Memorandum
Department of Public Works

TO: Michael O. Geisel, P.E.
City Administrator

FROM: James A. Eckrich, P.E.
Public Works Dir. / City Engineer

DATE: August 11, 2020

RE: Bipolar Ionization Air Purification System

The COVID-19 pandemic has affected people, businesses, and government agencies nationwide as we struggle with how to operate safely. The safe operation of City facilities is essential for local governments such as the City of Chesterfield that must continue to provide services including police and street maintenance. The Facility Maintenance Division allows City Hall to continue to function through its thorough cleaning and maintenance operations. Additionally, the Facility Maintenance Division is regularly researching new technologies, especially during the pandemic.

Through its research, the Facility Maintenance Division has found a technology which can attack and kill bacteria, mold spores, and viruses, including COVID-19. This technology is known as Bipolar Ionization Air Purification (BIAP). It is implemented by through attachments to the HVAC system. The BIAP system purifies the air by eliminating airborne particulates, odors, and pathogens. It does so through a process called agglomeration, whereby ions attach to the airborne particles, effectively increasing their mass and size. The ions take away hydrogen from the pathogens in the air, leaving them to die, resulting in clean and healthy indoor air.

This technology has been implemented by several regional leaders, including Emerson Electric and the Reinsurance Group of America (RGA). City Facility Maintenance personnel were invited to attend the BIAP installation at RGA. Once installed the BIAP system requires very little maintenance. The life expectancy of a BIAP system is twenty years.

The Facility Maintenance Staff has researched this technology extensively, as detailed in the attached memorandum from Assistant Building Maintenance Supervisor Tim Fister. We believe a BIAP system would be an effective tool in our fight against COVID-19 and future viruses. Additionally, we believe there is the potential for this expenditure to be reimbursed through the CARES Act. Facility Maintenance Staff

has contacted the Co-Director of the St. Louis County Department of Health, who is currently investigating the BIAP system further.

Regardless of whether the funding is later reimbursed, we believe the implementation of a BIAP system would be a worthwhile investment for the City, its residents, and its employees. Accordingly, the Facility Maintenance Division and I recommend the allocation of $80,000 toward a BIAP system. Due to underruns and a freeze on a number of capital expenditures, the BIAP system could be paid from existing funds within Account 120-079-5470. No supplemental funding would be required.

If you have questions or need additional information, please let me know. Otherwise, I will have member of the Facility Maintenance Division available at the August 20, 2020 meeting to provide additional information and answer questions.

Action Recommended

The Planning and Public Works Committee of City Council should consider whether the City of Chesterfield should install a BIAP system throughout the City facilities. If the PPW Committee concurs with City Staff it should recommend the $80,000 allocation to the full City Council. If approved, the project would be publicly bid and submitted directly to City Council at a later date.

Please forward to PPW for review, discussion and recommendation. NOTE: $80k request funds installation at multiple City Facilities. CARES funding is speculative and proposal is not contingent on said reimbursement.

2020-8-13

Memorandum
Department of Public Works

TO: Jim Eckrich, Public Works Director

FROM: Tim Fister, Asst.Building Maint. Supervisor

DATE: 8/7/2020

RE: GPS Bipolar Ionization Air Purification System

During this COVID-19 pandemic period an extensive amount of research has been performed to increase our capability to keep both the public and the employees of the City of Chesterfield safe while in all of our facilities.

Bipolar Ionization Air Purification System (BPI) delivers a public health product that can deliver results so that we can start coming together again safely. Integrated into our HVAC systems, the technology utilizes specialized tubes that take oxygen molecules from the air and convert them into charged atoms that then cluster around microparticles, surrounding and deactivating harmful substances like a Human Coronavirus, Airborne Mold, Bacteria, Allergens, Clostridium Difficili, Staphylococcus (Staph), Methicillin-resistant staphylococcus aureus (MRSA), and Escherichia coli (E. Coli).

Once installed and operational little to no maintenance is required, a simply gentle wipe off of the stripes during filter change. The life cycle for BPI is reported to be twenty years.

The cost to purchase and install a BPI System throughout the City's facilities is approximately $80,000 This cost is based upon a proposal to provide and install the BPI System from Murphy Company.

I was given the opportunity to visit RGA World Headquarters next door to City Hall and get a first hand look at a large scale installation and operation of a BPI System. Like us they performed the research and found this was a good option for them to protect their employees not only for the Coronavirus but additional harmful microparticles that can enter into their facilities.

The BPI System is superior to alternative such as Ultraviolet Germicidal Irradiation UVGI. UVGI in HVAC involves installing ultraviolet lights often referred to as "bulbs" in the HVAC system. The bulbs emit an intense, short wavelength light intended to kill or damage the cells inside microorganisms. The UVGI light generated from the bulbs is dangerous if people are exposed to it without protection. The estimated cost for a UVGI System is $115,000 with annual bulb replacement estimated at $10,000 to 12,000.

Action Recommended

The Facilities Division recommends that we purchase a BPI System and contract the installation at a cost of 80,000. Reimbursement of full or partial cost will be pursed through COVID funding. Please let me know if you have any questions or if additional information is needed.

References

A. City of Chesterfield Facilities HVAC Equipment List

B. Proposal Murphy Company

C. (GPS) Global Plasma Solution Brochure

D. Explanation of Coronavirus and Application of BPI to Disinfect Air and Surfaces Dr. Philip M. Tierno, N.Y. University School of Medicine

E. GPS Eliminates Static SARS-CoV-3 with BPI Technology

F. UVGI vs GPS Bipolar Ionization

G. Independent Laboratory Test Results

A.

City of Chesterfield Facilities HVAC Equipment List

City Hall

RTU 1 60 Ton Dakin RPS061DLAS5 / FBO151000201

RTU 2 40 Ton Dakin RPS042DLAS5 / FBO151000187

RTU 3 30 Ton Dakin RPS030DLAS5 / FBO151000230

RTU 4 40 Ton Dakin RPS0420DLAS4 / FBO151000328

RTU 5 35 Ton Dakin RPS035DLAS6 / FBO151000327

AHU 1 60 Ton McQuay / CAH025FDAC Coil retrofit See attached cut sheet

AHU 2 5 Ton Liebert MMD60E7CHELB / Y15JB10223

Public Works Facility

RTU 1 10 Ton Carrier 48PGDM12-D-50-AO / 1608G10015

RTU 2 7.5 Ton Carrier 48HCTD08A2M5A0A3A0 / S1612G20326

Parks Maintenance Facility

AHU 1 40 Tons York XT1054X078-JAHAO46A / AGTMXT0200

Parks Concessions Buildings

CVAC A AHU 1 15 Tons Carrier 40RM016B611HV / 3806U24301

CVAC B AHU 1 15 Tons Carrier 40RUAA16A2A6-A0A0 / 5014U07231

CVAC C OMB AHU 1 2 1 /2 Tons Trane 4TEC3F30B1000AA / 11196MBUAV

CVAC D/E AHU 1 15 Ton Trane TWE180E300AA / 11232SP8WA

CVAC F AHU 1 15 Ton Carrier 40RUAA16A6A60A0A0A / 0711U6013

Amphitheater Concessions Building

AHU 1 3 Ton Carrier FB4CNF036T00ABAA / 2610A72102

AHU 2 3 Ton Carrier FB4CNF060T00ACAA / 3510A82994

AHU 3 3 Ton Carrier FB4CNF060T00ACAA / 3510A82944

Swimming Pool Facility

AHU 1 5 Ton Carrier FB4CNP060 / 2618F11765

B.

MURPHY
SINCE 1907
MECHANICAL CONSTRUCTION MAINTENANCE SERVICE DESIGN
A CENTURY OF SOLUTIONS

1233 North Price Road
St. Louis, MO 63132-2303
phone 314-997-6600
fax 314-997-4536

PROPOSAL

July 24, 2020

Mr. Barry Johnson
City of Chesterfield

Project: **GPS System**

Thanks for the opportunity to provide the following GPS system pricing.

City Hall:
- One (1) GPS-iMod-90 Snap
- Four (4) GPS-iMod-84-Snap
- One (1) GPS-iMod-66-Snap
- One (1) GPS-FC-24-AC

Total cost $41,599.00

Public works:
- One (1) GPS-FC-48-AC

Total cost $1,094.00

Amphitheater:
- Four (4) GPS-FC-24-AC

Total cost $2,059.00

Park Maintenance:
- Two (2) GPS-iMod-90-Snap

Total cost $7,388.00

Concession:
- Four (4) GPS-iMod-78-Snap
- One (1) GPS-FC-24-AC

Total cost $16,328.00

Total $79,204

Labor cost for installation $10,736.00 (No electrical material included)

Please see the reverse side of the proposal for "General Terms and Conditions".

We appreciate the opportunity to be of service. If you have any questions, please call.

MURPHY
SINCE 1907

Sincerely,

Al Shields

Al Shields
Service Project Manager

Accepted: _____

Title: _____

Date: _____
please fax acceptance to 314-692-1100

GPS®

GLOBAL PLASMA SOLUTIONS

Engineering Air for a Cleaner World™

GPS®

VALIDATED

With over 30 patents and more than 150,000 installations worldwide using our NEEDLEPOINT BIPOLAR IONIZATION technology, also known as NPBI, GPS is truly the Indoor Air Quality (IAQ) revolutIONIZER.

Our proven technology delivers clean indoor air that is safe and healthy – producing neither ozone nor other harmful by-products. All our NPBI products are UL and CE approved. Through NPBI, our products purify the air by eliminating airborne Particulates, Odors and Pathogens. All this while saving you 30% on Energy consumption and lowering your carbon footprint by reducing outdoor air intake by up to 75%.

Engineering Air for a Cleaner World™

GPS FACT: GPS can be installed in any system in any building...

- Agriculture
- Airports
- Animal Care
- Arenas & Stadiums
- Banks
- Casinos
- Child Care
- Convention Centers
- Fitness
- Food Service
- Healthcare
- Hospitality
- Hospitals
- Institutional
- Manufacturing
- Office Building
- Retail
- Schools & Universities
- Senior Care
- Transportation
- Theater
- Worship

Truly a revolutIONIZER

A pioneer with many innovations:

1st

... with universal power supply
... with auto-cleaning
... duct-mounted design
... to use carbon fiber brush needlepoint emitters
... with ionization bar
... with flexible ionization strip
... modular ionization bar
... to achieve UL 867 Ozone Standard
... AND ONLY to pass the RCTA DO-160 standard for aircraft
... to be installed on a commercial jet
... to be certified by FAA
... to be installed in commercial hand driers
... AND ONLY to receive UL 2998 Ozone Free Certification
... to receive OSPHD seismic (OSP) certification

WHY GPS?

GPS DELIVERS P.O.P.E.

PARTICLES REDUCED

Particle Reduction

The GPS NPBI technology reduces airborne particles (i.e., dust, pet dander, pollen) through agglomeration. The ions attach to the airborne particles. The particles are subsequently attracted to one another, effectively increasing their mass and size. The air filtration system easily captures the larger particles, increasing the capture efficiency of your HVAC system.

PATHOGENS KILLED

Pathogen Reduction

During the GPS cleaning process the NPBI technology attacks and kills viruses, mold spores and bacteria. The ions steal away hydrogen from the pathogens, leaving them to die, and leaving you with clean and healthy indoor air.

ODORS NEUTRALIZED

Odor Reduction

During the GPS cleaning process chemical, pet, cooking, and other odors are broken down into basic harmless compounds, leaving the indoor air fresh smelling and free of odor causing VOCs.

ENERGY SAVED

Energy Saving

GPS' environmentally friendly cleaning process allows commercial buildings to significantly reduce the amount of outdoor air required to operate. This equates to a safer, more comfortable environment that requires up to 30% less energy to condition.

THE GPS ADVANTAGE

	GPS NPBI	OTHER BPI	CORONA DISCHARGE	HEPA FILTERS	CARBON FILTERS	ULTRAVIOLET (UV)	UV-PCO
Produces Harmful Byproducts	None	Yes	Yes	No	No	Yes	Yes
Reduces Airborne Particles	✔	Yes	Yes	Yes	No	No	No
Destroys VOCs	✔	Yes	Yes	No	Captures	No	Yes
Kills Pathogens	✔	Yes	Yes	No	Captures	Yes	Yes
Reduces Energy Cost	30%	Yes	Yes	No	No	No	No
UL 2998 No-Ozone Certified	✔	No	No	N/A	N/A	N/A	N/A
Treats In-Room Air	✔	Yes	Yes	No	No	No	No
No Replacement Parts	✔	No	No	No	No	No	No
Auto Self-Cleaning	✔	No	No	No	No	No	No
Simple to Install	✔	No	No	No	No	No	No
Low Total Cost	✔	Yes	No	No	No	No	No

AUTO-CLEANING NPBI

GPS-FC48-AC™

An automatic self-cleaning, lightweight NPBI system that handles up to **4,800 CFM or 12 tons**. Designed for multiple mounting options including fan inlet, interior duct walls or floors. The composite construction allows for mounting in corrosive environments.

Features

- > 400 Million + and – Ions Per cc/sec
- Universal Voltage Input (24 – 240 VAC)
- Programmable Auto-Cleaning Cycle
- Carbon Fiber Brush Emitters
- Alarm Contacts

UNIVERSAL VOLTAGE

MAINTENANCE FREE

GPS-FC24-AC™

An automatic self-cleaning, lightweight NPBI system that handles up to **2,400 CFM or 6 tons**. Designed for multiple mounting options including fan inlet, interior duct walls or floors. The composite construction allows for mounting in corrosive environments.

Features

- > 300 Million + and – Ions Per cc/sec
- Universal Voltage Input (24 – 240 VAC)
- Programmable Auto-Cleaning Cycle
- Carbon Fiber Brush Emitters
- Alarm Contacts

CARBON FIBER EMITTERS

APPLICATIONS

- Agriculture
- Airports
- Animal Care
- Arenas & Stadiums
- Banks
- Casinos
- Child Care
- Convention Centers
- Fitness
- Food Service
- Healthcare
- Hospitality
- Hospitals
- Institutional
- Manufacturing
- Office Building
- Retail
- Schools & Universities
- Senior Care
- Transportation
- Theaters
- Worship

GPS-DM48-AC™

The world's first automatic self-cleaning, duct mounted, lightweight NPBI electronic air cleaner. The maintenance free unit is designed for indoor or outdoor duct mounting and can handle up to **4,800 CFM or 12 tons.**

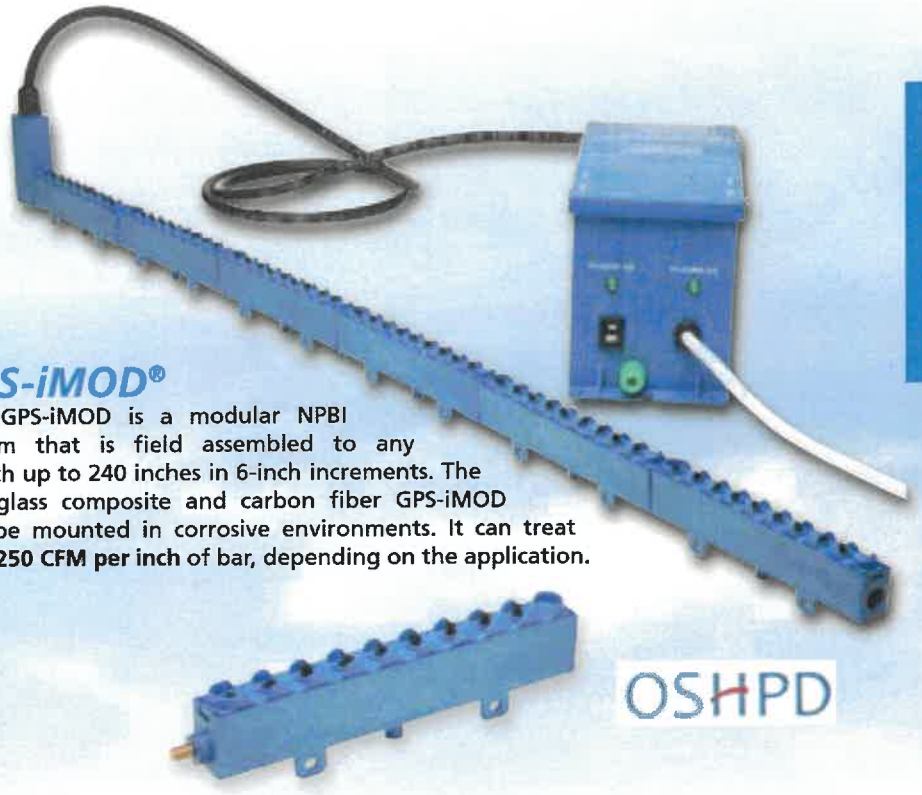
Features

- > 400 Million + and – Ions Per cc/sec
- Universal Voltage Input (24 – 240 VAC)
- Programmable Auto-Cleaning Cycle
- Carbon Fiber Brush Emitters
- Alarm Contacts
- 3/4 Quick-Turn Duct Adapter

SELF-CLEANING

2016 IAQ GOLD AWARD WINNER

BARS & STRIPS



GPS-iMOD®

The GPS-iMOD is a modular NPBI system that is field assembled to any length up to 240 inches in 6-inch increments. The fiberglass composite and carbon fiber GPS-iMOD can be mounted in corrosive environments. It can treat **50 – 250 CFM per inch** of bar, depending on the application.

Features

- > 140 Million + and - Ions Per Inch/cc/sec
- Universal Voltage Selector Switch
- Six HV Output Ports
- Alarm Contacts
- Illuminated On/Off Switch
- Plasma on Indication Light
- UL 2998 Ozone Free

VALIDATED

OSHPD

GPS-iRIB® 18/36

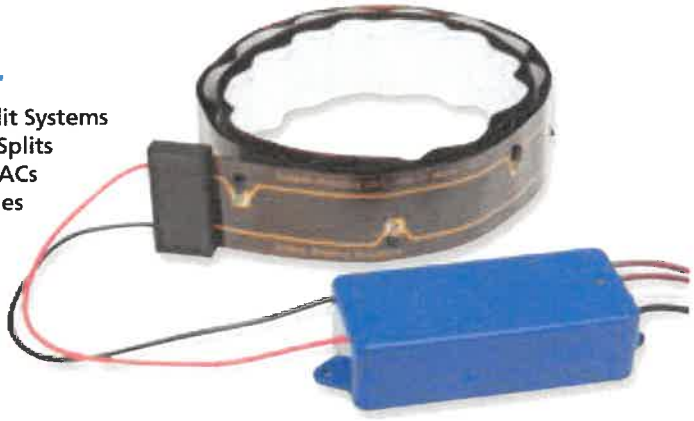
The GPS-iRIB is available in 18" and 36" lengths. They are made from a flexible chemical, heat and cold resistant Kapton® material containing a circuit with special carbon fiber ion emitters soldered into the circuit traces. This mechanism is engineered to deliver the highest level of ionization with the least amount of energy in the most compact size. **Designed for 3200 CFM or 8 tons.**

Features

- > 35 Million + and - Ions Per Foot/cc/sec
- Fold-To-Length Circuit
- Local LED Power Indication
- Integral Control Relay for BAS Interface
- Velcro® for Easy Installation
- Voltage Input 110VAC to 240VAC

Perfect For

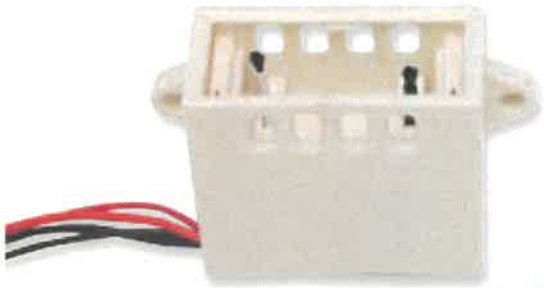
- Traditional Split Systems
- Ductless Mini Splits
- Heat Pump PTACs
- Ducted Modules
- Fan Coils



GPS-NEMA4-OE

The GPS-NEMA4-OE is a NEMA 4X-rated fiberglass enclosure designed to house one GPS-iMOD power supply. The panel adds a superior finished look to any project while providing the required protection against foreign substances, such as water and dust, when power supplies are mounted in non-NEMA 1 rated environment.

COMPACT NPBI



GPS-FC-1™ / GPS-FC-2™

The GPS-FC series is designed to be mounted inside fan coils, heat pumps, PTACs, ductless mini-splits and air handlers up to **1,200 CFM or 3 tons**. Their compact size allows them to be mounted almost anywhere in just a few minutes.

Features

- > 25 Million + and – Ions Per cc/sec
- GPS-FC-1 Powered by 110 - 120 Volts AC
- GPS-FC-2 Powered by 208 – 240 Volts AC
- Carbon Fiber Brushes
- LED Operation Status
- Carbon Fiber Brush Emitters

GPS-FC-3-BAS™

The GPS-FC-3-BAS unit is designed to be mounted inside fan coils, heat pumps, PTACs, ductless mini-splits, and air handlers up to **3,200 CFM or 8 tons**. Its compact size and simple mounting requirements allow it to be quickly mounted almost anywhere.

Features

- > 170 Million + and – Ions Per cc/sec
- Powered by 24 Volts AC
- Carbon Fiber Brush Emitters
- BAS Alarm Contacts
- LED Operation Status

SENSORS & MEASUREMENTS

GPS-iMEASURE™

The GPS-iMEASURE is the first commercially available ion detector that can be permanently mounted in the space to measure ion levels in real time and report back to a BAS.

MONITOR IONIZATION LEVELS REMOTELY

- Auto Calibration/Auto Zero
- 0 – 1,000,000 Ions/cc

GPS-iMEASURE-D™

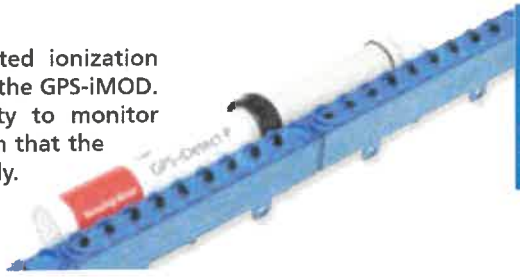
The GPS-iMEASURE-D ion detector is permanently mounted in the duct downstream of any GPS ionization device. It measures ion levels in real time and reports back to a BAS. It includes three sensitivity levels: 20,000/200,000/2,000,000 ions/cc/sec that can be set based on the application and in-duct location.

MONITOR IN-DUCT IONIZATION LEVELS

- 20,000 to 2M Ions/cc
- Input Voltage 12 to 24V AC or DC
- LED Operation Status

GPS-iDETECT-P™

The GPS-iDETECT-P is a plenum-mounted ionization detector that confirms the output from the GPS-iMOD. The GPS-iDETECT-P provides the ability to monitor ionization status in a plenum to confirm that the ionization equipment is working properly.

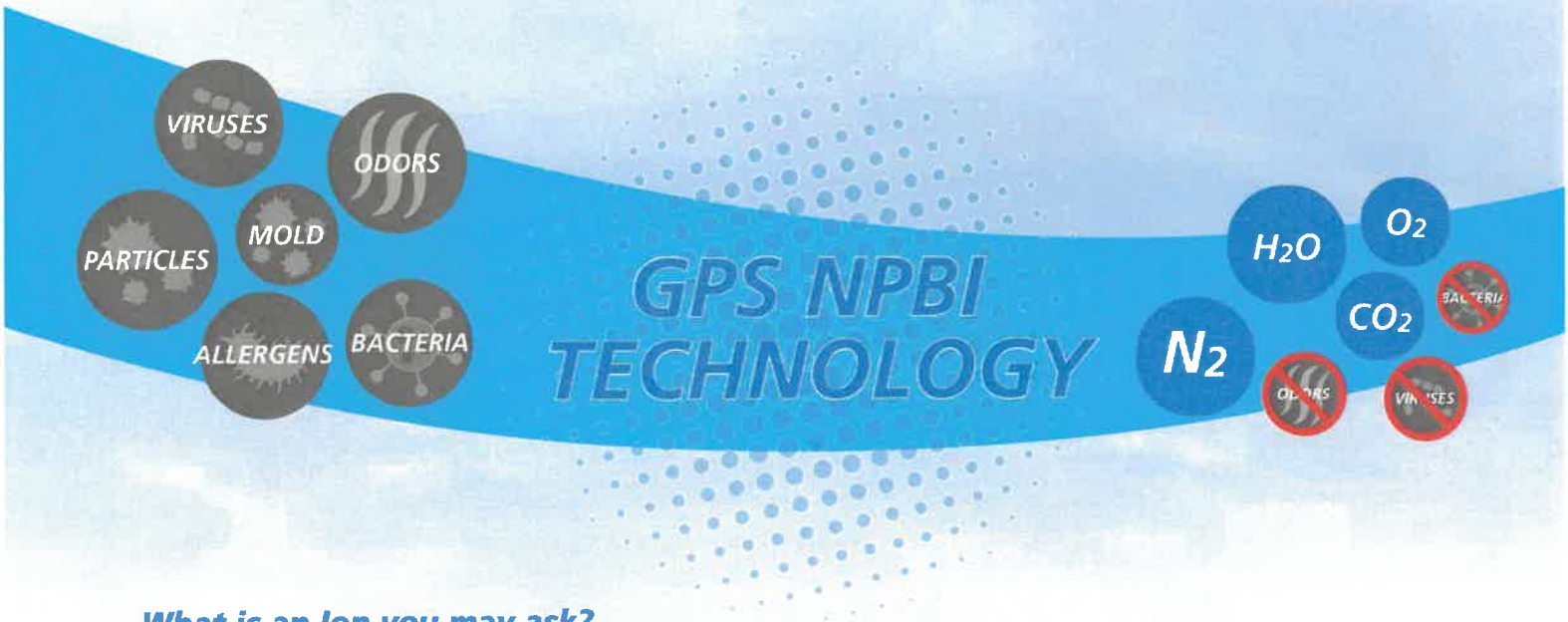


Features

- Universal Voltage Input
- 1,000 – 200,000,000 Ions/cc (+ or -)
- 0-100% Humidity

How Ionization Works

GPS' NPBI technology works to safely clean the air inside industrial, commercial and residential buildings. The patented technology uses an electronic charge to create a plasma field filled with a high concentration of + and - ions. As these ions travel with the air stream they attach to particles, pathogens and gas molecules. The ions help to agglomerate fine sub-micron particles, making them filterable. The ions kill pathogens by robbing them of life-sustaining hydrogen. The ions breakdown harmful VOCs with an Electron Volt Potential under twelve (eV<12) into harmless compounds like O_2, CO_2, N_2, and H_2O. The ions produced travel within the air stream into the occupied spaces, cleaning the air everywhere the ions travel, even in spaces unseen.



What is an Ion you may ask?

An ion is a molecule or atom that is positively or negatively charged, meaning that it has electrons to give or needs electrons to become uncharged, thus becoming stable.

Mother Nature's Way of Cleaning

GPS' technology generates the same ions as Mother Nature creates with lightning, waterfalls, and ocean waves. Mother Nature uses energy to break apart molecules. It is nature's way of cleansing the air naturally and creating a healthy environment. The only difference is that GPS' technology does it without forming ozone or other harmful byproducts.

GPS' NPBI technology has been certified by UL 867 and UL 2998 to be ozone free.

3rd Party Testing Summary

Pathogen	Time in Chamber	Kill Rate	Test Agency
Tuberculosis	60 minutes	69.09%	EMSL
Clostridium Difficile	30 minutes	86.87%	EMSL
Norovirus	30 minutes	93.50%	ATS Labs
MRSA	30 minutes	96.24%	EMSL
Staphylococcus	30 minutes	96.24%	EMSL
Mold Spores	24 hours	99.50%	GCA
E.coli	15 minutes	99.68%	EMSL
Legionella	30 minutes	99.71%	EMSL

Airborne Mold Spores Reduced by 95%

ATS LABS
EXCELLENCE IN ANTIMICROBIAL TESTING
Owned by Accuratus Lab Services

www.GlobalPlasmaSolutions.com

GPS PRODUCT CHART

AUTO-CLEANING LINE	VOLTAGE	CFM RATING	IONS/cc/sec
GPS-FC24-AC	24-240 VAC	2,400	> 300 million
GPS-FC48-AC	24-240 VAC	4,800	> 400 million
GPS-DM48-AC	24-240 VAC	4,800	> 400 million
COMPACT LINE	**VOLTAGE**	**CFM RATING**	**IONS/cc/sec**
GPS-FC-1	110-120 VAC	1,200	> 25 million
GPS-FC-2	208-240 VAC	1,200	> 25 million
GPS-FC-3-BAS	24 VAC	3,200	> 170 million
BARS & STRIPS LINE	**VOLTAGE**	**CFM RATING**	**IONS/cc/sec**
GPS-iMOD	24-240 VAC	50-250 CFM/inch	> 140 million/in
GPS-iRIB-18	110-240 VAC	3,200	> 35 million/ft
GPS-iRIB-36	110-240 VAC	3,200	> 35 million/ft

GPS FACT: Aviation Application

GPS' technology is the only active air purification system that has been designed and approved to operate in commercial and private aircraft. Aviation applications require passing the stringent RTCA DO-160 test proving the technology does not generate EMF, line noise or interfere with the avionics in any way. This is important to note because GPS' technology is used in many healthcare applications and will not cause interference with the imaging equipment.

RTCA
DO-160

GPS®
GLOBAL PLASMA SOLUTIONS
Engineering Air for a Cleaner World™

980-279-5622
www.GlobalPlasmaSolutions.com

D.

Dr. Philip M. Tierno, Jr.
Professor of Microbiology & Pathology
New York University School of Medicine

March 23, 2020

Explanation of Coronavirus and Application of Bi-Polar Ionization to Disinfect Air and Surfaces

Coronaviruses were first identified in the 1960s. Coronaviruses are enveloped RNA viral particles. The symptoms of most ordinary coronaviruses are similar to any other upper-respiratory infection, including runny nose, coughing, sore throat, and varying fever. In most cases you won't know whether you have a coronavirus, or a different cold-causing virus such as a rhinovirus. These ordinary strains are easily treated by over-the-counter medication.

In some of the more serious strains, the coronavirus causes an infection that can spread to the lower respiratory tract and cause pneumonia, especially in older people, people with heart disease, or people with weakened immune systems. Sometimes, but not often, animal coronavirus can jump species & infect humans. Such is the case with the novel coronavirus COVID-19, originally isolated from patients from Wuhan, China and currently causing a global Pandemic. According to the World Health Organization, it likely originated from an animal and passed to humans by contact at a live animal market in Wuhan. There is clearly person-to-person transmission as well as airborne spread (the virus has been reported in the air up to 3 hours). It has also been shown to contaminate hard non-porous surfaces like stainless steel and plastics for up to 3 days. COVID-19 virus infections will likely increase with time. This strain can cause severe respiratory disease, pneumonia, and death in some people especially the elderly and the immunosuppressed.

Keep in mind that COVID-19 virus is among several other serious disease-causing strains of the virus. For example, more than 475 people have died from the MERS coronavirus (Middle East Respiratory Syndrome). The MERS strain originated in Jordan and then Saudi Arabia in 2012 before spreading to other countries in Middle East, Africa, Asia, and Europe. In May of 2015 there was an outbreak of MERS in Korea, the largest outbreak recorded. In 2003, another severe respiratory Coronavirus killed many people and caused several cases of the acute respiratory disease known as SARS (severe acute respiratory syndrome). COVID-19 virus has thus far has caused over 350,000 infections and over 15,000 deaths globally.

In general, most coronaviruses spread in the same manner as other cold-causing viruses: via **aerosols directly** (infected people coughing, sneezing or touching an infected person's hands or face) or **indirect contact** (touching fomites like doorknobs, elevator buttons, elevator buttons, etc. then touching your nose, eyes, or mouth, the conduits of entry into the body). Since the virus is spread via direct and indirect contact, the **continuous application** of Bi-Polar Ions emitted to ambient air by the AtmosAir System continuously disinfect both the breathing space and surfaces. It is the most effective system for continuously cleaning and decontaminating indoor air.

As mentioned above, the possibility of aerosolized spread of COVID-19 and the ability of particles to hang in the air for extended periods of time, would make the consideration of an active air cleaning strategy even more prudent.

Also, because Coronaviruses are enveloped viruses, they are easier to kill compared to naked viruses like Noroviruses. AtmosAir has shown significant reduction of bacteria and viruses in both laboratory and in situ testing. Spaces like airport terminals where travelers from affected regions may carry and spread this virus could implement the AtmosAir bi-polar ionization air cleaning system as a step to combat the spread of illness.

Dr. Philip M. Tierno, Jr
Professor of Microbiology & Pathology
New York University School of Medicine

E.

Global Plasma Solutions Virtually Eliminates Static SARS-CoV-2 with Proprietary NPBI™ Technology

Global Plasma Solutions is the first air purification solution to test SARS-CoV-2, achieving a 99.4% reduction of the surface strain within 30 minutes

CHARLOTTE, NORTH CAROLINA — June 10, 2020 — Global Plasma Solutions, the leader in Indoor Air Quality, announced today industry-leading ionization testing results, demonstrating a 99.4% reduction rate on a SARS-CoV-2 (COVID-19) surface strain within 30 minutes, the first instance in which an air purification company has effectively neutralized SARS-CoV-2. Following initial testing of coronavirus 229E in March 2020, Global Plasma Solutions utilized its proprietary needlepoint bipolar ionization to inactivate SARS-CoV-2. The study was jointly executed with Aviation Clean Air.

In this laboratory study, Aviation Clean Air designed a test to mimic ionization conditions like that of a commercial aircraft's fuselage. Based on viral titrations, it was determined that at 10 minutes, 84.2% of the virus was inactivated. At 15 minutes, 92.6% of the virus was inactivated, and at 30 minutes, 99.4% of the virus was inactivated.

"The testing results we achieved through our proprietary needlepoint bipolar ionization technology clearly demonstrate that Global Plasma Solutions is the gold standard in air purification," said Global Plasma Solutions Founder and Chief Technology Officer, Charles Waddell. "For any kind of facility from commercial buildings to aircrafts, delivering the cleanest, safest indoor air environment will only become increasingly more important, and our ozone-free technology is one of the most sophisticated products on the market."

Understanding needlepoint bipolar ionization

Needlepoint bipolar ionization works to safely clean indoor air, leveraging an electronic charge to create a high concentration of positive and negative ions. These ions travel through the air continuously seeking out and attaching to particles. This sets in motion a continuous pattern of particle combination. As these particles become larger, they are eliminated from the air more rapidly.

Additionally, positive and negative ions have microbicidal effects on pathogens, ultimately reducing the infectivity of the virus. Global Plasma Solutions' needlepoint bipolar ionization is ozone-free and the only kind in its category to pass the RCTA DO-160 standard for aircraft. Traditional bipolar ionization systems produce harmful ozone as a byproduct.

About Global Plasma Solutions

Global Plasma Solutions (GPS) is the leader in Indoor Air Quality, with over 30 patents and more than 150,000 installations worldwide using our needlepoint bipolar ionization (NPBI) technology to deliver clean indoor air that is safe and healthy – producing neither ozone nor other harmful by-products. All of our NPBI products are UL and CE certified and registered and use NPBI to purify the air by eliminating airborne particulates, odors and pathogens. GPS was founded in 2008 and is headquartered in Charlotte, North Carolina.

4.

NPBI AS REPLACEMENT TO UVC

Needlepoint Bi-polar Ionization vs. UVC

	Bi-polar Ionization	UVC Light
Replacement Interval?	NONE	Annually
Produces Detectable Ozone?	NO	No
Kills Mold, Bacteria and Virus?	YES	Yes
Kills Pathogens in the Space?	YES	No
Controls Odors?	YES	No
Reduces Particulate?	YES	No
Contains Mercury?	NO	Yes
Electrodes Fragile?	NO	Yes
Shock Resistant?	YES	No
Hazardous Disposal Required?	NO	Yes

***NOTE:** Cleans entire coil depth, not just "line of sight"*

WET SIDE

DRY SIDE

GlobalPlasmaSolutions.com

G.

INDEPENDENT LABORATORY TEST RESULTS

Pathogens

GPS®

Reducing the Spread of Disease

GPS clears the air of particles faster

Particulate matter includes pollutants, dust, allergens, mold, bacteria – and viruses. GPS' technology constantly generates a high concentration of positively and negatively charged ions. These ions travel through the air continuously seeking out and attaching to particles. Larger by virtue of combination, these particles are removed from the air more rapidly.

GPS Inactivates Pathogens

When ions come into contact with pathogens, their microbicidal effects reduce the infectivity of the virus.

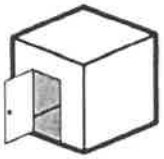
GPS is Safe

Our needlepoint bipolar ionization is OZONE free and safe to use across commercial, industrial and residential buildings. Traditional bipolar ionization systems produce harmful ozone as a byproduct.

Performance Validation*

SENSITIVITY TESTING

A petri dish containing a pathogen is placed underneath a laboratory hood, then monitored to assess the pathogen's reactivity to NPBI™ over time. This controlled environment allows for comparison across different types of pathogens.



SIMULATION TESTING

Counts of airborne pathogens are taken before and after aerosolizing them into a sealed, unoccupied laboratory environmental room installed with NPBI™ technology. The larger space more closely resembles a real-world environment.

*Global Plasma Solutions (GPS) uses multiple data points to formulate performance validation statements. GPS technology is used in a wide range of applications across diverse environmental conditions. Since locations will vary, clients should evaluate their individual application and environmental conditions when making an assessment regarding the technology's potential benefits.

SARS-CoV-2

Laboratory Name: Innovative Bioanalysis
Cap Lic No: 9501843
Date: 5/27/2020
Pathogen Tested: SARS-CoV-2

INNOVATIVE BIOANALYSIS
creating solutions | getting results

SENSITIVITY TEST

Objective:

Aviation Clean Air commissioned testing on Global Plasma Solutions' GPS-DM48-AC model to assess its ability to neutralize SARS-CoV-2 in high-ion concentration specialty applications.

Methodology:

Single RE22 control chambers were set on a stainless steel table with pressure verification seals. The chambers had an internal working dimension of 16.5"W x 9"H x 12"D for a total cubic footage of 1.031. Under initial observation it was determined to seal the unit completely with no intake or exhaust port. Testing and control were conducted in an average ambient temperature of 72.6 degrees Fahrenheit.

A singular fan unit was set up at a 45-degree angle and affixed to the testing chamber. The initial control fan speed was measured at an average of 870 Ft/m. Under the original control section, the primary fan was set 10 inches away from ion production unit A and the average air flow speed past the ion producing nodes was 250Ft/m.

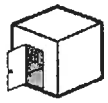
Experimental Results:

SARS-CoV-2 was exposed to needlepoint biploar ionization for a period of 10, 15, and 30 minutes. Based on viral titrations it was determined that at 10 minutes 84.2% of the viral particles became inactive, at 15 minutes 92.6% of the viral particles became inactive, and at 30 minutes 99.4% of the viral particles became inactive.

TIME IN CHAMBER	RATE OF REDUCTION
30 MINUTES	99.4%

Norovirus

Laboratory Name: ATS Labs
Project No: A14991
Date: 5/28/2013
Pathogen Tested: Feline Calicivirus



SIMULATION TEST

Objective:

The testing was conducted on the GPS-2400-1 model for its ability to inactivate Feline Calicivirus bacteria in the air.

Methodology:

The middle support bracket was attached to the bar containing one GPS-2400-1 Cold Plasma Generator at each end of the bar. The generators were placed with the carbon fiber brushes pointing down, in the back of a hood with the hood sash closed. Minimum Essential Medium (MEM) was supplemented with 5% heat-inactivated fetal bovine serum, 100 units/mL penicillin, 10 ~g/mL gentamicin, and 2.5 ~g/mL amphotericin B.

Experimental Results:

A 93.5% average reduction in viral titer was demonstrated following a 30 minutes of exposure time, as compared to the average titer of the dried virus control. The average log reduction in viral titler was 1.19 log.

Human Coronavirus

Laboratory Name: ALG Labs
Project No: A29381
Date: 4/14/2020
Pathogen Tested: Human Coronavirus, ATCC VR-740, Strain 229E

SENSITIVITY TEST

Objective:

Testing was conducted on GPS' technology to assess its ability to inactivate Human Coronavirus on a glass surface.

Methodology:

A glass carrier with the pathogen was placed 1" from the carbon fiber brushes of the GPS technology. The petri dish carriers were exposed to GPS' needlepoint bipolar ionization device for 1 minutes, 5 minutes, 15 minutes, 30 minutes and 60 minutes at room temperature and relative humidity. Following the exposure time, the carrier was removed and an aliquot of test medium was added to the petri dish.

Experimental Results:

A 90.0% average reduction in viral titer was demonstrated following a 60 minutes of exposure time, as compared to the average titer of the dried virus control. The reduction in viral titler was 1.00 log.

TIME IN CHAMBER	RATE OF REDUCTION
60 MINUTES	90.0%

Legionella

Laboratory Name: EMSL Analytical, Inc.
EMSL No: 151508127
Date: 10/14/2015
Pathogen Tested: Legionella pneumophila

SENSITIVITY TEST

Objective:
Testing was conducted on the GPS-2400 model to assess its ability to inactivate bacteria on a solid surface.

Methodology:
Legionella pneumonphila (L. pneumophila) was inoculated onto buffered charcoal yeast extract agar (BCYE) and incubated at 35°C for 48 hours. Colonies were harvested, suspended in phosphate buffer water, and vortexed for 1 minute to ensure homogenization. This suspension was then used to inoculate the test carriers.

Experimental Results:
The GPS-2400 system demonstrated the strongest efficacy after 30 minutes of exposure by inactivating 99.71% of the L. pneumophilae bacteria.

TIME IN CHAMBER	RATE OF REDUCTION
30 MINUTES	99.7%

Clostridium Difficile

Laboratory Name: EMSL Analytical, Inc.
EMSL No: 371208933
Date: 6/26/2011
Pathogen Tested: Clostridium difficile ATCC 70057

SENSITIVITY TEST

Objective:

Objective: Testing was conducted on the GPS-iBAR-36 model to evaluate its effectiveness in disinfecting solid surfaces contaminated with C. Difficile.

Methodology:

The GPS-iBAR-36, needlepoint bipolar ionization system, was first set up facing down with 5 cm of clearance from the surface. The test carriers in their respective Petri-dishes were then placed under the GPS-IBAR-36 and the system was turned on. The control was not exposing to the ionizer and instead placed directly into 10 mL of PBS. Serial dilutions were then created for each carrier by taking 1mL out and placing it into the 9 mL of PBS. For each dilution 100µL was plated onto a TSAB plate. The inoculated plates were then incubated in anaerobic conditions at 37°C for 48 – 72 h. The colonies were counted and recorded.

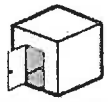
Experimental Results:

In conclusion, the GPS-IBAR-36 demonstrated the ability to disinfect C. difficile on a solid surface with an observed percent reduction of 86.87% in 30 minutes.

TIME IN CHAMBER	RATE OF REDUCTION
30 MINUTES	86.8%

Turberculosis

Laboratory Name: EMSL Analytical, Inc.
EMSL No: 371106420
Date: 7/15/2011
Pathogen Tested: Mycobacterium terrae ATCC 15755



SIMULATION TEST

Objective:

Testing was conducted on the GPS-iBAR-36 model to determine its ability to inactivate the bacteria in the air.

Methodology:

M. terrae first was innoculated on Tryptic Soy agar + 5% sheep blood (TSAB) and incubated at 35°C for 5 days under carbon dioxide conditions. A sterile inoculation loop was then used to collect colonies and place them into 5 mL of normal saline solution. Once testing was ready to begin, 60 psi of compressed air was pumped through the nebulizer, creating the release of 10.8 mL/h of aerosolized solution. This was run for 28 minutes, allowing for a total of 5 mL of solution being aerosolized into the test chamber.

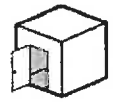
Experimental Results:

After correcting for the natural rate of decay it was observed that there was a 0.38 log reduction after 30 minutes of exposure and a 0.51 log reduction after 60 minutes of exposure. In conclusion, the GPS-IBAR-36 was observed to reduce M. Terrae by 69.09%

TIME IN CHAMBER	RATE OF REDUCTION
60 MINUTES	69.0%

MRSA

Laboratory Name: EMSL Analytical, Inc.
EMSL No: 371106420
Date: 6/13/2011
Pathogen Tested: Methicillin Resistant Staphylococcus aureus (MRSA) ATCC 33591



SIMULATION TEST

Objective:

Testing was conducted on the GPS-iBAR-36 model to determine its ability to inactivate the bacteria in the air.

Methodology:

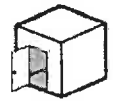
The nebulizer was connected to an air compressor with 1/4 inch plastic tubing and to the environmental test chamber through one of the testing openings created. The fan was turned on to create an air flow in the chamber but the ionizers were not turned on until after the initial sampling. Once testing was ready to begin, 60 psi of compressed air was pumped through the nebulizer creating the release of 10.8 mL/h of aerosolized solution. This was run for 28 minutes, allowing for a total of 5 mL of solution to be aerosolized into the test chamber.

Experimental Results:

In conclusion, the GPS-IBAR-36 demonstrated the ability to disinfect MRSA from the air with a 96.24% reduction after 30 minutes of exposure.

E. Coli

Laboratory Name: EMSL Analytical, Inc.
EMSL No: 371106420
Date: 7/21/2011
Pathogen Tested: Escherichia coli ATCC 8739



SIMULATION TEST

Objective:

Testing was conducted on the GPS-iBAR-36 model to determine its ability to inactivate the bacteria in the air.

Methodology:

The nebulizer was connected to an air compressor with 1/4 inch plastic tubing and to the environmental test chamber through one of the testing openings created. The fan was turned on to create an air flow in the chamber but the ionizers were not turned on until after the initial sampling. Once testing was ready to begin, 60 psi of compressed air was pumped through the nebulizer creating the release of 10.8 mL/h of aerosolized solution. This was run for 28 minutes allowing for a total of 5 mL of solution to be aerosolized into the test chamber.

Experimental Results:

In conclusion, the GPS-IBAR-36 demonstrated the ability to disinfect E. coli from the air with a 99.54% reduction after 30 minutes of exposure and a 99.23% reduction after 60 minutes of exposure.

Furthermore, these results demonstrate that the needlepoint bipolar ionization system tested does not require direct line of sight to produce inactivation rates comparable to those of ultraviolet light. The needlepoint bipolar ionization system's inactivation rates are indicative of those in the entire space.

Independent Laboratory Testing Results Summary

GPS

PATHOGEN	TIME IN CHAMBER	RATE OF REDUCTION	TESTING LAB
SARS-CoV-2	30 MINUTES	99.4%	INNOVATIVE BIOANALYSIS
Norovirus*	30 MINUTES	93.5%	ATS LABS
Human Coronavirus**	60 MINUTES	90.0%	ALG LAB GROUP
Legionella	30 MINUTES	99.7%	EMSL
Clostridium Difficile	30 MINUTES	86.8%	EMSL
Tuberculosis	60 MINUTES	69.0%	EMSL
MRSA	30 MINUTES	96.2%	EMSL
Staphylococcus	30 MINUTES	96.2%	EMSL
E. Coli	15 MINUTES	99.6%	EMSL

* Surrogate for Norovirus, actual strain tested was Feline Calicivirus, ATCC VR-782, Strain F-9
** Surrogate for Human Coronavirus SARS-CoV-2, actual strain tested was Human Coronavirus 229E