Is Your Building Ventilated Like Its 1978?

Why would you care?

Health

Did you know that humans breathe over 11,000 liters of air a day? Your staff and students will likely spend around 2000 hours per year breathing the air in campus buildings. Would you drink 900,000 liters of water if I said, "I actually have no idea what's in it or how long it has been sitting in this room…but it's fairly clear and doesn't really smell too bad."

Here are some interesting facts to consider about indoor air quality:

- Indoor air often contains 4X to 10X the amount of pollutants of outdoor air.
- Many studies have linked exposure to small particles (PM2.5 – defined as airborne particles smaller than 2.5 microns) with heart attacks, cardiac arrhythmias, strokes, chronic obstructive pulmonary disease, worsened symptoms of asthma and an increased risk of respiratory illness[1].
- The World Health Organization says that particulate matter contributes to about 800,000 premature deaths each year, making it the 13th leading cause of death worldwide[2].

Your Bottom Line and Student Performance

Employee wellness programs are great for employees and the university. The ability to reduce absenteeism and pre-absenteeism (working while sick) is the right thing to do and it goes directly to your bottom line. A study by Dominion Systems concluded that unscheduled absenteeism cost roughly $3,600 annually for an hourly worker and $2,650 for a salaried worker. Seems like a very compelling case for incorporating ventilation performance into your employee wellness program.

How about requiring proof that the small particle levels in that shiny new building are measured and controlled? Have it defined in your project; require Verified Ventilation Performance – VVP.

Now consider how verified ventilation performance (VVP) will increase productivity with your healthy employees and the positives effects it could have on student learning. United Technologies and The Harvard School of Public health conducted a study on the effects of indoor air quality on productivity[3]. It demonstrated that:

- **Lowering the levels of CO2 and VOC's, resulted in their participants scoring 61% higher on cognitive function tests compared with those in conventional offices.**
- **There was a 101% improvement on their cognitive function tests when the ventilation levels were doubled above the standard ASHRAE prescribed levels.**
- **Information usage scores were 299% higher than conventional offices when the ventilation rates were doubled.**

The conclusion of this study couldn't be more clear - verified ventilation performance will increase employee and student performance.

Consider VVP in lectures halls, libraries and classrooms across campus. Better cognitive function means, improving information retention, critical thinking and recall during exams.

How about attracting/retaining top talent- students, researchers, professors and staff - and how that affects you bottom line?

It is a fact that employees are paying attention more and more to the healthy conditions of their work environment. This is especially the case for researchers and their lab environment. We see surging growth in universities adopting lab design programs such as Smart Labs[4] which places an emphasis in the indoor environment quality of the lab and through certification programs as:

- Green Globes
- WELL Building
- WELCOA

If your building design mandates verified ventilation performance, you are already contributing significantly to points required to attain these programs certifications. Use the VVP as a recruiting tool!

OK, makes sense. What should you include?

Bottom line – make your inside air like outside air.

Let's look back a few decades and see how we got where we are with building ventilation. Most building design the core and shell with a set-it-and-forget-it strategy, which has been completed long before occupants ever arrive. I call this the 1970's Standard. Typically, this means that 80% of the indoor air is recycled. The percentage of ventilation air allowed in the facility is usually designed when the building is built and usually based on standard ASHRAE formulas. The amount of ventilation air that comes in is frequently dependent on the position of a damper on the air handler. Ask anyone you know in the building automation business how often they have experienced the actuators which control these dampers being broken. Oftentimes a building engineer has clamped the damper at a set position because the building was unable to maintain heating or cooling loads. Imagine it is a very hot and humid day. By reducing the ventilation air, the system isn't trying to cool 95-degree air (and dehumidify it). It only needs to cool air being returned from inside the building which has only gone up a few degrees above the building's set point. The same thing happens on cold days, with these values reversed.

Do you know where your buildings outside air damper is set? Do you know how much ventilation you are getting right now?

The Challenge

Maybe you are thinking, "Ok, this makes a lot of sense to me. I want fresh air in the place where my staff and students are going to spend 2000 hours this year, therefore I will demand that the air handling system not recirculate any air. I want 100% outside air coming in."

There are actually buildings that run on 100% outside air. Research laboratories on campus are an example. All the air entering the building comes in from the outside, blows through the rooms and is immediately exhausted out. They are designed this way to dilute chemicals which are usually in fume hoods but may occasionally escape into the breathing zone. Why not demand all buildings mandate this

type of HVAC system? The air would be fresh and clean all the time. It would be like standing outside on the roof of your building. Health and productivity would abound.

Here is why that won't work. The fans, cooling, heat and re-heat in lab buildings typically triple the first cost of the HVAC equipment of an ordinary building. Ongoing, they average 7 to 10 times the operating cost. As you can imagine, this will result in unattainable utility expenses.

Even if money was no object, the environmental impact of this strategy would be grave – which is why most energy codes do not allow for this. Please consider that buildings are the largest contributors to greenhouse gasses. In a 300,000 square foot non-critical space, running a standard HVAC system with 100% outside air would require an additional 27,580 MMBTU's. In layman's terms, your building would be adding 1686 Metric Tons of CO2 to the atmosphere every year… which would be the equivalent of:

- **Burning 239,826 gallons of gas every year, or**
- **Adding 479 cars to the roads every year.**

Financials and Mother Nature both preclude a standard HVAC system with the dampers set 100% open and no recirculated air for non-critical environments.

Stop reading for a minute and look around your office. Do you see people consuming every square foot of space? Normal office occupancy is between 7 and 10 people per 1000 square feet. That leaves significant open spaces. And many times, people are congregated. Rooms and large portions of space are open. What if you have a system that would increase ventilation, but only where/when you need it? The 1970's standard made a run at this. Using the best commercially available technology at that time, buildings were designed with some CO2 sensors on the walls. The intention of which is to keep ventilation levels low and to increase outside air based on CO2 levels. But here's the problem – brace yourself – air can be polluted by things other than CO2. So, we build these airtight spaces, reduce the outside air as much as possible to save energy (and the environment) and either have a fixed amount of outside air or vary it based only on one potential contaminant. Not a recipe for a healthy and productive 2000 annual hours.

It's 2019. You're not carrying an analog bag-phone anymore. You need to have real time measurement of the all contaminants in your office air and match that with real time control of the outside air coming into your environment. You need a building that:

- Brings in lots of outside air – but only exactly where and when you need it.
- Measures and controls more than just temperature and CO2.
- Display the ventilation performance for you, staff and students.

The Solution

It's 2019. This technology exists – just ask for it. You need to demand the new **2020 Ventilation Standard** in for your building. Think about it, you have a watch with sensors that tells you how much you slept, walked, and pumped blood. Your cars sensors prevent lane changes, collisions and will email you for maintenance needs. Your building – where you breathe thousands of liters of air every day - is ventilating the exact same way it did in the 1970's.

What should you ask for specifically? I highly recommend your project should require measured and verified ventilation that follow the criteria prescribed by the International WELL Building Institute, or some similar organization. They state that for optimal health, comfort and productivity the air in your space should remain:

a. **Total VOC's - less than 500 ug/cubic meter**
b. **Small Particles - (PM 2.5) to be less than 15 ug/cubic meter**
c. **Relative Humidity- 30% and 60%**
d. **Carbon Monoxide- Below 9 PPM**
e. **Carbon Dioxide- Below 750 PPM**
f. **And you need to be able to see it validated anytime on your computer or mobile device.**

Technology exists that can not only monitor these parameters but can actively control the ventilation rates to maintain high production/high health air. Many systems can also display this information with easy to understand graphics. You want staff, students and prospective employees to have full visibility to the great indoor environment you are delivering. This should be a marketing tool for attracting students and great talent.

You need to demand the 2020 Ventilation Standard as a part of your building projects for:

1- Your staff's health,
2- Your students' health,
3- Your recruiting,
4- Your productivity,
5- Your bottom line.

[1]*Newsweek Magazine, Your Office Air is Killing You, Douglas Main, 6/26/16*
[2]*Clearing the Air: A Review of the effects of Particulate Matter Air Pollution on Human Health, Jonathan O. Anderson, corresponding author Josef G. Thundiyil, and Andrew Stolbach, 12/23/2011*
[3]*naturalleader.com/thecogfxstudy*
[4] *betterbuildingssolutioncenter.energy.gov/accelerators/smart-labs*

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Mr. Tom Kolsun is a Strategic Accounts Manager of Aircuity, Inc. where he is responsible for developing campus wide, airside efficiency programs for the largest operators of research space on the East Coast. Tom has over 25 years of experience in the building industry focused on systems serving commercial facilities with a primary focus on technical sales, system design, and project management. Prior to joining Aircuity, he had over 15 years of wide-ranging entrepreneurial experience primarily in the commercial construction field as founder and president of two technology related companies. Tom holds a BA from the University of Maryland and an MBA from Pace University. He is the president and co-founder of the PA/NJ/DE chapter of the International Institute for Sustainable Labs and is active in the Association of Physical Plant Administrators of Universities and Colleges, The Building Owners and Managers Association, and the US Green Building Council.