CIBSE COVID MITIGATION GUIDANCE
VS
REME (REFLECTIVE ELECTRO MAGNETIC ENERGY),
AN ACTIVE AIR PURIFICATION TECHNOLOGY

LLOYD'S

LLOYD'S OF LONDON
COMPARISON CASE STUDY REPORT

Executive Summary

The purpose of this study was to compare Reflective Electro Magnetic Energy (REME), an Active Air Purification technology developed by RGF Environmental Inc (www.rgf.com) in terms of:

a) Actual space disinfection performance
b) Cost of compliance with COVID infection control guidance - capital and ongoing energy costs
c) Recurrent fogging costs

and to illustrate the enormous savings that can be achieved with REME as follows:

- 30% monthly reduction in energy costs compared to compliance to guidance
- 90+% lower one-off capital costs compared to recurrent fogging in Year 1 alone

The findings of this study provide businesses with a template for a viable, affordable, more effective and safer alternative for COVID mitigation which will lead to a safe return to workplaces for staff and customers and increases in productivity and in turn will lead to wider economic and social benefits.

Discussion / Value Proposition

CIBSE COVID ventilation guidance clearly states that the benefit to public health outweighs the reduction in energy efficiency when extending ventilation operation times and switching off recirculation control strategies.

This study shows that following this guidance does not come without a heavy financial burden in an already difficult economic climate. Energy costs increase, maintenance costs increase and the overall lifespan of HVAC plant and associated equipment reduces considerably, meaning replacement of large HVAC equipment will be required sooner than desired. Also, it should be noted it may not be possible to reconfigure many HVAC systems to meet the current recommendations as they were specified and installed during a time of less stringent ventilation requirements.

Following the guidance may help reduce the presence of airborne virus to a certain extent by air dilution but the virus is not destroyed in this process so if the extra capacity exists, the time and/or rate of air change alone will not provide a particularly effective means of preventing person to person transmission via airborne routes and none whatsoever for surface transmissions.

The logic of increased air changes to control transmissions is hopeful at best when you consider the actual practicalities of real world situations. For instance total air changes in commercial spaces can take several hours and airborne/surface microbial droplets can transmit from person to person in a matter of seconds.

Also recent research has shown a person is at higher risk of inhaling a steady stream of microbials created by increased airflow patterns if they stand in the wrong place. The many drawbacks of increased air changes must be recognised - not least the fact that it offers no protection whatsoever against surface contaminations that occur in between cleaning cycles.

Running HVAC equipment for longer durations and at a higher rate will increase utility, maintenance and component replacement costs. Reactive plant failure costs as a result of continuous use must also be considered as an additional budget item.

This study makes the case that an increase in HVAC running costs is detrimental to corporate bottom lines at a time of significant economic stress and national recession. This is magnified where large multi floor office buildings are involved. Running the entire HVAC system out of normal operating hours at an increased rate when a low level of staff occupies a building is an extreme and costly measure. This study proposes a realistic alternative that achieves the same objectives as the guidance but without any of these significant cost implications.

The guidance suggests increased cleaning regimes which has resulted in new recurrent sanitization processes being introduced. Termed “fogging” and using high concentrations of vaporised hydrogen peroxide aimed at reducing surface microbial contaminations throughout an indoor space, these routines have found their way into the periodic cleaning routines of many businesses which has added significantly to costs. In fact there are many who consider fogging as the only effective method of fighting COVID and the only route to rebuilding staff confidence to return to work. This study shows REME is equally as effective without anything like the enormous costs.

Fogging offers no protection against airborne transmission and much of the surface effect is fleeting and wears off in the hours or days after application. It will therefore not prevent transmission when occupants enter the space following the procedure and emit viruses into the air or touch them onto surfaces. Simply put, fogging offers no real time continuous surface disinfection protection and no airborne protection.

The guidance does briefly touch on the use of UVC and other forms of 'passive' air purification, each of which have significant and well documented limitations and drawbacks. Also it stops short of looking deeper into other technologies which work in fundamentally different and more effective ways to passive approaches.

Infection control and energy efficiency can be optimised with REME, with the added benefit of enhanced air quality covering all three main pollutant categories. It helps to deliver healthier indoor environments as we fight COVID and on into the future.

Unlike fogging or passive purification methods, the effect of REME is continuous and perpetual (save for periodic cell replacements) as the in-duct units managing the production of naturally occurring hydroperoxides are built into the existing HVAC strategy and the cost of a fraction of recurrent fogging.

These hydroperoxides mimic Earth's natural air cleaning processes by reverting back to harmless water vapour and oxygen once they have broken down microbials. Whether installed in duct or standalone - the effect of instantaneous disinfection is felt in every cubic cm of indoor air and surface space simultaneously and continuously, whereas fogging is a temporary application which has no continuous effect in the air. Studies have shown a 99% kill rate in simulated human sneeze tests carried out by Kansas State University, an independent nationally accredited testing laboratory in the US.

Entering the pandemic there were over 4 million installations in over 60 countries. Since then demand for the technology has skyrocketed with over 2 million installs of the REME HALO alone in the United States. REME has also been successfully tested against the SARS-CoV-2 coronavirus that causes COVID-19. REME is helping to rebuild public confidence in indoor spaces all around the world and get people and businesses back to work. The economic benefits of implementing REME must not be underestimated as they will be felt across all levels of society - local, regional and national. The pandemic has forced IAQ and virus transmission mitigation into the forefront of public consciousness and with growing confirmatory evidence of aerosol transmission routes, REME offers the best form of defence against this invisible enemy. It is the only mitigation process that is continuously effective everywhere and is not dependent on the actions or behaviours of people. REME is helping to rebuild public confidence in indoor spaces all around the world and get people and businesses back to work.

The study demonstrates not only the comparative effectiveness of REME but also the huge savings that can be made by incorporating the technology into an existing HVAC system.

Cost savings

The savings are enormous and will be replicated on a similar scale for other businesses with building wide HVAC strategies. For Lloyd's, it translates to a 30% monthly reduction in energy costs alone and more than 90% annualised cost (one off capital cost of REME versus ongoing cost of fogging). If we calculate the costs of increased maintenance for the HVAC plant, the savings would be even greater.

For Lloyd's return on their capital investment across the entire estate will be realised within just two months.

Case Study

Client: A commercial office building in the heart of the City of London, Lloyd's of London.

The information below is divided into the following sections:

1. Summary of current COVID mitigation guidance at the time of writing
2. Cost impact of adherence to this guidance
3. Understanding active v passive air purification and REME a new "active" mitigation method
4. The Lloyds installation, actual test results and images

The below extract is taken from the CIBSE COVID ventilation guidance which UK businesses are obliged to observe.

- START OF EXTRACT -

Current Public Health England guidance on infection control states that "The transmission of COVID-19 is thought to occur mainly through respiratory droplets generated by coughing and sneezing, and through contact with contaminated surfaces. The predominant modes of transmission are assumed to be droplet and contact."

Droplets will generally fall out of the airstream within a short distance (depending on airflow speed and direction), hence the guidance to remain 2m apart. However, these may evaporate, reducing in size and mass and travel further in air streams, contaminating surfaces and increasing the risk of airborne transmission.

While airborne transmission is not thought to be a primary route of transmission, there is an emerging and growing body of evidence that the SARS-CoV-2 can also be spread through the air, particularly in poorly ventilated indoor spaces, and that ventilation provision in buildings should be reviewed in the light of this. For an explanation of airborne transmission, see the series of tweets by Prof. Linsey Marr.

Emerging Findings

Proving modes of transmission during an outbreak is difficult. However, multiple recent studies are showing evidence of indirect contact (which may be linked to airborne spread) and have also linked airflow patterns to infection cases.

This has been particularly the case in high occupancy areas, in spaces with little outdoor air, and when people generate a lot of aerosols (e.g. shouting and singing). Given the growing body of evidence suggesting airborne transmission may be a route of infection and knowledge of aerosol generation and transport it is prudent to ensure ventilation is operating appropriately to protect occupants.
The following measures, using outside air wherever possible, should help to reduce the risks from airborne transmission.

Prevention

The primary mechanisms for preventing the transmission of coronavirus remain regular, thorough hand washing using soap and hot water for at least 20 seconds, coupled with strict adherence to social distancing requirements and staying at home. Surfaces which may be contaminated also need regular cleaning following the protocols set out by PHE.

Dilution of internal air should reduce any risk of potential airborne viral transmission by reducing exposure time to any airborne viral aerosols, and also reduce the chance for these aerosols to settle on surfaces.

Evidence shows that viruses can survive on some surfaces for at least 72 hours and hence any action to limit surface contamination is beneficial.

It is recommended that any ventilation or air conditioning system that normally runs with a recirculation mode should now be set up to run on full outside air where this is possible.

In buildings with mechanical ventilation systems extended operation times are recommended. In demand control systems CO2 set points should be set to 400ppm to increase the delivery of outside air. Ventilation should be kept on for longer, with lower ventilation rates when people are absent. It is not recommended to switch ventilation systems off in any buildings, even those temporarily vacated, but to operate them continuously at reduced speeds.

Recirculation of air between spaces, rooms or zones occupied by different people should be avoided. However, in the case of any systems serving a single space, partial recirculation of air within that space, such as through a local fan coil unit, is less of a concern. The reason is that the primary objective is to maximise the air exchange rate with outside air and to minimize the risk of any pockets of stagnant air.
If a local recirculation unit enhances air disturbance and hence helps reduce the risk of stagnant air then this should be considered when developing a strategy. Note that although these are relatively uncommon today, ceiling fans within a space can provide this function.

On colder days consideration must be given to human behavioural responses. A ventilation system on full outside air which is not adequately heated may create discomfort draughts. This may lead to users seeking to turn the system off, or with naturally ventilated spaces users may close vents or windows. These actions will reduce the air exchange rate and dilution of any contaminants (and not just any viral contamination) and overcome the primary objective of the ventilation strategy. It is important that where users can intervene in the control of the ventilation that they are made aware of the benefit of these for reducing the circulation of infectious material.

Care should be taken with any ventilation grills that can be blocked, e.g. floor grilles for displacement ventilation, and occupants educated on the purpose and benefits of these.

The potential benefit to public health at this time outweighs the reduction in energy efficiency caused by not recirculating air. Airborne contaminants may be minimised by proper and effective filtration and regular maintenance. Viral material that settles in ductwork will become unviable over time. In the event that some viral material entered ventilation and air-conditioning systems prior to buildings being vacated due to the current restrictions, it is extremely unlikely that that material will pose any risk when those buildings are re-occupied.

Where cleaning or planned maintenance of ventilation systems is required, such as in catering premises, it should be undertaken in line with agreed industry guidance, including that relating to site operations under social distancing requirements. Appropriate PPE should be worn and all materials, including old filters, should be carefully bagged and disposed of safely. Given the requirement for many business premises to close for the immediate future, there is unlikely to be a requirement to undertake work on their ventilation or air conditioning systems at this time.

In poorly ventilated spaces with a high occupancy and where it is difficult to increase ventilation rates it may be appropriate to consider using air cleaning and disinfection devices. The most appropriate devices are likely to be local HEPA filtration units or those that use germicidal UV (GUV) radiation. GUV devices use radiation in the UV-C spectrum and have been shown to inactivate coronaviruses, although there is not yet specific evidence of the efficacy of UV-C irradiation for SARS-CoV-2.
There are currently uncertainties about a variety of factors affecting UV performance including dosage, wavelength, and exposure time. In addition, consideration will need to address the specific room and system configuration, air flow, distribution, and humidity.

Any potential equipment will need to be properly tested, validated and quality assured and demonstrated to provide the specific irradiation properties it is designed to and nothing else. It is essential that appropriate safety interlocks are installed to ensure UV cleaning equipment is not operated when people may be exposed to the radiation.

They can be applied as an upper-room system or a stand-alone consumer unit, but it is important that these are sized correctly for the room as many do not have the flow rate to be effective in larger spaces. In-duct UV-C is not recommended to control disease transmission unless it is to decontaminate air that is recirculated. Devices that emit ozone or other potentially hazardous by-products should not be used in occupied spaces.

The key actions are:

- *Understand your ventilation system*
- *Run your ventilation at higher volume flow rate; this may require changes to CO 2 set points (for both mechanical ventilation and automated windows)*
- *Avoid recirculation/transfer of air from one room to another unless this is the only way of providing adequately high ventilation to all occupied rooms*
- *Recirculation of air within a single room where this is complemented by an outdoor air supply is acceptable*[1]
- *If applicable enthalpy (thermal) wheels should be switched off, but the pressure difference will need to be maintained between supply and extract to minimise any leakage flow from the extract to supply side*

- END OF EXTRACT –

The guidance essentially asks businesses to forego energy efficiency in the name of public health.
Many businesses have invested considerable sums of money in carbon footprint reduction initiatives and now as a result of the pandemic are already under financial pressure.

Turning off air recirculation and running HVAC systems for longer durations and at higher rates results in an increase in energy costs, which ultimately affects the bottom line and will eventually lead to more difficult decisions being made by those at top levels of organisations that could have been prevented.

Whilst we support efforts to control the virus outbreak, the technological advances made in the IAQ industry compel us not to concur with much of the advice being the only option available to businesses.

Before we look at the alternative, we need to look at the real world cost impact of following the guidance.

Energy usage of fit for purpose ventilation (pre covid-19)

Our test site for the case study is the world famous Lloyd's of London. Their original ventilation system comprises a supply and extract AHU using LTHW and CHW systems for temperature control providing approximately 9,621CFM (cubic feet per minute) of air throughout each occupied floor with built in air recirculation for optimal efficiency.
The HVAC plant is set to run during operating hours every day to allow for when the majority of staff and customers are present in the building.

The usual energy consumption of the HVAC system for the building is based on power consumption of 866,372 kWh per annum.

Effects of altering the building ventilation strategy on power consumption

After lockdown, the client was advised by the local authority a set of guidelines to follow (CIBSE guidance) for their particular facility, which required running the ventilation for longer and at a higher rate and altering the programming on the Building Management System (BMS) to switch off the recirculation of air.

This would result in the total HVAC energy consumption for the whole building consuming an additional 418,756 kWh per annum. (Total of 1,258,128 kWh per annum).

Effects on ongoing maintenance costs

An increase in the duration of the AHU and associated plant hours of operation also take their toll on the electrical and mechanical material aspects of the installation and thus increase the workload on the facilities team who maintain them. One must then consider altering the existing SFG20 maintenance regime frequencies to accommodate continued uninterrupted operation of HVAC plant and the life span of such equipment. One can make the logical assumption that if the plant is being called for longer, then the life span may shorten dramatically and service intervals will increase - and reactive call outs will increase due to more frequent breakdowns.

Consultation with the FM provider suggested that maintenance costs would likely increase by approximately 20% per annum with the increase in maintenance intervals and breakdowns.

Filters would likely require changing every 3 months as opposed to 6 months, motor belts and bearings would experience increased rate of wear in fan motors. Inverters, heating and chilled water pumps, boilers, chiller components, valves, actuators, and associated pipework would also wear faster. This would also mean ductwork and ventilation cleaning would need to be undertaken more frequently as the rate of dust matter build up would increase.

The reason for the guidance recommending the altered operation of the ventilation system is dilution, displacement and replacement of air as a means of reducing stagnation and concentration of harmful airborne pathogens. However we know that airflow patterns and the nature of person to person virus transmission means that this strategy is largely ineffective. Stand in the wrong place and you're essentially inhaling a steady stream of germs and microbials.

Combined with an increased cleaning regime and monthly fogging aimed at reducing surface transmission, many businesses assume this is their only option to fight COVID-19 and give their staff the confidence to return to work. This proves to be extremely costly, given the energy costs mentioned above, and also the cost of increased cleaning and fogging which run into the tens, often hundreds of thousands for commercial buildings.

The alternative solution to this is using an air purification process that is effective in all areas of the indoor air and surface space simultaneously and continuously. However not all forms of purification work like this and it is imperative that one understands the types and limitations of all the different technologies available. With the exception of REME, they all make bold claims but in fact their reach is limited and their effectiveness and performance is highly conditional.

Understanding Active Vs Passive Air Purification

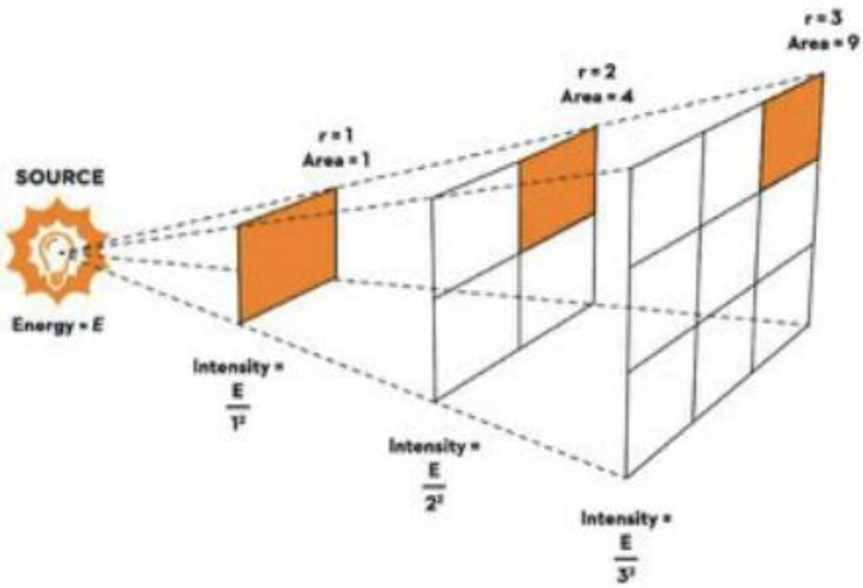
Before considering which method of purification to use, you must first understand whether the technology you are considering is passive or active. True active technology like REME works in all parts of the indoor space simultaneously and continuously across all pollutant categories without conditions whereas passive systems are limited in their reach and coverage of pollutant categories and their performance is highly conditional. For example, there are many passive technologies being sold as solutions for viral transmission prevention yet in truth they are subject to the following conditions being met:

- The pathogen or pollutant or particulate must first be drawn into the unit.
- The pathogen or pollutant or particulate must be stationary and/or have passed very close to direct UV-C source and/or through an ionisation field.
- The pathogen or pollutant or particulate must not be smaller than the filter grading which excludes all viruses.

If one considers it can take hours/days/never and lots of energy for these conditions to be met for airborne particles and never for surface contamination it is undeniable that the risk of viral transmission remains high with passive systems so they must not be used for this purpose especially if more effective alternatives exist.

There are other drawbacks with passive systems. Filters collect dust and quickly become clogged up which affects performance. They also become breeding grounds and harbours for viruses and bacteria which creates a health risk when filters are changed and allows pathogens to fall off and get passed back into the room. Also filters, UV-C and PCO technologies do not guarantee to remove or destroy all pathogens as they pass through the unit. For example, HEPA's smallest grade is 0.3 microns yet all viruses are smaller than this so will pass straight through and back into the room. Also, UV-C and PCO are subject to the Inverse Square law and require "dwell time" to deactivate viruses, bacteria and odours meaning their effectiveness drops off considerably the further away the particle is (at 4 inches distant UV strength is reduced by 93.75%) and they have no effect on particles in a moving airstream. Ionisation only technologies cause particles to drop out of the air or collect on plates and viruses, bacteria or odours remain infectious and a health risk for hours before they are deactivated. Similarly, PCO and ionisation technologies are known to produce dangerous and even carcinogenic by-products including ozone and Formaldehyde.

Visual representation of UV and PCO affected by the inverse square law.



REME mimics Earth's natural air cleaning processes. The "oxidiser soup" of hydroperoxides, super oxides and hydroxide ions is released into the air stream and reaches into every cubic cm of indoor space, continuously breaking down and destroying viruses/microbials in the air and on surfaces as it goes and reverting back to water vapour and oxygen afterwards. This process is essentially the opposite of the passive approaches described above. The air does not need to be passed through the device to be treated rather it treats all of the air and all of the surfaces in every part of the indoor space simultaneously and continuously. It is impossible for any passive technology to work like this.

These are the fundamental differences between active and passive technologies and they explain why it is important to understand how each technology works.

Below, the following two videos taken from RGF's IAQ training guides, explain the attributes, differences and drawbacks of Filtration, UV-C and PCO/Ionisation in better detail:

Passive: https://youtu.be/6KYCPZE2vmw

All of the air in a space must be pulled through a device/filter in order to be treated. In practice only air close to the unit is pulled through. Air further away from the unit is not treated.

Examples are HEPA/UVC/PCO/ionisation/non-thermal plasma. These technologies can be used for large particle filtration/coil disinfection/extending coil and filter life. In other words they can be used for AC maintenance but they should not be used as a solution to minimise person to person transmission risk of COVID (or any other form of virus/bacteria/germs in the open space). They do not provide continuous real time at source deactivation in every part of the air space and offer nothing for surface contamination. Similarly there are some technologies that produce dangerous levels of ozone or make claims that are either impossible or dangerous or both, such as hydroxyl "cascades" (due to the short lived and highly unstable nature of these oxidisers.)

Active: https://youtu.be/ZxUINHW4N18

"we were looking for a system that kills viruses and bacteria instantly the moment they are emitted into the air or touched onto surfaces to replace our passive UVC systems. REME ticks all the boxes and has helped reduce absenteeism and improve productivity"

RGF Environmental Inc has two patented active purification technologies which are used in millions of products (in-duct, standalone) across numerous vertical markets (residential, commercial, industrial, public sector/government, military) in over 60 countries around the world. They are Photohydroionisation (PHI) and it's more advanced sister Reflective Electro Magnetic Energy (REME). They use broad spectrum UV light shined onto a quad metallic hydrophilic catalyst cell, which continuously releases low and safe levels of hydro peroxide molecules into the air. This "plasma" is distributed throughout the entire indoor space, continuously sanitising the air and surfaces as it goes and creating a healthy environment free of pathogens, pollutants and particulates. In essence, this means that if a person were to enter a room and emit the virus into the air by coughing or touch it onto a surface, it would be instantly deactivated no matter where in the room the person is located. No passive form of purification can make this claim. Importantly, both PHI and REME technologies were developed over 15 years ago and are the most scrutinised, exhaustively tested and proven of all air purification technologies. RGF has recently been awarded the IAQ industry's first 'zero-ozone' certification under the latest UL867 standards (0.005 ppm or less) by Intertek. Other technologies that claim to be zero ozone do not meet these new stringent requirements:

https://www.intertek.com/news/2020/08-12-intertek-sustainability-issues-first-zero-ozone-cert ification-to-rgf-environmental-group/

The REME Solution

The suggested alternative to altering the strategy of the HVAC system was to incorporate REME into the existing HVAC system. By doing so, less air changes (dilution of microbials) would be required given that the air itself is being continuously disinfected by the purification system.

REME, a 15 year old technology used in millions of RGF products in many countries around the world, combines Photohydroionisation with bi-polar ionization and is certified ozone free by Intertek. Demand for RGF products around the world has skyrocketed since the COVID pandemic hit.

REME has been tested against SARS-Cov-2 in the United States in a 20″ x 8″ x 8″ chamber to simulate a real world scenario and yielded a 99% kill rate of the virus.

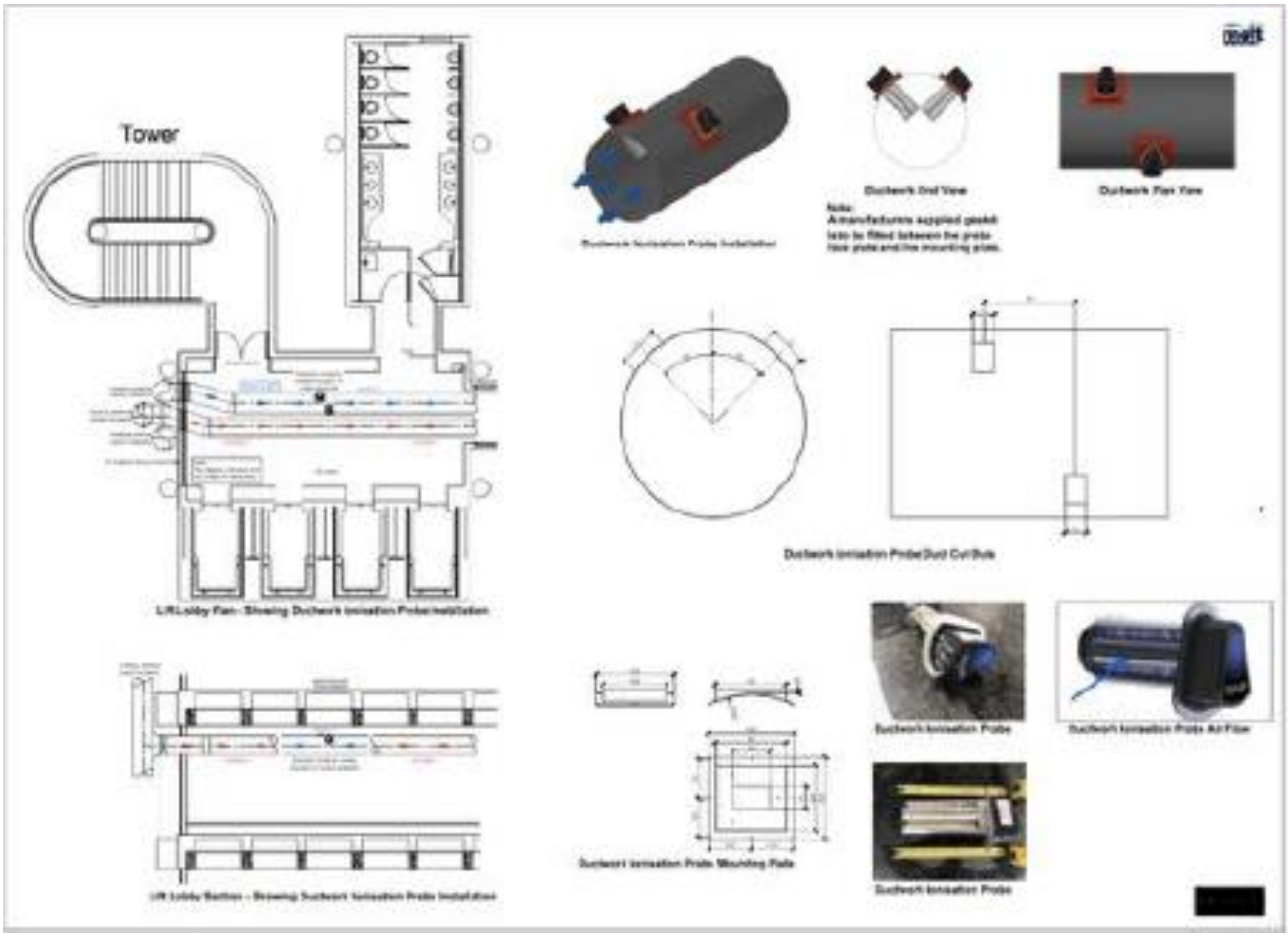
The REME HALO LED unit is mounted in-duct or as a standalone unit and distributes a safe level of hydroperoxides, superoxide ions and hydroxide ions into the surrounding air or passing air stream. These hydroperoxides are nature's natural air cleaning agents and are constantly found in outdoor air. REME mimics the natural outdoor process indoors and these oxidisers continuously break down harmful pathogens throughout the entire conditioned air space.
The concentrations of hydrogen peroxides produced by the units is an important consideration. The levels are between 0.02 and 0.04ppm. Comparatively, typical outdoor levels are between 0.01 and 0.03ppm and these levels drop very quickly to zero when outdoor air ingresses into untreated indoor environments due to typical organic loading that causes them to break down. Our units effectively replenish the indoor environment with these same cleaning agents which are found outside. These levels pose no risks to consumers and are well below OSHA standards.

REME is uniquely effective across all three types of indoor pollutants: microbials, VOCs/gases and particulates. The hydroperoxides rapidly break down microbials, germs, viruses, mould and reduce odours whilst the ionization effect causes airborne particulates to 'clump' together, making them heavier so they fall out of the air and larger causing them to be captured by existing HVAC filtration. This is a particular advantage where PM2.5 is concerned, thought to be responsible for 5% of the world's cases of lung cancer. Many buildings use some level of filtration (G4, F7, HEPA) and these tiny particulates are so small they can be ingested via the lungs and even pass directly into the bloodstream. REME is similarly effective all the way down into the ultrafine range (PM0.001 and smaller).

Installation Topology

We surveyed the customer's City of London site and reviewed the design and commissioning ventilation rates for the building.

In this instance we were able to recommend REME HALO LED units installed in the main branches of the supply ductwork that serves the office spaces that maximise the airflow scalability designed into the products and therefore offer the best possible value and return in investment capability. The following image was produced by the client's consultant who procured the unique adapters for the building's ductwork and who performed the installation.



REME Power Consumption and Running Costs

Below we compare the power consumption and costs of this approach vs current guidance and the actual cost of fogging being used by the client at the time of writing.

REME HALO LED: 17W

Running costs of the air purification system combined was 19.32 kwh a day which equates to 7051.80 kwh annually and based on the price of electricity at the time of writing 12.58 pence per kwh and is estimated to cost only £2248 annually.
In comparison to following current guidance, an annual energy saving cost of £106,741.60 alone would be made if this approach was used.

Efficacy of REME vs Fogging

The study was intended not only to demonstrate massive cost savings, but also to determine the efficacy of REME on one floor, vs fogging on another floor. The size and layout of the floors were almost identical and the air flow rates were also similar and unchanged from their pre-COVID commissioned settings. The study required an independent third party analysis of the microbial counts of both fogging and active air purification over the agreed duration following the fogging treatment and the installation of the air purification system. Also note, fogging uses approx 5% hydroperoxide in most cases, which requires occupants to vacate the treatment area for several hours, whereas active air purification contains under 0.04ppm which is effective against microbials yet safe for human presence, therefore productivity is not affected as it is with fogging.

The testing revealed a sharp decrease in the microbial count after the fogging treatment and then a strong upward trend in the hours and days following treatment. (Due to the high cost and requiring the area to be vacated, it would usually be another 4 weeks before treatment is reapplied.)

Following the installation of REME it yielded a drop in microbial counts within 48 hours of installation, which in stark contrast to the fogging, continued to fall and remained at a stable, low count continuously afterwards.

Site Address	Lloyds of London, Gallery 5
Date of Work	28th August 2020
Task	Swab test before and after installation of active air purification

Method of Works
○ Pre and post installation swab of key touch points in 6 work areas with recorded score. ○ NO Application of Zoono using cold foggers to communal areas. ○ Post swab of key touch points in 6 work areas with recorded score.

Swab results – Room 569			
10th Sep 2020	14th Sep 2020	28th Sep 2020	Comments
Pre – 45	Post – 15RLU	Post – 7RLU	

Swab results – Tower 6 – as shown on map location			
10th Sep 2020	14th Sep 2020	28th Sep 2020	Comments
Pre – 96	Post – 7RLU	Post – 7RLU	

Swab results – Tower 1 – as shown on map location			
10th Sep 2020	14th Sep 2020	28th Sep 2020	Comments
Pre – 44	Post – 18RLU	Post – 3RLU	

Swab results – Tower 4 – as shown on map location			
10th Sep 2020	14th Sep 2020	28th Sep 2020	Comments
Pre – 410 - fail	Post – 38RLU (1)	Post – 12RLU	

Swab results – Room 547			
10th Sep 2020	14th Sep 2020	28th Sep 2020	Comments
Pre – 20	Post – 15RLU	Post – 15RLU	

An additional third-party test was carried out to ensure the results:

2nd October 2020

Client: Lloyds of London
Address: 1 Lime St, Lime Street, London EC3M 7HA

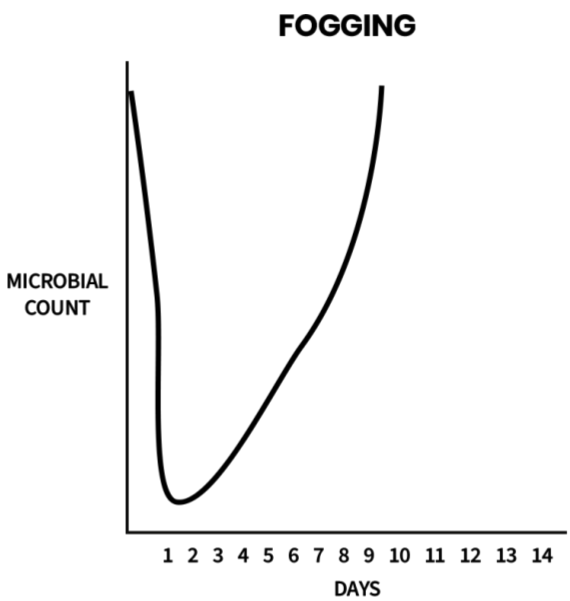
Task: ATP testing of 6 point on the 5th floor

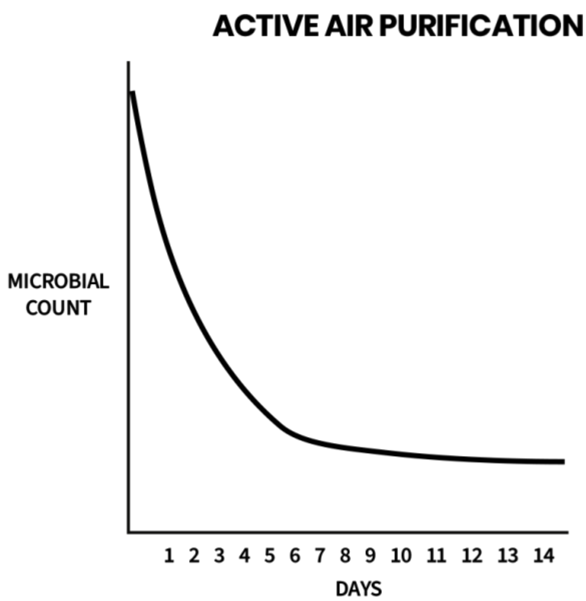
Following my site visit today using our Systemsure Plus (111684) machine. The results are as follows

Location	Result
1. Tower 3 Tea Point	13 RLU
2. Meeting room 547	1 RLU
3. Tower 4 Desk	4 RLU
4. Meeting room 567	2 RLU
5. Tower 1 Desk A	2 RLU
6. Tower 1 Desk B	11 RLU

Using the same measurement instrument, a sample was also taken from the hand of the laboratory technician carrying out the testing:

If this were to be depicted on a graph as fogging vs REME you would see the following patterns based on our results:



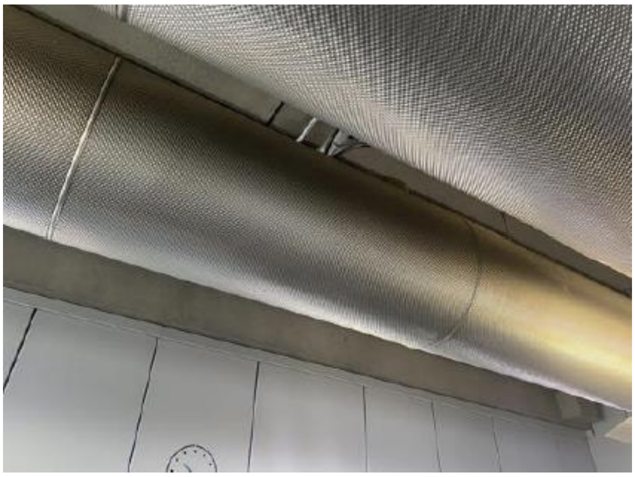


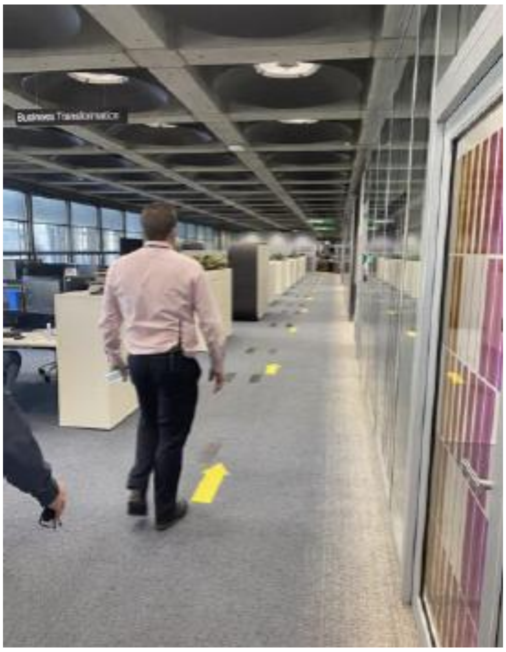
The ‘rinse and repeat’ approach of fogging is not a viable method of infection transmission control due to its temporary effect and prohibitive cost. REME installed in the facility has proven to reduce the risk dramatically and will not only serve as a COVID-19 transmission prevention strategy, but also for a host of other viral infections and germs and improves indoor air quality as a whole.

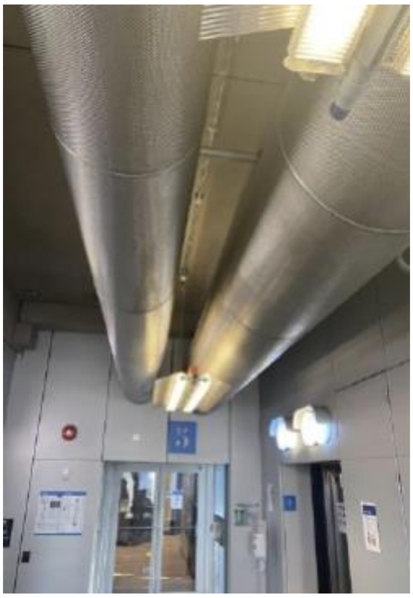
Studies by Harvard professors have shown that improved indoor air quality can reduce symptoms of 'sick building syndrome' resulting in reduced absenteeism. This improves productivity and yields up to 10% on a companies' bottom line.

Due to the efficacy of the technology and the nature of REME vs the temporary effects of fogging which lessen over time, the environment is safer and the threat of virus transmission is reduced dramatically. By installing this technology, we are able to offer an effective low cost, low energy alternative.

Test Area Images







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