

IAQ RADIO+

Show Number: 755 Blog Wane A. Baker, P.E. CIH (retired) "The V in HVAC"

Good day and welcome to IAQ Radio+ episode 755+ blog. This week we welcomed Wane Baker back to discuss "The V in HVAC" and much more. Wane recently retired after teaching the last 11 years at the Trane Graduate Training Program. Prior to retiring from Trane, he worked as an IEQ / EH&S professional on a full-time basis for nearly 25 years. He recently contributed to the AIHA Guidance Document "Aerosolized Transmissible Diseases" during which the discussion of ventilation was a hot topic. We had to get him back to share his knowledge with our audience at least one more time.

Nuggets mined from today's episode:

Wane Baker officially retired in February of 2024. He enjoys maintaining and improving their home and property, hanging out with the dog, and reading about IAQ and HVAC, topics which he still considers fascinating. To get out of the house and get in some additional steps, he has even taken a part-time job at Home Depot!

For the benefit of the kids

In the summer of 2000, when Wane and Dawn Baker moved from the Twin Cities to the relatively small college town of La Crosse, Wisconsin, they were justifiably hesitant about the range of available employment options. But they wanted to make the move to a smaller town for the benefit of their young children, and La Crosse was a natural choice because Dawn's family was still there.

Building on success as a consultant

Following a successful career as in IAQ/EHS consultant, Wane attended a local ASHRAE chapter meeting in 2013, where he approached an industry friend who worked for Trane and asked if there might be an opening for him there. In due time, this inquiry led to a successful interview and a position as an instructor in the Trane Graduate Training Program (GTP) where Wane spent the final 11 years of his 42-year career, instructing young men and women entering the HVAC/R industry.

Trane's Graduate Training Program

The Trane Graduate Training Program is a 20-week course that typically teaches 40-60 "newly minted" engineer employees of Trane a range of related skills, including communications, critical thinking, attention-to-detail, and the practical application of the topics they learned in their college studies, ultimately preparing them for their new roles at Trane. This program, created by Reuben Trane and company management many years ago, graduated its first class in 1926, and as such, will soon celebrate its 100th anniversary. Attendees are typically selected by Trane's sales offices and come to La Crosse from across the globe.

Wane described the program as a "mini-master's degree", where 8 weeks is spent on engineering fundamentals (heat transfer, psychrometrics, refrigeration, systems and components, coil selection, etc.), 8 weeks is spent on system design and control, and the final 4 weeks are spent tying it all together.

How did COVID affect your time at Trane?

According to Wane, the environment for teaching in the GTP was 'horrible' during the pandemic. GTP attendees were stuck in their rental homes or hotels, and classes were conducted virtually. Students and faculty missed the personal connections of classroom learning. Homework and examinations had to be entirely reworked. And due to global supply chain issues, Trane – as with all manufacturers - had difficulty obtaining needed materials and components, which led to extended lead times on the production lines.

Mechanical Ventilation During Pandemic Outbreaks

The conversation with Wane then explored the challenges of keeping people safe and healthy during the COVID-19 pandemic. It's widely recognized that in the event of a pandemic with an airborne transmissible disease, HVAC systems are generally ill-equipped to fully protect building occupants. In most cases, system performance can be improved, but there may still be a need for additional portable air cleaning devices or technologies.

Several considerations regarding this topic are discussed in the new AIHA guidance document, including: the critical importance of mechanical ventilation, the familiar Hierarchy of Controls, and the "Swiss Cheese model" for risk mitigation, which highlights the importance of a layered approach to managing risk and protecting building occupants.

Wane went on to discuss the importance of mechanical ventilation during such an outbreak, emphasizing the need to maximize outdoor air intake and improve

filtration using higher level MERV filters while still controlling indoor humidity levels. Perhaps key to the entire conversation, he also highlighted certain discrepancies in the industry's common use of the terms "ventilation" and "ventilation air", including across ASHRAE documents, noting that while some define it as outdoor air only, others include recirculated air that has been treated or conditioned in some manner. He repeatedly advised practitioners to clarify a shared definition of "ventilation" with clients and colleagues to avoid potential misunderstanding.

Wane also talked briefly about ASHRAE Standard 241, which was developed with the encouragement of the White House COVID-19 Response Team and was recently published for public review and comment (see hyperlink below).

Airborne Transmission of SARS-CoV-2

The discussion then focused on how viruses, particularly SARS-CoV-2, can be transmitted long distances through the air. Wane explained that small particles (perhaps ~1 micron in size) containing the virus can remain airborne for extended periods, challenging the previous belief that droplets and occupant proximity was the main transmission route. He emphasized that ventilation, through frequent air changes, can help dilute these airborne particles, while surgical and cloth masks primarily serve as "source control" to prevent infected individuals from spreading the virus to other individuals within the occupied space.

The conversation also touched on the role of relative humidity, noting that the infective potential of viral particles is reduced at relative humidity levels between 40-60%. Various mechanisms have been proposed to explain the U-shaped curve, which consistently shows greater viral spread at lower or higher RHs.

Risks of Novel Indoor Air Purification Technologies

This segment of the discussion focused on the effectiveness and potential risks of various indoor air purification technologies, particularly ozone, hydroxyl radicals, hydrogen peroxide, and UV lights. In addition to claiming virucidal/biocidal effects, the systems often claim to reduce levels of volatile organic compounds (VOCs).

Wane explained that ultra-violet lights can be effective in reducing viral loads when deployed as "upper room" UVGI, a technology that has been studied for decades. UV can also be very effective when mounted downstream of the cooling coil and used to continuously irradiate the wetted surface of DX and chilled water coils.

At the same time, the use of "additive" technologies, like hydroxyl radicals, bipolar ionizers, and dry hydrogen peroxide introduce the potential for unexpected and undesirable chemical reactions. These chemical reactions can occur in the air and on surfaces within the indoor space. Those who promote these technologies oftentimes claim that VOCs present in the space will be broken down into nothing but water vapor (H₂O) and carbon dioxide (CO₂). Wane shared the example of "canned air", which many listeners have undoubtedly used to blow debris out of their computer keyboard. But 'canned air' is actually a refrigerant (R-152a) -- a fluorinated hydrocarbon, called 1,1-difluoroethane. And the question remains: if R-152a is cleaved by one of these oxidizing agents, what happens to the two fluorine atoms?

What did we get wrong during the pandemic?

A lot, but Wane reiterated the errors we made by focusing on handwashing, surface cleaning, the belief that "the 6-foot rule" provided protection, and our general misunderstanding about how the SARS-CoV-2 virus could spread via aerosols that remained airborne for hours, in addition to the distribution of 'ballistic' droplets.

Link to AIHA Guidance Document on Aerosolized Transmissible Diseases. <u>https://www.aiha.org/education/guidance-documents/aerosolized-transmissible-diseases</u>

Link to the previous episode with Bill Bahnfleth discussing ASHRAE Standard 241 on IAQradio <u>https://www.iaqradio.com/bill-bahnfleth-phd-pe-ashrae-control-of-infectious-aerosols-standard-the-future-of-iaq-standards-after-covid/</u>

RoundUp

- MERV 13 filters can be assumed to remove ~80% of COVID particles
- The SARS-CoV-2 virion is approximately 0.12 micron in size, but is generally airborne as part of a larger particle. Such particles are emitted by infected persons as a mucous-laden droplets, which desiccate quickly, leaving behind droplet nuclei that can remain afloat for hours.
- A draft of the newly revised ASHRAE 241-2023 document on Control of Infectious Aerosols is available for public review through June 9, 2025 on the ASHRAE website, here: <u>https://www.ashrae.org/technical-</u> <u>resources/standards-and-guidelines/public-review-drafts</u>.

• According to several cognizant authorities, a ventilation rate equivalent to 5-6 air changes per hour is recommended during a pandemic to mitigate the potential spread of airborne transmissible diseases indoors.

Wane's Last Word:

The conversation concluded with Wane praising the hosts for their work on IAQ Radio and expressing gratitude for the opportunity to share his expertise.

Z-Man signing off

Trivia-

The founder of the TRANE Company was an immigrant from what country? Answer:

Norway

Answered by: John Lapotaire, Indoor Air Quality Solutions, Sanford, Florida