PRS

The world's leading UVC Solution for
Commercial Air Handling Systems

PRS FOR HEALTHCARE:
EFFICACY & PERFORMANCE

Patents

Granted:
GB 2601361 B, GB 2614287 B

Applications:
Worldwide: PCT/GB2021/0503091
UK: 2208032.9

PATHOGEN
REDUCTION SOLUTIONS

Contents

PRS Healthcare Benefits

There are considerable advantages to installing PRS systems in healthcare settings:

- Reduction of airborne pathogens means:
  - Improved patient outcomes
  - Less intra-ward transmission
  - Higher staff confidence and productivity
  - Generally greater operational efficiency
- Increased air recirculation due to sanitisation means:
  - Considerably less HVAC energy consumption
  - Reduction in amount of polluted external air used
  - Lower levels of mould

Executive Summary

This document introduces the technology of Pathogen Reduction Solutions Limited (PRS), outlining the general capabilities of its high-intensity UVC light system, providing evidence of the efficacy of this innovative technology application, and covering benefits within the healthcare sector. We demonstrate how safer (sanitised) internal air and energy savings can be achieved concurrently.

From an initial design theory generated during early in the pandemic, PRS equipment been validated as effective through lab testing, third party certified as being safe by multiple industry standards groups, and piloted for extended periods in a major London office building. PRS's multi-patented system's performance has lived up to, and now surpassed, the original theory.

PRS systems have been extensively testing with live viruses including SARS-CoV-2, Influenza, and Measles in a Bio Safety Level (BSL) 3 Laboratory, achieving reductions in excess of 99.99%. These results were achieved in fast moving air (6 m/s) which replicates the speed of the air within a commercial building's air handing system. The viruses were inactivated in under 0.17 of a second, in a single pass, confirming the pathogen reduction effectiveness of PRS's ground-breaking design..

As part of the ongoing pilot programme, PRS units have been installed and operating in the HVAC systems of a client's London office building since August 2023. Performance of the PRS-protected floor is being compared to the floor below, which is similarly occupied and configured, and in addition, data samples have been taken across all 10 of the client's occupied floors. Our technology has shown compelling results on the PRS-protected floor by reducing relative airborne bacteria by 97-99% and mould counts by 78-94%. Full details can be found in subsequent sections of this report.

Benefits to Healthcare Operations

While delivery of sanitised air is an obvious benefit to any indoor environment, the key impacts of PRS technology in healthcare settings can be refined into three key categories:

Biological

PRS units have undergone detailed performance analysis, involving both BSL3 lab and live site testing, with data collected on viruses, bacteria, mould, and total volatile organic compounds (TVOCs). Continual sanitisation of internal air ensures significant reductions in all of these contaminants and will reduce intra-ward transmissions, improve patient outcomes, and protect staff and visitors.

Historically, the healthcare sector has rightly focused on increasing the levels of 'fresh' air in hospital buildings. Unfortunately, in most metropolitan areas, the external air is often polluted with contaminants such as nitrogen dioxide (NO_2) and particulate matter. Applying PRS systems will safely allow higher recirculation rates, and thereby reduce the reliance on polluted external air.

Operational

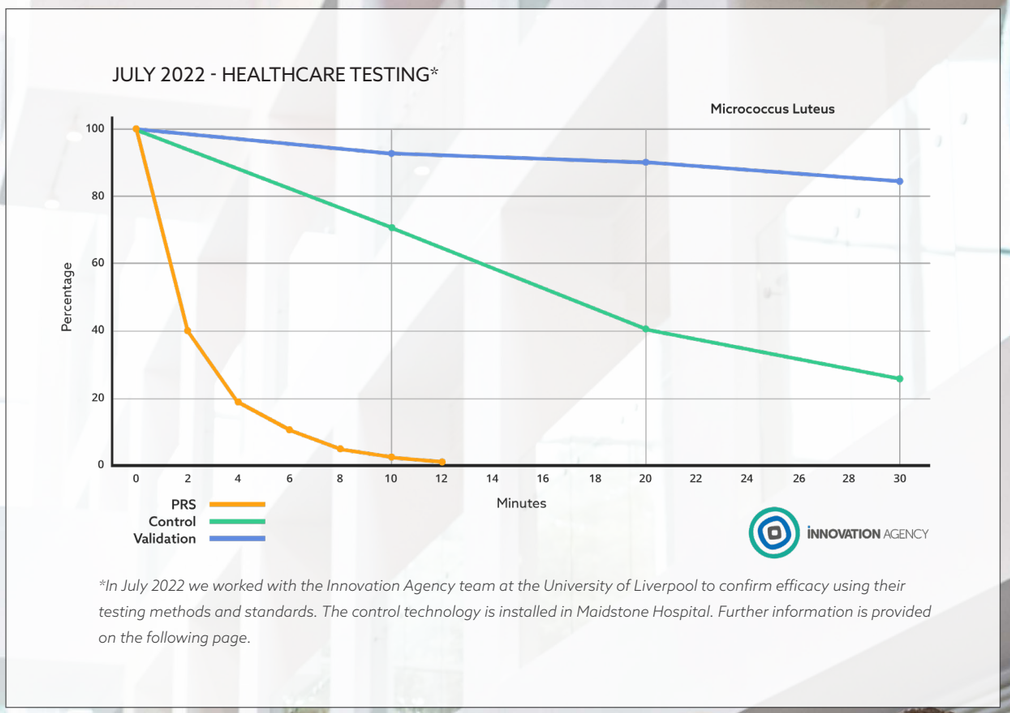
With safe air assured, air recirculation levels can be increased without endangering occupant welfare. This increase in air recirculation will lead to a significant saving of energy used to heat, cool, dehumidify, etc. buildings, while improving staff productivity, and reducing patient stay durations related to fairly common cross-contamination with other in hospital-acquired airborne infections.

Erring on the side of caution, the hypothetical projections made in this document (see pages 23-27) assume that the energy saving on total HVAC-related consumption is only 15%. The actual percentage could be much higher as empirical testing, based on PRS systems applied in commercial office buildings, generates average energy savings in the to 15-30% range. As another point of reference, an on-going study by Imperial College and Butterfly Sensors estimates a 40% savings based upon a 70% internal air recirculation target.

Financial

PRS is a solution provider, and as such we design and implement system configurations that best meet our clients' human occupant safety, energy conservation, operational efficiency and environmental stewardship goals. Variations in a building's location, layout and age must be considered in tandem with the performance objectives before a project proposal can be submitted. New build projects will typically be more cost effective due to pre-build planning, however retrofits are usually easily achievable on a cost effective basis with minimal operational disruption.

The slightly higher costs to install in older buildings can quickly be recouped by the additional revenue opportunity and savings tied to generally higher operational efficiency. These savings will primarily be derived from lower energy consumption, and reduced patient stays due to less healthcare associated infections. To accurately calculate a realistic return on investment, we need project-specific data to work with, but we confidently forecast that the full capital outlay could be recovered in 12-24 months with attractive economic returns on investment over the 20-25 year design life of the PRS kit.



In July 2022 we worked with the Innovation Agency team at the University of Liverpool to confirm efficacy using their testing methods and standards. The control technology is installed in Maidstone Hospital. Further information is provided on the following page.

Introduction

About PRS

Pathogen Reduction Solutions Limited (PRS or the Company) has developed a ground-breaking, joint UK/US- developed proprietary technology for safely and effectively inactivating airborne pathogens passing through indoor Heating Ventilation and Air Conditioning (HVAC) and other enclosed air handling systems. Harmful airborne pathogens in this case include bacteria, viruses, and mould.

The system employs high intensity ultraviolet light (UVC) for this purpose, a widely accepted application for sanitising generally static surfaces, but through proprietary design elements does so when the pathogen transit time is measured in a fraction of a second. PRS is practical as either a retrofit and complement to an existing air handling system or incorporated in new build as part of a state-of-the-art smart air handling system, in both cases for the effective life of the building and its air handling infrastructure.

While PRS was founded in 2020 during the height of the pandemic to tackle SARS-CoV-2, we have since focused more broadly on the improvement of global human health and wellbeing by providing safe indoor air for all. PRS's multi-patented technology, as now proven in large scale built and controlled lab environments, enables a significant improvement in patient outcomes, while reducing operating costs and generally improving the confidence and wellbeing of all building occupants... including healthcare employees who were collectively under such intense pressure to deliver care and sustain capacity during the last pandemic.

Testing Proves Healthcare Benefits

Clearly, a technology that actively tackles airborne pathogens is a huge benefit in a healthcare setting where consistent quality delivery and improving medical outcomes are the primary focus. Where deployed, our systems will reduce airborne-based inter-building infection transmission, improve operational efficiency, save energy, and most importantly, improve and/or save lives in the collective process.

Having already proven our efficacy against a range of viruses, bacteria, and mould in a BSL3 laboratory, we then worked with the **Innovation Agency** team at the **University of Liverpool** to confirm efficacy using their testing standards. Their protocol differed considerably from our earlier BSL-3 lab testing, and involved using Micrococcus Luteus, a bacterium that is far harder to inactivate than the viruses used in our earlier testing (largely because bacteria form highly resilient spores while viruses do not). An air sanitisation technology utilised in Maidstone Hospital was selected by University of Liverpool to be used as a control for comparison, and PRS's system outperformed this control technology by a factor of 10 (see chart on page 5 for details).

Most recently, we have been collecting performance data in a Class A commercial office in London where our units have been installed since August 2023 on a single 32,000 sq. ft. floor which was then compared to a control floor with near identical occupancy and configuration, and other similar floors occupied by this client. We periodically tested for a variety of airborne pathogens via the use of petri dish samples collected and analysed by a certified third party specialist, and used data from floors without PRS protection for comparisons. In addition, we employed near real time IAQ monitoring throughout the PRS-protected floor – monitoring temperature, humidity, CO_2, particulates and Total Volatile Organic Compounds (TVOCs) and near real time External Air Quality (EAQ) monitoring on roof where the external air was being drawn in by the building's HVAC system. The latter EAQ monitoring informed our understanding of occupants' status quo exposure to harmful carcinogenic like NO_2 and other suspected carcinogenic gases if PRS was not enabling safe internal air recirculation.

The systematic, large-scale testing at this site produced very compelling results, both with respect to the efficacy of PRS in inactivating pathogens on the protected floor, and to the need to build pathogen resiliency in the built environment as our monitoring exposed large bacteria and moulds spikes/exposures on the floors unprotected by PRS. The results from this large-scale site pilot and our extensive lab testing build a strong case for application in hospitals and major healthcare facilities. Details of this comprehensive testing can be found from page 11 onwards.

In April 2022 PRS agreed to be the lead sponsor at the **NHS IPC Conference** in Birmingham. Our Chief Science Officer, Robert McCullough, PhD, gave the keynote address on the subject of Future Proofing Indoor Environments. This led to some collaboration with Professor Tony Fisher of the University of Liverpool and Frank Mills, a consulting engineer to the NHS, which resulted in the Innovation Agency testing outlined above.

Video recordings of the IPC event and a subsequent webinar with Messrs Fisher and Mills can be viewed at the links at the bottom of page 8.

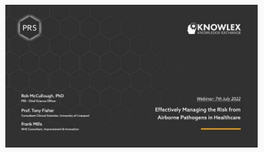
Operational Benefits

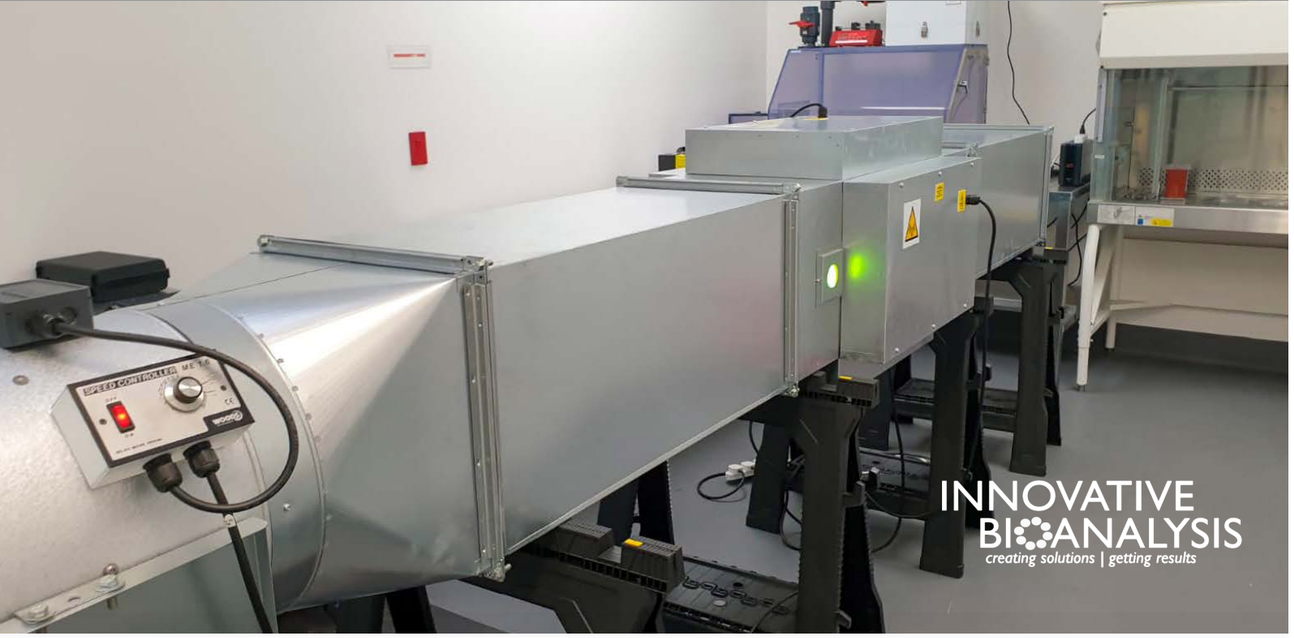
Beyond the obvious improvement in patient outcomes, it is important to draw attention to the considerable savings PRS drives by allowing safe air recirculation. PRS is proven effective in a single pass with air traveling at 6m per second and a residence time of 0.17 of a second, far higher air flow rates than any prospective competitor can manage with comparable efficacy and 2.4x the American Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE) standard of 2.54m per second. The best innovation has to be practical in application and this PRS design feature enables PRS to accommodate and complement conventional air handling systems typically operating around this speed 6m per second flow level.ting where consistent quality delivery and improving medical outcomes are the primary focus. Where deployed, our systems will reduce airborne-based inter-building infection transmission, improve operational efficiency, save energy, and most importantly, improve and/or save lives in the collective process.

An increase in air recirculation means consistent sanitisation treatment of all internal air, whether 'fresh' or possibly polluted external air entering the building or air already in the mix. The remixed air is still ambient and therefore needs little heating or cooling. When compared to a much larger mix of external air, the energy savings employing PRS is significant and estimated to be between 10-30% depending on building occupancy and configuration and average external temperatures and seasonal conditions.

As our solution integrates with and complements existing HVAC systems, PRS's achieves these results with limited energy consumption thanks to the proprietary design of our optical cavity, and without the inconvenience of multiple standalone air sanitisation units taking up valuable patient care space, requiring regular maintenance and filter changes with careful disposal (often involving biohazard disposal protocols), and subject to easy power disconnects by disgruntled patients and/or staff. PRS's primary application is induct in centralised air handling systems, but in situations where space constraints don't allow for an induct installation and/or a more localised sanitisation is appropriate PRS can incorporate our technology in bespoke standalone or wall units. Such standalone units have been operational and fully effective in the United States since 2021.

In early 2023, PRS was asked by **NHS Lanarkshire** to design a solution for removing black mould in a ward occupied by immune deficient patients in **Monklands Hospital**. The resulting PRS proposal included building a dedicated system specific to the ward, with all external and recirculated air being sanitised by the PRS unit while maintaining positive pressure in the ward. As the hospital is due to be replaced within a few years, NHS Lanarkshire management decided not to proceed but to specify our technology for the replacement building. Specific details of the proposal are available on request





Comprehensive BSL3 Lab Testing

To date, our testing regime has included the following live pathogens:

1. **Viruses:**
    a. SARS-CoV-2
    b. Influenza A
    c. Measles
2. **Moulds:**
    a. Aspergillus Niger
3. **Bacteria:**
    a. Micrococcus Luteus
    b. Mycobacterium Parafortuitum

*Copies of test results available in **Technical Info** pack in the Appendix.*

PRS Performance

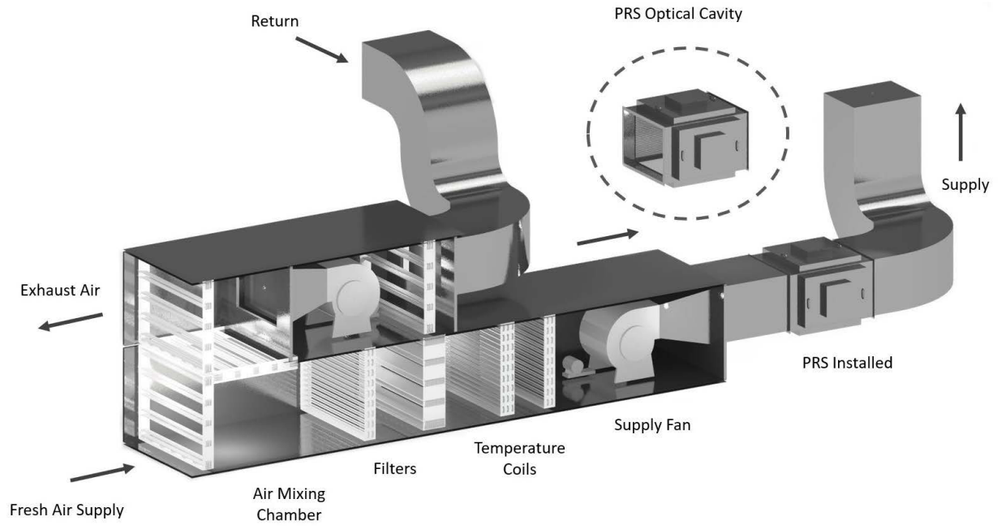
Overview

PRS uses ultraviolet light at a 254nm wavelength (UVC) in a uniquely designed optical cavity to ensure both intense irradiation of pathogens travelling within an air stream and efficient use of electrical power to generate the required energy flux density. Ultraviolet light's ability to inactivate pathogens is well documented and consequently, its application has been widespread for decades in surface sanitisation and water purification.

While most historical UVC applications have involved static surfaces (i.e., 2-D) or slower moving mediums (as in water purification), PRS's application is effective at inactivating airborne pathogens when the optical cavity transit time is measured in a fraction of a second by effectively irradiating the streaming pathogens in three dimensions (3-D).

Industry air handling standards groups such as ASHRAE had historically documented that such a UVC application with such PRS-proven efficacy was neither practical nor possible.

PRS CONFIGURATION INTO AIR HANDLING UNIT



PRS innovation has been formally recognised by the United Kingdom's Intellectual Property Office with the grant of patents numbered GB 2601361 and GB 2614287. Other patents covering both proprietary design elements and geographies are pending.

Extensive Efficacy Testing – Live Viruses, Bacteria and Mould

PRS management believes that the company has already undertaken more extensive third-party testing than any of its prospective peers. This biological testing was undertaken at a fully certified Biosafety Level-3 lab in the United States. Live viruses tested include Measles, Influenza A and SARS-CoV-2. Live bacteria testing included Mycobacterium Parafortuitum and Micrococcus Luteus, primarily because these bacteria were specified as test protocol pathogens by ASHRAE and University of Liverpool, respectively. Aspergillus Niger (aka, black mould) was the subject of the Company's mould testing.

Our design standard was based upon inactivating measles at a 99.99% rate, thereby designing in conservatism with respect to SARS-CoV-2 killing efficacy – as measles is roughly 2x as hard to kill as SARS-CoV-2. This conservatism ensures that PRS inactivates all variants of SARS-CoV-2 along with many other harmful pathogens. During testing by University of Liverpool, against the far tougher Micrococcus Luteus, the PRS system surpassed their benchmark control technology (Midtherm) by approximately 10x.

Using our test results as a foundation, we have been able to calculate the sensitivity ratio of a wider range of pathogens to UVC 254nm produced within the PRS optical cavity (see the diagram on the following page).

Extensive Safety Testing

PRS has undertaken and completed extensive testing on all electrical system safety and on UVC lighting safety. Nemko, an international testing and certification company ensuring since 1933 compliance with standards around the world, fully tested and certified the Company's electrical systems with SISTEMA safety sign-off, to a residential level (higher standard of safety than a commercial standard).

LUX TSI laboratory fully tested PRS's UVC lighting, proving it completely safe for people and plant infrastructure. In addition, PRS has many built-in safety features designed to protect against any human UVC light exposure and to protect surrounding HVAC and plant infrastructure and equipment and PRS's lighting fixtures are certified for zero ozone emissions under UL 2998.

PRS systems have qualified for the IWBI "Works with WELL" license

Technical Accreditations

Electrical Safety

Electrical system is designed and certified to EN-60204-1, 2014/30/EU, EN 13849-1, ISO 14120 with SISTEMA product safety sign off, and is CE certified.

Nemko testing and certification confirmed compliance to the following specifications:
EN 60335-2-65:2003 +A1:2008 +A11:2012
EN 60335 1:2012 +A11:2014 +A13:2017 +A1:2019 +A14:2019 +A2:2019
EN 62233: 2008

Ballasts and Lamps are certified IEC 62471, IEC 61347-2-3, NL 41271, EN 62471-2008, NL 731120, CE, UL Listed 704G, RoHS compliant.

UVC Safety

Tested and certified to EN 62471-2008 at LUX TSI laboratory.

Personnel Safety: External to unit exempt. Testing proves that there is no risk to personnel working adjacent to ductwork.

Within Ducting: Proprietary Containment Device restricts radiation to Risk Group 2. No detrimental effect to existing building infrastructure.

Manufacturing

Manufacturing, Installation, and maintenance services certified to: ISO 9001, ISO 14001, ISO 45001 and DW/144.

Nemko
Electrical Safety Testing

LUX TSI
UVC Safety Testing

PATHOGEN SENSITIVITY RATIO

Understanding the difference between inactivating viruses and moulds

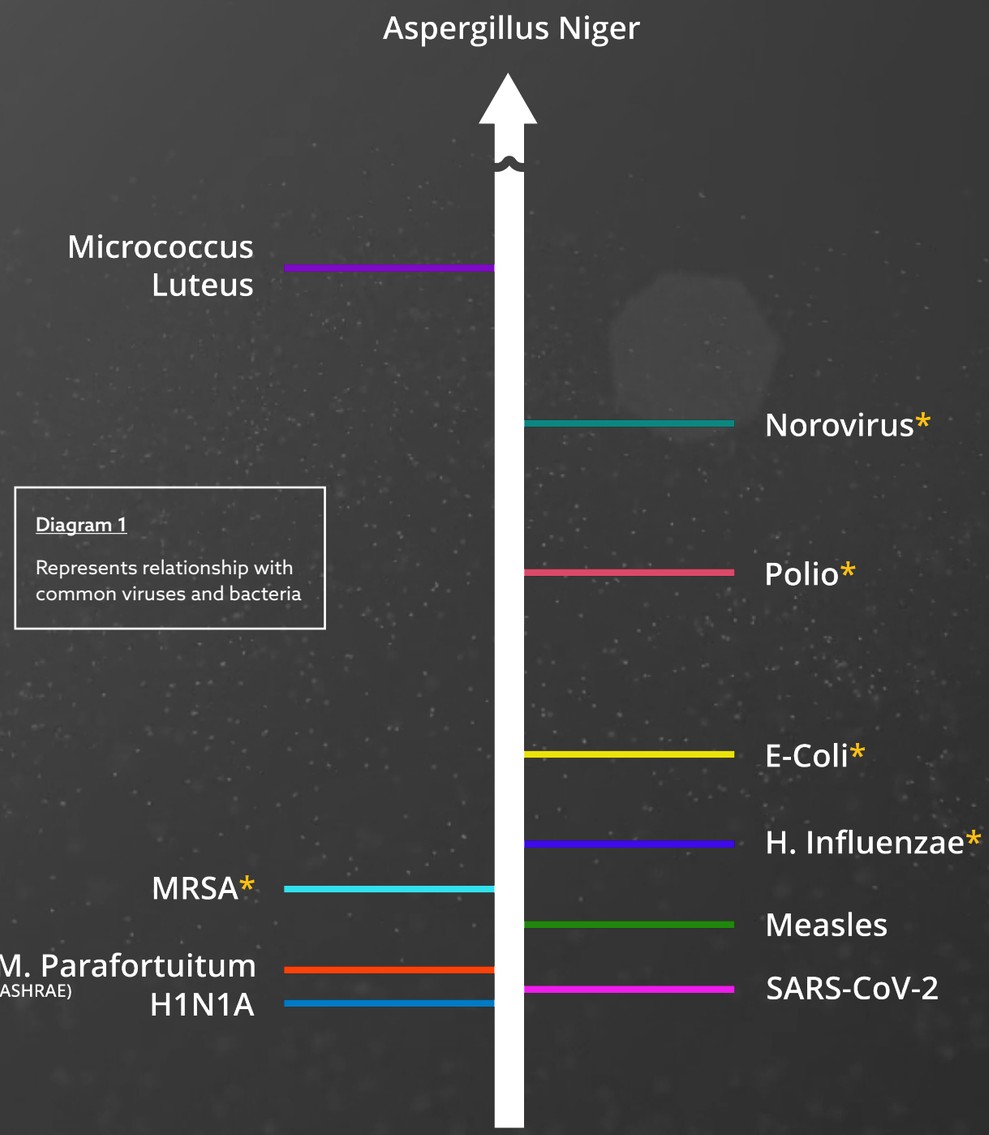


Diagram 1

Represents relationship with common viruses and bacteria

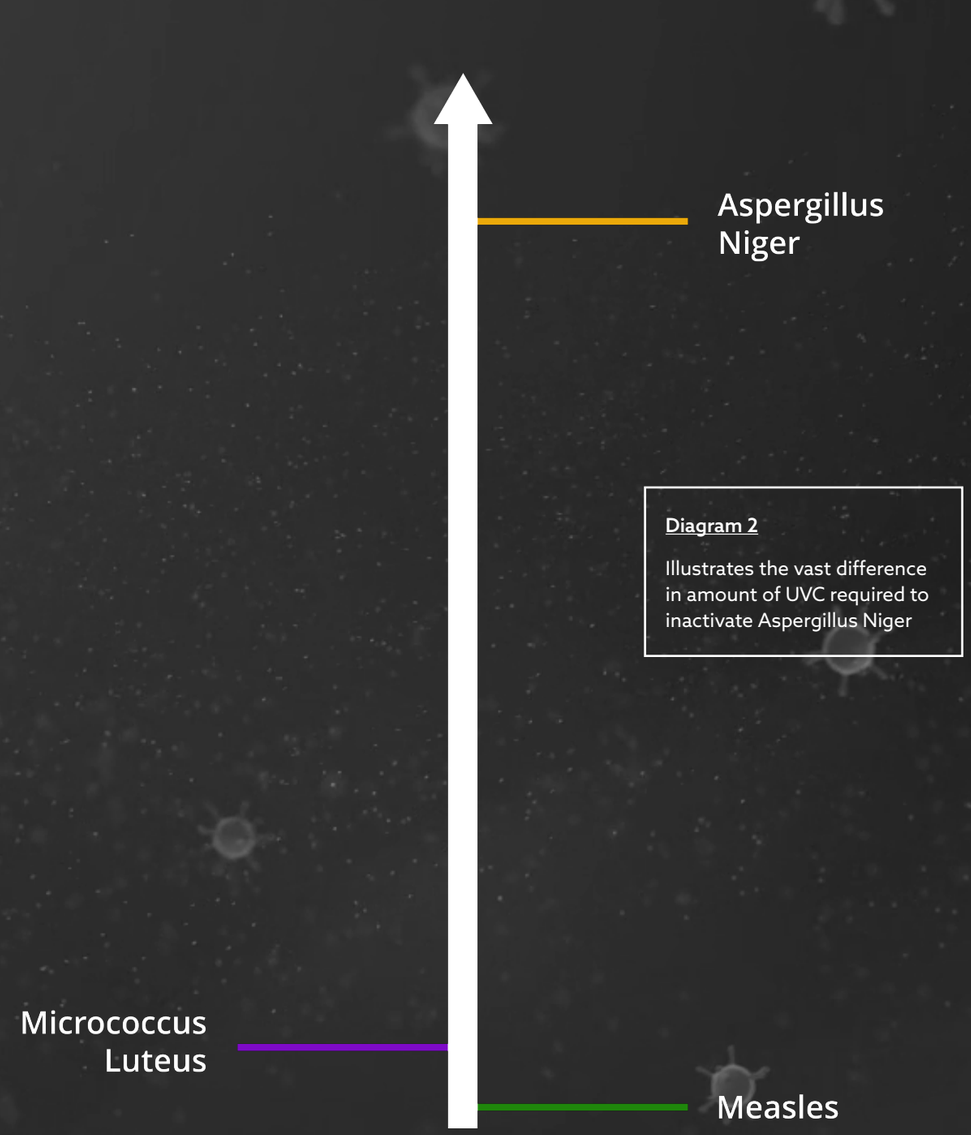


Diagram 2

Illustrates the vast difference in amount of UVC required to inactivate Aspergillus Niger

Key: Sensitivity ratio representation of quantity of UVC 254nm required for the inactivation of given pathogens in moving air in a single pass. Tested in a BSL3 Lab using a PRS system 14040. Data applicable to PRS optical cavity configuration only.
*Not tested – tabulated from Kowalski UVGI Handbook

Live Site Results

In early 2023 our client, keen to understand our innovative approach to air sanitisation, agreed to pilot at their global headquarters in London PRS on a 32,000 sq. ft. floor in their roughly 1 millon sq. ft. office building. The client already had an air quality testing regime in place and were looking to progressively expand this practice and better understand the impact of higher IAQ on: (i) better general health and reduced absenteeism, (ii) improved cognitive performance and productivity, and (iii) employee confidence if and when asked to return to a more pre-pandemic office hour norm.

Testing to date is highly compelling, as shown below, in terms of both PRS's efficacy against pathogens, and our client's opportunity to improve the effectiveness and efficiency of their air management. They initiated testing in August of 2023, installing PRS units on the 22nd floor with the 21st floor serving as a control floor. Both 32,000 sq. ft. floors have similar physical configurations and near identical occupancy levels.

The first series of results from mid to late August of 2023 confirmed our system's effectiveness in pathogen reduction: PRS reduced bacteria and mould exposures on the 22nd floor by 97% and 93%, respectively, compared to levels measured on the control floor (see below excerpt from our client's first internal briefing on the testing). In addition, Total Volatile Organic Compounds (TVOCs) monitoring during this same period in August indicates 63% and 81% reductions, respectively, at the one day and one-week intervals with PRS operating on the 22nd floor.

VOCs are known to be harmful to human health, especially over long-term exposures, and are emitted as gasses from everyday products such as building materials, maintenance equipment and cleaning products; e.g., benzene and formaldehyde are known and suspected carcinogens, respectively. We expected this TVOCs reduction but note that further controlled lab testing will be required before we are prepared to make any formal claims about the magnitude of this secondary benefit.

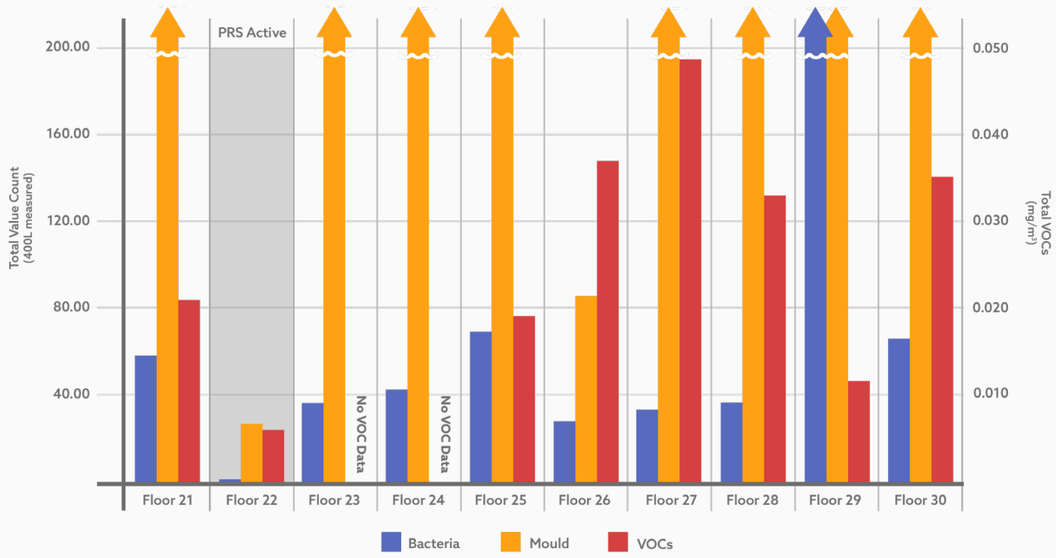
INITIAL TESTING AUGUST 2023 - AVERAGE RESULTS PER FLOOR

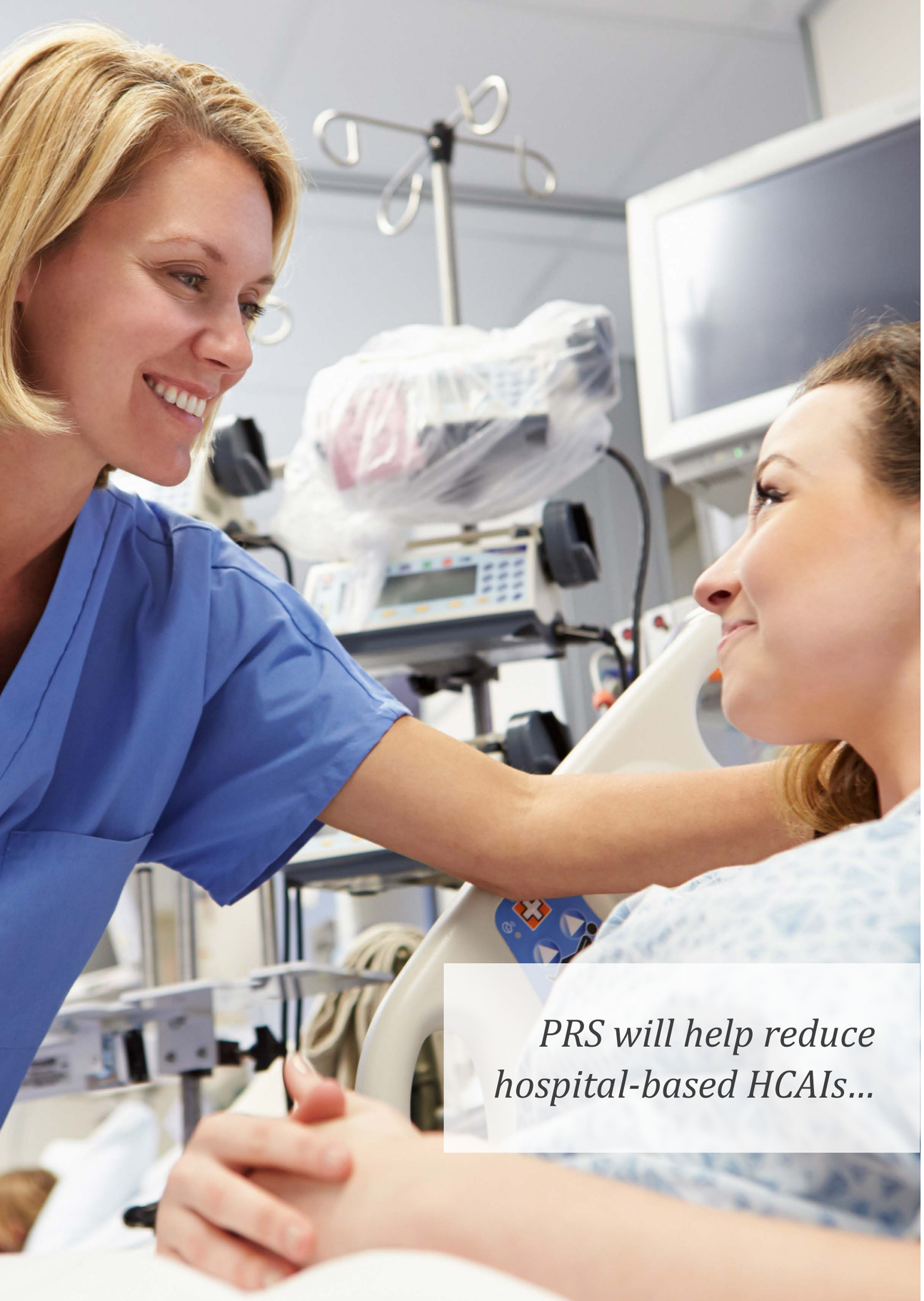
Sample date (11am)	22 August	22 August	23 August	23 August	30 August	30 August
Building Floor	21st – control	22nd – NO PRS	21st – control	22nd – with PRS	21st – control	22nd – with PRS
TVOC's	253	582	301	111	700	136
Occupancy	100 (53%)	102 (63%)	62 (33%)	59 (36%)	49 (26%)	52 (32%)
Sickness (August)	84 (0.48 avg. pe)	43 (0.26 avg. pe)	84 (0.48 avg. pe)	43 (0.26 avg. pe)	84 (0.48 avg. pe)	43 (0.26 avg. pe)
Other factors	-	-	-	-	-	-

The round of pathogen testing in early November 2023 produced even more compelling results. Occupant exposures experienced on the PRS-protected 22nd floor were 98.7% and 77.9% less than the average bacteria and mould exposures, respectively, as conservatively averaged across testing on nine other floors including the original 21st control floor (see below a summary by floor of concentrations in bacteria, mould and TVOCs).

In general, moulds require more energy to inactivate in a single pass than the targeted viruses and bacteria, so this differential between bacteria and mould exposures on the 22nd floor is scientifically supported. Viruses, given their materially smaller size (typically around 1/10 the size of bacteria), require a different monitoring method which PRS used during testing in the BSL-3 lab setting, but that is less practical on such a site.

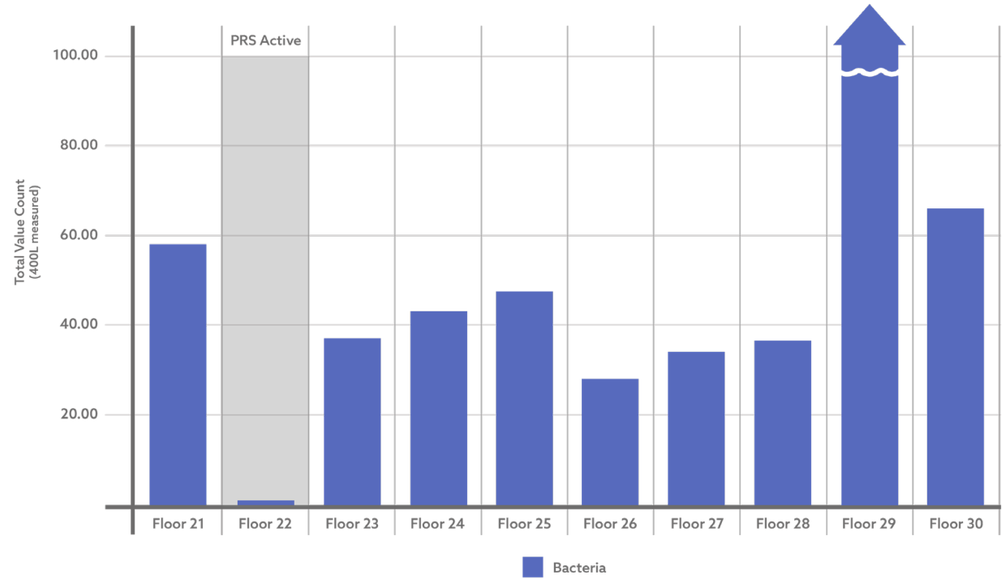
NOVEMBER 1ST, 2023 RESULT - INDOOR AIR QUALITY SUMMARY





Most viruses require less energy to inactivate than either bacteria or moulds, so in this graphic we use just bacteria counts as a proxy for PRS's impact on viruses. The increased challenge in inactivating bacteria and moulds is because both are capable of forming spores, one of the most resistant organisms on earth, increasing bacteria and mould survival rates even under very harsh environmental conditions.

NOVEMBER 1ST, 2023 RESULT - BACTERIA ONLY



NB. Viruses are typically easier to inactivate or kill than bacteria and moulds
PRS's demonstrated efficacy with bacteria is the best proxy for efficacy with targeted viruses

The testing identified several high mould counts on other floors, in most cases downstream from physical filtration. There was one exceptionally high upstream mould count reading on the 22nd floor, but after the air passed through the PRS (i.e., downstream from the PRS), the 22nd floor occupants' mould exposure was reduced by over 94% vs. the 78% average reduction cited above.

In order to systematically document PRS's performance through varying weather and seasonal conditions, site monitoring and testing are ongoing.

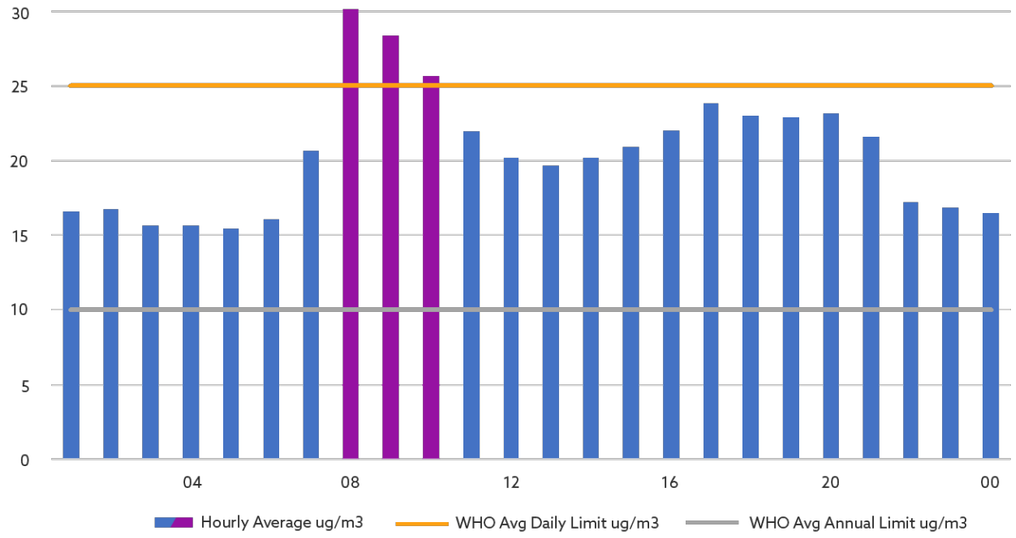
Pollutants in Fresh Air

The importance of fresh air in healthcare settings has been abundantly clear since the days of Florence Nightingale. Unfortunately, external air in major metropolitan areas is neither 'fresh' nor clean. Studies suggest that around 50% of exposure to external air pollutants arises when indoors, where pollutant concentrations are often 2-5 times higher. It is therefore important to monitor the external air quality surrounding a building to understand the consequences of the 'fresh' external air being introduced into the internal air mix.

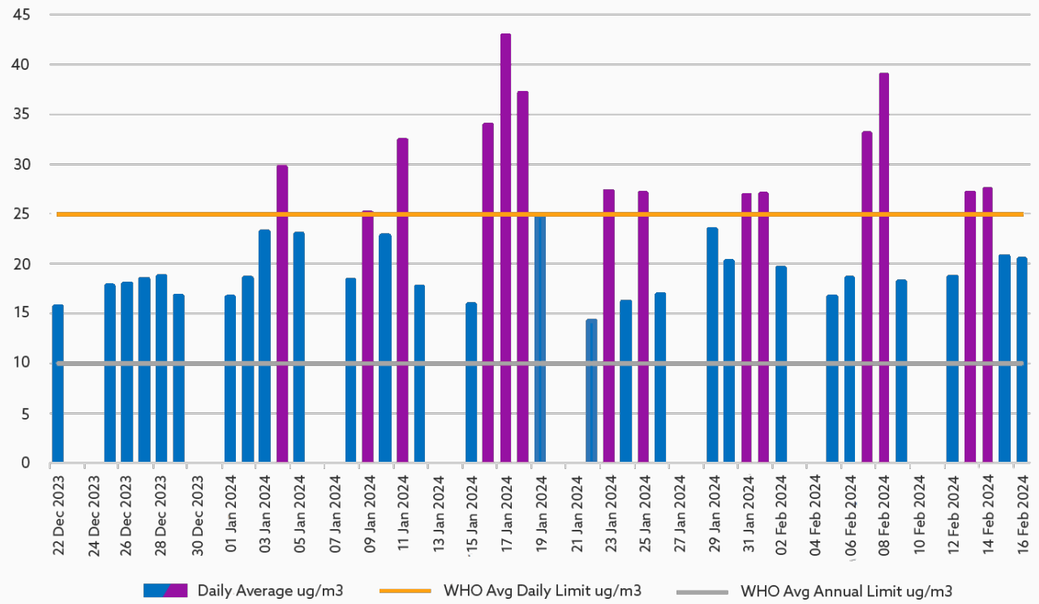
PRS will improve health outcomes by safely allowing a higher air recirculation rate and therefore, reduce the presence of external pollutants in the building. As also outlined earlier, increasing recirculation will significantly reduce HVAC-related energy consumption – another critically important PRS benefit that frees up valuable budgets. This also enhances environmental sustainability as mandated in many parts of the world through carbon footprint reduction..

PRS has since December of 2023 been collecting (EAQ) data on the roof of the London office site. The graphs below focus on levels of NO_2, a known human carcinogen, with benchmarks provided by the World Health Organisation (WHO) noting recommended safe exposure levels on a daily and annual basis.

ROOF SENSOR - NO_2 HOURLY AVERAGE, WORKING DAYS 22/12/23 - 16/02/24



ROOF SENSOR - NO_2 DAILY AVERAGE (7.00 - 19.00), WORKING DAYS



Max 89 ug/m3 - 14 WHO breaches out of 41 days (34%)

AIR QUALITY DATA IS MONITORED BY A SERIES OF SENSORS LOCATED THROUGHOUT THE BUILDING. LEVELS OF BACTERIA, MOULDS AND VOCS ARE CALCULATED VIA PETRI DISH ANALYSIS BY AN ACCREDITED THIRD-PARTY LABORATORY.

Our Value Proposition

Overview

PRS technology offers broad scope solutions for better IAQ across the built environment. In a healthcare infrastructure context, we provide answers, unique in terms of scale and performance, that solve problems particular to the industry, such as intra-building infection transmission, and the resulting increase in operational efficiency.

We highlight the ability to safely increase air recirculation, which will reduce the reliance on potentially polluted external air, while improving energy efficiency as HVAC systems are able to cost effectively maintain an ambient temperature. Cleaner air with reduced transmission will lead to shorter patient stays, with better outcomes, another commercial benefit.

Given natural interdependencies between many of the 6 core components of PRS's value proposition, other components of our proposition will also resonate with healthcare stakeholders:

- Harvard public health study shows IAQ significantly impacts employees' cognitive function, including response times and ability to focus.
- Pathogen-free air will reduce absenteeism caused by airborne infections and should reduce the cost of employee health coverage.

Enhanced Occupant Wellbeing

- According to Deloitte Insights strong ESG performance can reduce the cost of capital. US$ 1 trillion has been invested into ESG focused funds in recent years.
- Progressive IAQ measures demonstrate ESG accountability, leading to better rental prospects and higher yields.

Proven ESG Accountability

- As IAQ becomes a bigger focus for employees with return to office work policies, providing the safest workplaces will protect against possible litigation.
- A safer working environment can reduce healthcare costs (claims & severity) while increasing employee loyalty.

Improved Risk Management

- Safe air will allow higher recirculation levels with less dense filtering, reducing fuel use and system pressure which leads to plant equipment wear and tear.
- PRS reduces mould, a major problem due to increased 'fresh' air circulation led by pandemic protocols, and a factor underlying Sick Building Syndrome.

Facility Management Efficiency

- PRS ensures safe air within the building, allowing higher recirculation rates and operational efficiency with less energy used for heating and cooling, etc.
- The removal of micro pathogens means filter density can be reduced, lowering air handling pressure loads and thereby fuel consumption.

Reduced Operating Costs

- Buildings with demonstrable environmental and occupant wellbeing benefits are shown to enjoy higher rents and lessee retention.
- Lower grade properties risk obsolescence as the rental market shrinks due to the increase in hybrid working habits.

Asset Value Protection

PRS Operational Efficiency Projection

Impact of PRS application on healthcare associated infections (HCAIs) in a 200 bed hospital

NHS England - General & Teaching Hospital Adult Admissions 2016/17*

	Total	200 Beds
Adult admissions	13,800,000	29,870
Adult beds	92,200	200
Adult bed days	33,653,000	72,842
HCAIs	653,000	1,413
Deaths due to HCAIs	22,800	49
HCAI Bed Days	5,600,000	12,121
Cost of HCAI	£2,100,000,000	£4,545,455
HCAIs per Bed Day	16.64%	
HCAIs per admission	4.73%	
Cost per HCAI	£3,215.93	

Key Causes of HCAIs:

Respiratory tract infections	22.80%
Urinary tract infections	17.20%
Surgical site infections	15.70%
Clinical sepsis	10.50%
Gastrointestinal infections	8.80%
Bloodstream infections	7.30%
PRS infection reduction performance assumption *(against respiratory infections only)*	90%

PRS Impact on HCAIs:

Projected lives saved:	**10**
Reduction in HCAI associated costs:	**£932,727**

Performance Projections

As outlined above, there are two key commercial benefits to implementing PRS systems within a hospital facility. Below we extrapolate the potential savings relative to the cost of PRS application to demonstrate the compelling ROI opportunity that PRS offers the healthcare sector.

Operational Efficiency

Taking data from a 2016/17 NHS study* as a foundation, we are able predict the positive impact of PRS in terms of both monetary savings and lives saved. The study identifies healthcare-associated infections (HCAIs) in adult patients admitted in general and teaching NHS hospitals in England. Taking the key data points from the study we can recalculate the numbers to produce the projection for a 200-bed hospital to be found on the adjacent page.

The study clearly identifies the huge cost of HCAIs, underscoring the value of implementing PRS's technology-enabled solution. The author writes:

> *"In England, the annual incidence of HCAIs among patients in acute care hospitals is reported to be 0.047. An estimated 3.5% of patients who acquire a HCAI are reported to die from their infection, although these HCAI-related deaths are preventable. The costs incurred to manage a patient who acquires a HCAI is around three times higher than that of managing a patient without a HCAI. This potentially represents a significant cost to the whole NHS. Hospital inpatients who acquire a HCAI have a higher probability of having their length of admission extended. Hence, the cost associated with HCAIs is primarily attributable to patients' increased length of hospital stay. Healthcare professionals (HCPs) may also acquire a HCAI through patient contact."*

The study includes breakdowns for the key causes of HCAIs and these are provided in the projection for reference. It should be noted that our estimate of the lives saved and the reduction in operational costs is only based on PRS's impact on respiratory tract infections and any potential mitigation of the other causes is not included.

We expect there to be a tangible operational benefit by increasing the protection for healthcare staff in the building although the study found that the associated costs of staff acquiring HCAIs were negligible when compared to that of patient care. Various workplace studies (see Appendix for examples) have highlighted the impact that improved indoor air quality has on staff productivity and cognitive function. While difficult to immediately quantify, this will be a further benefit that PRS brings to healthcare.

*Modelling healthcare costs and outcomes attributable to healthcare associated infections: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7045184/

Energy Efficiency

As detailed earlier, there are obvious efficiency reasons why commercial buildings recirculate air, but in healthcare settings, and hospitals in particular, recirculation is usually avoided to prevent the intra-hospital transmission of airborne pathogens. Using proven PRS technology to continually sanitise, air can safely be recirculated, considerably reducing energy consumption.

Buildings that only use external air for ventilation risk drawing in pollutants and moulds. Both can be mitigated by using PRS systems to safely treat the recirculating air. Note the proven performance against Aspergillus Niger (black mould) in BSL3 lab testing, and the compelling results for mould removal in the London office building trial.

Air handling within the built environment worldwide accounts for an estimated average 40-45% of the total energy consumed in a building's operation. Given the high use of electronic equipment in healthcare facilities, the predisposition towards using 'fresh' air for ventilation, and the typically 24x7 operating profiles, the percentage of total air handling-related energy consumption is likely much higher than that of the 40-45% cited above.

With these factors in mind, the adjacent projection assumes that HVAC operation accounts for 50% of overall fuel consumption. Considering our own pilot testing, and study-based estimates by Imperial College London, we typically forecast energy savings to be between 10-30% for large HVAC-driven buildings that use an element of recirculation. While healthcare settings typically avoiding recirculation and need to use higher air change rates, we have used a conservative estimate of just 15% saving on the HVAC-associated energy consumption to build the projection. We also note that savings may vary considerably depending on the seasonal variations and changing environmental conditions .

As a foundation for the projection, we use energy data taken from NHS England 2022/23 Estates Returns Information Collection (ERIC)** for the Barts Health NHS Trust and then present a projection for a 200-bed hospital accompany the operational parameters above.

Combined Summary

Based on these assumptions, we estimate an annual combined savings of around £1.2 million for a hypothetical 200-bed inpatient hospital.

Annual Savings Projection for 200 Bed Inpatient Hospital	
Reduction in HCAI associated costs:	£932,727
Reduction in Energy costs:	£279,143
Total Annual Saving:	*£1,211,870*

**NHS England - Estates Return Information Collection (ERIC) 2022/23
https://digital.nhs.uk/data-and-information/publications/statistical/estates-returns-information-collection/england-2022-23

PRS Energy Efficiency Projection

Impact of PRS application on energy consumption in a 200 bed hospital

NHS England - Estates Return Information Collection (ERIC) 2022/23**

Projection based on Barts Health NHS Trust data only (1,800 inpatient beds):

	Total	200 Beds
Electricity Use @ £0.2815 / KWh	£19,513,056	£2,168,117
Gas Use @ £0.0766 / KWh	£12,287,210	£1,365,246
Oil Use @ £0.0737 / KWh	£23,398	£2,600
Other Energy Use	£1,673,456	£185,940
Total Energy Cost	£33,497,120	£3,721,902
HVAC Energy Cost (Est. 50%)	**£16,748,560**	**£1,860,951**
Benefits of PRS Application:		
Reduction in Energy Costs (Est. 15%)	**£2,512,284**	**£279,143**

Conclusion

Measurable Performance

For the financial year 2022/23 NHS England consumed 11.2 billion KWh of energy across all sources. Using the Barts Health Trust as a broad guide for energy sources, this would mean approximately 6.7 billion KWh of electricity and 4.5 billion KWh of gas, for a total cost of around £2.2 billion. While PRS technology is not necessarily applicable across all the NHS estate, it would deliver considerable energy consumption savings in the larger facilities. **A saving of just 5% would be worth £650 million annually.**

The NHS 2016/17 data on HCAIs used in our earlier projection estimated the total cost of healthcare related infections for that period to be around £2.1 billion, with this figure reported to now be £2.7 billion. Our projection makes no reduction assumptions for any other type of infection except respiratory tract, although we expect that other infection types may also see a modest improvement. Our confidence in predicting a 90% reduction in respiratory infections (around 20% of all infections) is based on our lab and live site test results which demonstrate material reductions in viruses, bacteria and moulds. **An annual reduction in HCAIs of just 10% would save £270 million across the NHS estate, and more importantly, save an estimated > 2,000 lives per year.**

Contact **enquiry@pathogen-reduction** for further information.

PRS-delivered operational efficiencies ensure a return of capital within 12-24 months...

APPENDIX

Reference Documents

Sysco - Client Test Results

Sysco - Report Oct 2023

Sysco - Report Nov 2023

Sysco - Report Dec 2023

Available on request,
upon completion of NDA

PRS Information

PRS - Technical Info

PRS - Detailed FAQs

Healthcare Studies Used

NHS - ERIC 2022/23

NCBI - NHS 2016/17

Government & NGO Info

UK Ventilation Reg F

WHO - Air Polution Risks

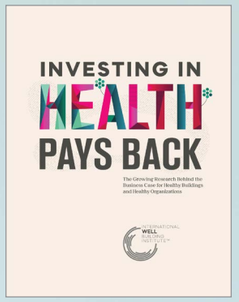
EEA - Air Quality in Europe

NERA - Infection Resilient Environements

Environmental Research: PM2.5 and CO2

Buillding Wellbeing Reports

Stok - High Performance Buildings



IWBI - Investing in Health Pays Back

IWBI - Impact of WELL Certification

ESG Reports

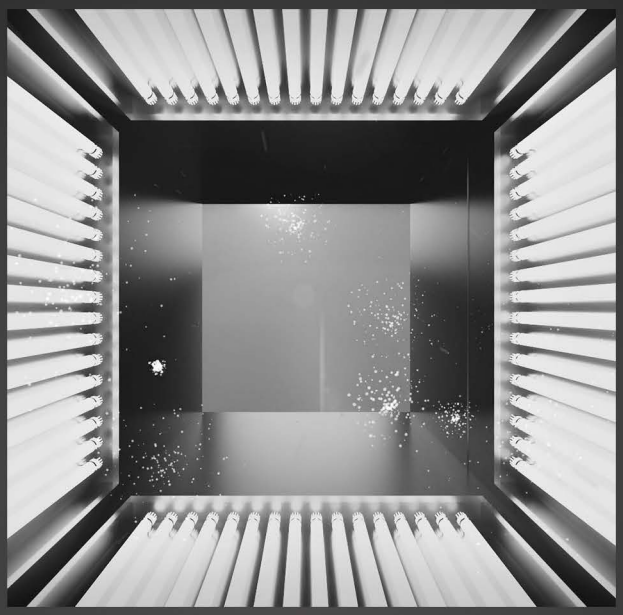
Morgan Stanley - ESG Report 2022

RICS - The Impact of ESG

Marsh McLennan - ESG Report 2022

"PRS provides sustained economic and environmental benefits, significantly reducing energy costs and carbon footprints, while creating a healthier and more productive environment for all..."

- PRS Team



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