Louie Cheng

President
PureLiving Indoor
Environmental Solutions

Louie is President and founder of PureLiving, an indoor environmental health and safety consulting firm and the director of the China chapter of the Indoor Air Quality Association. With offices in Shanghai, Beijing, Chengdu, Hong Kong, and New Delhi, PureLiving provides a total range of solutions including pollutant testing, design and installation of cutting-edge filtration systems, monitoring, and odor and chemical reduction.

Louie has over 22 years of experience in the scientific and consulting fields in the US, Europe, and Asia. He has personally conducted or supervised over 2000 successful indoor environmental consulting projects in China. More than 40% of the largest 100 companies in China are among Pure Living's clients.

Previously, Louie was the Asia-Pacific Director of Strategy and Business Development for Thomson Reuters' Healthcare and Science business. Before that he was a Managing Consultant with IBM's Strategy & Change practice. Louie is a graduate of Harvard University and completed his MBA from Dartmouth.

He began his professional life in the US Army as an enlisted soldier and is a Lieutenant Colonel in the Army Reserves. His training in the Army included biological defences and among other roles he served as a chemical officer, combat engineer, and operations officer.

How to Build a Bio-Resilient Facility Against

COVID-19

PURELIVING
Indoor Environmental Solutions

Disclaimer

The following information presented is collected from collaborative sources and is intended to inform and guide with practical experience. It should not be treated as a definitive authority on virus management.

PURELIVING
Indoor Environmental Solutions

- China's first indoor environmental quality consulting and engineering company
- Turnkey approach: Assess, Design, and Implement Solutions and Monitoring
- Over 8000 Projects completed in China
- Advisor to over 35% Fortune 100 companies in China
- IAQA China Chapter Founder; BOMA Official Trainer, IFMA Member
- WELL/ASHRAE/LEED APs

* Services cover by SHANGHAI office

IAQA MA U.S. GREEN BUILDING COUNCIL LEED USGBC ASHRAE CIE IFMA International Facility Management Association BOMA International

Engineering CLEAN Environments

Any COVID Defense Program Must Consider Transmission Methods

Direct

(Touch or droplets)

Indirect

(Fomite transmission)

Airborne

(Aerosolized droplets)

Masks – Just Do It

- Surgical Mask
- Lower filtration – only stop droplets.
- Protects others, not the wearer
- Fit matters!
- Single (daily) use

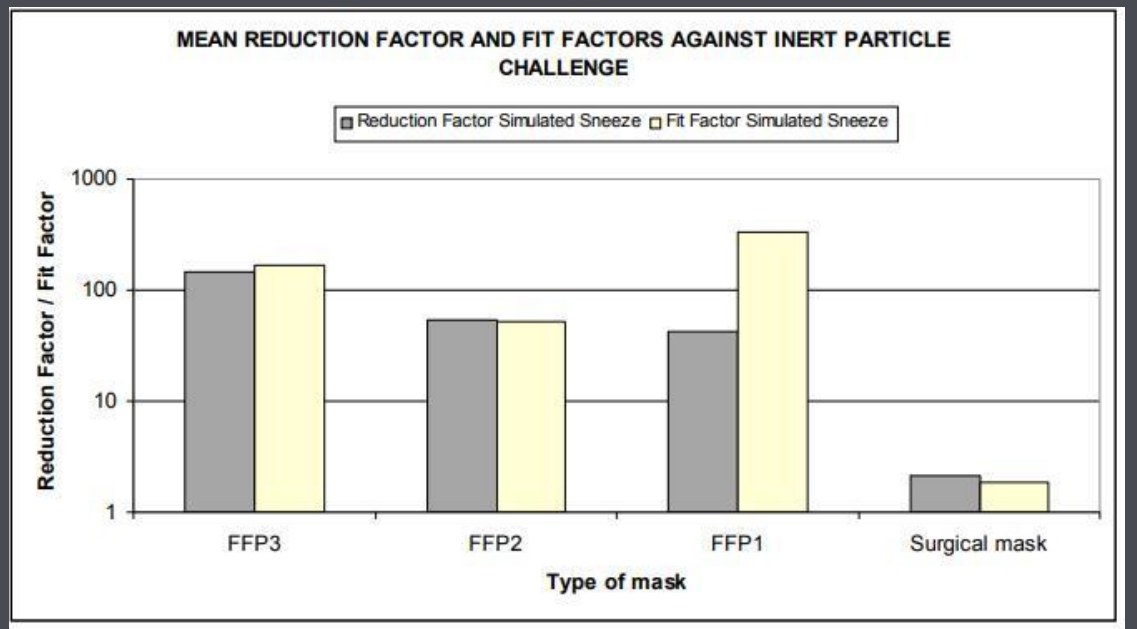


Figure 3.6 Mean values of the reduction factors and fit factor results for the grouped range of filtering facepieces and surgical masks tested against the inert simulated sneeze

- N95/FFP2 rated respirators
- High filtration level
- Protects wearer AND others only if no valve
- Better fit
- More durable & longer life

- 10-15x difference in protection factor to wearer of surgical masks vs respirators

Indirect Contact –
Bacteria or Viral “Hot Spots”

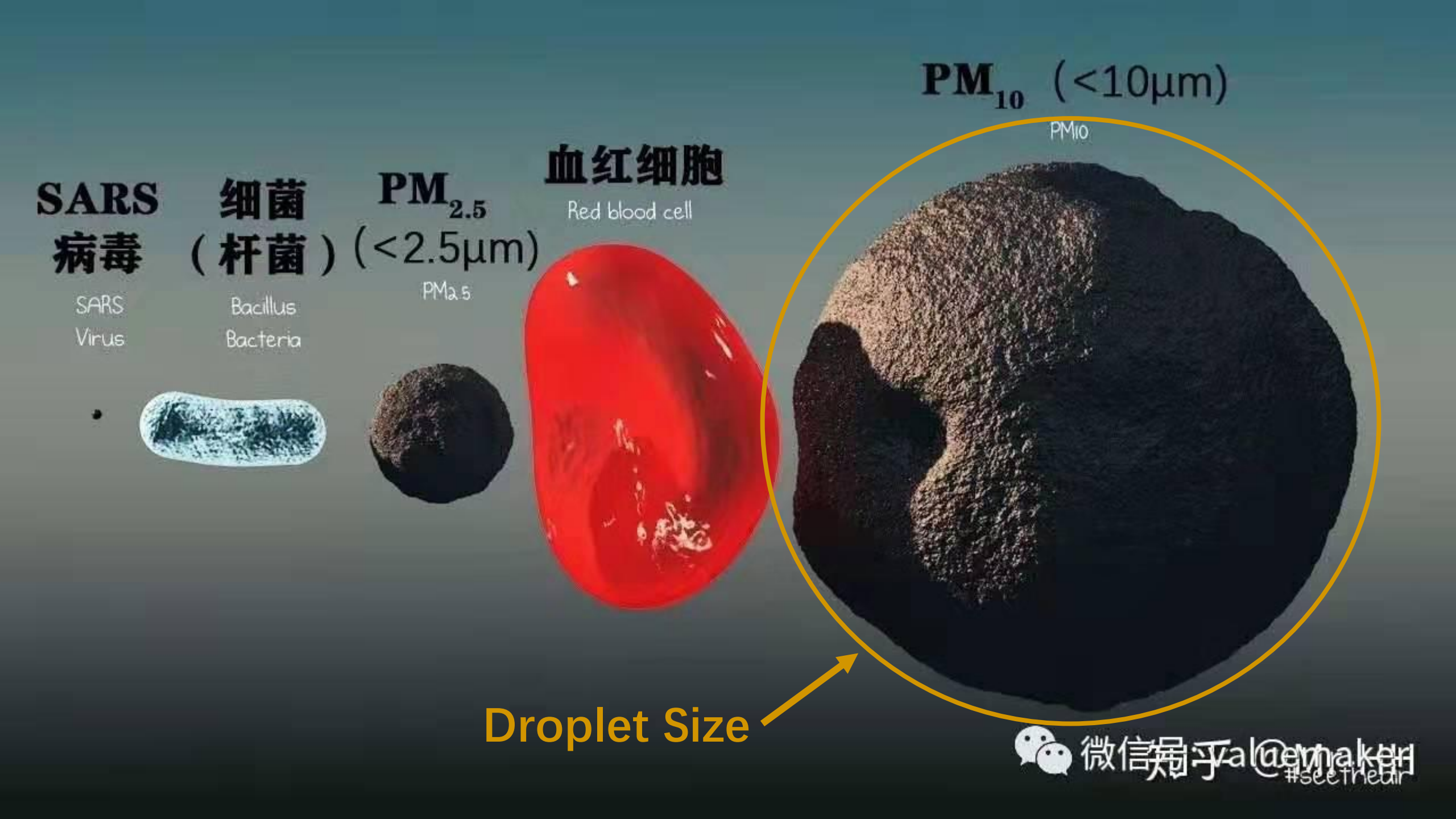
Solution	Concentration	When to use	Contact time	Pro	Con
CLO2	2 x 1g of 10% by weight tab per litre water	Cleaning hard non porous surfaces, floors, walls door knobs etc. Fogging / spraying. HVAC	>10 minutes	Easily soluble in water, low toxicity at typical concentrations	Slight irritant if high concentration in a enclosed space
Bleach	1:10 dilution with cold water. (hot water inactivates sodium hypochlorite	Cleaning hard non porous surfaces, floors, walls door knobs etc.	>10 minutes	Widely available, strong disinfectant	Easily inactivated by organic material Is an irritant **Do not mix with alcohol**
Hydrogen peroxide	50:50 mix of 4% hydrogen peroxide with cold water	Cleaning hard non porous surfaces, floors, walls door knobs etc.	>10 minutes	No toxic by-products	Easily inactivated by organic material Irritant
Alcohol based	Min 60% ethanol based mix with water 1:1	Cleaning hands, electronics	Instant	Quickly evaporates; good for small items	Flammable; not cost-effective for large surfaces
Quats	Pre-made solution or wipes	Not recommended	>30 seconds	Wide spectrum kill of bacteria and virus	Irritant, listed as a pesticide by EPA

In-Room Sterilization

STERILIZATION FOGGER

Sterilizes surfaces between procedures or patients for maximum safety.

- More efficient than manually cleaning
- Should not be used while occupied and requires ventilation post-use
- Runs automatically on timer or manually.
- Can be moved between rooms or areas.
- Ensure operation is in accordance with EPA registration


SARS
病毒
SARS
Virus
细菌
（杆菌）
Bacillus
Bacteria
PM2.5
(<2.5μm)
PM2.5
血红细胞
Red blood cell
PM10 (<10μm)
PM10
Droplet Size
微信号 Talentmaker
#seetheair

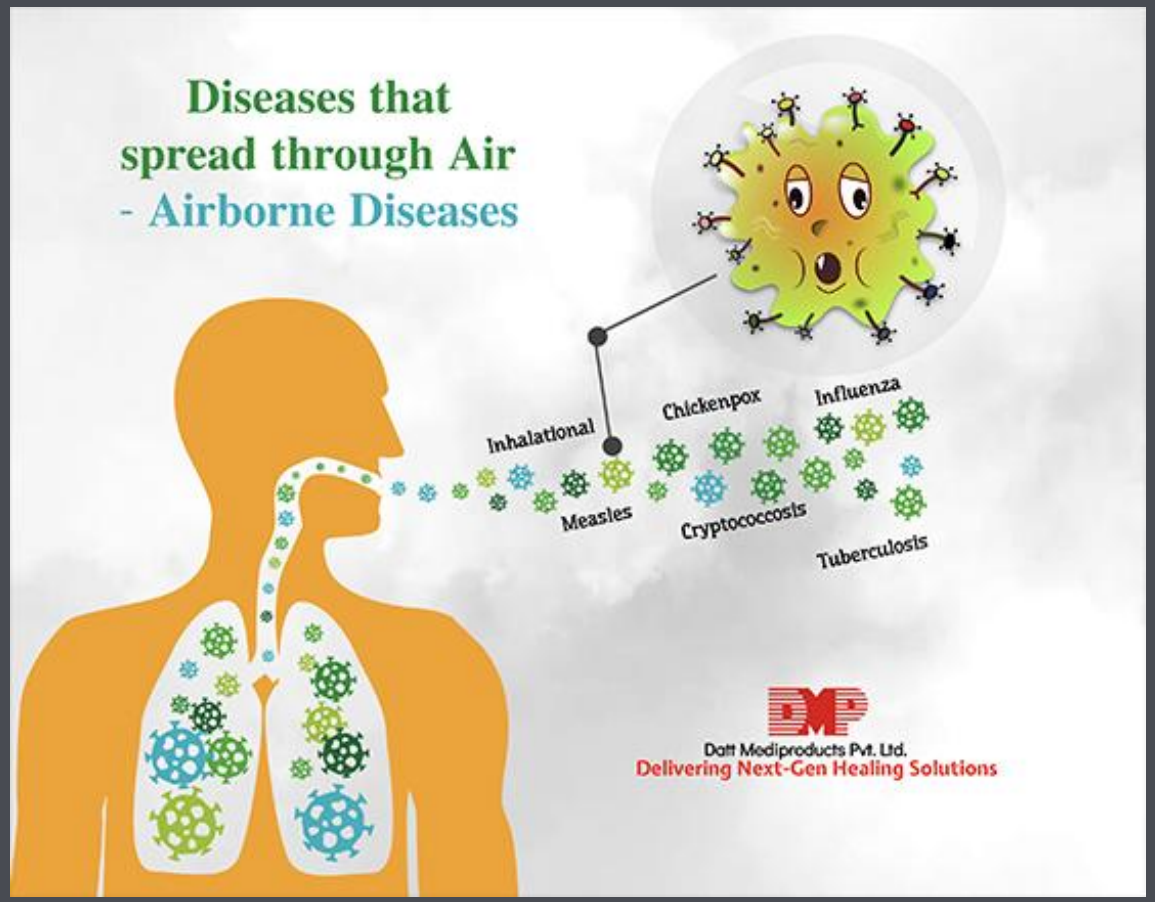
Direct Contact

Coughing releases over 30,000 saliva droplets

Travel at more than 90kph and reach 50m away

Evaporation can shrink droplets = airborne

Now recognition that COVID can be spread through air



REUTERS

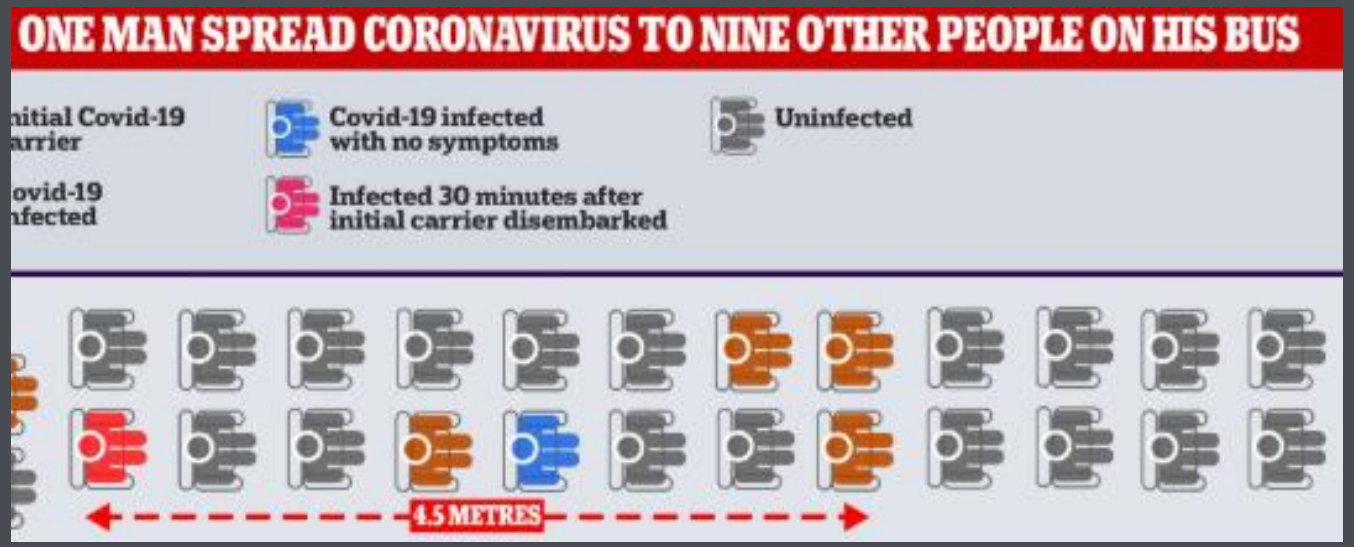
RCH 11, 2020 / 9:25 AM / 9 DAYS AGO

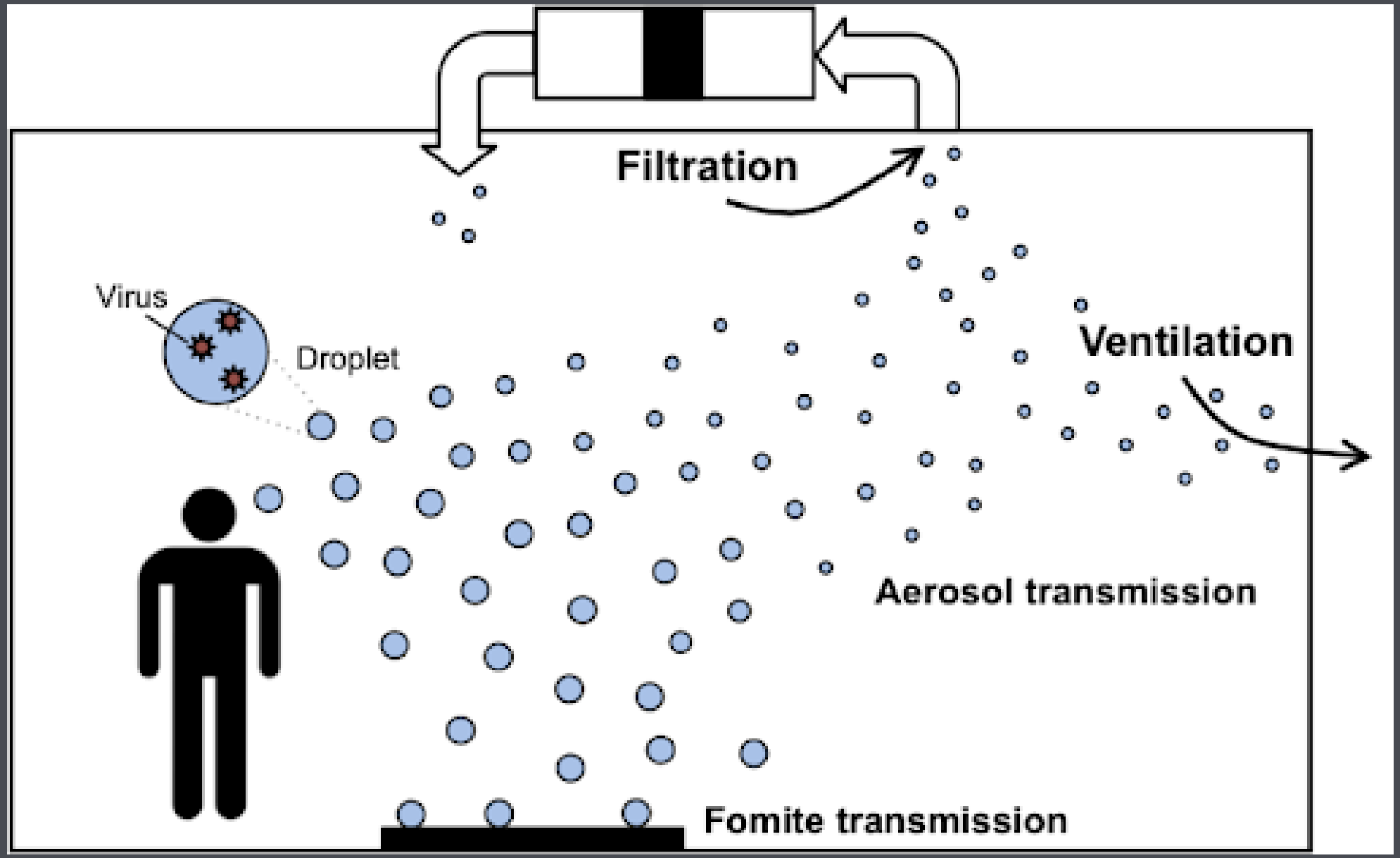
South Korea reports jump in coronavirus cases after call centre outbreak

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Evidence of Airborne Transmission of the Severe Acute Respiratory Syndrome Virus



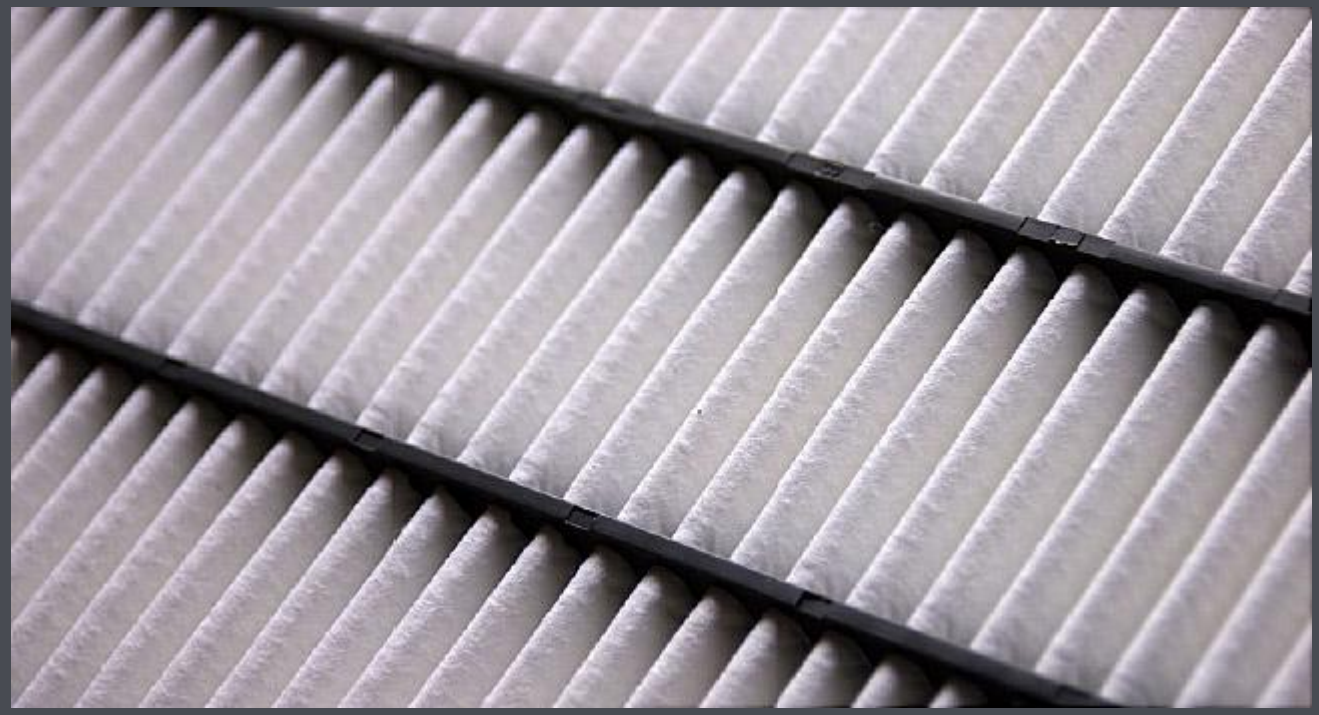


Wells-Riley Equation for assessing the role of airflow on the risk of airborne infection in hospital wards

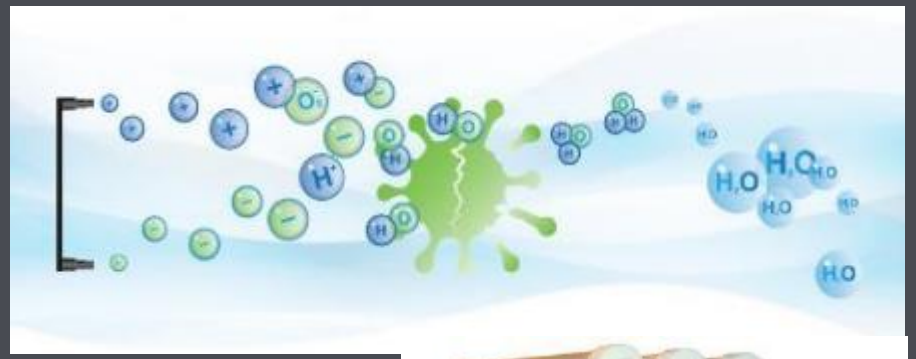
HVAC Filtration

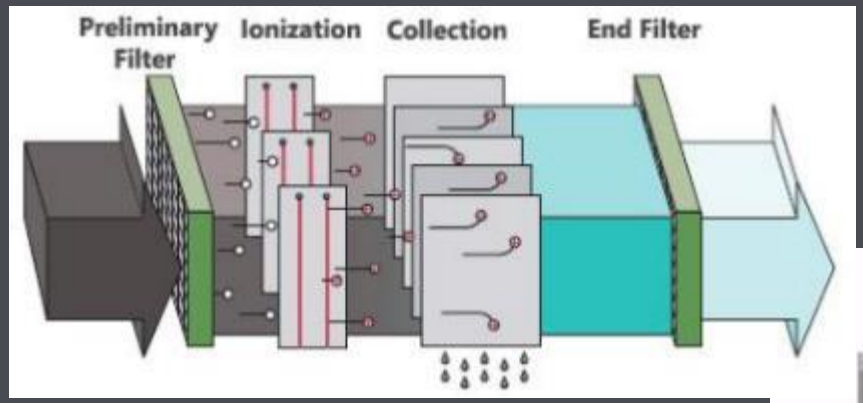
Recirculating filtration systems

- Media filters minimum efficiency F7 (MERV 13) for HVAC systems
- Portable and recirculating systems should have true HEPA H13
- Particles carrying the virus can become trapped
- Best to be paired with other technologies such as UV-C to kill virus trapped on filter



BPI (Bi-polar Ionization)





ESP (Electrostatic precipitator)

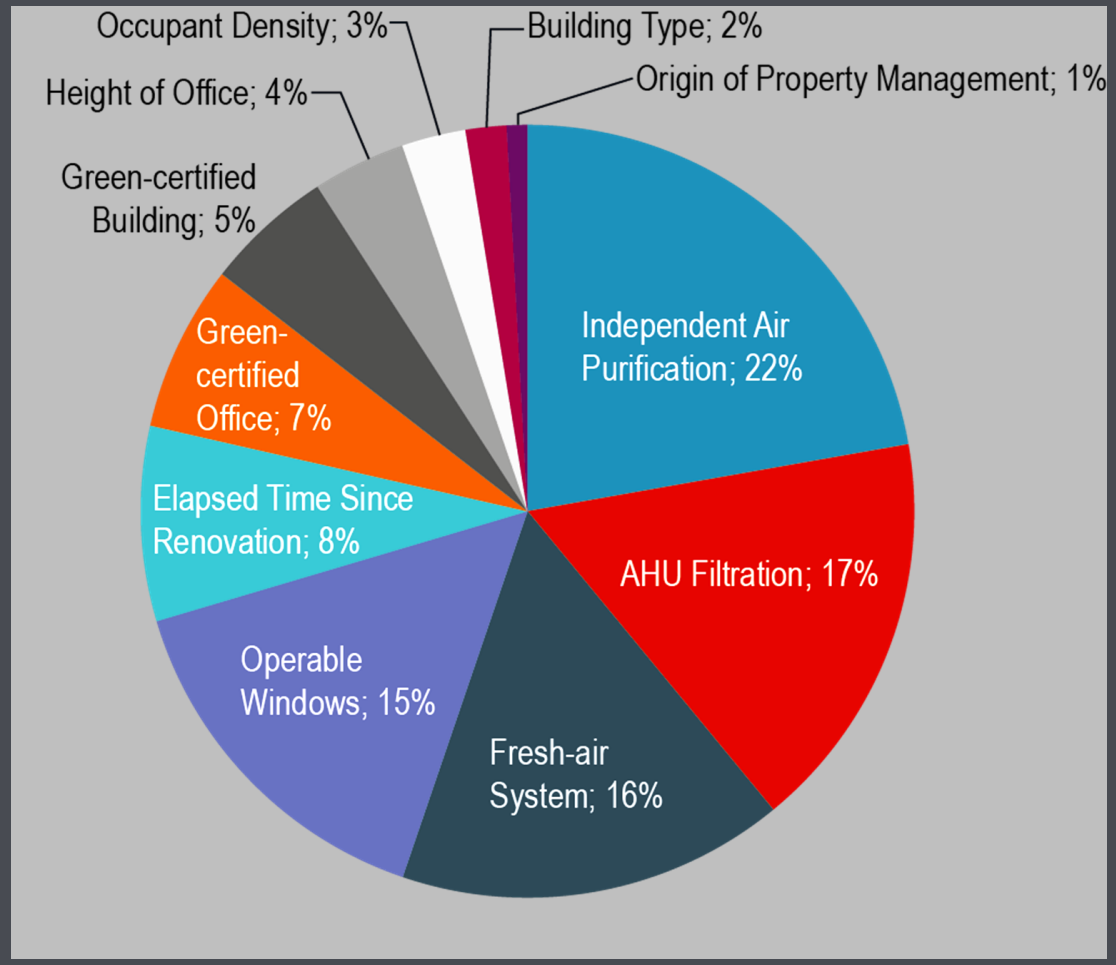
IFD (intense field dialectic)

UVGI in HVAC

- Widely used in healthcare to sterilize
- Needs to be UV-C (200-280nm wavelength)
- Air Speed and contact time dictates performance
- Needs to be shone direct onto surfaces (won't sterilize bacteria or viruses in fast moving air)
- Install across filter banks in AHU's or recirculating filtration systems to inactivate viruses trapped in filters

But building HVAC systems alone are not enough for filtration

Relative Impact of Factors on PM2.5 Reduction



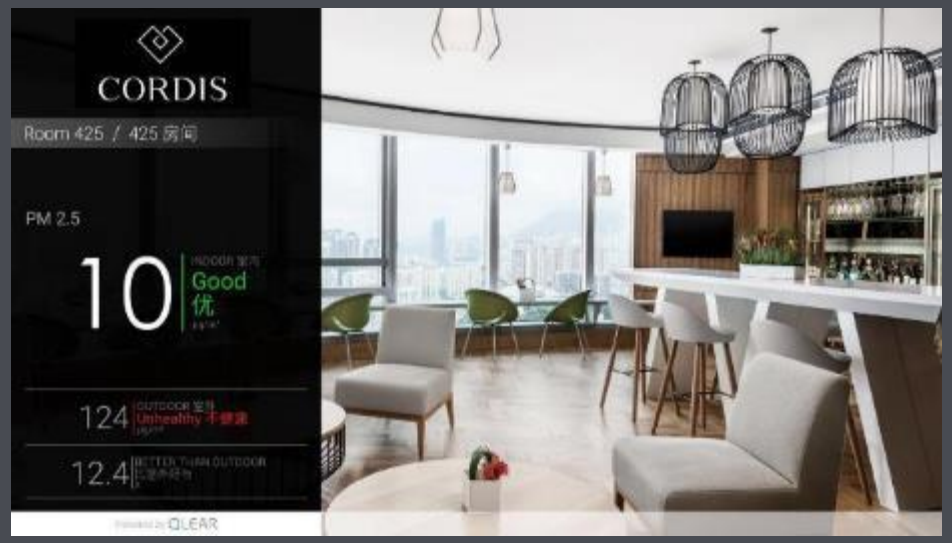
- JLL analysed 100 data points collected from 50 commercial office buildings at offices around China
- We found that mechanical systems had the greatest impact on PM2.5 levels indoors
- Offices with independent recirculating air purification generally had the best air quality (PM)

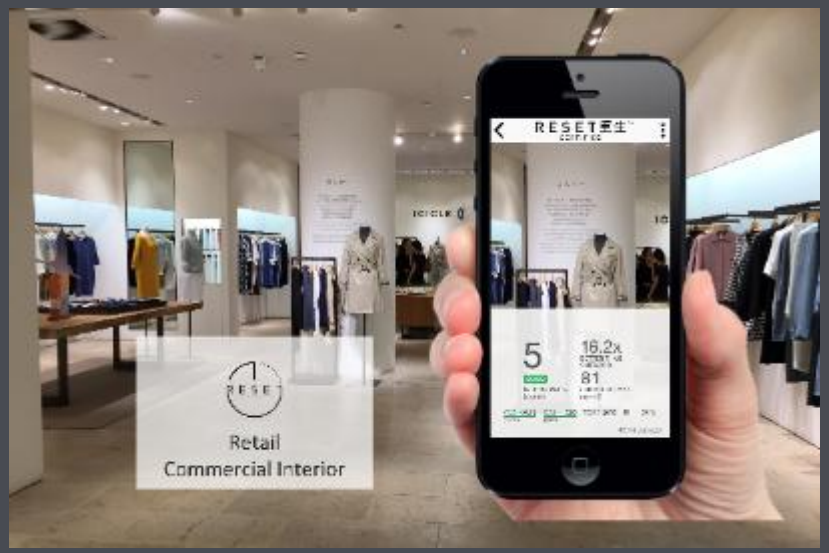
Source: "Every Breath We Take – Transforming the Health of China's Office Space," JLL Research and PureLiving White Paper

Recirculating Filtration – A New Approach

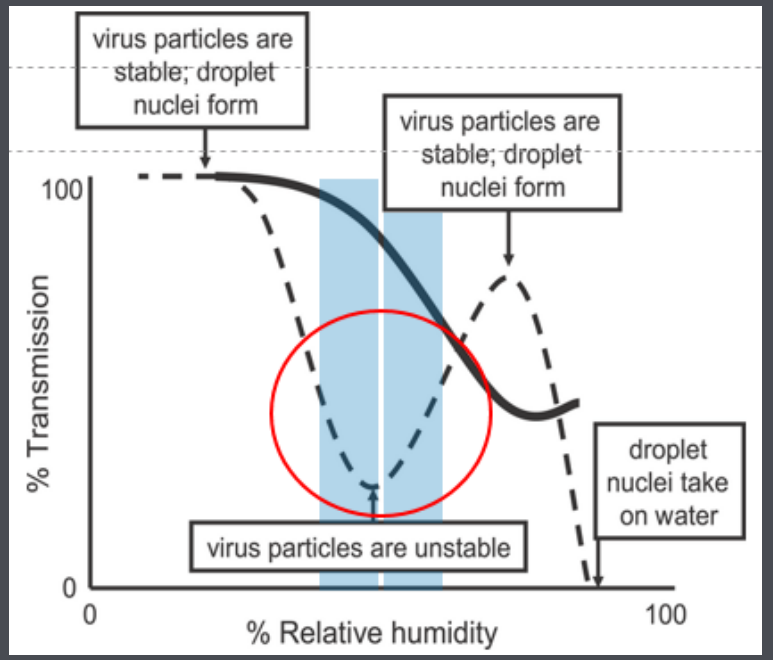
- In-ceiling mounted recirculating commercial filtration units are modular and independent of building HVAC so don't need building management approval
- Flexible platform: Medical grade filtration HEPA H13, specialty carbon filters, UV-C sterilization, and bipolar ionization removes over 99.997% of airborne contaminants, chemical odors, and biologicals
- Exceptionally low noise filtration solution with **silencer** meeting LEED/WELL certification target of <45db
- High performance **automated** system responds to environment situation and eliminates need for operator control
- Fresh air and medical variants can resolve stuffiness and increase ventilation and also exhaust virus-laden droplets to outdoors

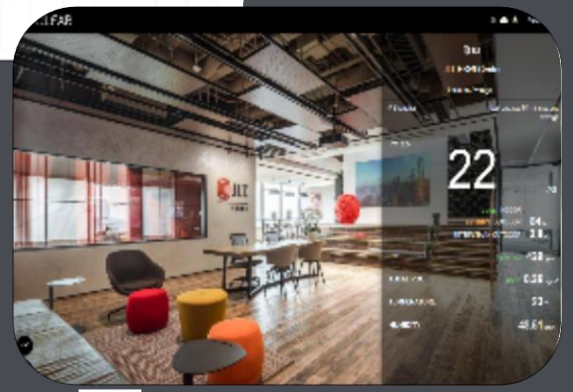
Real time Environmental Monitoring





Why Monitor?





Monitors can estimate the risk of virus transmission in real-time

Results are tracked and can be reported out on a user friendly dashboard. Data is also kept and can be used for long term trend analysis / performance validation

Results tell building owners and operators how the building is performing and end users confidence in the building they're occupying

I heard humidity doesn’t affect SARS-CoV-2.

Does it matter how long I stay in a building?

What’s the impact of PM2.5 on infection rates?

Should I ventilate or not?

Does recirculation of air help or harm?

Why are we managing our building spaces without data?

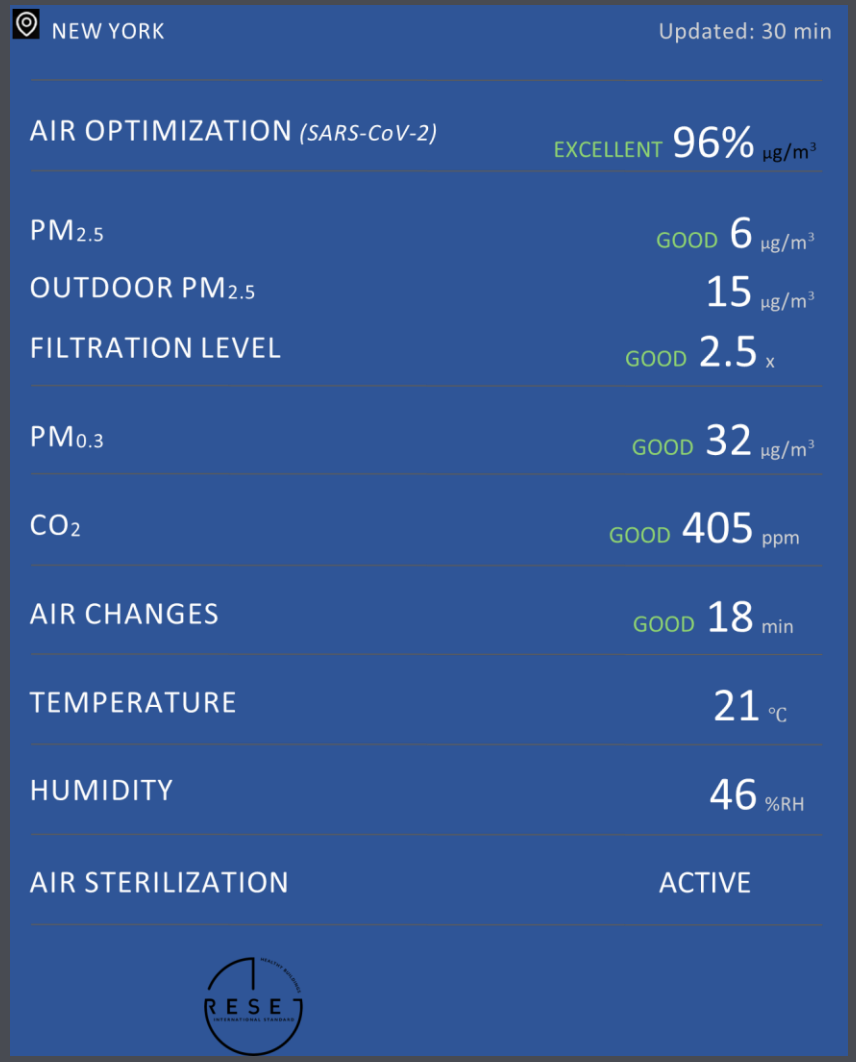
Why are we running blind?

“YOU CAN'T MANAGE WHAT YOU CAN'T MEASURE”

Peter Drucker

We can't monitor airborne viral concentration in real-time… but we can monitor the parameters that impact infection

IAQ Parameter	Indicative of Activity	Target Levels (daily average)
Relative humidity	Environment hostile to virus; supportive of human immune systems	50-65%
Temperature	Environment hostile to virus; comfortable for occupants	24-27C
Carbon dioxide (CO2)	Ventilation sufficiency to dilute viruses and other indoor pollutants	<1000PPM
Particulate Matter (PM2.5)	Effectiveness of filtration	<15ug/m3 (or >85% reduction of outdoor levels



The QLEAR COVID Transmission Risk Index helps you manage, communicate, and market the safety of your space

Case Studies from China: Real world experience achieving ROI

Internal:

What was done:

- Building upgrades (ventilation and filtration)
- Implementation of bipolar ionization
- Enhanced real-time monitoring and reporting
- Internal town hall for employees
- Social media campaign

Business results:

- In March, staff was reluctant to return
- System improvements have made staff appreciative and greatly supported their return to the office
- Monitoring used to manage building environment

External:

What was done:

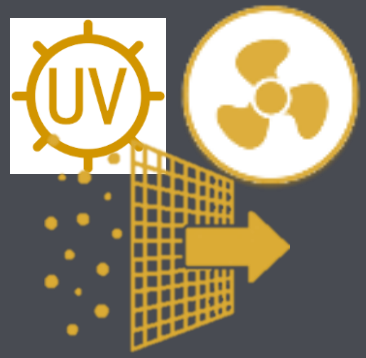
- Conducted technical risk assessment
- Implemented: improved access control, enhanced building filtration, real-time monitoring
- Highlighted COVID defense in proposals as differentiator
- Social media campaigns & In space signage

Business results:

- Brought largest number of new customer signings, 20% of new customers reported positive influence.
- Won a key client: Huawei (cited Covid-safety)

Solution Summary

All-in-one easy to implement solution to combine with effective use of PPE and robust infection control measures that combines environmental monitoring, risk algorithm scoring, third party credibility, scientific rigor, and solutions to **reduce transmission risk; make environments safer; and communicate effectiveness to staff**



Air systems

Filtration, ventilation, exhaust air, and in air sterilizing (UV-C, Ionization, Activated Carbon)

Room Sterilization

Active sterilisation to decontaminate areas after use

Monitoring

Measure in real time

- PM2.5
- CO2
- TVOC
- Temp
- RH

Dashboard

Report results benchmarked against scientific rigour and int'l standards

Automation

Automate air systems to run intelligently based on real time need or schedule