

DISINFECTION IN A FLASH

# Smart, Healthy Office Buildings



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# Introduction

People spend approximately 90% of their time indoors and research has indicated that pollutants inside can be 2 to 5 times worse than outdoors. This led to the development of a series of strategies, including numerous certification programs designed to improve the indoor environment.<sup>1</sup>

There are also well-established links between the quality of a person's indoor environment and various factors that influence their overall health and wellness, which can also influence other outcomes, such as the productivity of employees. And, with the advent of the COVID-19 pandemic, where so many office buildings and offices were closed down, the relationship between office spaces and employees, staff and visitors become even more important.

This white paper, written by PURO Lighting's technology partner Violet Defense, lays out the challenges that offices face in keeping the air and surfaces clean, and how advances in UV disinfection technology can lead to cleaner spaces and other benefits for businesses and their employees.

# Trends in Healthy Buildings

While the origins of many building standards or codes trace back to efforts to ensure occupant safety, especially in the event of emergencies, more recent standards began to think more holistically about the impact of building design and construction. In the 1990s, the focus turned toward sustainable building practices, largely led by the U.S. Green Building Council (USGBC), which was co-founded by Mike Italiano, David Gottfried and Rick Fedrizzi in 1993.

Those efforts led to the development of Leadership in Energy and Environmental Design (LEED) standards, which are now “the most widely used green building rating system in the world.” While the number of LEED standards grew from a single standard for new construction to a series of 6 standards covering aspects of design, construction, operation and maintenance, their focus also expanded.<sup>2</sup>

More information has emerged about not only the quality of indoor environments, particularly air quality, but the relationship between those environments and human health.

## LEED CERTIFICATION

As a result of this growing research base about the role of the indoor environment on health, the LEED standards began to emphasize their ability to not only increase energy efficiency and reduce waste, but to also have a positive impact on the well-being of occupants. LEED has reported that retrofits, which improved the indoor environment of a building, resulted in “reductions of: communicable respiratory diseases of 9-20%, allergies and asthma of 18-25%; and non-specific health and discomfort effects of 20-50%.”<sup>3</sup>

While lowering operating costs is still the leading driver behind green buildings, occupant health and wellness has emerged as a strong contender as the most important benefit of a green building to respondents in a 2018 World Green Building Trends report.<sup>4</sup>



“We know that the places where we live, learn, work and play — indoors and out — must support our overall wellness.”

U.S. Green Building Council

## WELL CERTIFICATION

The standards include features such as ensuring reduced contaminant levels in drinking water, entry walk-off systems to reduce particulates from entering buildings, and promoting the consumption of fresh fruits and vegetables in cafeterias or if food is provided to workers.

There is a fair amount of synergies between LEED and WELL for buildings that may want to pursue dual certification. Some estimates (Green Ideas Building Science Consultants) indicate that achieving WELL certification places a building largely on the path (~70%) toward meeting the LEED requirements. WELL offers cross walks that help demonstrate the overlap between the two sets of standards.<sup>6</sup>

## FITWEL STANDARDS

In 2015, the Center for Active Design joined the certification arena with the Fitwel standards, which look at the built environment, as well as specific strategies to increase physical activity and nutrition of occupants. The ultimate goals of the 55+ evidence-based design and operational strategies from Fitwell are to reduce morbidity and absenteeism, instill feelings of well-being, and promote occupant safety.<sup>7</sup>

In 2014, Delos entered the building standard market with the WELL Building Standard, “the world’s first building standard focused exclusively on human health and wellness.”<sup>5</sup> With the goal of shaping daily routines through intentional planning and design, the WELL research-based standards measure features around seven concepts: air, water, nourishment, light, fitness, comfort, and mind.



# Value for Your Business

Across over 165 countries and territories, there are over 94,000 projects using LEED to help create greener, healthier environments. As of 2018, the cumulative total of LEED-certified area worldwide was 6.5 billion square feet, with another 13 billion in the queue.<sup>8</sup> The WELL certification has also spread quickly already at 266 million square feet in 43 countries after just 5 years in the field.<sup>9</sup>

“When it comes to indoor office spaces in particular, research has long shown that good air quality, ventilation, lighting, acoustics, and thermal control lead to greater productivity and employee retention.”

U.S. Green Building Council

Given the appetite for these programs, businesses are clearly seeing value in what these certifications can mean for their bottom line. Building owners and managers can see the return on investment in terms of higher premiums as LEED-certified buildings routinely yield higher rents.<sup>3</sup>

However, individual businesses can also reap benefits, whether they own or rent a LEED-certified or other WELL-certified space. Research has shown that improved indoor environments can lead to greater productivity and employee retention.

With the amount that businesses spend on employees (typically personnel makes up about 92% of a building's overall costs), increased productivity can have a meaningful return.<sup>6</sup> One cost analysis indicates that a 5% improvement in worker productivity would result in a savings of nearly \$15 per square foot, as compared to \$0.15/square foot for a 5% energy improvement.<sup>6</sup>

A study by the National Institutes of Health reported companies moving from non-LEED to LEED-Certified buildings reaped gains on a variety of employee wellness factors after just 3 months.<sup>10</sup>

Employees reported fewer hours affected by asthma and respiratory allergies, depression and stress, and perceived an increase in their overall productivity.

Even helping reduce the spread of the flu alone each year could make an investment in better cleaning and disinfection worth it.



It was estimated that the increased productivity would translate to a net gain of nearly 39 hours per year.<sup>11</sup>

The Journal of Occupational Environmental Medicine calculated that health-related lost productive time (LPT) was costing employers over \$225 billion per year, or \$1,685 per employee (ISSA). Not only does day-to-day productivity matter, but unplanned absences can have dramatic impact with an estimated 54% decrease in productivity/output and a 39% decrease in customer service.<sup>12</sup>

However, pollutants that affect employee health are not solely related to the quality of air. Harmful pathogens that can spread illnesses among workers are often found on common workplace surfaces, including desks, computer mice, desk phones, break room sink faucets, microwave door handles, keyboards, water fountains, vending machines, etc.

The Healthy Workplace Project explored the impact that a cleaner environment can have specifically on absenteeism. It was estimated that improved disinfection, including better surface decontamination could result in as much as a 46% reduction in absenteeism.<sup>12</sup>

Even helping reduce the spread of the flu alone each year could make an investment in better cleaning and disinfection worth it. It's estimated that there are 230 million workdays lost to sickness during the flu season, with \$30 billion in flu-related costs to employers.<sup>13</sup>

Therefore, the most impactful return on investment in healthy buildings may come from the cleaning and disinfection standards that a business chooses to implement.

## The Role of UV in Healthy Buildings

Each of the leading building certification programs include standards related to cleaning and acknowledge the connection between reducing exposure of occupants to harmful contaminants and pathogens with better health outcomes. The standards typically require buildings to have protocols or policies in place relating to their cleaning practices.

Fitwel standards call for spaces to adopt regular cleaning schedules for bathrooms, citing that “regularly cleaned bathrooms may contribute to employee well-being and reduce transmission of bacterial infections, potentially reducing employee absenteeism.”<sup>7</sup>

LEED standards emphasize equipment that will meet its sustainability criteria but also encourage collecting occupant feedback to evaluate new technologies for cleaning.



UV germ-killing lights provide a real value to businesses.

The WELL standards specifically highlight several technologies that could be implemented to assist with enhanced cleaning, including “processes and equipment that use short wavelength ultraviolet (UV-C).”<sup>9</sup>

Specifically for high touch surfaces, including counter tops and fixtures, doorknobs, light switches, etc., certified spaces may clean these surfaces with a UV cleaning device per the manufacturer recommendations. Buildings may also implement advanced cleaning protocols to help eliminate bacteria and other pathogens from high risk areas using full-room ultraviolet germ irradiation (UVGI) sterilization treatment from a professional service.

While not a “new” disinfecting technology, UV light has rapidly been growing in use in hospital settings as it is a proven disinfectant for surfaces, instruments, and air. With over 140 years of research behind it, UV light has been proven effective at killing bacteria, viruses, mold, and fungi.

Ultraviolet light attacks microorganisms at the DNA and RNA level. Microbes are not able to develop resistance to ultraviolet light, compared to their ability to form resistance to certain types of chemical disinfectants.

Ultraviolet light has been repeatedly proven effective against pathogens, including *C. diff*, MRSA, *E. coli*, Salmonella, Norovirus, coronaviruses and many more. The ability of UV light to kill microorganisms is directly related to the energy dosage produced by the UV source as a function of spectrum, time and distance to the target.

UV light, particularly UV-C, has also been shown to have great benefits when combined with other cleaning methods for optimal results. Researchers at Duke University and the UNC Schools of Medicine found an additional 94% reduction in epidemiological-important pathogens when UV was added to the standard use of quaternary compound disinfectants.<sup>14</sup>

Until recently, implementing the use of UV cleaning in an office setting would require expensive professional services or the use of labor-intensive hand-held devices. For example, the hand-held UV wands that could be used to meet the standard for high touch areas typically require users to hold the device ½” from surface and hold it there for 10 seconds — covering approximately 12” wide area at a time. Even if just used on high touch areas, that can still be a major time commitment for staff to clean a typical office building.

However, advancements in UV technology have yielded new options to meet these standards, or more broadly to protect any type of office or other environment. PURO Lighting, powered by Violet Defense technology, has a line of products that can be installed in workspaces, bathrooms, conference rooms, and break rooms, to effectively kill germs in both the air and on surrounding surfaces. These germ-killing lights provide a real value to businesses in terms of cleaner environments, which have been shown to lead to more productive employees and reduced absenteeism.



# Conclusion

Ultraviolet light has an extensive history of effectively killing microbes in the air and on surfaces, which has been proven to reduce the infection rates of MRSA, *C. diff*, VRE and other harmful pathogens.

As a result of the miniaturization of this technology, it is now possible to deploy UV disinfectant technology in dramatically more settings than ever before, thereby creating cost-effective deployments to fight off harmful germs, particularly when used in combination with existing cleaning protocols.

Given the value that clean, healthy buildings can produce, it is advantageous to businesses to add ultraviolet technology as a cost-effective way to disinfect air and surfaces throughout their facilities.

# References

1. Volatile Organic Compounds' Impact on Indoor Air Quality | US EPA. Retrieved from <https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality>
2. The Leadership in Energy and Environmental Design (LEED). Retrieved from <http://environment-ecology.com/environment-and-architecture/81-the-leadership-in-energy-and-environmental-design-leed-.html>
3. The Business Case for Green Building | U.S. Green Building Council. (2015). Retrieved from <https://www.usgbc.org/articles/business-case-green-building>
4. Benjamin, H. (2018). World green building trends in 2018: Health and wellness | U.S. Green Building Council. Retrieved from <https://www.usgbc.org/articles/world-green-building-trends-2018-health-and-wellness>
5. Whitaker, J., Stodola, N., Quint, L., Enck, C., Cederberg, S., & Sparks, M. (2017). Applying LEED and The WELL Building Standard. Retrieved from <https://www.wellcertified.com/en/resources/applying-leed-and-well-building-standard>
6. Cribbs, J. A Compliment to LEED: WELL - A New Building Standard Focused On Health & Wellness - Green Ideas. Retrieved from <https://www.greenideas.com/resources/blog/well/>
7. Standard | Fitwel. Retrieved from <https://fitwel.org/standard>
8. Stanley, S. (2018). U.S. Green Building Council Releases Annual Top 10 States for LEED Green Building Per Capita | U.S. Green Building Council. Retrieved from <https://www.usgbc.org/articles/us-green-building-council-releases-annual-top-10-states-leed-green-building-capita>
9. International WELL Building Institute. (2019). Retrieved from <https://www.wellcertified.com/>
10. O'Keefe, L. (2017). Going Green: The Evolution of Building Sustainability and Certification Systems. Retrieved from <https://www.bisnow.com/national/news/office/workplace-design-is-changing-part-3-the-evolution-of-health-in-the-office-81660>
11. Singh, A., Syal, M., Grady, S., & Korkmaz, S. (2010). Effects of Green Buildings on Employee Health and Productivity. American Journal Of Public Health, 100(9), 1665-1668. doi: 10.2105/ajph.2009.180687
12. Frank, D., & Peduto, J. (2012). The Value of Cleaning. American Institute for Cleaning Sciences (ISSA).
13. Flu Took Serious Toll in 2012-2013, Walgreens Survey Finds. (2013). Retrieved from <https://www.pharmacytimes.com/publications/issue/2013/november2013/flu-took-serious-toll-in-2012-2013-walgreens-survey-finds>
14. Rutala, William, et al. "Microbial Load on Environmental Surfaces: The Relationship Between Reduced Environmental Contamination and Reduction of Healthcare-Associated Infections." Open Forum Infectious Diseases, vol. 3, no. suppl\_1, 2016, doi:10.1093/ofid/ofw172.128.

## ABOUT PURO UV DISINFECTION LIGHTING

Launched in 2019 in Lakewood, Colorado, PURO™ Lighting products, powered by Violet Defense™ technology, have set out to take proven UV light disinfection technology to the next level by making it more powerful, more affordable and most importantly, smaller and easier to utilize. PURO Lighting products can rapidly disinfect any room of any size and at any time using the proprietary miniaturized, pulsed Xenon Light Engine System. Our high intensity broad-spectrum UV disinfection units rapidly kill up to 99.9% of viruses and bacteria and can significantly reduce the growth of fungi such as yeasts and molds. All in remarkably small, yet powerful fixed or mobile units designed for any sized space. For more information, visit [www.purolighting.com](http://www.purolighting.com).

## ABOUT VIOLET DEFENSE

Founded in 2012, Violet Defense is on a journey to find new ways to protect people from harmful germs that have grown resistant to traditional forms of cleaning and disinfecting. Its patented technology is the only known Pulsed Xenon UV solution that can be installed into a room full-time, creating continuous way to address disinfection needs of all types of settings, including healthcare and non-healthcare alike. Designed to bring hospital-grade disinfection to everyday spaces, Violet Defense has cost-effective solutions to kill up to 99.9% of bacteria and viruses, including *E. coli*, Salmonella, MRSA, Norovirus and *C. diff*. For more information, visit [www.violetdefense.com](http://www.violetdefense.com).



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