

Health and Wellness in Buildings: Addressing Challenges Now and in the Future

Strategies for optimizing building health



Empowering Trust[®]



Joseph Allen, the assistant professor of exposure assessment science, director of the Healthy Buildings Program at the Harvard Center for Health and the Global Environment, emphasizes the harmful effects of considering indoor environmental quality (IEQ) as “... an afterthought.” With so much time spent in buildings, ensuring the health of buildings we work and live in could greatly impact our quality of life.

Many factors account for what makes a building healthy. Humidity levels, air ventilation, temperature, lighting, the presence of chemical-emitting materials, and plumbing all affect the health of the occupants of any building. Yet since the 1970s, buildings have been constructed to be airtight and more energy efficient. However, some of these changes have unintentionally led to negative impacts, such as decreased ventilation. Although these methods of building construction sometimes lower the cost of maintenance, it is important to consider their effects on health by assessing the impact of IEQ on building occupants. And although many new buildings are energy efficient while considering IEQ, a lack of ongoing performance metrics allows IEQ to drift out of focus.

In this e-book, we will examine what healthy buildings are, why they are important and how to maintain healthy buildings that can increase occupant satisfaction.



We spend **90% of our time indoors** and **90% of the cost of a building are the occupants.**

— Joseph Allen in a Harvard press release entitled “Green office environments linked with higher cognitive function scores.”



What is a healthy building and why does it matter?

Simply put, healthy buildings support the health and well-being of occupants through nine key elements that have been defined by public health experts. These elements span from indoor air quality, water quality, and lighting quality, to things like security, human resource policies and the like.



The most important aspects that can be controlled by building management all relate to IEQ. Air and water quality, acoustics and lighting factors all play a part in determining IEQ. Optimizing the indoor environment can lead to a number of benefits for building occupants.

While focusing on the IEQ aspects of a healthy building, direct management strategies and best practices can be uncovered. For example, sitting water can produce unhealthy bacteria buildup such as Legionella, which causes respiratory conditions and flu-like symptoms known as Legionnaires' disease. Not flushing plumbing systems regularly instigates this type of overgrowth, along with possibly leaching heavy metals from the piping. High levels of humidity can also cause mold growth and worsen dust mite populations, leading to an increase in likelihood that the occupants will have an allergic response. These health conditions can be prevented with a careful approach to building health assessment and response, leading to many benefits for businesses and occupants.



The National Institute for Occupational Safety and Health (NIOSH) defines IEQ as “the quality of a building’s environment in relation to the health and well-being of those who occupy space within it” (“Indoor Environmental Quality,” 2013).

The EPA defines Indoor Air Quality (IAQ) as “the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants” (“Introduction to Indoor Air Quality,” n.d.).



Benefits of a healthy building

Healthy buildings provide a number of benefits to occupants. Along with preventing negative health impacts, healthy buildings promote air quality management, provide access to good quality drinking water, and create more comfortable lighting and acoustics. These improvements increase productivity and have additional lasting positive outcomes for building occupants. Owners and managers also benefit, since a safe environment attracts and retains employees and tenants.





BENEFIT #1

Attract and keep better tenants and employees

A healthy building, with good IEQ, can affect changes to cognitive function and quality of life. In the “CogFX Study” by the Harvard T.H. Chan School of Public Health’s Center for Health and the Global Environment, researchers identified that characteristics like ventilation, indoor pollutants, lighting, daylight and views were shown to affect health, quality of life, focus and productivity (2015). The study, published in Environmental Health Perspectives, tested the difference between conventional buildings that have been built with products that emit higher levels of volatile organic compounds (VOCs), green buildings designed to have lower VOCs, and enhanced green buildings with low VOCs and low carbon dioxide, mimicking additional ventilation (Allen et al., 2015).

Buildings that were characterized as enhanced green buildings improved participants’ abilities to strategize, respond to crises, focus and remain task oriented.



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BENEFIT #2

Increase employee return on investment (ROI)

The second CogFX study found that this impact goes beyond the workplace: participants in certified green, high-performing buildings also slept better at home, even after they left the building they were working in (Allen et al., 2015).

Employees in buildings with a better IEQ increased their productivity at an average of making \$6,500 more per year.

Clearly, enhancing the quality of a building improves the lives of employees and forwards the overall success of any business. While employees remain happy because they can complete their job efficiently and in good health, employers benefit from a stronger employee retention rate. Building owners also benefit from tenant retention.





The origins of healthy building testing

Testing buildings for health remains a crucial aspect of ensuring that these benefits arise. Studies that were designed to determine the health of buildings were created in tandem with measuring the environmental footprint of buildings.

Implementing factors related to health, well-being and safety in the construction and maintenance of buildings, also aligns with the UN Sustainable Development Goals. This simultaneously enhances the lifestyle of building occupants and people in the surrounding communities.

Employing strategies to optimize healthy buildings helps provide a safe future by improving the health and performance of those occupying the building while also enhancing building efficiency. Therefore, owners and operators of buildings who prioritize air quality make informed decisions that positively impact their tenants, the surrounding community and the future of the global environment.



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What are the elements of a healthy building?

Many factors contribute to healthy buildings including IAQ, temperature, building materials and lighting. Understanding these considerations will help ensure that your building does not negatively affect its occupants or surrounding environment, while simultaneously fostering a healthy and productive occupancy. Whether you are trying to avoid mold, reduce viral and bacterial outbreaks or lower VOCs, knowing these standards will help you make informed decisions on how to optimize your building.





NIOSH explains that Indoor Environmental Quality (IEQ) contaminants may originate from “office machines, cleaning products, construction activities, carpets and furnishings, perfumes, cigarette smoke, water-damaged building materials, microbial growth (fungal, mold, and bacterial), insects, and outdoor pollutants” (CDC, 2013). Furthermore, humidity and ventilation might affect how occupants respond to potential contaminants or other environmental factors. The EPA asserts that an increase in contaminants can sometimes be caused by higher humidity levels. Inadequate ventilation, a lack of filtration and improper air cleaners can also contribute to low IAQ. While these measures help to ensure the safety of a building’s occupants, scholars of building performance and diagnostics such as Vivian Loftness, assert that IEQ is “multifactorial” (Loftness et al., 2007). IEQ includes measures such as how occupants keep a space clean and what materials they use inside it.

Many standards and measurement systems have been implemented to determine your building’s IEQ and outline steps for eliminating any potential hazards. The complex nature of practices and items contributing to IEQ means that it needs to be addressed through both prescriptive measures and defined best practices, along with ongoing measurement and monitoring of performance metrics (Loftness et al., 2007).





9 Foundations of a Healthy Building

To provide a simple, evidence-based overview of the key elements of a healthy building, a group of scientists and researchers released the 9 Foundations of a Healthy Building. This study was published by the Harvard T.H. Chan School of Public Health and lists nine qualities that work together to create a healthy building. These include: ventilation, air quality, thermal health, moisture, dust and pests, safety and security, water quality, noise, lighting and views. Along with these, they recommend nonsmoking environments and constructing a building to support active lifestyles.



Air should be circulated and filtered in a manner that removes odors, chemicals, carbon dioxide and nanoparticles. This requires checking that HVAC systems are up to standard, undergo regular maintenance, are closely monitored and are swiftly repaired when problems arise. Successful air filtration will prevent outdoor pollutants from coming indoors.

Ventilation



Building materials should not emit hazardous chemicals. Older buildings must undergo checks for other dangerous materials such as asbestos and lead. Regular checks for air quality should be conducted. Poor air quality can contribute to conditions such as asthma and allergies.

Air quality



Optimize the temperature of buildings to help ensure that humidity levels are maintained at a safe level. Higher humidity levels make it harder for the body to cool off. Verify that temperature levels remain consistent throughout the entire building. Ideal temperature conditions can drastically improve performance levels.

Thermal health





Regularly check for moisture in the HVAC system and throughout the building, removing excess moisture immediately if discovered. Mold from moisture build-up can cause various health issues, including respiratory problems and skin rash.

Moisture



Vacuum and clean surfaces regularly to prevent dust from accumulating. Prevent pests by checking for proper sealing and removing trash. Pests like dust mites and cockroaches can introduce allergens that can lead to conditions such as hay fever.

Dust and pests



Confirm that your smoke detectors and carbon monoxide monitors are working properly. Create an emergency action plan and confirm that exits are free of debris and have proper lighting. Security systems that prevent crime can also lead to improved psychological states because of their tendency to decrease worry.

Safety and security



Flush pipes regularly to prevent build-up of microbes or heavy metals. Lead exposure causes a variety of health issues, including nerve disorders and kidney issues. Use a filtration system for drinking water and check water quality regularly.

Water quality



Reduce outdoor sounds as much as possible, especially from traffic and construction zones. Keep indoor equipment noises at a minimum. Noise reduction increases productivity and overall well-being of building occupants.

Noise



Provide as much natural daylight as possible and do not block windows. Artificial lighting should be adequate and comfortable to the eyes. Our circadian rhythm, an internal clock that relies upon exposure to light during daytime hours, helps control a variety of bodily functions necessary to maintain proper health.

Lighting and views



To assess a building's health, numerous organizations have designed standards to verify that these markers are met. Next, we will examine the leading buildings programs and standards that help building owners measure the health of their buildings and report on their achievements.



A comparison of leading health and wellness standards

UL's Verified Healthy Buildings provides building occupants with peace of mind with proven IEQ testing and verification. Our methodology focuses on four key areas:

- IAQ
- Water quality
- Building hygiene
- Lighting and acoustic quality

These are an efficient and effective way to monitor your building health and demonstrate ongoing compliance, while focusing on IEQ performance metrics.



With more than 76 million square feet in the program and counting, UL is the leading verifier of healthy buildings. By becoming verified, owners of buildings demonstrate to their occupants that the space protects and supports their health and lifestyle. With testing and advisory services, safeguarding proper IEQ leads to retaining customers, keeping tenants and helping ensure that employees are happy. This simultaneously reduces liability by providing a safe environment to building occupants.



Several standards evaluate factors related to building health and wellness, and each have their own areas of focus. The following are the leading programs: LEED, WELL, Fitwel, ASHRAE and BREEAM. We'll expand on each below.

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has created an IAQ guide which addresses moisture and dirt in HVAC systems, a lack of proper ventilation, improper air filtration, and sources of indoor contaminants from building materials, equipment and activities ("IAQ Guide," n.d.). The ASHRAE IAQ guide references suggestions for design and operational features.

LEED

Leadership in Energy and Environmental Design (LEED) provides standards for all stages of a building's life, from construction to operations to refurbishing. Its standards include approaches to commercial buildings, homes and neighborhood development. LEED has a variety of rating systems based on the state and stage of your building, whether you are constructing a new facility, testing an existing building or redesigning one. Once you choose the rating system, there are 104 credits used to rate the building, including items such as Rainwater Management, Low-Emitting Materials and Heat Island Reduction.

WELL Building Standard

The WELL Building Standard implements a holistic approach to health by preventing illness while generating happiness and productivity. To bring this approach to buildings, when testing for a healthy environment this standard considers: air, water, nourishment, movement, thermal comfort, sound, materials, mind, community, innovations.

Each category has a precondition that must be met in order to be deemed safe. Furthermore, the WELL standard also encourages ethical and practical principles, such as equal access to healthy spaces, along with interventions that are possible and relevant across the globe. It maintains strategies that are backed by evidence, supports industry best-practices and will hold up in an ever-changing world.



Fitwel

Fitwel Building certification creates project-specific scorecards to determine the environmental quality of a building and its impact on the community. This includes sites with both indoor and outdoor spaces, single or multi tenant buildings, and commercial, retail and residential spaces. Each scorecard has the goal of reaching seven impact categories:

- Enhancing community health
- Reducing absenteeism and morbidity
- Upholding social equity and uplifting vulnerable populations
- Imparting well-being
- Increasing access to healthy food
- Maintaining occupant safety
- Encouraging physical activity

BREEAM Health and Well-being

BREEAM's In-Use assessment checks the sustainability and operational performance of already-occupied buildings. This standard assesses the cost of using the building while also accounting for sustainability, with a goal of netting zero carbon emissions. At the same time, BEAM aims to improve the air quality and lifestyle of building occupants, leading to an increased performance rate and improved measures of happiness. To take these measurements, the assessment considers both the building composition and its management. While many of its health and well-being measurements are like the other standards already listed, BREEAM adds an assessment of rest areas and access to indoor versus outdoor space. This helps ensure that building occupants enjoy a comfortable and calming atmosphere, leaving them in a better mindset, which helps them focus on the work at hand.

Many of the credits within the LEED, WELL, Fitwel and BREAM standards address specific design and operational features related to IEQ for new and existing buildings. They also encourage ongoing testing and monitoring of IEQ.



How to create and maintain a healthy building

Starting a healthy building program may seem complicated, but there are four key steps that can help simplify the process and foster continuous improvement.





Think

To think through maintaining optimal IEQ for your building, you must consider how each standard of healthy buildings will be met. By thinking through each standard, you can determine which standards will likely be at a higher risk of falling short. Here are some considerations to help you think through various building quality standards. Consider:

- **The requirements of your building's occupants and their needs.** A multi-tenant building will have different needs than a building that houses one employer, for instance. What are the goals of its occupants? From this information, you can determine what will lead to optimized well-being of the people inside.
- **How the building will be used.** This will determine the required method of cleaning and whether there might be VOC-emitting materials brought into the building.
- **How and when the building was constructed.** Older buildings may need more in-depth assessment of materials used for construction to evaluate that they are low emitting.
- **The building's location.** Figure out the pollution levels of the surrounding area and determine whether your building will undergo extreme weather conditions. Consider the means by which your building will impact the surrounding community, and vice versa.

In addition, make a plan about how you will communicate IEQ metrics and practices with building occupants.





Plan

Once you prioritize standards for measuring building health, you can generate a plan to resolve issues and minimize future risks. Consider creating and implementing the following plans:

- Responding to fires, natural disasters, crime and air quality issues
- Regular monitoring of the HVAC system, moisture levels, and IAQ
- Determining ways your building will reduce its carbon footprint
- Outlining a calendar and protocol for regularly cleaning facilities
- Choosing furniture, lighting arrangements, design, and acoustics that enhance the lives of building occupants



Act

Put your plans into action by testing your building and hiring the proper experts to implement your plan, along with any problems that may arise. Consider using [UL's Indoor Environmental Quality Testing and Advisory Services](#) to check on potential IEQ issues and determine which steps to take to resolve them. If your building was unoccupied during a health hazard, [schedule a discussion](#) to help determine the steps necessary to reoccupy your building safely.



Verify

Certify that your building meets all IEQ standards by [verifying your buildings with UL](#). After an initial on-site inspections and verification, biannual reinspections should be conducted to confirm its ongoing safety and success. By placing a UL Verified Healthy Building Mark on your building, you will gain trust from your building occupants. Tenants and employees can feel confident that their space contributes to their overall well-being.





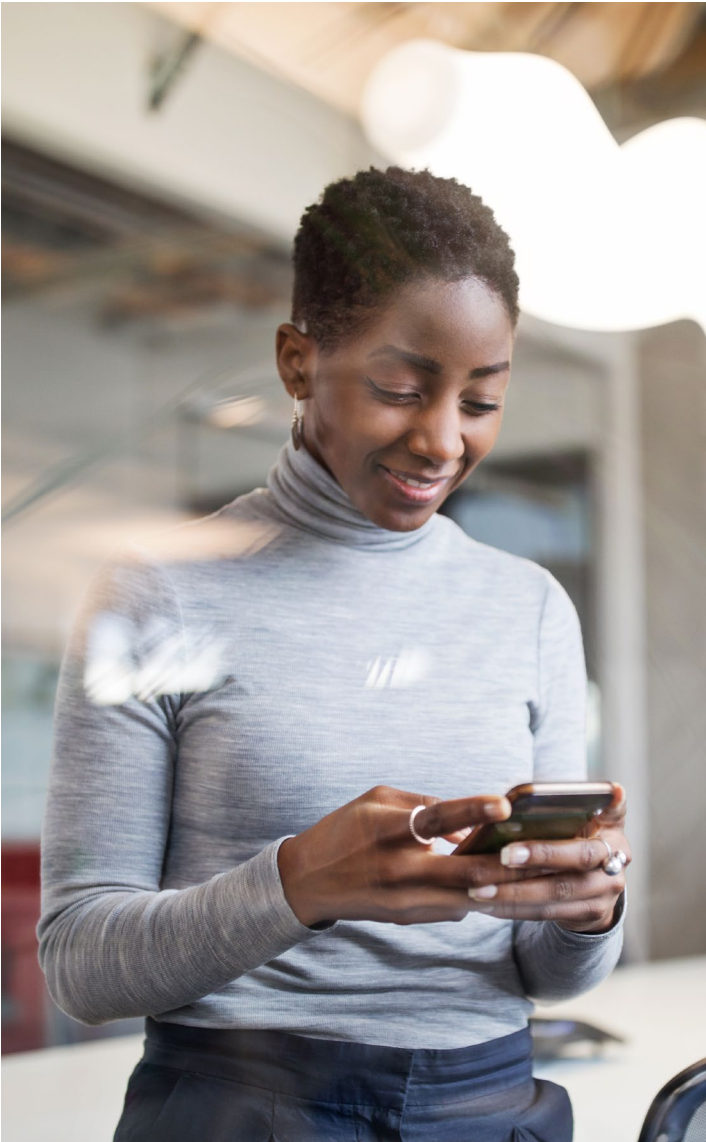
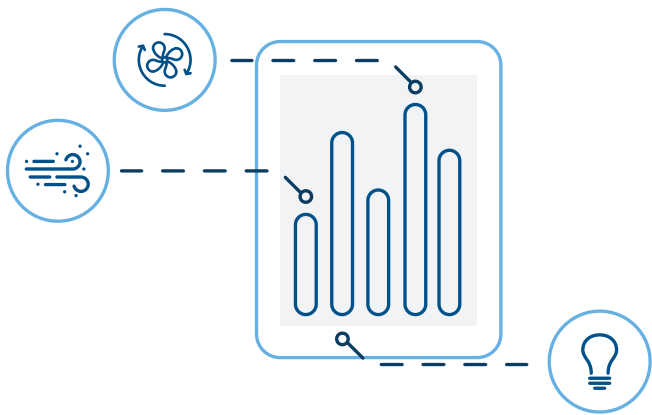
Demonstrating ongoing building health through communication

By showing tenants and employees your commitment to building health, they will understand that you recognize the importance of their health, longevity and productivity. This encourages a healthy relationship between tenant and owner, and company and employee – extending the interest of a building occupant to remain in that building. Whether that means retaining tenants in a multifamily home or having long-lasting, highly efficient employees, the building health delivers limitless benefits. Furthermore, demonstrating that your building integrates well with the neighborhood and reduces its carbon footprint helps provide a healthy relationship with the surrounding community. By exhibiting the focus on the health of your building to tenants, employees and the community, you open a window for marketing your space's success and your overall interest in the well-being of the people inside it.





Many companies use successful IAQ reports to share with tenants, in order to exhibit their interest in constructing a healthy building environment. When sharing reporting with tenants, be sure to implement clear communication strategies that break down the details of the report in understandable terms. Some IEQ assessments provide certifications and badges that easily communicate the success to your building’s occupants and customers. While reports show occupants the measurements of a building’s health, certifications help assure building occupants that it has achieved and maintains the thresholds necessary to keep building health intact.



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If you use a building health verification program, its initial check and ongoing testing will provide you with a foundation to confirm and maintain ideal IEQ. Additionally, the ongoing COVID-19 pandemic has generated a need to consider the importance of ongoing building health assessments during periods of building occupancy or prior to reoccupancy. Because of the difficulty in keeping viruses out of buildings, building owners and managers must assess which measures are the most impactful for preventing the spread of the virus.





One beneficial means to reduce chances of the virus spreading involves ensuring proper ventilation through the HVAC system. This also requires a proper air filtration system, with filters regularly checked and replaced when necessary. Minimizing transmission in the workplace also requires social distancing, along with figuring out which workstations and devices employees share or reuse. Similar to measures for regular building health assessment, you should think, plan, act and verify. What happens if an employee or building occupant is diagnosed with the virus? How do you hinder the outbreak, ensure proper cleaning, and—once the outbreak has subsided—return to regular operations? This requires ongoingly assessing which strategies work best. As stated in this [Building a pandemic response plan with UL](#), building managers and cleaning professionals should implement cleaning best practices. This involves confirming that your sanitation methods meet the proper OSHA standards. Many products are claiming to sanitize without proper testing and verification, so using verified resources to check the technology being used to clean is imperative. The EPA provides a list of verified sanitation products, known as List N. Consider using [UL's COVID-19 Support Services](#) to prepare for and respond to an outbreak. When buildings are ready to be reoccupied, UL can provide on-site building evaluations to help ensure a smooth return to normalcy.

Whether for a pandemic or for ongoing building health, regular testing supports ongoing improvement of IEQ. Keeping up a regular testing regimen will help ensure that no new issues have arisen, and if they have, that you can treat them. It will provide tenants with a level of comfort that will enhance their health and give them peace of mind.

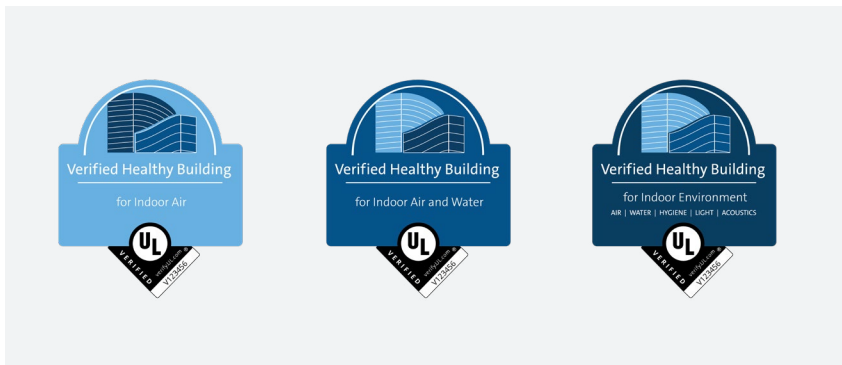




Healthy buildings are critical now and in the future

If COVID-19 has drawn you to begin testing building health for the first time, you can expect the benefits of testing to go far beyond the pandemic. In addition to verifying and recognizing foundational IAQ management procedures, the same proactive testing schedule that can be used to lessen the impact of COVID-19 leads to improvements in air quality, prevents VOC emissions, reduces moisture levels and more. These measures will support the health of your building occupants, increase their productivity, create a positive relationship with the surrounding community, and generate a positive global future by reducing harmful emissions. With a verification program to promote your building's health quality, UL has the expertise to help you build trust in your buildings.

Learn more at <https://www.UL.com/services/verified-healthy-buildings>



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