



NOVAERUS

CAHF: WEB-X, JANUARY 18, 2017 “CLOSING THE LOOP ON INFECTION CONTROL”

Skilled nursing facilities have successfully reduced Nosocomial infection rates using airborne pathogen technology

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Objectives

- **Maintaining resident health in reducing readmissions.**
- **More than just a service issue!**
- **A new home for technology.**

Nurses

- High Quality of Care
- Prevent Readmissions/Admissions
- VBP Programs
- Continuum of Care/Over Three Years
- Nursing Home Compare



Nurses (cont.)

- Financial Penalties 2018
- Preempt Infections and Disease Outbreaks (Flu/NORO)
- Patients, Staff, and Visitors.
- Productivity/Presentism



Infection Control Vectors

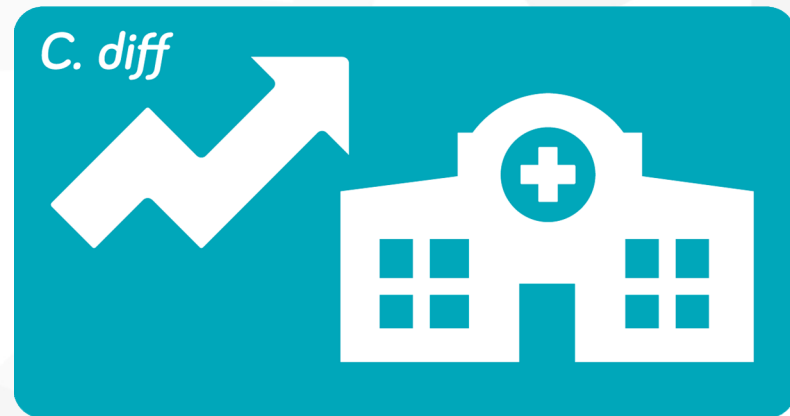
- Airborne Droplets
- Surface Contact
- Person to Person/Handwashing
- Particle Distribution/Particles Disturbed



OIG Report

- Pneumonia/Flu
- Post Surgical Sites
- CAUTI
- Clostridium difficile

250,000
INFECTIONS PER YEAR



Source: CDC



NOVAERUS

Indoor Air Quality is a global problem

Indoor Air Quality is a growing issue and is the #1 complaint to property managers.

Things like: Voc's and pathogens are detrimental to health and well-being as we spend 90% of our lives indoors.



Novaerus Technology Treats the Air



What We Do

Novaerus has developed a unique, patented plasma technology to clean the air.



What It Does

Provides a healthier in door environment for everyone.



How We Do It






By continuously treating the air with our In-Duct or stand alone solutions

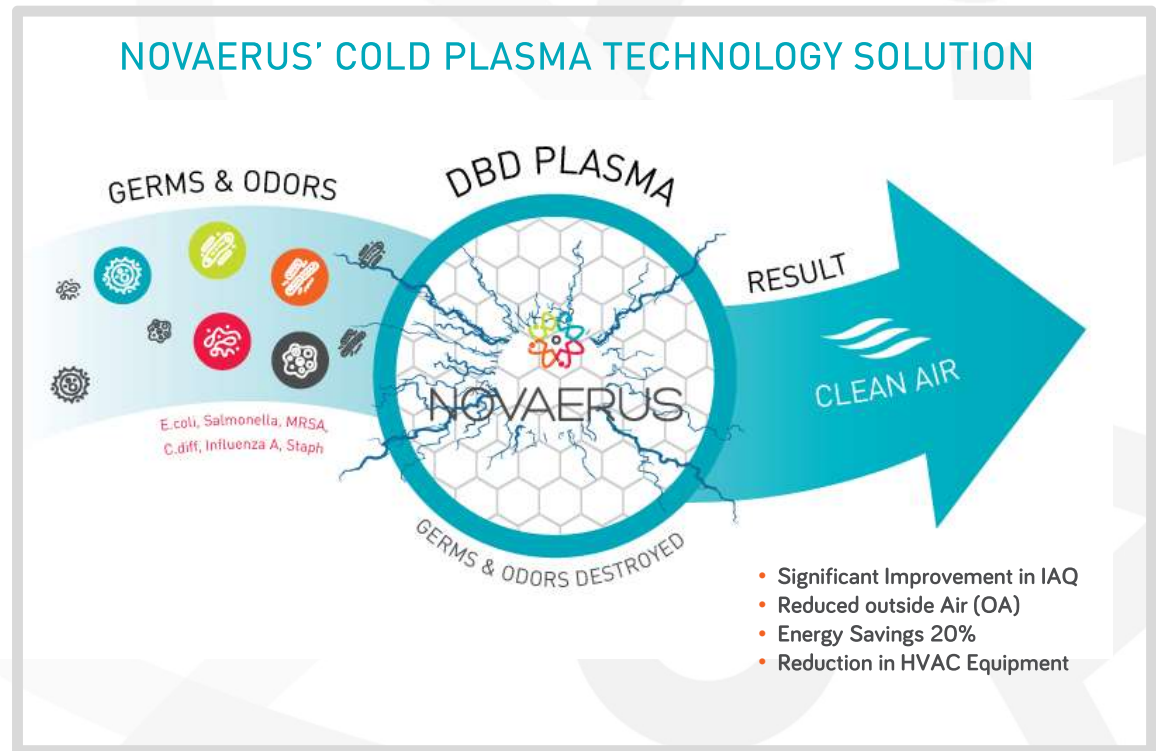
Novaerus offers Plasma-clean Systems

Novaerus' unique plasma technology that can be installed in the Air Duct or Stand alone, eradicates all allergens and pathogens so people can breathe easy all year.



The Novaerus Solution

-  Reduce Airborne Viruses
-  Decrease Bacteria
-  Eliminate Odors & VOCs
-  Eradicate Allergens
-  Remove Mold & Spores



Novaerus Patented Technology

DBD Plasma

THE SECRET TO THE NOVAERUS TECHNOLOGY

- ▶ Novaerus technology generates plasma
- ▶ Plasma field is called the Dielectric Barrier Discharge (DBD)
- ▶ Plasma caused by an electrical charge to two electrodes
- ▶ The electric field is the energy source that transforms the gas



Plasma = Energized Gas

DBD Plasma

- An extremely destructive force relative to the size of the microorganisms
- Immediately kills organisms and totally destroys all of their genetic material
- Safe to use around patients and staff



Surface of Novaerus Coil



Testing by World Renowned Independent Institutions & Laboratories

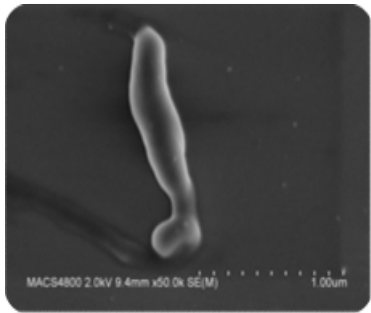


The image displays logos for four independent institutions and laboratories: Microsearch Laboratories Ltd, MICROBAC, NASA (two instances), and Karolinska Institutet.

- Microsearch - multiple organisms including bacteria, mold, spores and virus
- MICROBAC Lab – Staph aureus
- ARE Labs – Staph epidermidis, MS2 virus
- AMES Research Lab, NASA, Mountain View, CA – studies the effect of plasma on bacteria microorganism
- Karolinska Institute Stockholm, Sweden

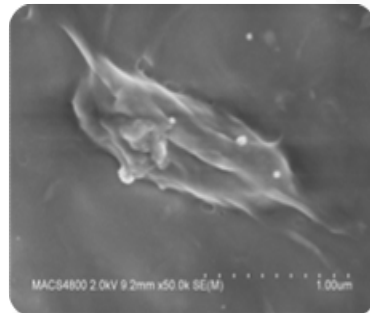
Novaerus Uses Multiple Simultaneous Deactivation Methods

Effects of non-thermal **Dielectric Barrier Discharge (DBD)** plasma generated within a closed coil source at normal atmospheric pressure.



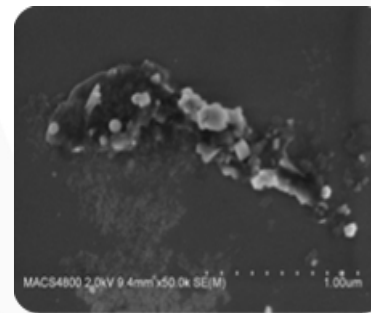
1. Electroporation

- Radicals etch the cell walls of the microorganism causing them to be stressed and deformed



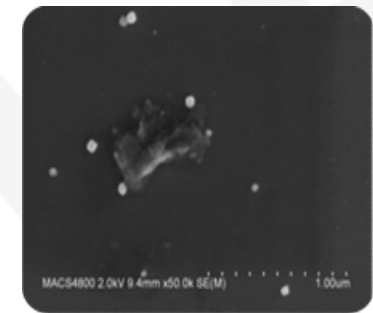
2. Electron Bombardment

- Destroys DNA and prevents DNA replication



3. Photon Irradiation

- UV photons break bonds and unstable compounds are eroded



4. Oxidation & Etching

- Species are broken down into small, safe, molecules
- Picture showing molecule after 0.002 seconds



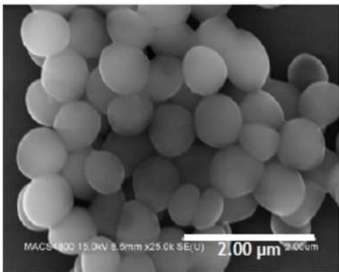
Images taken under scanning electron microscope at NASA Ames Research Laboratory

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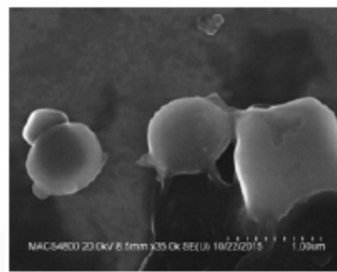


Novaerus effect on Staphylococcus

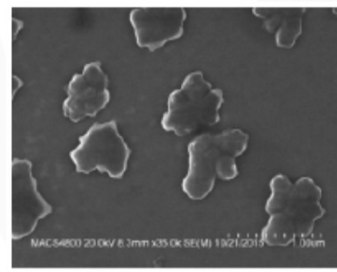
'Healthy' Staphylococcus
Bacterium
prior to exposure



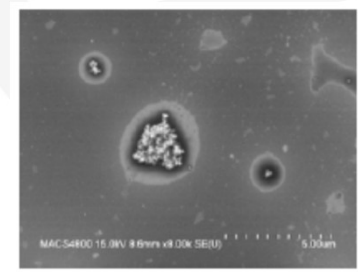
Cells are ruptured



Bacteria
become stressed
and deformed



Novaerus Plasma
after 0.002 Seconds

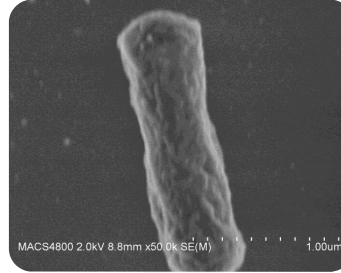


*Scale is 1 Micrometer or 1 millionth of a meter
Images taken under scanning electron microscope at NASA Ames Research
Laboratory

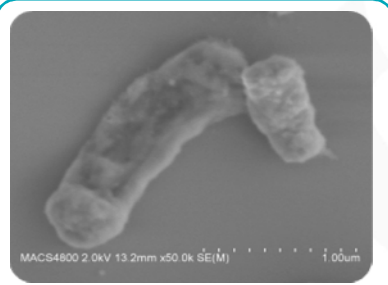
Time to Kill - Traditional Sterilization Vs. Plasma



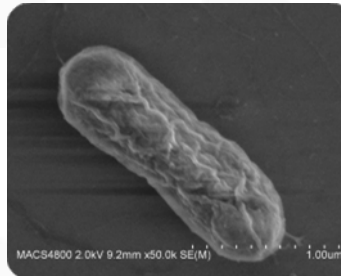
NOTE: These images use the same scale



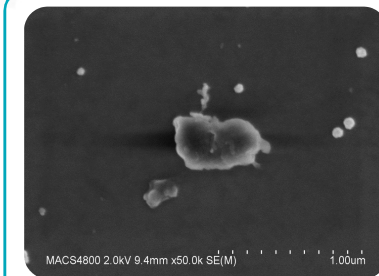
Healthy E.Coli Bacteria



Heat (160°C for
(2 hours))



Ozone 350,000ppm for
(2 hours)



Novaerus Plasma
(after 0.002 secs)

Tested on Bacteria, Fungi, and Spores

- Gram positive
- Gram negative
- Gram positive spores
- Yeasts and Mold Spores
- **>Log 5 kill rate for all classes**

Escherichia coli	Gram -ve	2.1E+05	0.0E+00	>5	>99.999
S.Typhi murium	Gram -ve	4.6E+05	0.0E+00	>5	>99.999
E.agglomerans	Gram -ve	3.9E+05	0.0E+00	>5	>99.999
E.bergoviae	Gram -ve	4.2E+05	0.0E+00	>5	>99.999
A.aerogens	Gram -ve	7.1E+05	0.0E+00	>5	>99.999
S.marcescens	Gram -ve	8.2E+05	0.0E+00	>5	>99.999
E.sakazakii	Gram -ve	3.4E+05	0.0E+00	>5	>99.999
E.coli O157 H:7	Gram -ve	3.5E+05	0.0E+00	>5	>99.999
P.aeruginosa	Gram -ve	6.1E+05	0.0E+00	>5	>99.999
P.putida	Gram -ve	8.2E+05	0.0E+00	>5	>99.999
S.aureus oxford					
S.aureus MRSA	Gram -ve	4.3E+05	0.0E+00	>5	>99.999
S.epidermidis	Gram -ve	4.8E+05	0.0E+00	>5	>99.999
S.epidermidis	Gram -ve	3.7E+05	0.0E+00	>5	>99.999
M.luteus	Gram -ve	9.0E+05	0.0E+00	>5	>99.999
S.faecalis	Gram -ve	7.3E+05	0.0E+00	>5	>99.999
S.pyogenes	Gram -ve	3.6E+05	0.0E+00	>5	>99.999
B.cereus	Gram -ve	7.1E+05	0.0E+00	>5	99.999
B.globigii	G+ve Spore	7.9E+05	1.0E+01	>5	>99.999
B.subtilis	G+ve Spore	2.1E+05	3.0E+01	>5	99.986
B.megaterium	G+ve Spore	6.2E+05	9.0E+01	>5	99.985
S.cerevisiea					
S.bailli	Yeast	4.3E+05	0.0E+00	>5	>99.999
S.bailli	Yeast	7.2E+05	0.0E+00	>5	>99.999
Pichia mixed sps	Yeast	6.3E+05	0.0E+00	>5	>99.999
S.ludwigii	Yeast	6.0E+05	0.0E+00	>5	>99.999
A.niger	Mould mycelial	6.2E+05	0.0E+00	>5	>99.999
A.flavus	Mould mycelial	7.8E+05	0.0E+00	>5	>99.999
F.poea	Mould mycelial	7.2E+05	0.0E+00	>5	>99.999
P.digitatum	Mould mycelial	6.9E+05	0.0E+00	>5	>99.999
F.graminerium	Mould mycelial	4.3E+05	0.0E+00	>5	>99.999
A.niger	Mould Spore	8.2E+05	0.0E+00	>5	99.991
A.flavus	Mould Spore	6.7E+05	0.0E+00	>5	99.993
F.poea	Mould Spore	8.2E+05	0.0E+00	>5	>99.999
P.digitatum	Mould Spore	6.7E+05	0.0E+00	>5	>99.999
F.Graminerium	Mould Spore	2.9E+05	0.0E+00	>5	>99.999

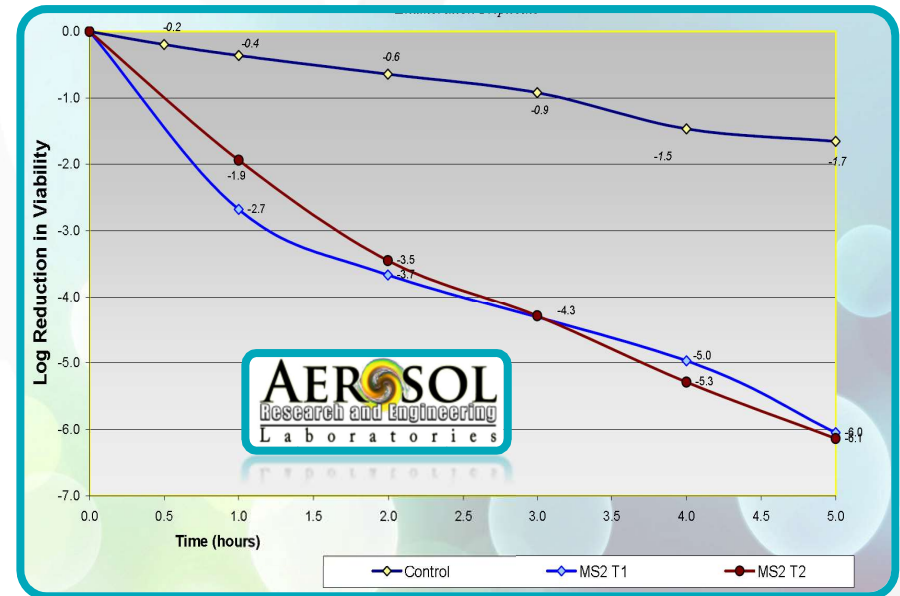
Tested on Viruses

Organism	Class	Mean cfu/m ³ ./Hr at input Treatment stream	Mean cfu/m ³ ./Hr posttreatment exit stream	Mean decline log/cfu/m ³ ./Hr postTreatment exit stream	Percentage reduction
CTX	SS DNA	4.3E+12	8.1E+02	>12	>99.999
ScV-L-BC	DS RNA	9.2E+12	4.6E+02	>12	>99.999
FcoV (attenuated)	SS + RNA	7.1E+12	3.0E+02	>12	>99.999
T4 Phage	DS DNA	5.3E+12	7.4E+02	>12	>99.999

- Single / Double Strand DNA & RNA
- >Log 5 single pass 'kill rate'
- Total annihilation over 1 hour

NOVAERUS Plasma efficacy against Influenza

- Challenge micro-organism: MS2 virus – surrogate for Influenza virus
- NOVAERUS device: NV900
- Test conditions: 565 ft³ (16 m³) test room, up to 6 hours operation
- Results: 4.4 log (> 99.99%) reduction
- Test Lab: Aerosol Research and Engineering labs (ARE Labs, Olathe, Kansas)



NOVAERUS HVAC efficacy against multiple micro-organisms

Pathogen Type	Pathogen Name	Removal Rate	Testing Organization
Virus	Influenza H1N1	99.67%	Kitasato Research Center, Japan
Bacteria	Escherichia Coli	99.43%	EMSL Analytical, USA Istanbul University, Turkey
	Staphylococcus Aureus	99.54%	EMSL Analytical, USA
	MRSA	99.47%	EMSL Analytical, USA
	Pseudomonas Aeruginosa	99.94%	Istanbul University, Turkey
Mold/Fungus	Cladosporium Cladosporioides	99.69%	EMSL Analytical, USA
	Dichobotrys Abundans	99.56%	Professor Joseph F. Boatman, USA
	Penicillium	95.78%	Professor Joseph F. Boatman, USA
	Aspergillus Niger	99.14%	EMSL Analytical, USA
Spore	Bacillus Subtilis var Niger	99.73%	Istanbul University, Turkey

Field Results tested for VOC's, Bacteria, Mold, Bacillus, Cocci

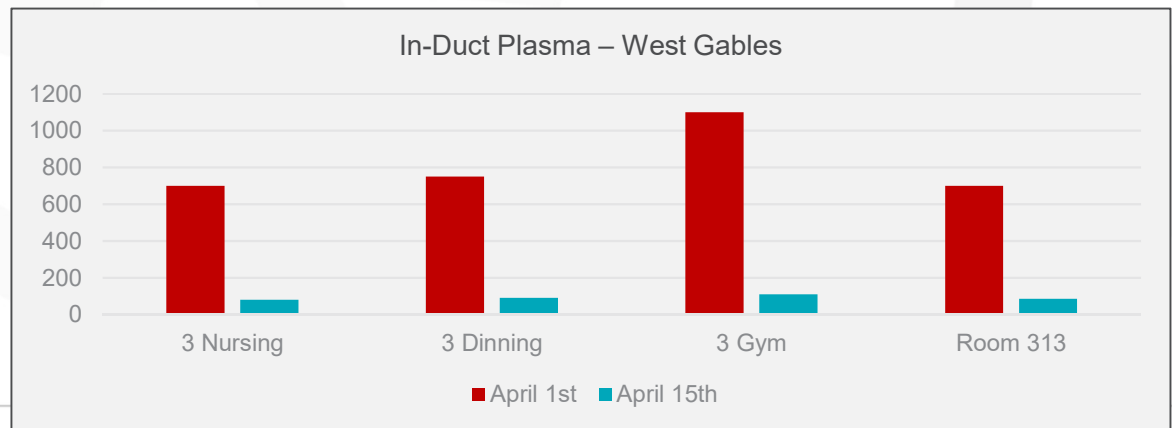
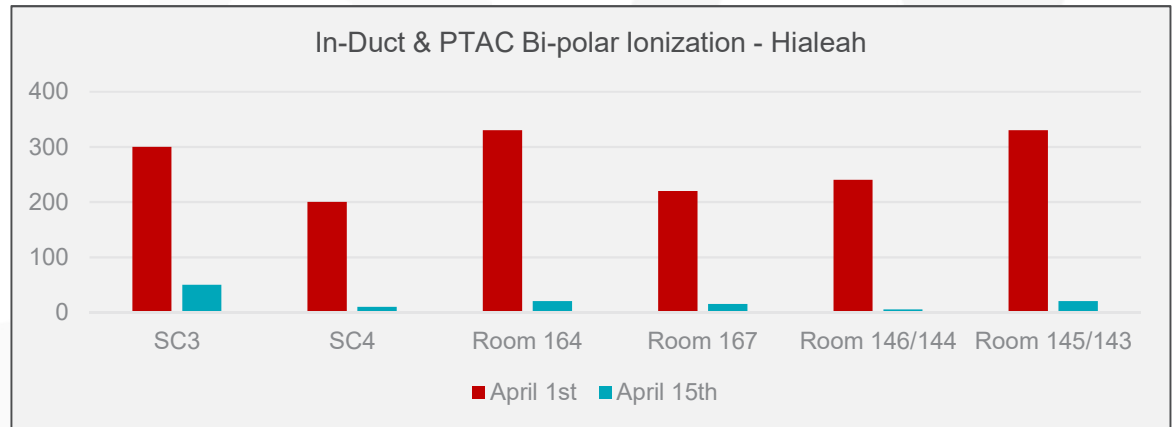
Results:

HIALEAH
Nursing and Rehabilitation Center

86% Reduction

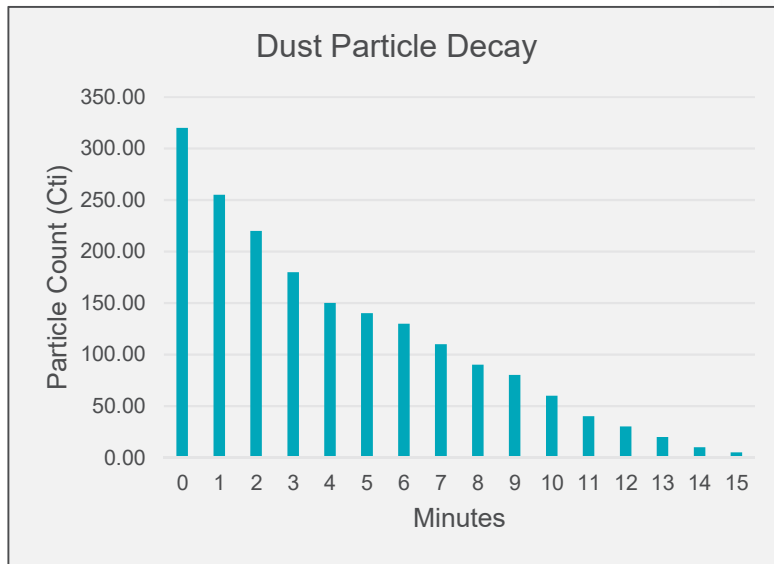
West Gables
REHABILITATION HOSPITAL

83% Reduction

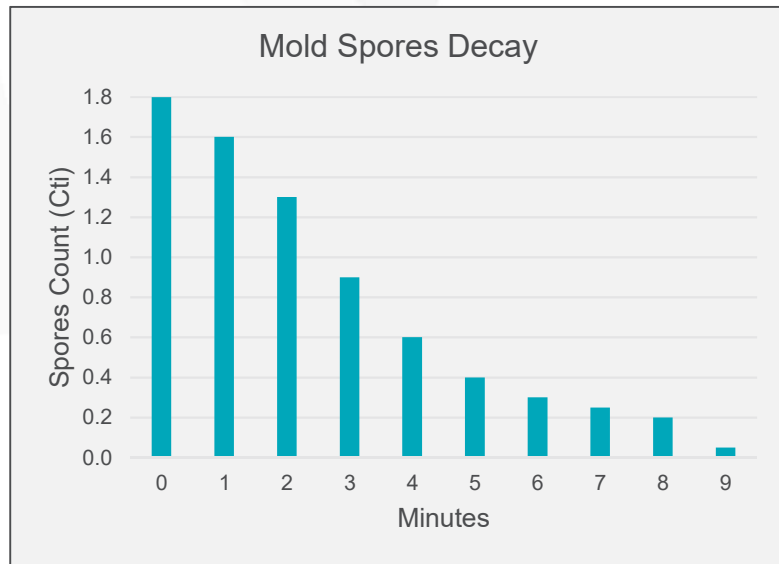


Product Performance – Laboratory Testing

Effectiveness on Airborne Particles



NOVAERUS HVAC Plasma 95.8%



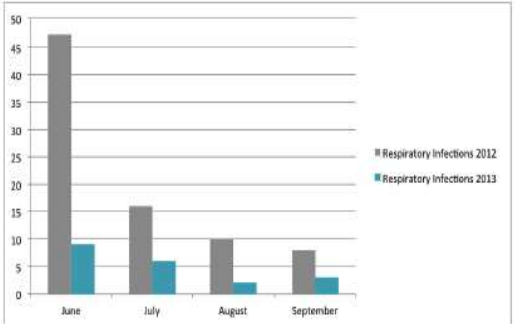
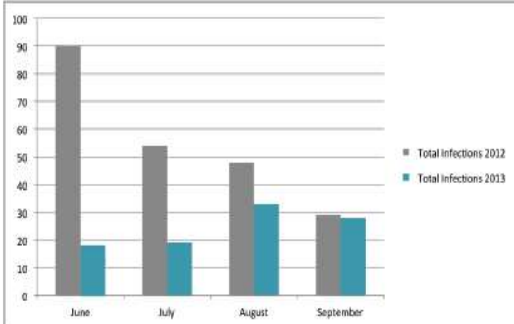
NOVAERUS HVAC Plasma 91.1%



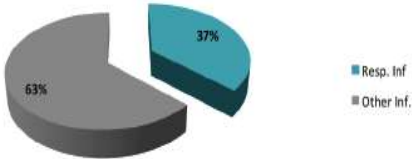
REPORT
INTERTEK, ETL SEMKO
3933 US ROUTE 11 CORTLAND, NEW YORK 13045

Customer Case Study- Long Term Care

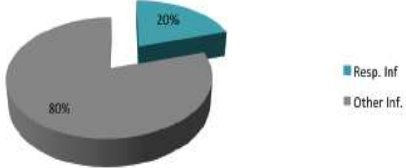
PAGE REHAB CASE STUDY COMPARISON OF NOSOCOMIAL INFECTION RATES FOR THE JUNE-SEPTEMBER PERIOD - 2012 VS. 2013



RATIO OF RESPIRATORY INFECTION TO OTHER INFECTIONS 2012



RATIO OF RESPIRATORY INFECTION TO OTHER INFECTIONS 2013

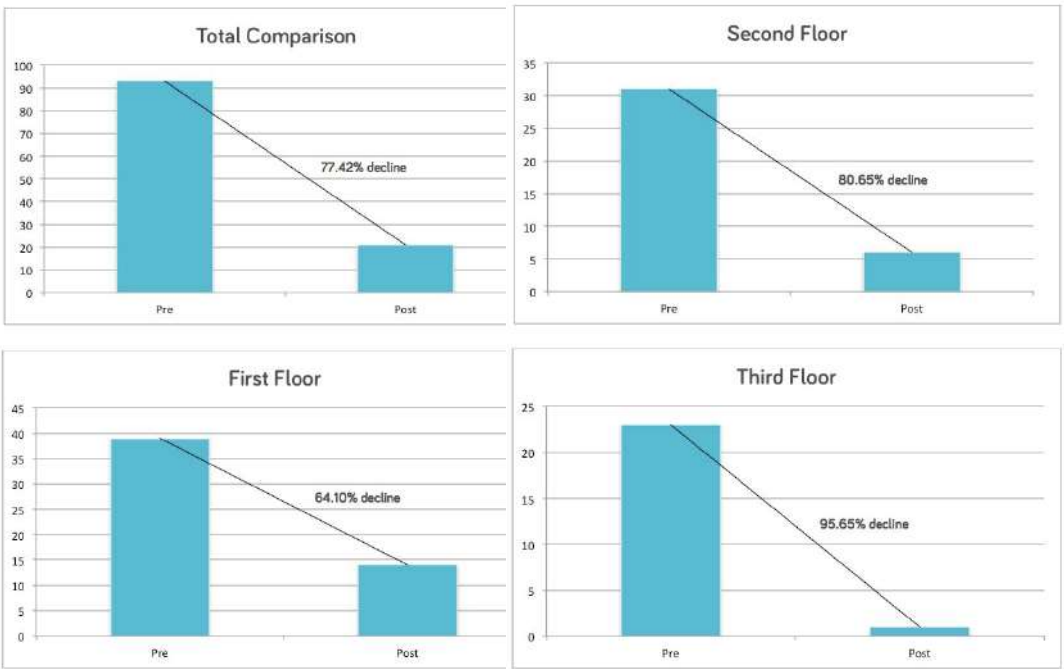


Nosocomial Infections
DOWN 56%

Respiratory Infections
DOWN 75%

Customer Case Study- Long Term Care

MEADOW VIEW CASE STUDY COMPARISON OF NOSOCOMIAL INFECTION RATES OVER 24-MONTHS



Nosocomial Infections
DOWN 77%

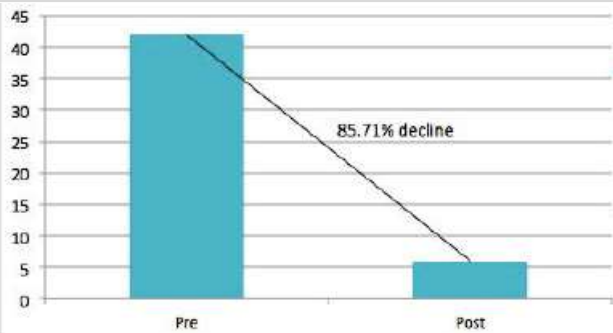
Floor 1 Infections
DOWN 64%

Floor 2 Infections
DOWN 80%

Floor 3 Infections
DOWN 95%

Customer Case Study- Long Term Care

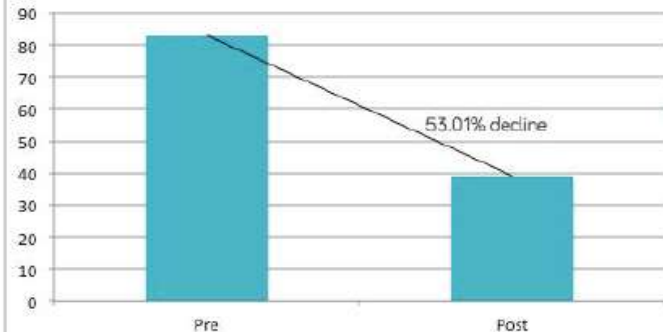
NAAMANS CREEKS CASE STUDY COMPARISON OF NOSOCOMIAL AND C.DIFF INFECTION RATES



Nosocomia
| C. Difficile
Infections

Nosocomial Respiratory
Infections
DOWN 53%

Nosocomia
|
Respiratory
Infections



Nosocomial C. Difficile
Infections
DOWN 85%

Novaerus Portable Solution



NV 1000

- Terminal Unit



NV 900

- ~900 sq. ft.
- Wall Mounted
- High Traffic Areas



NV 400

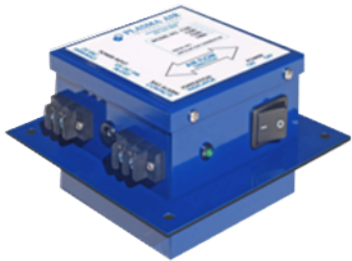
- ~200 sq. ft.
- Wall Mounted
- Soiled Utility Unit



NV 200

- ~200 sq. ft.
- Move Strategically
- Portable Isolation
- New Admits
- High Risk/ Odiferous

Popular HVAC/In-Duct System Offerings



7000

Needlepoint-style ionizer duct mounted on small to medium HVAC systems. Ideal for classrooms, office buildings and conference rooms. Maintenance-free design requires no tube replacement.



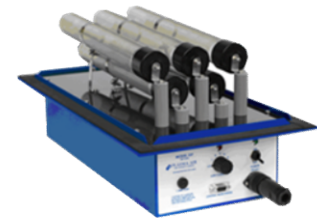
600

Brush 600 for small to medium HVAC systems. Ideal for installation at the inlet of the fan wheel of RTUs, AHUs, PTACs, WSHPs and ductless VRF ceiling cassettes.



100

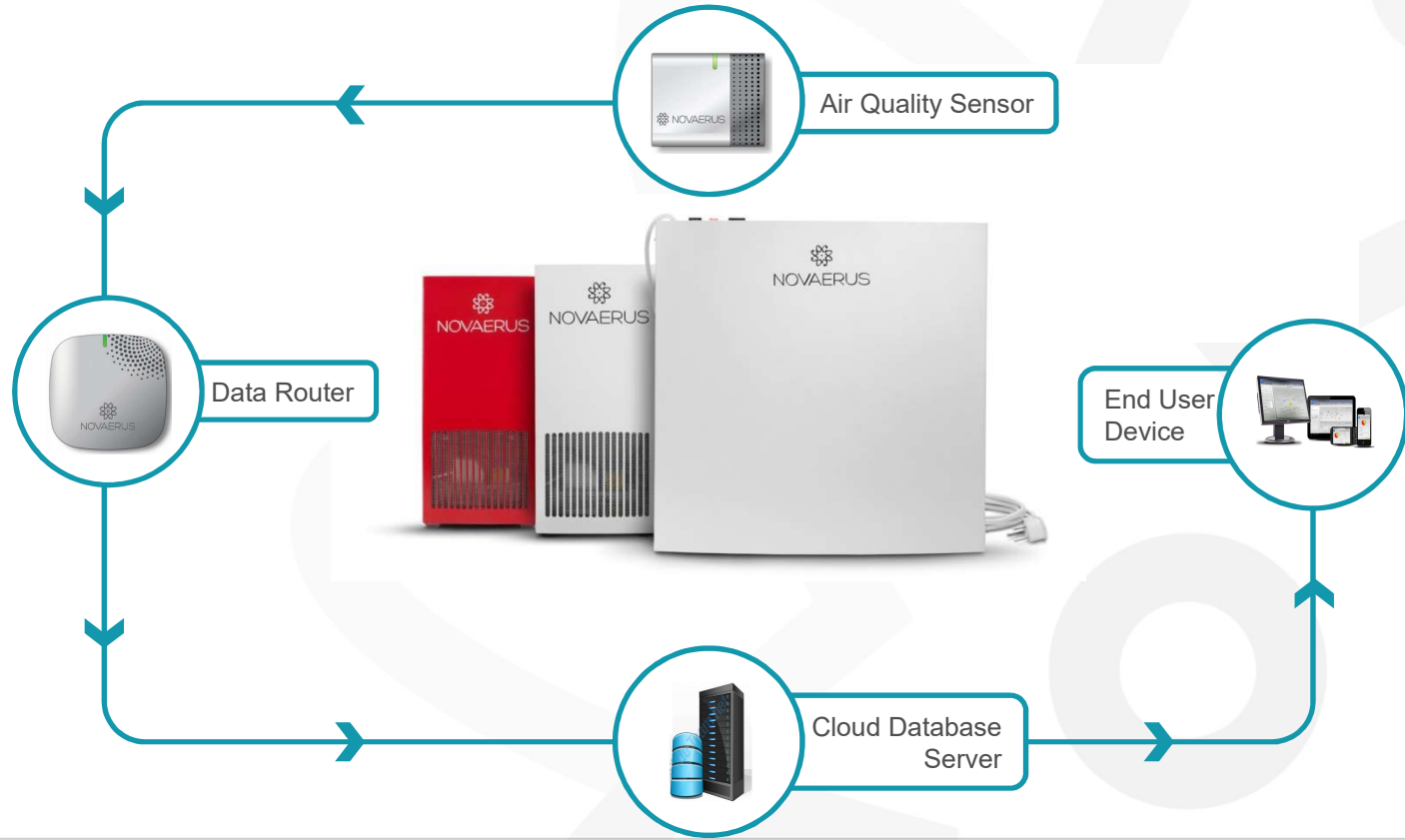
In-duct unit for small to medium central HVAC systems. Ideal for classrooms, conference rooms, daycare facilities, nursing homes, office buildings, casinos, hospitals and restaurants.



50

In-duct unit for larger central HVAC systems. Ideal for schools, gyms, arenas, offices, daycares, casinos and industrial projects including manufacturing, and sewage treatment plants.

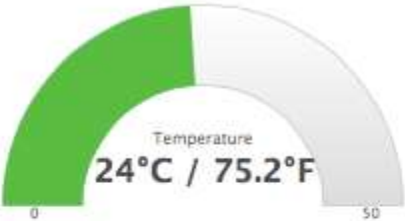
Realtime™ Air Quality Monitoring



Smart Technology Sensors

Sensor Overview – 4F_WD_418

Sensor Info



CO ₂ [ppm]	Air Quality
2100	BAD Heavily contaminated indoor air
2000	
1900	MEDIOCRE Contaminated indoor air
1800	
1700	
1600	
1500	FAIR
1400	
1300	GOOD
1200	
1100	EXCELLENT
1000	
900	
800	



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THANK YOU