SPECIAL REPORT

YOUR AIR MAKES ME SICK!

The Secret to a Healthier, More Productive Workplace

AERAMAX PROFESSIONAL

II. INTRODUCTION: PRODUCTIVITY RULES

It's the mantra of business and industry, a focal point for countless consultants and managers trying to eke out a percentage point of profit by aiming to have employees work smarter—and harder. Given that many industries have seen significant contraction after the Great Recession of 2008, more are doing with less—less resources, less employees and less margin.

So, companies cling to potential panacea: smartphones that keep workers tethered to the workplace. The latest desktop app that touts improved collaboration and connectivity. Proprietary methodologies that reorganize structures. An emphasis on work/life integration, not work/life balance.

Yet, business still often ignores one of the most important factors that affects productivity every day— the internal work environment. While companies have switched from cubicles to an open floor plan and from seated to standing desks, little attention has been paid in the past to Indoor Air Quality (IAQ)— **each worker inhales some 3,000 gallons of air per day**. More often than not, it's air infused with allergens and viruses, as well as the volatile organic compounds (VOCs) from cleaning products used to keep the workplace clean. That, in turn, impacts everything from productivity to absenteeism. So, while the latest widget or management model may seem like a solution, it's time managers at all levels of organizations look at IAQ.

For example, recent research suggests that something as simple as increasing ventilation rates provides an estimated average of $6,500 in increased productivity per employee per year.[1] Ultimately, clean facilities are productive facilities...and without clean air, managers aren't providing an environment in which workers can be their best.

In fact, temperature, air quality and odors can affect a person's ability to concentrate. Something as simple as **doubling ventilation rates can yield a 33-percent reduction in short-term sick leave rates**, according to the May 2016 issue of ASHRAE Journal.

Clearly, it's time to move beyond well-worn productivity solutions and re-examine the physical world: the germs we spread, the chemicals we use, the air we breathe.

III. THE IMPACT OF INDOOR ENVIRONMENTS ON PRODUCTIVITY

To that end, researchers have recently focused on the impact of internal environment on worker productivity. Previously, research efforts centered on blue-collar workers, who often worked outdoors in varied conditions. Conventional wisdom assumed that, because outdoor air was polluted, blue-collar workers would be greatly affected.

However, no substantive studies were conducted on indoor work environments, perhaps thinking that HVAC ventilation systems corrected air quality problems. That thinking has changed, considering that **indoor air is two to five times more polluted** than outdoor air. So, more research has been done on so-called "white-collar" work environments like office buildings, distribution centers and retail spaces, and has yielded stunning results.

For example, a study conducted in 2012 by the Department of Energy's Lawrence Berkeley National Laboratory assessed the effects of carbon dioxide (CO_2) in enclosed spaces, where concentrations of the gas may be higher because of recirculated air. In a controlled setting meant to mimic an office environment, participants were subjected to increasing levels of CO_2, ultimately reaching amounts people would experience during a typical working day.

As a benchmark, typical CO_2 levels in outdoor air are 400 parts per million (ppm), where facility managers in buildings try to keep CO_2 levels indoors below 1,000 ppm, through ventilation and air circulation. However, researchers found that crowding in office spaces of conference rooms could bring CO_2 levels up to 2,500 ppm.

In the study, participants were given computer-based decision assessment tests once they had acclimated to increased CO_2 levels. The result: the participants had impaired thinking processes, couldn't concentrate and reached "dysfunctional" levels of performance.[2]

Given that the 2012 study was small in scale, Harvard University, SUNY Upstate Medical Center and Syracuse University recently replicated the study and confirmed the earlier test's results: **productivity was greatly impacted by the indoor environment.**

Perhaps the most quantifiable study on the impact of environment occurred in 2015. That's when a comprehensive study on the impact of green building construction on cognitive functions, called COGfx, was undertaken. In the study, 24 white-collar worker participants were given cognitive performance tests to compare test scores in green building office environments versus those using conventional construction.

DID YOU KNOW?

$220
BILLION DOLLARS
evaporates from the economy every year in lost productivity from sick days.

The EPA estimates that Sick Building Syndrome alone is responsible for

$60 BILLION IN LOST REVENUE

The average cost of one employee sick day is

$2,650

A key differentiator in the green buildings was enhanced air ventilation (low VOCs and high ventilation); conventional buildings didn't have such improved ventilation in place. Participants were given daily cognitive assessment tests in areas such as crisis response, strategy development and information usage.

Based on the study, the white-collar workers averaged scores 101 percent higher in enhanced green buildings than not; crisis response scores were 131 percent higher in the enhanced building settings. In information usage tests, scores were 299 percent higher in enhanced air ventilation environments than conventional settings, and were 288 percent higher during strategy tests.

Given the results, researchers then set about to quantify productivity increases and the costs associated with ensuring these increases.

> "Studying three ventilation strategies and four different heating, ventilating and air conditioning (HVAC) systems across seven U.S. cities, the team found that the indoor environment previously associated with a doubling of cognitive function test scores can be achieved at an energy cost between $14 and $40 per person per year and result in as much as a $6,500 equivalent in improved productivity per person per year. When energy-efficient technologies are utilized, the study found the energy costs to be between $1 and $18 per person per year, with a minimized environmental impact equivalent to approximately 0.03 cars on the road per building per year."[3]

"We have been ignoring the 90 percent," said Joseph Allen, assistant professor of exposure assessment science, director of the Healthy Buildings Program at the Harvard Center for Health and the Global Environment, and lead author of the COGfx study, in a Harvard T.H. Chan School of Public Health press release. **"We spend 90 percent of our time indoors and 90 percent of the cost of a building are the occupants**, yet indoor environmental quality and its impact on health and productivity are often an afterthought. (These results suggest that) even modest improvements to indoor environmental quality may have a profound impact on the decision-making performance of workers."

Cleaning surfaces just isn't clean enough. That's because germs, allergens, odors and irritants lurk in the air we breathe.

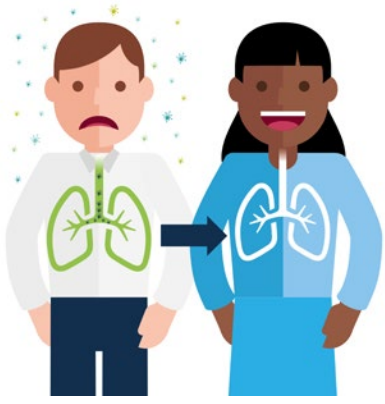
Most recently, a sweeping study was conducted in China, where air pollution is a grave concern. The 2016 study looked at productivity by call center employees, correlated to changes in specific city Air Pollution Indices (API). By monitoring call volume, the length of breaks and the API near call centers, researchers found a negative impact on productivity, which could be quantified in terms of lost revenue. For example, a 10-unit increase in the API decreased the number of daily calls handled by a worker by 0.35 percent on average. Ultimately, the amount of logged-in time for call center workers decreased with increases in pollution. In addition, increases in pollution also meant increases in employee breaks away from tasks, decreasing productivity further.

According to the study:

> "These impacts are economically significant. A back-of-the-envelope calculation suggests that even a very modest drop in air pollution could increase productivity in the Chinese service sector by billions of dollars per year. That consistently significant effects manifest themselves at an API of 150 also underscores that these impacts are not isolated to the most polluted cities in the developing world. Major metropolitan areas around the world, most of which employ considerably more non-manual labor, exceed that level with varying degrees of frequency. For example, Los Angeles, California, experienced 13 days with API greater than 150 in 2014, and Phoenix, Arizona, experienced 33 such days, with nearly half of those exceeding an air quality index of 200."[4]

In the study, researchers quantified the potential revenue gains if IAQ was increased. A 10-unit reduction in pollution levels would result in a monetized value of worker productivity of **more than $2.2 billion U.S. per year.**

Better air quality could save $ 2.2 BILLION U.S. per year



Extrapolating the data, the study also drew a conclusion for the U.S.:

> Given the size of the service and knowledge sectors in the developed world, and the relatively high levels of labor productivity within them, even very small impacts from pollution could aggregate to rather substantial economic damages. The case of Los Angeles is illustrative. In 2014, the air quality index exceeded the EPA standard on 90 days. If all of those days were brought into regulatory compliance, service sector productivity in the county of Los Angeles would have been $374 million larger. The sum of these impacts across all major metropolitan areas in the US would be substantially higher.[5]

On an academic level, many researchers are also exploring factors that can lead to the ideal work environment. For example, Mayo Clinic and wellness real estate pioneer Delos recently partnered in the development of the Well Living Lab™, a facility designed specifically to test how indoor environments affect human health and well-being.

In a pilot program, Mayo Clinic is taking workers from one of its departments and relocating them to the lab for a 10-week trial, where the workers' normal work environment will be monitored via sensors situated throughout the lab. During the trial, researchers will adjust everything from air exchanges to the level of indoor lighting to determine what affects workplace productivity, as well as the impact of incremental changes. In addition, stress levels will be monitored via wearable technology, with workers outfitted with wearables in order to determine if elevation of heart rates during peak stress situations can impact productivity.

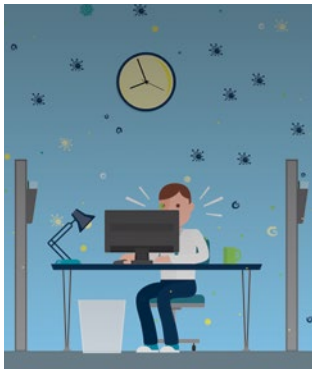
Another example includes sneeze studies being conducted at MIT's Fluid Dynamics Lab, in which researchers have found that **one cough or sneeze can contaminate an entire room within minutes** and that some droplets even remain airborne long enough to contaminate ventilation.[6]

Despite these findings and ongoing research, facility managers, human resources personnel and others responsible for staff wellness are not sufficiently apprised of the findings.

In fact, many executives probably don't think about how building materials and cleaning products can lead to illnesses or sick building syndrome, which immediately cause symptoms in occupants. They likely are also unaware of how targeted air purification can mitigate the spread of influenza or reduce allergy triggers.

"Organizations invest a lot in their employees, so if there's even a slight possibility that improving indoor air quality might help them make it to work for one extra day every three months or so, then there's some payoff there," said Dr. Brent Stephens, associate professor of architectural engineering at Illinois Institute of Technology. "It doesn't take a lot of extra effort to make an impact."

Targeted air purification can mitigage the spread of influenza or reduce allergy triggers.



IV. CLEAN FACILITIES BENEFIT PRODUCTIVITY

As research has shown, facility cleanliness can make a significant impact: clean facilities help prevent occupants from getting sick and can improve cognitive ability.

Comprehensive cleaning efforts come down to three basic principles: **handwashing, surface cleaning and cleaning the air.**

Handwashing has become a staple of good public hygiene and the practice does provide a company with financial benefits. By helping reduce absenteeism, handwashing and hand sanitizing also help

keep down costs. In fact, research from GOJO suggests absenteeism can be lowered by as much as 21 percent just by providing hand sanitizer and basic education regarding workplace hygiene.[7]

However, handwashing alone is not enough. For one, it would take extreme diligence to ensure employees' hands are always germ-free.

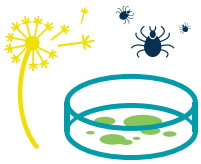
Similar to handwashing, cleaning surfaces has its value. Surface cleaning is integral to keeping germs off surfaces and preventing the buildup of dust, allergens and other resting contaminants. The downside to surface cleaning is that products often contain VOCs, which pollute the air and can cause immediate symptoms for occupants.

Surface cleaning also doesn't protect against contagious airborne contaminants. During flu season, for example, one cough or sneeze can contaminate an entire room, regardless of facility cleanliness.

Cleaning the air complements these other practices by removing pollutants workers would otherwise regularly breathe. As previously mentioned, indoor air is often two to five times more polluted than outdoor air, and can be contaminated by viruses, allergens, VOCs, elevated levels of carbon dioxide and dust, among other harmful particles. So, clean air benefits productivity on several fronts:

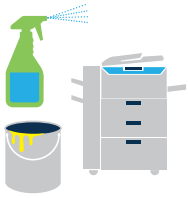
REDUCE ABSENTEEISM

By minimizing contagious germs in the air, such as the flu, organizations can reduce absenteeism. Since people are generally most contagious as they just begin exhibiting symptoms, isolation via a sick day or leaving early is usually too late to be entirely effective.



REDUCE ALLERGY & ASTHMA ATTACKS

By reducing allergy and asthma triggers (e.g. dust mites, pollen, mold spores), workers are less likely to experience day-to-day reactions or attacks. This benefits well-being and peace of mind.



INCREASE FOCUS AND PRODUCTIVITY

By decreasing CO_2 and VOC levels, workers generally perform better on cognitive testing and have more immediate focus and productivity.[8]

MINIMIZE COMPLAINS AND IMPROVE PERCEPTION

By removing dust and unpleasant odors, organizations can reduce common workplace complaints and improve worker perception of their work facilities.

In summary, improving air quality can help improve both short- and long-term productivity when used in tandem with other cleaning initiatives. Together, implementing this triumvirate of methods will increase day-to-day productivity and reduce absenteeism, thereby providing a healthy return on investment.

V. CONCLUSION: COMPREHENSIVE CLEAN AIR STRATEGIES FOR YOUR ORGANIZATION

Most businesses have a thorough system of hand hygiene and surface cleaning in place. However, cleaning the air is rarely a priority. The U.S. Environmental Protection Agency recommends three methods for cleaning the air:

- **Source control** (both of building materials and cleaners)
- **Increased ventilation**
- **Air purification**

There are two main methods for controlling sources of pollutants: ensuring facilities are free of unhealthy materials (e.g. lead, asbestos, etc.); and limiting the use of hazardous cleaning supplies that emit VOCs into common airspace. The latter suggests using green cleaners when possible, as well as ventilation and air purification to prevent the buildup of VOCs.

Increasing ventilation is a simple investment that many organizations don't make because they're concerned about the cost. However, the COGfx study estimates that doubling ventilation rates, a cost of approximately $40 per employee per year, leads to an increase in productivity averaging $6,500 per employee per year.

Yet, there are some shortcomings to ventilation as well. HVAC systems often don't effectively distribute air throughout an entire facility, causing some areas to have chronic air quality problems. Furthermore, while ventilation can reduce CO_2 and VOCs, it can also contribute to the spread of other harmful contaminants, as the MIT research revealed.

For this reason, **targeted air purification is a valuable tool to improve indoor air quality and maintaining clean and productive facilities**. For example, AeraMax® Professional is a commercial-grade air purifier that **removes 99.9 percent of airborne pollutants**, creating healthier, cleaner and more productive facilities for workers and visitors.

AeraMax Professional is designed for targeted air purification and is the first commercial-grade air purifier to be certified asthma and allergy friendly™ by the Asthma and Allergy Foundation of America. By integrating air purifiers into common areas, your organization can eliminate the vast majority of common airborne contaminants, mitigate complaints, reduce absenteeism and provide a higher standard of occupant well-being.

1. "Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments," by Joseph G. Allen , Piers MacNaughton, Usha Satish, Suresh Santanam, Jose Vallarino, and John D. Spengler. Environmental Health Perspectives, October 26, 2015. **http://ehp.niehs.nih.gov/wp-content/uploads/advpub/2015/10/ehp.1510037.acco.pdf**

2. "Is CO_2 an Indoor Pollutant? Direct Effects of Low-to-Moderate CO_2 Concentrations on Human Decision-Making Performance," by Usha Satish, Mark J. Mendell, Krishnamurthy Shekhar, Toshifumi Hotchi, Douglas Sullivan, Siegfried Streufert, and William J. Fisk. Environmental Health Perspectives, December, 2012. **http://ehp.niehs.nih.gov/1104789/**

3. **http://thecogfxstudy.naturalleader.com/improved-productivity-quantified/**

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6. "Violent expiratory events: on coughing and sneezing," by Lydia Bourouiba, Eline Dehandschoewercker and John W. M. Bush. Journal of Fluid Dynamics, April 11, 2016. **https://www.researchgate.net/publication/262983673_Violent_expiratory_events_On_coughing_and_sneezing**

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