BETTER

INDOORS

Clean Air for Healthy Buildings

RGF®

ENVIRONMENTAL GROUP, INC.

ISO 9001:2015 CERTIFIED COMPANY

Case Study

The Challenge:

BUPA is one of the world's leading health insurance and healthcare companies.

BUPA has expressed a potential interest in PHI/REME active air purification for continuously sanitising the air and surfaces in the common passageways of its UK care homes to provide extra protections against indoor viral emissions to its patients, staff and visitors with a view to minimising and preventing community spread of norovirus and other pathogens and minimising staff absenteeism thus optimising staff productivity as the UK prepares to emerge from the COVID pandemic.

BUPA designated its Leominster Care Home (first floor common passageways) as the location for this Case Study. This location is currently fully staffed.

The Solution:

BUPA Leominster first floor comprises 31 patient rooms plus a number of other rooms and 7 corridor areas separated by fire doors which remain open at all times thus creating a single common passageway throughout the entire floor. The ventilation strategy of the building is System 1. Background ventilation is provided via trickle vents on windows. Extraction ventilation is via decentralised extractors. A total of 6 standalone HALO ROVE units and 3 REME ION units were installed at strategic points on the ceilings in the common passageways. These units run 24/7 365 days a year and require virtually no maintenance save for filter cleaning (REME IONs only) every 3 months and cell changing every 2 years.

The HALO ROVE and REME ION units comprise the world leading PHI/REME active air purification technology that is proven to eliminate harmful bacteria and viruses including Norovirus, SARS-CoV-2 and VOCs throughout the indoor environment.

Manufactured by US based RGF Environmental Group Inc, the technology uses no chemicals or harmful substances and works by continuously maintaining similar concentrations of hydrogen peroxide molecules, to those found in the outdoor air.

When coming into contact with microbials and VOCs, the naturally occurring molecules break them down, destroy them and then revert the back to harmless water vapour and oxygen. The air purification technology produces 1 quadrillion of these molecules every second, quickly killing any airborne virus or bacteria, including COVID-19.

The Outcome:

The HALO ROVE and REME ION units were installed on 21/22 October 2021. Prior to the installation on 20 Oct 2021, 5 ATP swab locations were identified and a single set of 5 control readings were taken. A second set of 5 ATP swabbings were taken at the same locations on 4 Nov 2021.

ATP measurements showed an average 66.67% reduction in potentially harmful microbial contaminations across the 5 swab locations.

Context / The Problem

The COVID pandemic has brought with it unique challenges:

- Deadly mutating respiratory virus that transmits rapidly via airborne and surface routes
- People are most contagious without showing symptoms (asymptomatic)

Transmission mitigation measures have focussed on:

- Wearing of masks, washing of hands, social distancing
- Test & trace processes that trigger self isolation/distancing
- More frequent cleaning/disinfection processes, increased ventilation, use of filtration/UVC
- Lockdowns to force people apart from each other

The fact that subsequent waves have occurred all around the world illustrates the relative futility of these mitigations and what underlies this is their ineffective and behavior dependent nature in the context of asymptomatic contagion and the inexplicable exclusion of safe and proven environmental air treatments. Experience has shown us that as soon as lockdown measures are lifted and people start to mix together again the indoor R rate starts to rise and COVID infections still occur in buildings where the COVID mitigation guidance is followed to the letter including hospitals, care homes, factories and supermarkets.

The simple fact is that these ineffective and behavior dependent measures against this asymptomatic virus are not enough. The indoor R rate will always be at risk of rising because the measures do not create real time continuous protection against COVID emissions. In other words there is no indoor environmental process that instantly and continuously destroys the virus at the point of emission either into the air or onto surfaces. Even with the vaccine rollout, the UK still runs the risk of having to repeat the cycle of lockdowns along with the associated economic risks unless a solution to controlling the indoor R rate especially in high occupancy locations such as offices is adopted that is effective without relying on the actions or behaviours of people. RGF's technology is one such solution.

Further to this, it is essential for employers to demonstrate their buildings are safe environments back to which their staff and customers can confidently return. Equinix is aware of the limitations of the current measures and is considering whether it can fulfill its desire to create the safest possible indoor environment for their staff and customers through the implementation of RGF's safe and proven environmental air purification technology.

Overview of Solution & Technology

Limitations of COVID Mitigation Measures

Ventilation is important but:

- It can make rooms uncomfortably cold
- It increases energy consumption and cost
- It increases outdoor pollution ingress
- It does not destroy viruses

Active air purification safely avoids these consequences whilst creating environmental protection throughout the air and surface space.

What is Active Air Purification ?

- Non-chemical process that imitates nature's air cleaning processes indoors.
- Ionised hydroperoxides produced from patented photocatalytic reaction (broad spectrum UV/quad metal catalyst) and ambient water vapour that reach into every cubic cm of air and surface space.
- Effective across all 3 categories of pollutants – microbials, VOCs/gases/odours and particulates/smoke.
- Breaks down microbials through cell lysing and VOCs/odours by changing molecular structure and rendering cell harmless. Agglomerates particulates.
- Treats the air and surfaces. Provides real-time instantaneous and continuous protection against emissions and fomites of common and dangerous viral and bacteria including SARS-CoV-2 anywhere in the indoor space.
- Developed over 15 years ago. 35 year old manufacturer. Tested, proven and widely used. Millions of installs in over 60 countries.
- Creates environmental effect. Adds unique extra layer of protection
- Not behaviour dependent
- Creates safer healthier future proofed environments

Why is our Active Air Purification different ?

An environmental process that works everywhere simultaneously and continuously. This is a completely different process to passive air treatments.

Passives only treat air that passes close or through giving no real time continuous protection elsewhere.

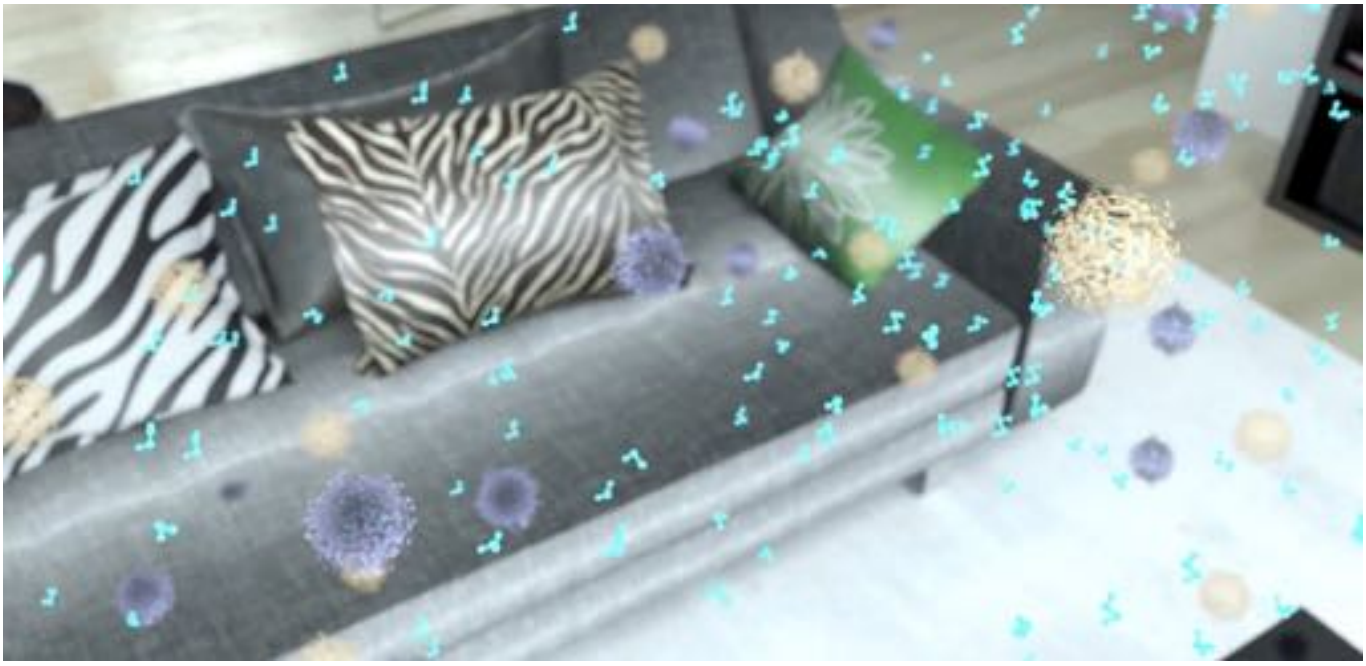
- Viral emissions are alive until removed by ventilation or caught by the system.
- No protection against fomites
- No guarantee of removal when passing by/through

Passive technologies include filtration, UV-C, PCO and bipolar ionization

What are the known benefits of Active Air Purification ?

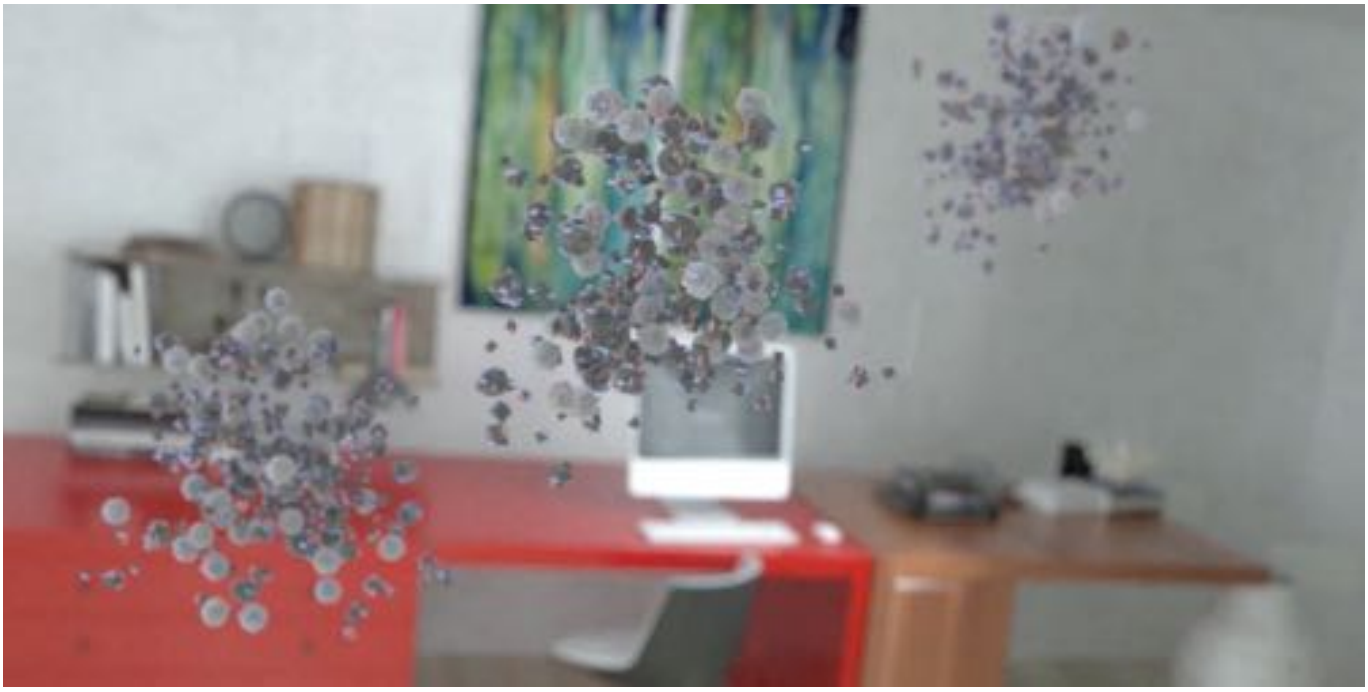
- Improved IAQ. Improved health & wellbeing
- Reduced illness, HAIs and absenteeism. Improved productivity
- Reduced energy costs. Improved energy efficiency
- Eliminates need/cost of recurrent fogging
- Added layer of protection for frontline NHS/emergency workers
- Creates safer, healthier indoor environments
- Improves staff and customer confidence in indoor spaces
- Products for all types of buildings/HVAC, vehicles
- Quick and easy to retrofit (2-4 weeks)
- Affordable. Lease rental / hire purchase options
- Rapid procurement

The Technology Inside



Photohydroionisation (PHI) provides instant protection against viral emissions including SARS-CoV-2 and other dangerous pathogens plus VOCs and gases throughout the air and surface.

Reflective Electro Magnetic Energy (REME) is a more advanced version of PHI with integrated bipolar ionisation for particulate control



PHI units can be accompanied by quadpolar ionisation units for particulate control.

- PHI invented in late 1990s. Came to prominence post 9/11 late 2001
- Sandia Labs / Sneeze Machine developed to prove process
- REME invented 2006
- Both technologies are protected by global patent

Safety

- Units designed to maintain vaporised hydrogen peroxide "equilibrium" – 0.02 ppm or 2% of EH40/2005 Workplace Exposure Limit (1 ppm).
- World's first to comply with UL-867 v5 Verified Zero Ozone by ETL-Intertek. Does not exceed 0.005ppm or 5ppb ozone

- Millions of installations in over 60 countries
- Completely safe. Never a single safety issue

Efficacy (across all 3 pollutant categories)

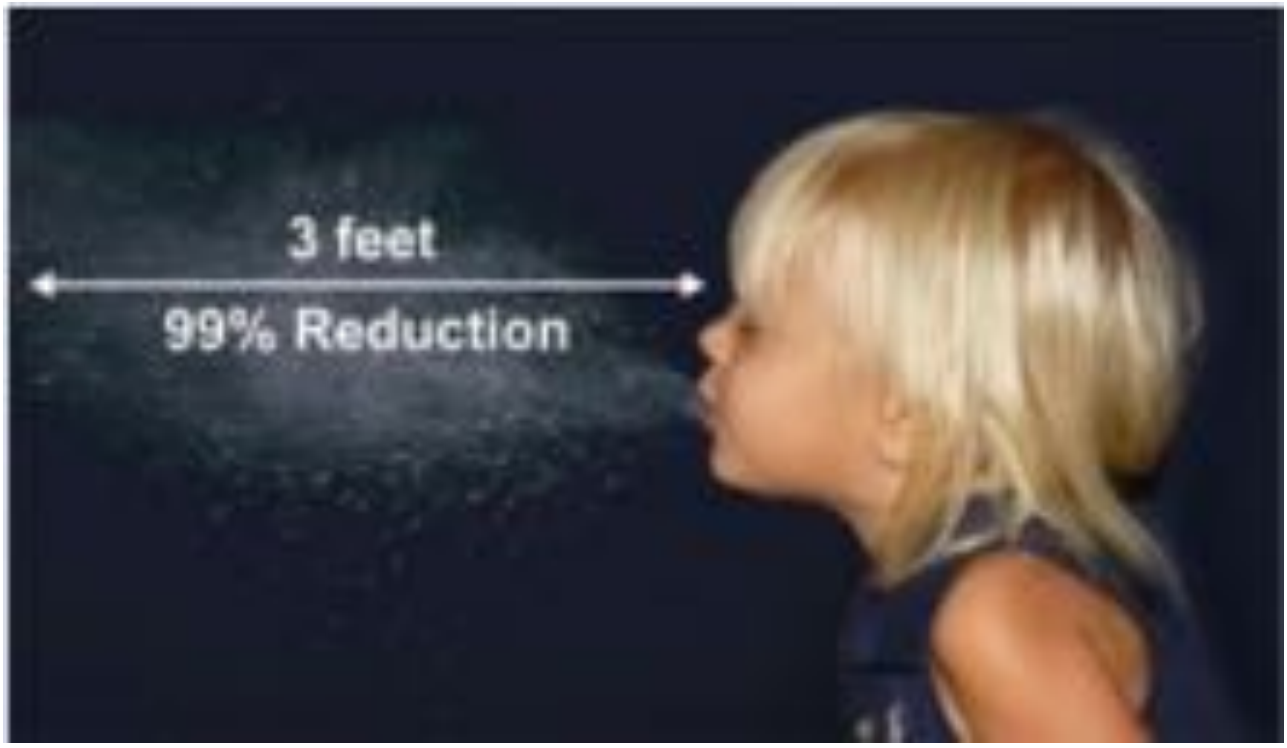
(quoted samples from university and independent lab tests and major corporation studies)

- 99.99% reduction in surface and aerosolized SARS-CoV-2
- 99+% reduction in surface H1N1 swine flu
- 4-log reduction (99.99%) surface bacteria/virus
- 99% of human sneeze microbes killed at 3 feet
- 97% airborne bacteria reduction
- 99% reductions of E-Coli, Listeria, Strep, Tuberculosis, Bird Flu and many others
- 85% odour reduction
- 97% airborne mould spore reduction
- US Military approved for mould protection in field hospitals
- Hospital approvals Infectious Diseases – US and International 99% reduction of Staph (MRSA)
- Major US city school reported 20% reduction in absenteeism
- Tested and approved by the Chinese government in 2003 for protection against SARS-CoV-1
- Fox News 3-part indoor air series featured RGF and concluded substantial mould and bacteria reductions
- RGF's technology has been featured on Fox, ABC, CBS and in Popular Science Magazine

➢ Cells produce 1 quadrillion ionised VHP molecules every second.
➢ No other technology comes close for reach and scalability
➢ Translates into best value for money

Testing & Compliance

- RGF pioneered the development of aerosolized microbial testing protocols which remain unique in the world
  - 2006 Sneeze Machine tested by KSU
  - Kills 99% of sneeze germs within 3 feet



- 99.9% reduction in surface and aerosolized SARS-CoV-2.
  - 2020 Innovative Bioanalysis – 8'x20'x20' chamber. Kill rate same at varying distances proving environmental effect throughout chamber

- Tested and approved by
  - ETL Intertek, TUV SUD, CSA
  - US Military
  - Chinese government
  - Japanese government
  - Canadian government
  - European Union (CE markings)
  - Norovirus/MRSA protection plans of US restaurant chains, theme parks, cruise lines, public schools and hospitals

Who Are We ?

RGF® ENVIRONMENTAL GROUP, INC.
ISO 9001:2015 CERTIFIED COMPANY

- 35 year old world leader in environmental manufacture and innovation
- 500 products (air & water purification, food sanitisation)
- 32 active patents
- 700+ staff
- $5m+ in new production facilities in 2020
- Global distribution network – 60+ countries
- 500% global sales growth in 2020
- COVID critical manufacturer (US Dept Homeland Security)

The Deployment

The following photographs show the installed locations of the HALO ROVE and REME ION units on the ceilings of the common passageways at BUPA Leominster.

External View – Rear Entrance

REME ION 1

HALO ROVE 1

HALO ROVE 2

HALO ROVE 3

REME ION 2

HALO ROVE 4

HALO ROVE 5

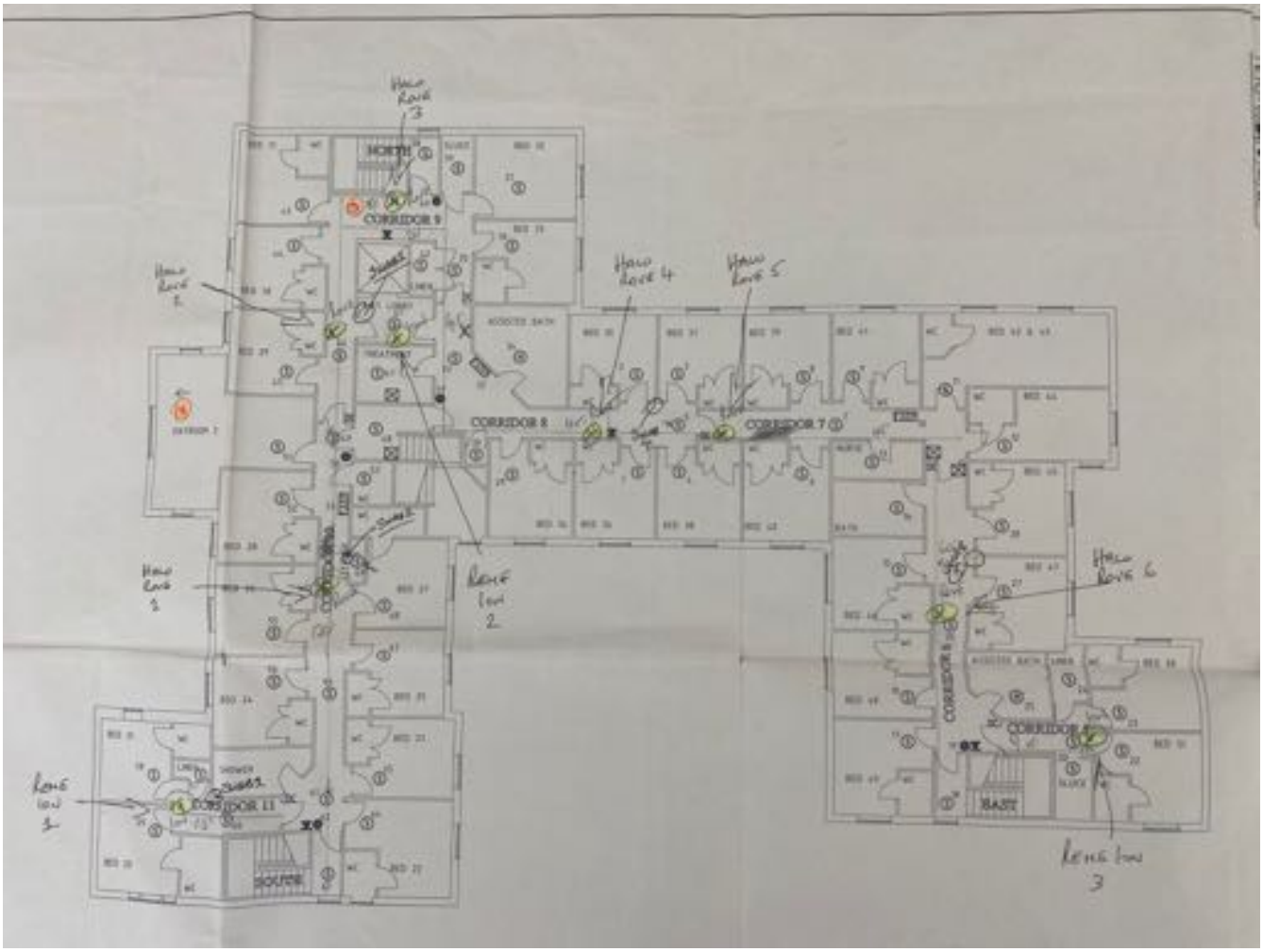
HALO ROVE 6

REME ION 3

Proving the Environmental Effect

BUPA Leominster is currently staffed at normal capacity.

The below floor plan diagram shows the ATP swab locations in relation to the HALO ROVE and REME ION unit positions



The measured ATP readings show an overall cumulative reduction in actual ATP/RLU across all swab locations of 66.67% over 15 days.

Location Name	20/10/21	04/11/21	Change	%
	CONTROL	+ 360 HOURS 15 DAYS		
Swab Location 1 (Corridor 11)	66	4	62	93.94
Swab Location 2 (Corridor 10)	99	38	61	61.62
Swab Location 3 (Lift Lobby area)	334	134	200	59.88
Swab Location 4 (Corridor 8/7)	89	33	56	62.92
Swab Location 5 (Corridor 6)	129	30	99	76.74
	717	239		
	Change	478		
	Change %	66.67		
Carbon Dioxide (proxy for ventilation)	633 ppm	GOOD	per IAQ Rating Index - IAQ UK	

NOTES

1. The unit locations were selected per normal specification methodology from the manufacturer.

2. The units have been running 24/7 since installation per normal operating instructions.

3. We measured CO2 levels during the control visit given the natural ventilation strategy of the building which is notoriously inefficient especially during winter. It was evident during both visits that staff are proactively ventilating the property and the measured CO2 levels show the ventilation rates are sufficient.

4. BUPA Leominster advised there had been approx. 5 instances of Norovirus infections in recent days in patient rooms and with one member of staff but importantly there has been no evidence of community transmission which suggests the process is having the desire effect in the common passageways. We recommend installing units in all occupied spaces including patient rooms for optimal protection. Please note we do not claim the technology will stop all infections and transmissions. Best protections are achieved when the entire building and all indoor spaces are being actively treated.

5. There are various ATP scoring systems depending on vertical. In general levels between 20-30 are considered clean, between 30-80 as moderate/watch and 80+ as dirty/in need of cleaning. On this measure the test created 2 clean surfaces and 2 moderate/watch surfaces from 1 moderate and 4 dirty in essentially 15 days of treatment. This is an effective continuous treatment and a clear demonstration of the unique active capability of PHI/REME in occupied spaces.

ATP Swab Photos
Control 20/10/21

Treated 4/11/21

What is ATP/RLU ?

Adenosine Triphosphate, or ATP, is the energy molecule found in all living things, making it a perfect indicator when trying to determine if a surface is clean or not. Companies use ATP systems to rapidly verify surfaces have been cleaned thoroughly.

An ATP monitoring system analyses the light emitted from the ATP on a swab sample when mixed with a reagent. The light emitted is in direct proportion to the amount of ATP present in the sample. ATP is measured in RLU's (relative light units). Therefore the greater the ATP or surface contamination, the higher the RLU.

It must be noted that ATP/RLU is simply a measure of how much cellular debris there is on a surface at the time of the swabbing. It will not give a reading on how much of that debris is dead or alive. Also, any high traffic touch point will sometimes show increases in ATP/RLU but that doesn't mean the process is not working and protection is not happening in the air or on surfaces and it would be entirely wrong for such conclusions to be drawn. The following analogy might help illustrate what is going on at the molecular level.

Imagine going to the garden and taking a spade full of dirt and spreading it over a table surface and then placing a grain of rice on top of the dirt. The dirt is all the cellular debris on a surface and the grain of rice is a virus that has fallen onto a surface (molecule sizes do not compare in this analogy). These exposed dirt and virus cells are instantly and continuously deactivated yet they will still show up on a ATP/RLU measure because it takes time for the cells to be broken down sufficiently to reduce the ATP reading. Then each time you touch a surface you effectively add another layer of dirt which increases the ATP reading even though the deactivation starts immediately on the new exposed layer giving immediate protection.

Background & Context – ATP/RLU Surface & Aerosolized Microbial Testing

It must be noted that the ATP/RLU metric is the only practical measure for this process that is in any way meaningful and is not astronomically expensive. ATP/RLU has been used by other adopters of RGF technology including Lloyds of London. Another method is air swabbing for bacteria and mould but this is not the most relevant for an office wishing to protect against viral emissions. In fact there are no currently available standards or protocols for testing the removal of airborne aerosolized virus anywhere in the world so any such attempts at testing this area will incur serious expense.

RGF is responsible for the most meaningful research and testing of aerosolized virus removal techniques over the past 2 decades having first developed the Sneeze Machine and aerosolized test protocol in the aftermath of 9/11 in consultation with Sandia Labs and the US Dept of Homeland Security. Their most recent research collaboration is the 2020 multi phase testing of PHI and REME by Innovative Bioanalysis against the actual aerosolized SARS-CoV-2 virus using a real world sized 8'x20'x20' chamber – the only testing of its kind anywhere in the world. This produced 3-4+ log reductions throughout the chamber proving the environmental effect. This work has spawned interest from academic and governmental authorities to establish the world's first real time aerosolized virus removal air model. In a recent video Dr James Marsden, Executive Director of Science and Technology at RGF said "we will be the first to have a true air model to test what is happening in the air in real time".

Therefore, the only truly meaningful data evidence that exists for the removal of aerosolized SARS-CoV-2 virus is that performed by RGF and Innovative Bioanalysis. All other evidence is anecdotal but no less powerful. Better Indoors' most recent domestic installation is a good case in point. A family in Hounslow recently installed PHI on the same day a family member was diagnosed with COVID who was already suffering severe symptoms (eyes swollen and very painful, severe headache, high temperature, no

taste, lack of appetite). Self isolation and social distancing in the property is a challenge due to lack of space with one person sleeping in very close proximity to his infected brother and they do not open windows due to the cold. After 2 days his symptoms had eased significantly and were gone completely after 3 days and no other family member has become infected after 30 days despite all family members having had 3 further COVID tests. On top of this the indoor air is fresher and the allergy symptoms of one family member have subsided for the first time in years.

Comparison to VHP Fogging

Fogging processes are surface treatments. They offer no protection against aerosolized virus. Most use 5% VHP which is deadly whereas RGF's process is constantly maintained at between 0.0001-0.0004% VHP - same as the outside air. Obviously there is a big difference between these two levels but our prior ATP testing with Lloyds showed our process can break down cellular material just as quickly when averaged over a minimum period of 48 hours. The process kills aerosolized pathogens instantly as the KSU Sneeze Test of 2006 proved but as described above you cannot test in the real world without incurring serious expense. Also we caution against the use of real time viral readers with RGF because these will show incorrect values as they will count dead viral cells as well as live ones.

Fogging processes claim 4-6 log reduction in surface contaminations (99.99-99.9999%) but this is only a snapshot in time. What fogging companies dont tell you is recontamination starts immediately after the fogging (despite their claims) so the 99.9999% is irrelevant because none of us live in a snapshot moment - we all live in continuous time. RGF's process is 3.5-4+ log reduction (99.96-99.99%) but is continuous everywhere and the various surface and aerosolized testing and real world anecdotal evidence proves this is sufficient for any indoor environment. The performance of the RGF process must not be directly compared to fogging or surface disinfection wiping. These are one off more powerful toxic processes that cannot be compared to a safe continuous one that happens in background with people present.

The following example illustrates the "value" of each log reduction step. A colony of 1 million MRSA bacteria would reduce thus:

- A 1-log kill reduces the colony to 100,000 bacteria after a 90% reduction;
- A 2-log kill reduces the colony to 10,000 bacteria after a 99% reduction;
- A 3-log kill reduces the colony to 1,000 bacteria after a 99.9% reduction;
- A 4-log kill reduces the colony to 100 bacteria after a 99.99% reduction;
- A 5-log kill reduces the colony to 10 bacteria after a 99.999% reduction;
- A 6-log kill reduces the colony to 1 MRSA bacterium after a 99.9999% reduction