NOVAERUS

Laboratory & Clinical Research Summary

In independent laboratory studies Novaerus products have been shown to safely and effectively reduce bacteria, viruses, allergens, volatile organic compounds, and particulate matter.

In clinical settings, Novaerus products have been demonstrated to reduce airborne pathogens, surface bacteria, infections, antibiotic use, and odours.

Escherichia coli (E. coli) Deactivation

Laboratory Name:	**NASA Ames Research Center Universities Space Research Association**
Laboratory Location:	**Moffett Field, Mountain View, CA**
Date:	**February 2016**
Device Tested:	**NV200**
Space Treated:	**0.51m³ (18 ft³)**

Objective

To explore the morphological and chemical modification of the cell structure of aerosolized *Escherichia coli (E. coli)* treated with a dielectric barrier discharge (DBD).

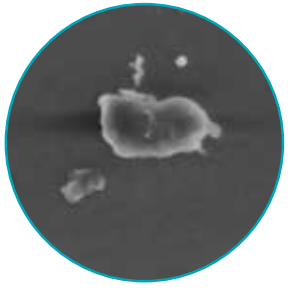
Methodology

The NV200 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 DBD 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 DBD.

Healthy bacteria



Bacteria after DBD treatment

Influenza A Reduction

Laboratory Name:	**Airmid Health Group Ltd.**
Laboratory Location:	**Dublin, Ireland**
Date:	**April 25, 2018**
Device Tested:	**NV1050**
Space Treated:	**28.5m³ (1006 ft³)**

Objective

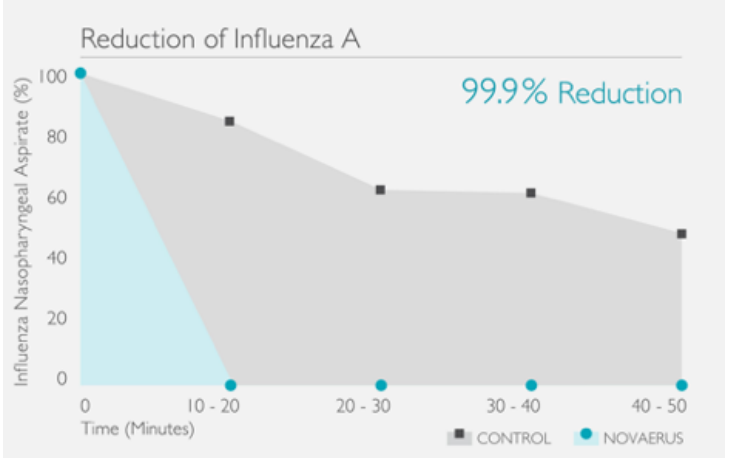
To evaluate the efficacy of the NV1050 on removing Influenza A.

Methodology

Testing of the NV1050 was conducted in a 28.5 m³ environmental test chamber. The chamber was preconditioned to 20±3°C and 50±10% relative humidity prior to commencement of the tests. For the test runs, the NV1050 was placed on the floor in the centre of the chamber.

Summary of Results

The NV1050 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 max speed.



Aspergillus niger Spore Reduction

Laboratory Name:	**Aerosol Research and Engineering Laboratories**
Laboratory Location:	**Olathe, Kansas**
Date:	**May 28, 2018**
Device Tested:	**NV1050**
Space Treated:	**15.9m³ (562ft³)**

Objective

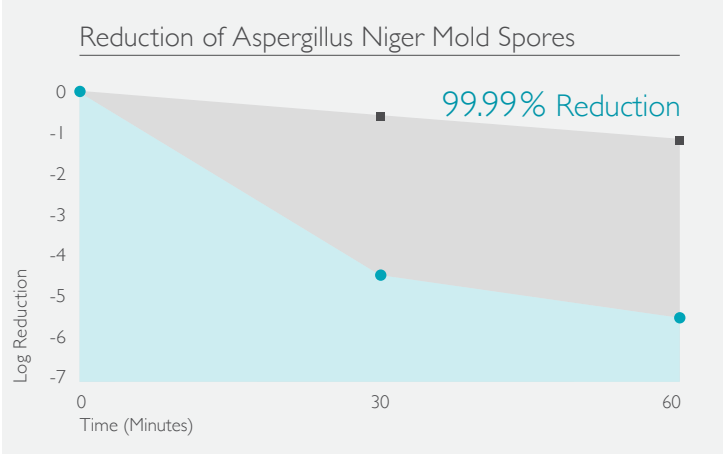
To evaluate the efficacy of the Novaerus NV1050 system against aerosolized *Aspergillus niger* spores.

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 NV1050 system 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.



Staphylococcus aureus (MRSA) Bacteria Reduction

Laboratory Name:	**Microbac Laboratories, Inc.**
Laboratory Location:	**Wilson, NC**
Date:	**January 20, 2016**
Device Tested:	**NV800/NV900**
Space Treated:	**1m³ (35ft³)**

Objective

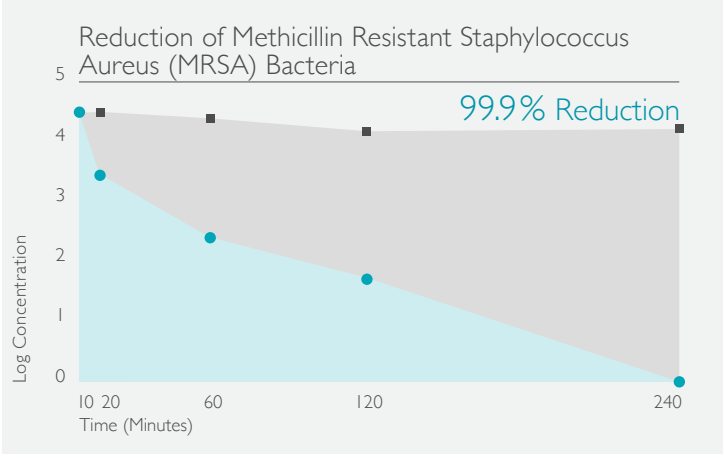
To evaluate the efficacy of the NV800/NV900 on reducing methicillin-resistant *Staphylococcus aureus* (MRSA).

Methodology

The challenge bacteria were aerosolized using a six-jet collision nebulizer under high pressure air and introduced into the chamber with the NV800/NV900.

Summary of Results

The NV800/NV900 reduced 99.99% of *Staphylococcus aureus* bacteria over the course of four hours.



DEHS and Toluene Reduction

Laboratory Name:	**Camfil Laboratories – Tech Center**
Laboratory Location:	**Trosa, Sweden**
Date:	**April 25, 2018**
Device Tested:	**NV1050**
Space Treated:	**19.72m³ (696ft³)**

Objective

To evaluate the particulate and molecular efficiency of the NV1050 in a test chamber using DEHS and Toluene.

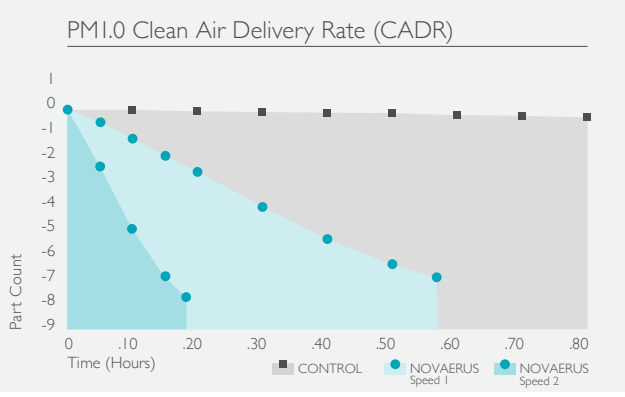
Methodology

Test method: CADR

The DEHS aerosol and toluene were generated in the laskin nozzle and injected into a room until a pre-set concentration was achieved then the air cleaner was turned on.

Summary of Results

The NV1050 reached a minimum efficiency with a 55% DEHS particle reduction on the low speed and a maximum efficiency with an 89% DEHS particle reduction on the high speed. In the toluene declination test, the NV1050 removed 90% of the toluene within 6 minutes on the high speed and 90% after 17 minutes on the low speed.



Bioaerosols Reduction

Laboratory Name:	**Aerosol Research and Engineering Laboratories**
Laboratory Location:	**Olathe, Kansas**
Date:	**December 7, 2016**
Device Tested:	**NV800/NV900**
Space Treated:	**15.9m³ (563ft³)**

Objective

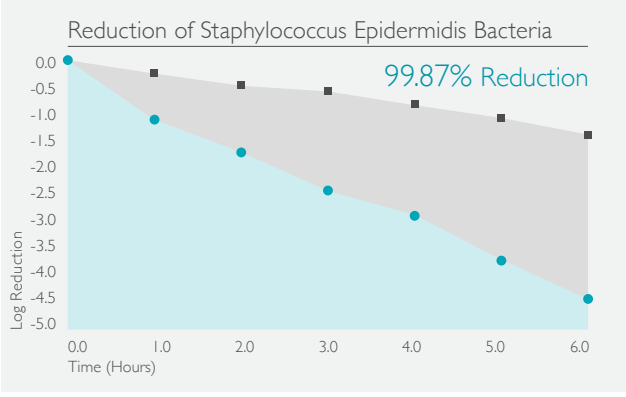
To evaluate the efficacy of the NV800/NV900 on neutralizing bioaerosols. The device was assessed on four aerosolized biologicals: *Staphylococcus epidermidis*, MS2 bacteriophage, *Aspergillus niger* fungus, and *Bacillus subtilis* endospores.

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 NV800/NV900 was extremely effective at reducing viability of bioaerosols in all conducted studies: a 99.87% reduction of *Staphylococcus epidermidis* bacteria, a 99.99% reduction of MS2 (a surrogate for influenza and norovirus), a 98.85% reduction of *Aspergillus niger* mold, and an 86.5% reduction of *Bacillus subtilis* bacteria spores.



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Allergens Reduction

Laboratory Name:	**Indoor Biotechnologies Ltd.**
Laboratory Location:	**Cardiff, UK**
Date:	**September 9, 2016**
Device Tested:	**NV800/NV900**
Space Treated:	**1m³ (35ft³)**

Objective

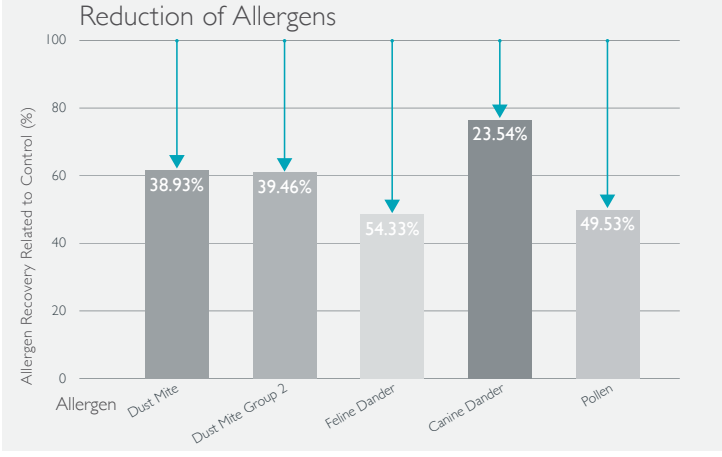
To evaluate the efficacy of the NV800/NV900 on reducing airborne allergens.

Methodology

Testing was performed with the NV800/NV900 placed in a closed, thoroughly cleaned experimental chamber measuring approximately 1m³.

Summary of Results

The NV800/NV900 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.



Formaldehyde Reduction

Laboratory Name:	**Avomeen Analytical Services**
Laboratory Location:	**Ann Arbor, MI**
Date:	**May 27, 2014**
Device Tested:	**NV800/NV900**
Space Treated:	**1m³ (35ft³)**

Objective

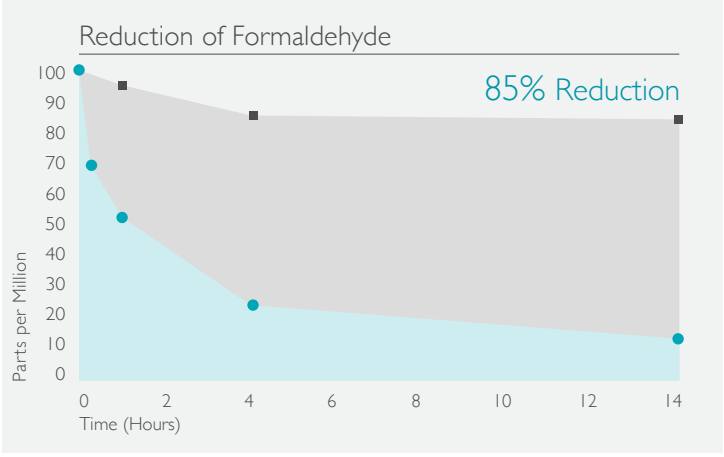
To evaluate the efficacy of the NV800/NV900 on reducing formaldehyde.

Methodology

A plexiglass chamber was built for formaldehyde testing of the NV800/NV900. 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 120 degrees Celsius with a constant temperature hot plate.

Summary of Results

The NV800/NV900 reduced formaldehyde from 100 ppm to around 13 ppm during a 14-hour testing experiment, an 85% reduction.



Evaluation of the Novaerus 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 moulds.

Evaluation of the Novaerus 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 Novaerus Technology in Hospital Wards

Leopardstown Park Hospital
Dublin, Ireland

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

Evaluation of the Novaerus 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 Novaerus 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 Novaerus air purification system to be tolerable, easy to use, and safe for patients and staff. The Novaerus air purification system complements existing measures to combat infections and does not require additional interventions to ensure that it functions without interruption.

Evaluation of the Novaerus 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 Novaerus devices were installed, the amount of microorganisms in subsequent tests were low.

Evaluation of the Novaerus 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 units, the number of overall infections increased by 35% from 2013 to 2014. In the section with Novaerus units, the number of overall infections fell 23% during the same time period.

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

Międzyrzecz Hospital
Międzyrzecz, Poland

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 Novaerus 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/m^3 for general wards).

Defend 1050
(NV1050)

Protect 800/900
(NV800 / NV900)

Protect 200
(NV200)

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NV-AAA-UK-004