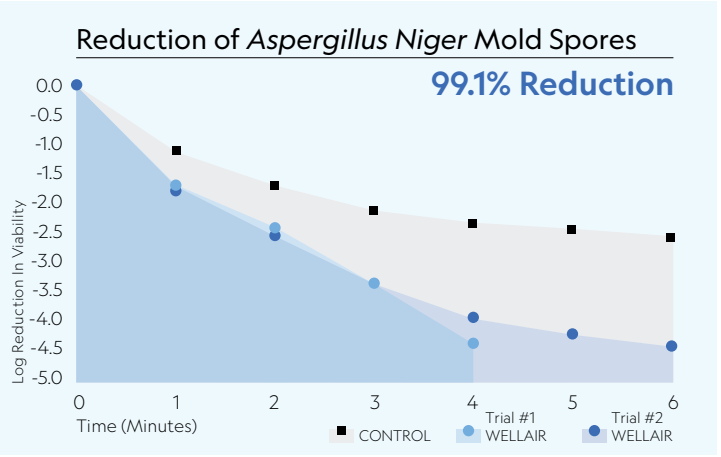
To evaluate the efficacy of the Protect 900 air disinfection device on neutralizing aerosolized biological *Aspergillus niger* fungus.

Methodology

A large sealed aerosol test chamber was used to replicate a potentially contaminated room environment and to contain any potential release of aerosols into the surrounding environment.

Summary of Results

Test results show the Protect 900 device was extremely effective at reducing viability of *Aspergillus niger* mold reducing it by 99.1%.



Nitrogen Dioxide Reduction

Laboratory Name:	Aerosol Research & Engineering Laboratories
Laboratory Location:	Olathe, Kansas
Date:	July 27, 2018
Device Tested:	Defend 1050
Space Treated:	562 ft^3

Objective

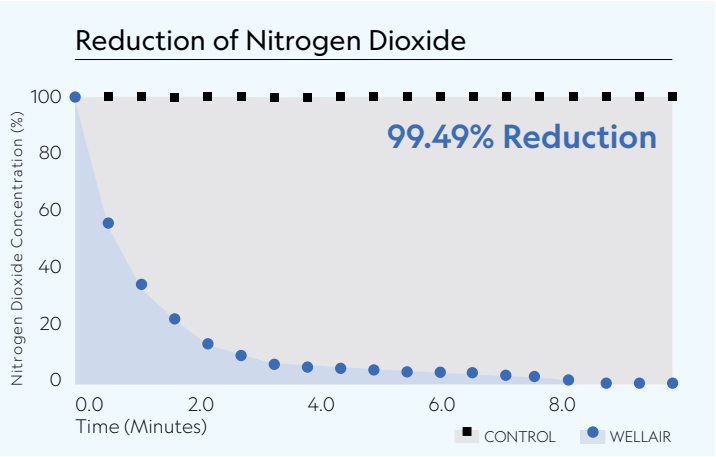
To evaluate the efficacy of the FDA cleared Defend 1050 air cleaning system on eliminating nitrogen dioxide (NO_2).

Methodology

NO_2 gas was released into a 562 ft^3 sealed chamber while the monitoring of the concentration was logged with specialized detectors. For the control trial, the Defend 1050 remained outside the chamber, and the gases were allowed to dissipate naturally over time.

Summary of Results

The Defend 1050 showed an average 99.49% reduction of NO_2 in 7.2 minutes.



Formaldehyde Reduction

Laboratory Name:	Aerosol Research & Engineering Laboratories
Laboratory Location:	Olathe, Kansas
Date:	July 27, 2018
Device Tested:	Defend 1050
Space Treated:	562 ft^3

Objective

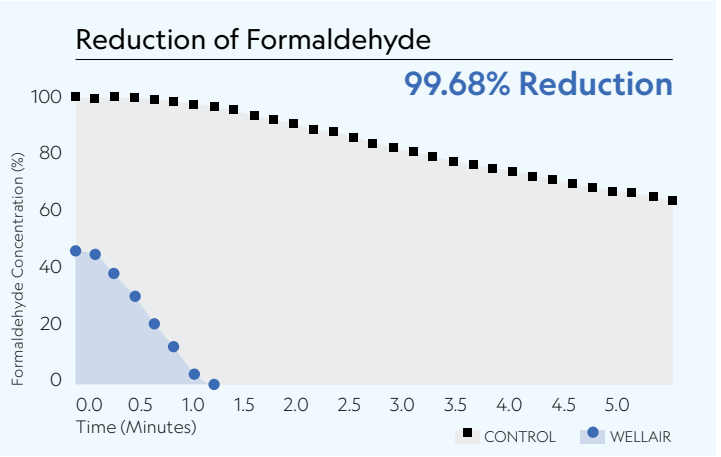
To evaluate the efficacy of the FDA cleared Defend 1050 air cleaning system on eliminating formaldehyde.

Methodology

Formaldehyde gas was released into a 562 ft^3 sealed chamber while the monitoring of concentration was logged with specialized detectors. For the control trial, the Defend 1050 remained outside the chamber, and the gas dissipated naturally over time.

Summary of Results

The Defend 1050 showed an average 99.68% reduction of formaldehyde in 1.1 minutes.



Formaldehyde Reduction

Laboratory Name:	Avomeen Analytical Services
Laboratory Location:	Ann Arbor, MI
Date:	September 11, 2015
Device Tested:	Protect 900
Space Treated:	35 ft^3

Objective

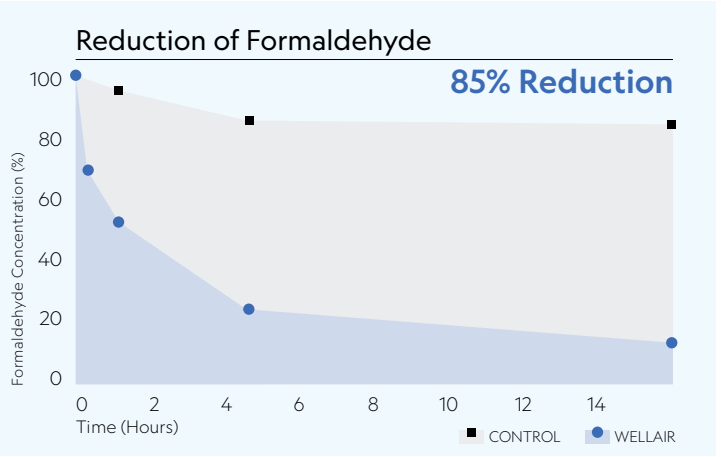
To evaluate the efficacy of the Protect 900 air disinfection device on reducing formaldehyde.

Methodology

A plexiglass chamber was built for formaldehyde testing of the Protect 900. This chamber was also equipped for proper ventilation and interior air circulation. A calculated amount of formaldehyde solution was evaporated in an aluminum pan heated to 248 degrees Fahrenheit with a constant temperature hot plate.

Summary of Results

The Protect 900 device reduced formaldehyde from 100 ppm to around 13 ppm during a 14-hour testing experiment, an 85% reduction.



Toluene VOC Reduction

Laboratory Name:	Camfil Laboratories – Tech Center
Laboratory Location:	Trosa, Sweden
Date:	April 25, 2018
Device Tested:	Defend 1050
Space Treated:	696 ft^3

Objective

To evaluate the particulate and molecular efficiency of the FDA cleared Defend 1050 air cleaning system in a test chamber using Toluene, a volatile organic compound (VOC).

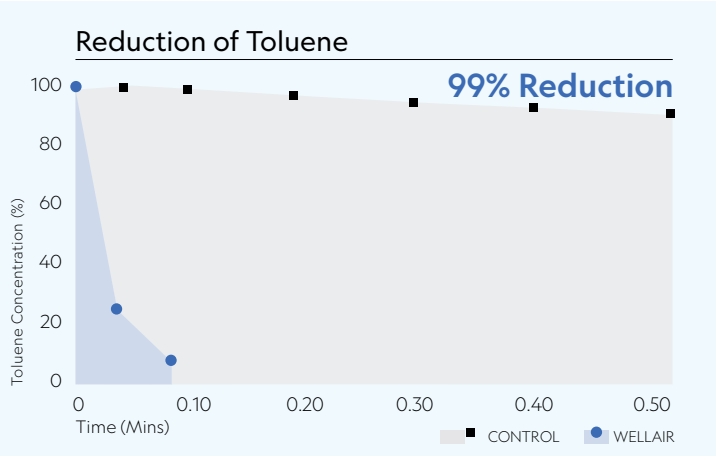
Methodology

Test method: CADR

Toluene was generated in the laskin nozzle and injected into a room until a pre-set concentration was achieved then the air cleaner was turned on. The results were then compared to the normal reduction of particles over time in the test chamber.

Summary of Results

The Defend 1050 produced a VOC CADR of 351 CFM. On the high speed, the Defend 1050 was shown to remove 90% of the toluene within 6 minutes and 99% within 9.1 minutes. On the low speed, the Defend 1050 was shown to remove 90% within 16 minutes.



PM1 and PM2.5 Reduction

Laboratory Name:	Camfil Laboratories – Tech Center
Laboratory Location:	Trosa, Sweden
Date:	April 25, 2018
Device Tested:	Defend 1050
Space Treated:	696 ft^3

Objective

To evaluate the particulate and molecular efficiency of the FDA cleared Defend 1050 air cleaning system in a test chamber using DEHS.

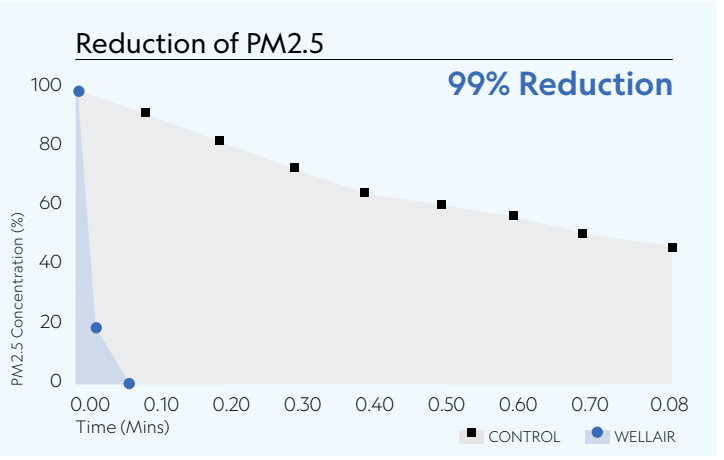
Methodology

Test method: CADR

DEHS was generated in the laskin nozzle and injected into a room until a pre-set concentration was achieved then the air cleaner was turned on. The results were then compared to the normal reduction of particles over time in the test chamber.

Summary of Results

The Defend 1050 produced a CADR of 513 CFM against PM2.5 and a CADR of 507 CFM against PM1. It removed 99% of PM2.5 within 6.26 minutes and 99% of PM1 within 6.33 minutes.



PM1 and PM2.5 Reduction

Laboratory Name:	Aerosol Research & Engineering Laboratories
Laboratory Location:	Kansas, USA
Date:	May 11, 2021
Device Tested:	Defend 400
Space Treated:	562 ft³

Objective

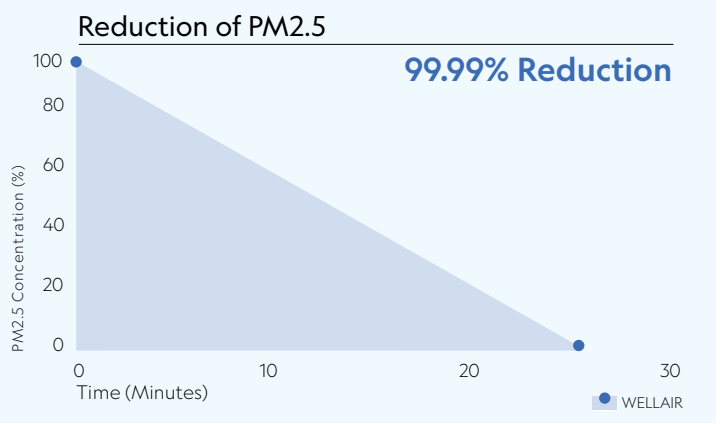
To evaluate the efficacy of the FDA cleared Defend 400 air cleaning system at reducing Particulate Matter and determine the equivalent clean air delivery rate (eCADR).

Methodology

Testing was conducted in a 562 ft³ environmental test chamber with polystyrene latex microspheres of 0.5 to 5.0 µm in diameter and an aerodynamic particle sizer (APS). A TSI Aerodynamic Particle Sizer model 3321 (TSI Inc., Shoreview, MN) was used to measure particle size and concentration of PSL microspheres. The APS provided real-time aerodynamic particle characterization with a size range from 0.54-20.0 µm with 52 size bins of resolution. Sampling was continuous with a data export interval of 1 second. The APS had a continuous flow rate of 1 LPM. The APS was connected to a splitter with on/off valves in order to sample inhaled aerosols as well as ambient aerosols within the chamber. PLS microspheres were nebulized into the test environment and one control and one test run were completed.

Summary of Results

The Defend 400 reduced PM 1 by 99.99% in 26 minutes with an eCADR of 340.7 m³/h. PM 2.5 was reduced by 99.99% in 25.9 minutes with an eCADR of 341.0 m³/h.



Allergens Reduction

Laboratory Name:	Indoor Biotechnologies Ltd.
Laboratory Location:	Cardiff, UK
Date:	September 9, 2016
Device Tested:	Protect 900
Space Treated:	35 ft³

Objective

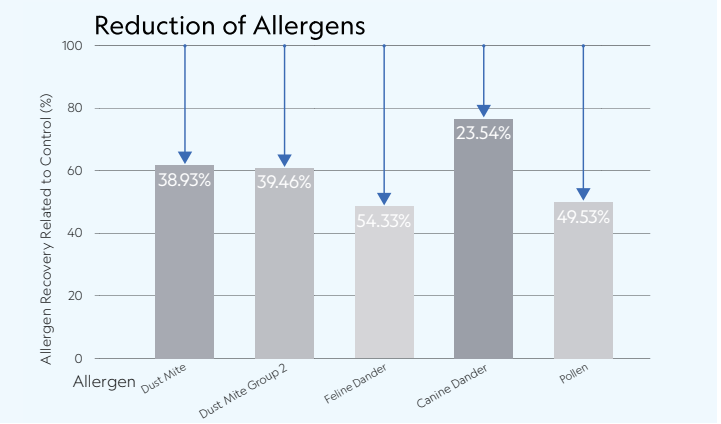
To evaluate the efficacy of the Protect 900 air disinfection device on reducing airborne allergens.

Methodology

Testing was performed with the Protect 900 placed in a closed, thoroughly cleaned experimental chamber measuring approximately 35 ft³.

Summary of Results

The Protect 900 produced an overall allergen reduction of 41.16%, with a 38.93% reduction of house dust mites, a 39.46% reduction of house dust mites (group 2), a 54.33% reduction of feline dander, a 23.54% reduction of canine dander, and a 49.53% reduction of pollen.



CLINICAL RESEARCH & FIELD EVALUATIONS

Evaluation of the WellAir Technology in a Dialysis Centre

Fresenius Dialysis Centres: Vedras and Alverca

Portugal

Testing reflected an 87% reduction in airborne bacteria, a 93% reduction in VOCs, and up to a 67% reduction in molds.

Evaluation of the WellAir Technology in an Emergency Hospital

Bucharest Emergency University Hospital

Bucharest, Romania

The testing of air samples reflected an 89% reduction in airborne bacteria CFU/m^3, an 87% reduction in airborne fungi CFU/m^3, and up to a 100% reduction in airborne *Staphylococcus* CFU/m^3.

Evaluation of the WellAir Technology in Hospital Wards

Leopardstown Park Hospital

Dublin, Ireland

Testing reflected no outbreaks of MRSA, *C. diff*, influenza, or norovirus in wards with WellAir (Novaerus) devices units installed in three years, a continued decline in staff sickness, a reduction in odors throughout the wards, and a reduction in infections and antibiotic use.

Evaluation of the WellAir Technology in a Hospital

Royal Free Hospital

Hampstead, London

Testing reflected a 97% reduction in environmental surface MRSA, a 49% reduction in environmental surface TVC, and a 75% reduction in environmental air MRSA.

Evaluation of the WellAir Technology in an Infectious Disease Hospital

The “Dr V. Babes” Hospital of Infectious and Tropical Diseases

Bucharest, Romania

The testing of air samples reflected a 96% reduction in airborne bacteria CFU/m^3 and airborne fungi CFU/m^3. The hospital staff found the WellAir (Novaerus) devices to be tolerable, easy to use, and safe for patients and staff. The air cleaning and disinfection devices complements existing measures to combat infections and does not require additional interventions to ensure that it functions without interruption.

Evaluation of the WellAir Technology in Intensive Care

Brothers Hospitallers of Saint John of God Hospital

Łódź, Poland

Results of the microbiological test indicated significant reduction in the number of microorganisms in the air in the DAIC. Since the WellAir (Novaerus) devices were installed, the amount of microorganisms in subsequent tests were low.

Evaluation of the WellAir Technology in a Nephrology Clinic

Rigshospitalet

Copenhagen, Denmark

There was a significant reduction in bacterial loads on high surfaces and window sills. In the control section with no devices, the number of overall infections increased by 35% from 2013 to 2014. In the section with WellAir (Novaerus) devices, the number of overall infections fell 23% during the same time period.

Evaluation of the WellAir Technology in a Paediatric Department and a Pulmonology Clinic

Międzyrzecz Hospital

Międzyrzecz, Poland

WellAir (Novaerus) devices effectively reduced the number of airborne pathogens in the admission room of the Paediatric Department by 61% and by 19% in the Pulmonology Clinic.

Evaluation of the WellAir Technology in a Pulmonology Department and a Traumatology, Septic Department

Uzsoki Hospital

Budapest, Hungary

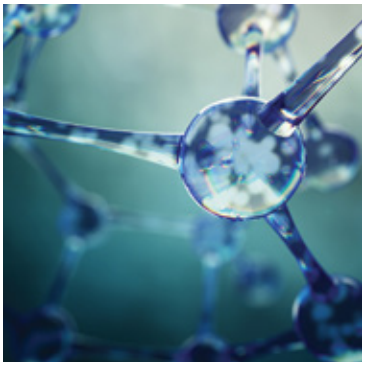
Testing reflected an 82% drop in CFU rates and a 93% reduction in fungi count. The air quality now meets the Swiss Class III standard (500 CFU/m³ for general wards).

Evaluation of the Effectiveness of Air Purifiers in Intensive Care Units: An Interventional Study

Hospital Intensive Care Unit: Kutahya Health Sciences University, Kutahya, Turkey

Evaluation of changes in the intervention ICU over time revealed a significantly lower colony concentration in the air and on surfaces on Day 60 compared to Day 1 ($P_{air}<0.001$ and $P_{surface}<0.001$). There was a significant positive correlation between the number of colonies detected and the rate of hospital-acquired infections in the intervention ICU ($r=0.406$, $P=0.049$) and in the control ICU ($r=0.698$, $P=0.001$). Conclusion: Using WellAir (Novaerus) air cleaners may be an effective way to reduce the microbial load in the air and on surfaces, and thus hospital acquired infections.

Needlepoint Bipolar Ionization Technology



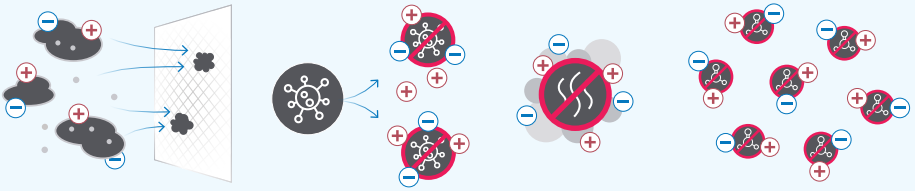
Plasma Air

HVAC AIR PURIFICATION

Plasma Air's Needlepoint Bipolar Ionization technology reduces particulate matter, odors, bacteria and viruses and is independently proven safe and effective for continuous use. All Plasma Air products are UL 2998 validated for zero ozone emissions, are UL 867 safety certified and are CARB certified.

VIRUS	VIRUS	VIRUS	MOLD	BACTERIA
99.99% reduction	**99.9% reduction**	**86.6% reduction**	**97.14% reduction**	**99.43% reduction**
Active SARS-CoV-2	Active Omicron Variant	Influenza A (H1N1)	*Aspergillus niger*	*Escherichia coli*
AutoClean 1500	PA600 Series	PA7000 Series	PA7000 Series	PA7000 Series

How Bipolar Ionization Technology Works



Airborne particles are charged by the ions causing them to cluster and be caught in filters

Bacteria and viruses bond with oxygen ions and are inactivated

Many odorous gases and aerosols oxidize with oxygen ions and are neutralized

Oxygen ions cause a reaction with VOCs breaking down their molecular structure

SARS-CoV-2 Reduction

Laboratory Name:	Innovative Bioanalysis, Inc.
Laboratory Location:	Costa Mesa, CA
Date:	February 2022
Device Tested:	PA662, applicable to PA660 Series & PA600 Series
Space Treated:	1,280 ft^3

Objective

WellAir/Plasma Air supplied the Plasma Air PA662 for testing purposes to determine efficacy against viral pathogens. This study evaluated the effectiveness of the PA662 in its ability to reduce the viral strain referred to as SARS-CoV-2 Omicron within the air. Note, the PA600 Series and PA660 Series use the same ionization component.

Methodology

Testing was conducted in a sealed 20' × 8' × 8" chamber per Biosafety Level 3 (BSL3) standards. The overall dimensions of the test chamber provided a displacement volume of 1,280 ft^3 (approximately 36,245 liters) of air. The chamber remained closed during testing, with no air entering or leaving the room. The chamber was equipped to create the necessary airflow to produce the required concentration of ions. The temperature during testing was approximately 72 ±2°F (22.2 ±1.1°C), with a relative humidity of 37%. A 7.01 × 106 TCID50/mL of SARS-CoV-2 in viral media was nebulized into the chamber with mixing fans before collection. Air samples were collected at 30, 60, and 90 minutes after exposure.

Continued...

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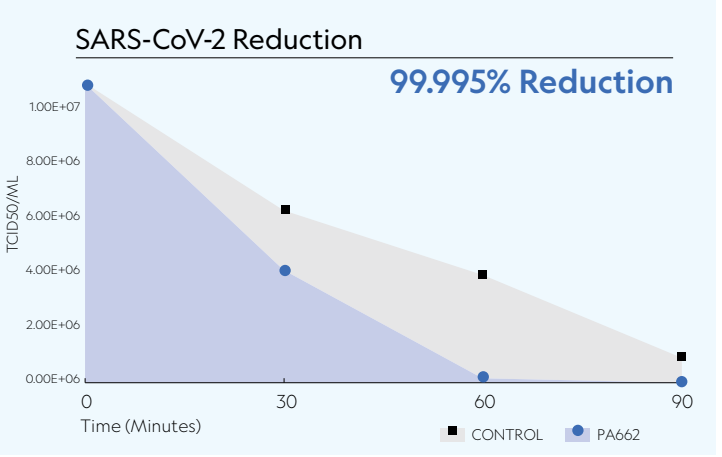
Summary of Results

Control testing was conducted without the device operating in duplicate, and samples were taken at the corresponding time points used for the challenge. The results displayed a natural viability loss over time in the chamber and were used as a comparative baseline to calculate viral reduction.

The Plasma Air PA662 demonstrated an overall capability in reducing aerosolized SARS-CoV-2 Omicron viruses at each time point faster than the natural viability loss rates. After 30 minutes of operation, a 62.401% gross reduction was observed and increased with longer exposure time, as shown by the 99.995% (5 log) reduction achieved after 90 minutes.



SARS-CoV-2 Reduction

Laboratory Name:	Innovative Bioanalysis, Inc.
Laboratory Location:	Costa Mesa, CA
Date:	December 2021
Device Tested:	AutoClean 1500, applicable to AutoClean 1560
Space Treated:	1,280 ft^3

Objective

WellAir/Plasma Air supplied the AutoClean 1500 for testing purposes to determine efficacy against viral pathogens. This study evaluated the effectiveness of the AutoClean 1500 in its ability to reduce the viral strain referred to as SARS-CoV-2 within the air. Note, the AutoClean 1560 uses the same ionization component.

Methodology

Bioaerosol Generation Test Substance: SARS-CoV-2 USA-CA1/2020 The nebulizer was filled with 7.01 × 06 TCID50/mL of SARS-CoV-2 in viral suspension media and nebulized at a flow rate of 1mL/min with untreated local atmospheric air. After nebulization, the nebulizer's remaining viral stock volume was weighed to confirm roughly the same amount was nebulized during each run. Bioaerosol procedures for the controls and viral challenges were performed in the same manner with corresponding time points and collection rates.

Testing was conducted in a sealed 20' × 8' × 8' chamber per Biosafety Level 3 (BSL3) standards. The overall dimensions of the test chamber provided a displacement volume of 1,280 ft^3 (approximately 36,245 liters) of air. The chamber remained closed during testing, with no air entering or leaving the room. The chamber was equipped to create the necessary airflow to produce the required concentration of ions. The temperature during testing was approximately 72 ±2°F (22.2 ±1.1°C), with a relative humidity of 37%. A 7.01 × 106 TCID50/mL of SARS-CoV-2 in viral media was nebulized into the chamber with mixing fans before collection. Air samples were collected at 30, 60, and 90 minutes after exposure.

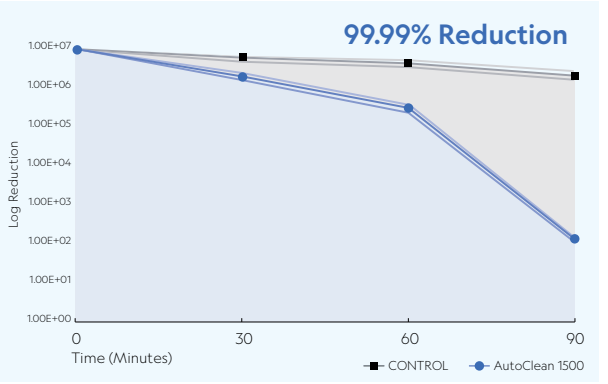
Continued...

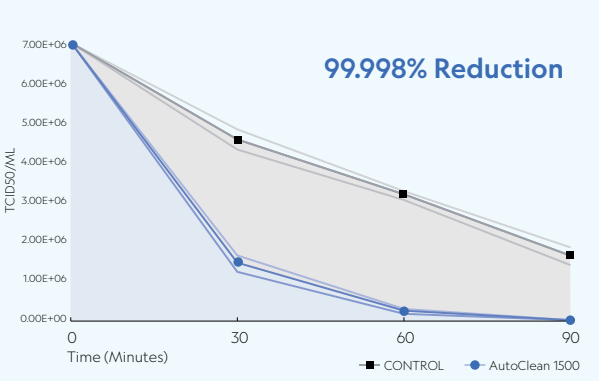
Continued...

Summary of Results

The AutoClean 1500 demonstrated the ability to reduce aerosolized SARS-CoV-2 USA-CA1/2020 across all time points compared to the natural loss rate observed in the controlled setting. The device achieved greater than 99.99% (4 log) reduction of active viruses after 90 minutes of exposure.

The study focused on the impact the ionizer would have on a specific volume of space. Therefore, when applied to a different sized room, the results will scale and vary due to variables present, such as room size, occupancy rating, air movement, and more. Every effort was made to simulate a real-life situation and address constraints with the experimental design and execution while taking the proper precautions when working with a BSL-3 pathogen. These efforts are reflected in the meaningful recovery of the virus in the control test.





Additional Virus, Bacteria, Mold, VOC and Particulate Testing

TYPE	NAME	REDUCTION	TIME	MODEL
 VIRUSES	Influenza A (H1N1)	86.6%	1 hr	Model 7000 Series
	Influenza A (H1N1)	86.6%	1 hr	Plasma BAR
	MS2 Bacteriophage	99.39%	4 hrs	Plasma Air 600 Series
	Live SARS CoV-2	99.99%	90 min	AutoClean 1500/1560
	Omicron Variant, SARS CoV-2	99.945%	90 min	Plasma Air 600 Series
 BACTERIA	*Pseudomonas Aeruginosa*	99.99%	1 hr	Model 7000 Series
	Pseudomonas Aeruginosa	99.99%	1 hr	Plasma BAR
	Escherichia coli	99.43%	2 hrs	Model 7000 Series
	Escherichia coli	99.43%	2 hrs	Plasma BAR
	Bacillus subtilis var. niger	89.3%	1 hr	Model 7000 Series
	Bacillus subtilis var. niger	89.3%	1 hr	Plasma BAR
	Staphylococcus Aureus	91.5%	1 hr	Model 7000 Series
	Staphylococcus Aureus	91.5%	1 hr	Plasma BAR
	MRSA[2]	99.47%	1 hr	Model 7000 Series
	MRSA[2]	99.47%	1 hr	Plasma BAR
 MOLD SPORES	*Aspergillus Niger*	97.14%	2 hrs	Model 7000 Series
	Aspergillus Niger	97.14%	2 hrs	Plasma BAR
	Cladosporium Cladosporioides	36.27%	2 hrs	Model 7000 Series
	Cladosporium Cladosporioides	36.27%	2 hrs	Plasma BAR
	Dichobotrys Abundans	90%	1 hrs	Model 7000 Series
	Dichobotrys Abundans	90%	1 hrs	Plasma BAR
	Penicillium	95%	1 hr	Model 7000 Series
	Penicillium	95%	1 hr	Plasma BAR
	Candida Albicans	97.69%	2 hrs	Model 7000 Series
	Candida Albicans	97.69%	2 hrs	Plasma BAR
	Acetaldehyde, Acrolein,	80%	6 hrs	Plasma Air 600 Series
	Candida Albicans	97.69%	2 hrs	Model 7000 Series
	Candida Albicans	97.69%	2 hrs	Plasma BAR
 VOCs	Acetaldehyde, Acrolein, Benzaldehyde, Formaldehyde, Glutaraldehyde, Propianaldehide, Crotonaldehyde	80%	6 hrs	Plasma Air 600 Series

1. MS2 Bacteriophage Virus is an accepted surrogate for Influenza, Norovirus and SARS-CoV-2.
2. Tested on *Staphylococcus epidermidis*, a surrogate for MRSA.

WELLAIR

Protected by NanoStrike™ | WellAir Portable Devices

Defend 1050

FDA Cleared
Class II Medical Device

Defend 400

FDA Cleared
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Protect 900

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Plasma Air | Plasma Air HVAC In-Duct Devices

600 Series (PA600)

660 Series (PA660)

AutoClean 1500/1560
(AC1500/1560)

Plasma BAR

7000 Series (PA7000)

Products not to scale

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