PlasmaAir

Commercial Buildings and Covid-19: Air Purification Takes on New Urgency

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It wasn't long ago that you'd walk into a commercial building and take note of the architecture, the floor plan, the décor, the mood. Few of us thought: Could I catch a lethal virus in here? Covid-19 has changed how the public perceives buildings and has raised the stakes for the engineers and managers who operate them.

Worldwide, coronavirus clusters have been traced to large indoor spaces. A mall in China, a whiskey bar in Idaho, an office building in South Korea, a hotel in Boston — all played a role in stoking fears of this global pandemic. Now, as restrictions loosen and buildings come back to life, building operators face twin challenges: minimizing the risk of coronavirus transmission and inspiring confidence among employees and customers. With a thoughtful approach, both goals can be achieved.

"As much as buildings can spread disease, if operated smartly, they can also help us fight against it."

– Joseph Allen, D.Sc.,

Director of the Healthy Buildings program at Harvard University's school of public health.

To some degree, each sector is developing its own strategies: online check-ins for hotel patrons, plexiglass buffers between casino slot machines, office desks positioned at 90-degree angles and outfitted with hand sanitizers. And certainly, all buildings have enhanced cleaning protocols for stairwells, restrooms, elevators, and other high-touch areas. However, building operators must do more than engineer social distancing and augment surface disinfection. The indoor air must be cleaned as well.

"When people cough or sneeze," explains Joseph Allen, D.Sc., director of the Healthy Buildings program at Harvard University's school of public health, "they expel not only large droplets but also smaller airborne particles called droplet nuclei, which can stay aloft and be transported around buildings." Sneezing patrons aren't the only concern for building operators. As research now indicates, the novel coronavirus, SARS-CoV-2, also can be spread via the speech, even the sighs, of people who feel fine but are nonetheless infected. A single minute of loud talking could launch over 1,000 virus-containing droplets, no small concern when co-workers convene in a conference room or restaurant patrons linger over dinner.

"Just sharing an enclosed space with lots of people can lead to massive spread," cautions biologist Erin Bromage, Ph.D. an infection expert at the University of Massachusetts, Dartmouth. Air disinfection technology, particularly bipolar ionization, has the potential to disrupt this spread, neutralizing the virus along with indoor pollutants such as volatile organic compounds (VOCs) and particulate matter.

Harvard's Dr. Allen ranks air quality among the "9 foundations of a healthy building" and predicts clean indoor air will become an increasingly valued commodity — one that building owners and business leaders will leverage to recruit talent and attract customers. In the post-pandemic world, Dr. Allen says, a healthy building will go "from a 'nice to have' to a competitive 'must have.'"

"Safe and Healthy Workplace" Takes on New Meaning

Before the emergence of SARS-CoV-2, bipolar ionization, typically integrated into the HVAC system, was becoming more prevalent in buildings worldwide. Upscale hotels from Dublin to Beijing have installed the technology to accommodate guests with breathing challenges and chemical or pet sensitivities. Casinos deploy the units to neutralize tobacco odors and toxins that circulate via air currents.

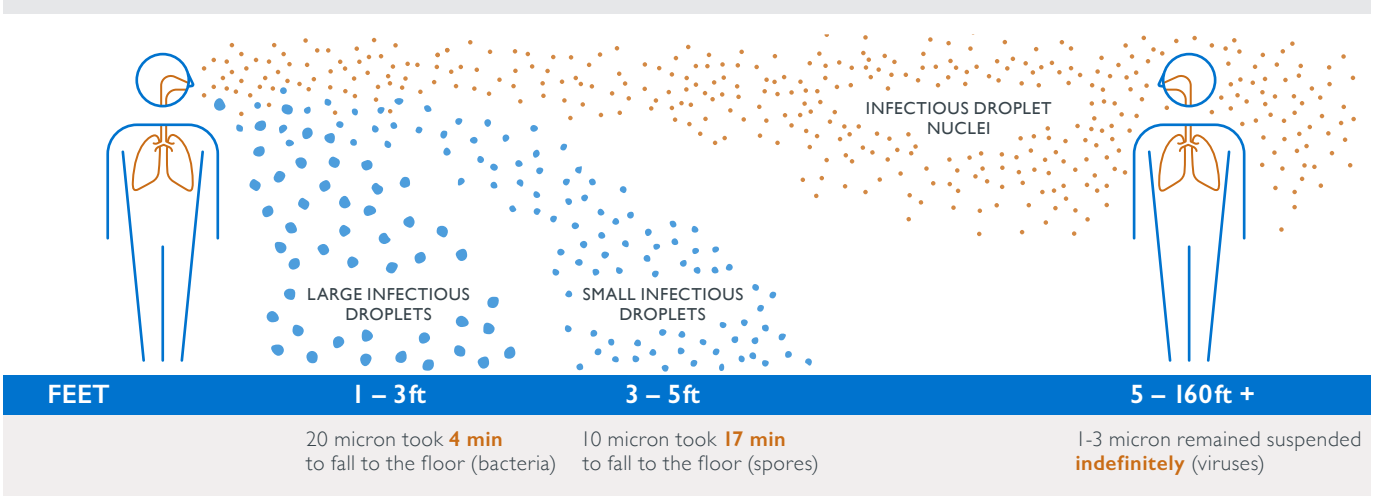
In the office setting, bipolar ionization is used to minimize the spread of influenza and colds — after all, 16% of flu transmission occurs in the workplace — while reducing pollutants that trigger headaches, exacerbate allergies, and compromise work performance. A majority of schools in the USA have adopted the technology to boost attendance during flu season and reduce asthma-related absenteeism related to mold, pollen, and chemical pollutants.

But with the explosion of Covid-19 — and evidence pointing to aerosol spread of the virus — air purification in commercial buildings has taken on new urgency. As the U.S. Centers for Disease Control (CDC) states in its Covid-19 guidelines for businesses: "Employers are responsible for providing a safe and healthy workplace." Whereas building safety once meant protection from criminal activity or fire hazards, it now includes, foremost, defense against a deadly virus.

How big a concern is aerosol spread of SARS-CoV-2? Bigger than originally thought. When the virus emerged, scientists assumed it was transmitted only by sick people spewing respiratory droplets — droplets that might land in the mouths or noses of people nearby or fall on surfaces that are touched.

Droplet-transmitted diseases typically have minimal implications for building operators; the infectious particles rarely travel more than a few feet, and the people who emit them generally feel too sick to venture out in public. That's largely why earlier coronaviruses, such as SARS (Severe Acute Respiratory Syndrome) and MERS (Middle East Respiratory Syndrome), were quickly contained. But the SARS-CoV-2 has proven to be more cunning.

Clearly, the virus is commonly spread by droplets, but scientists strongly suspect it's also spread via aerosols, microscopic particles that can travel long distances. And there's no doubt infected people can sicken others without, or before, developing symptoms themselves. Clues pointing to aerosol transmission have come from the tracing of "super spreader"



J.W. Tang, Y. Li, I. Eames, P. K. S. Chan, G. L. Ridgway, Factors involved in the aerosol transmission of infection and control of ventilation in healthcare premises. Department of Microbiology, The Chinese University of Hong Kong, Prince of Wales Hospital. Hong Kong; Department of Mechanical Engineering, The University of Hong Kong, Pokfulam, Hong Kong; Department of Mechanical Engineering, University College London, London UK School of Public Health.

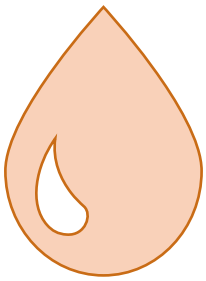
events. In South Korea, 94 employees on a single floor of a call center — 44% of the workforce on that floor — tested positive for the virus. At a choir practice in Washington state, held in a rehearsal hall the size of a volleyball court, 53 out of 61 singers became infected, and two died.

"Even if they were 50 feet away, a low dose of the virus in the air reaching them over a sustained period was enough to cause infection and, in some cases, death," says Dr. Bromage of UMass. The phenomenon of "stealth spread" also points to aerosol transmission. Research suggests at least 44% of Covid-19 infections emanate from people who feel just fine, whether they remain asymptomatic or eventually develop the telltale fever, cough, and muscle pain.

to patient rooms. Over 66% of these samples tested positive for SARS-CoV-2 particles. Inside patient rooms, coronavirus residue was found on ventilation grates and ledges of windows that patients hadn't even touched. Airflow modeling showed the particles likely had floated there.

Laboratory experiments simulate how aerosol transmission can happen. In one study, conducted by the National Institutes of Health, a volunteer repeated "stay healthy" for 25 seconds into the open end of a cardboard box; meanwhile, researchers used laser light to visualize the thousands of droplets released from the volunteer's mouth. The upshot: if you're infected, simply talking may infect others.

DROPLET FACTS:



1,000 # of **droplets** released by – **1 minute of loud talking**

3,000 – **a cough**

30,000 – **a sneeze**

200,000,000 # of **viral particles** potentially released when an infected person sneezes

"There are people out there spreading the virus who don't know that they're infected," cautions Jeffrey Shaman, Ph.D., a professor of environmental health sciences at Columbia University. Plenty of those people will work at the office, shop at the mall, and dine at a restaurant, possibly all in a single day.

Covert carriers, as they're known, can harbor as much virus as those with fevers and coughs, and they can shed viral particles into the environment for up to 5 days before symptoms surface. The more time these silent spreaders spend in a building, the more virus they release.

Scientists aren't just guessing that SARS-CoV-2 hovers in the air; hospital air-sampling studies have confirmed it. At the University of Nebraska Medical Center, where infected cruise-ship evacuees were quarantined, air samples were collected in the hallways adjacent

Normal speech generates airborne droplets that can remain suspended for tens of minutes or longer and are eminently capable of transmitting disease in confined spaces," researchers from the University of Nebraska concluded.

There are countless ways to become infected, explains Dr. Bromage of UMass. You could inhale 1,000 infectious viral particles in a single breath, 100 viral particles per breath over 10 breaths, or 10 viral particles per breath over 100 breaths. "Each of these situations can lead to an infection," says Dr. Bromage of UMass.

Research at an MIT lab found viral droplets in a sneeze cloud could travel as far as 27 feet and stay suspended for hours. What's more, gusts from everyday activity — foot traffic in a mall, office doors opening and closing, restaurant patrons removing their coats — can

further disperse viral particles. Some may be inhaled; others will settle on surfaces.

Buildings are contending with those surfaces in numerous ways: installing touch-free sinks, deploying cleaning crews hourly, even removing restroom doors to create airport-style, no-touch entrances. As one manufacturer of restroom equipment observed, "We're seeing a commitment to almost relentless levels of cleaning."

Yet even the most diligent cleaning crews are no match for SARS-CoV-2. Custodians can't continually wipe down every elevator button, slot machine handle, mall railing, or conference-room table. Nor can they clean the air.

No doubt, the best defense against transmission of Covid-19 is the outdoors, where infectious particles blow away. But indoors, it's bipolar ionization, a critical addition to building ventilation and filtration systems.

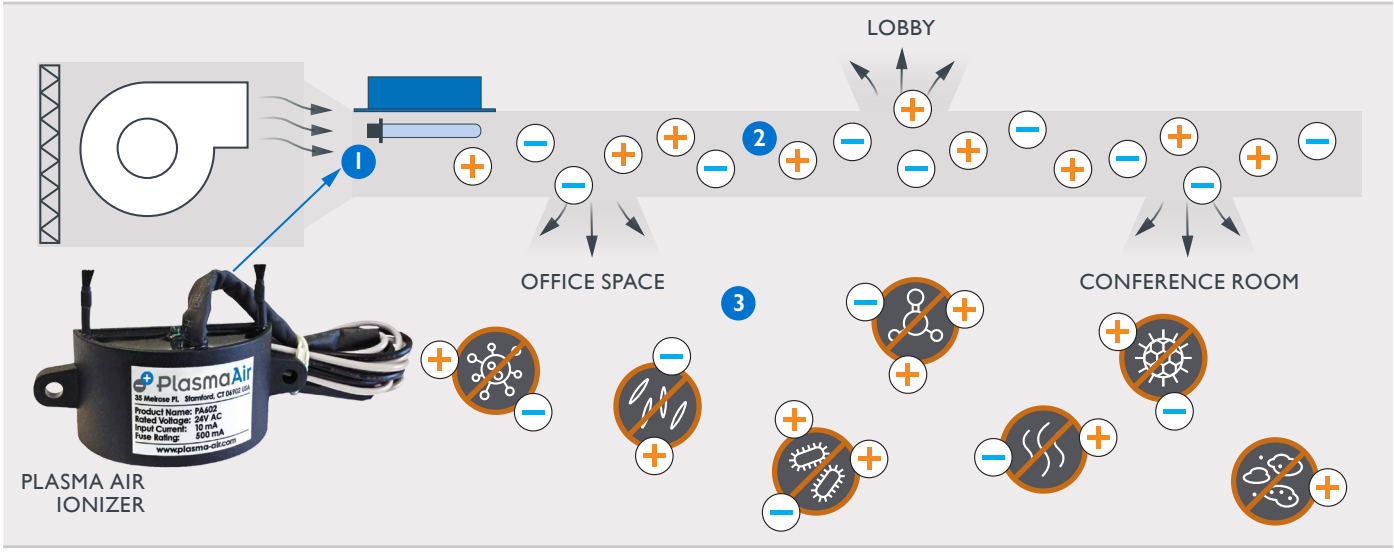
Bipolar Ionization in the Covid Era

The original SARS coronavirus, unleashed in China in 2002, was contained within eight months, having infected just 8,400 people. This was due partly to unprecedented global cooperation and partly to luck: patients weren't contagious until they felt quite sick. "In the end, the virus just ran out of steam," says John Oxford, Ph.D., a professor of virology at The Royal London Hospital.

SARS-Co-V-2, despite having infected millions, is nowhere near out of steam, and containing this wilier virus will require a more powerful and varied arsenal. Among the critical weapons is bipolar ionization, a technology Dr. Oxford has long advocated.

In dozens of studies, the technology has been shown to neutralize a range of viruses, including coronaviruses, H1N1 influenza, H5N1 avian influenza (bird flu), and polio. In particular, the technology has proven highly effective against MS2 bacteriophage, a commonly used surrogate for influenza that is now used as a surrogate for SARS CoV-2. In addition, bipolar ionization can destroy bacteria such as MRSA and *E. coli*, as well as pollen, mold, dust-mite allergens. The technology is equally effective against chemical toxins, such as fine particulate matter (PM2.5) and VOCs.

As the "relentless" cleaning of buildings continues during the Covid-19 pandemic, the emission of toxic gases from cleaning products will increase; bipolar ionization can purge the air of those pollutants. To



1 Air passes over the Plasma Air ionionizers and millions of positive and negative ions are formed.

2 Ions travel through the duct system and out into the occupied space where they interact with airborne virus particles.

3 Viruses, bacteria and other harmful pollutants are killed and neutralized by the positive and negative ions.

accomplish this, bipolar ionizers made by Plasma Air create billions of positively and negatively charged ions. These ions travel through the duct system into open spaces, where they attach to airborne pathogens, such as viruses causing a chemical reaction on the surface of the cell membrane. This deactivates the viruses, rendering them harmless, so they can no longer spread or cause infection.

The ions produce a chemical reaction on the cell membrane surface that inactivates the virus," explains Philip Tierno, a clinical professor of microbiology and pathology at the NYU School of Medicine. "It can reduce 99.9% of microbes in a matter of minutes."

At that point, the virus can't cause infection, even if it enters the body.

Notably, Plasma Air ionizers operate continuously, no small advantage against a virus that's always on the move, and they require nminimal or no maintenance.

For any commercial building, bipolar ionization is a critical addition for building safety. Viral particles are so small that even hospital-grade filters may only capture only 80% of them; in many commercial buildings, filters trap less than 20%.

Stopping This Pandemic, Preparing for the Next One

Plummeting air pollution has been a big Covid-19 story, but as cities race to make up for lost time, the familiar toxic haze will reappear — and quickly. As before, this mixture of dust, soot, and chemical particles will seep into our buildings, wreaking havoc on the eyes, lungs, and immune systems of many who inhale it. Other everyday hazards are generated from within the building, by consumer products that emit irritating gases: shampoos, cosmetics, printer ink, glues, hand sanitizers, and the like. Of course, influenza, norovirus, and other viruses will always be circulating in public spaces, and absolutely no one is predicting the current pandemic will be the last.

Dr. Oxford is not just a virologist but also a historian of the 1918 flu pandemic, which killed over 50 million people worldwide. Years ago, he foresaw a 21st-century pandemic — and predicted that our society, lulled into complacency by medical advances, would find itself unprepared. "It's going to be exceedingly difficult for modern societies to contend with this outbreak, when it comes," Dr. Oxford told National Public Radio back in 2006. He was right. It's been difficult, to say the least. But today we have virus-fighting weapons that did not exist in 1918. Among these is bipolar ionization technology. At some point, the Covid-19 pandemic will end, ideally with the arrival of a vaccine. But the need for clean virus eliminating purified indoor air will outlast this particular crisis.

Interested in learning more about Plasma Air products? **Contact us at info@plasma-air.com.**

Learn more about air purification technology at

www.plasma-air.com