



Jie Zhao, PhD

Head of Delos Labs & Executive Vice President at Delos
Keeping Our Buildings and Homes a Safe Oasis
Show Number: 706

Dr. Zhao is the Head of Delos Labs and an Executive Vice President at Delos. Delos is a wellness, real estate and technology company headquartered in New York City. As the creator of the WELL Building Standard, Delos develops products, programs and solutions that transform our environments into vehicles for health, well-being, performance, and resilience. Jie leads the research team to support product innovations and market strategies. He is also a lecturer in the Weitzman School of Design at the University of Pennsylvania. His research focuses on Human-building Interactions, including total building performance, occupant behavior in buildings, sensing and controls in buildings, health, comfort, and productivity of building occupants, as well as building energy efficiency and sustainability. Jie received his PhD in Building Performance and Diagnostics from Carnegie Mellon University.

This week we welcomed back Jie Zhao, PhD Head of Delos Labs and VP at Delos for a show on keeping our buildings and homes a safe oasis. With heat extremes, wildfires, hurricanes, heavy rains, train derailments, Ozone action days and other atypical environmental hazards becoming more frequent it's important that our buildings be prepared to provide a safe oasis.

Nuggets mined from today's episode:

Radio Joe is working on the AIHA committee producing a guideline for IEPs dealing with atypical environmental hazards.

Wildfires and IEQ? Wildfires create immense quantities of PM 2.5. Short term human exposure to PM 2.5 particles is known to cause respiratory discomfort and irritation. Short term exposure to PM 2.5 is also known to trigger asthma. In longer term exposure PM 2.5 particles enter the blood stream, heart and

cardiovascular system and cause heart and cardiovascular disease and other health problems. PM 2.5 is the #1 environmental risk health factor. PM 2.5 from Canadian wildfires is crossing the border and carried deep into the US. The number of wildfires worldwide is increasing due to global warming and forestry factors.

Wildfire preparation, resistance, and remediation? Airtight buildings are more wildfire resistant. Buildings can prepare for wildfires by sealing exterior cracks and crevices to prevent wildfire residues from getting indoors. It's recommended that HVAC filters be upgraded to MERV 13 or better. HVAC filters need to be changed routinely. Placement of standalone air-cleaners in occupied spaces, and use of low cost sensors (or better) and air monitoring equipment are highly recommended. Weather Apps on smart phones show weather patterns. Be aware, be prepared. airnow.gov

Does tightening buildings for energy efficiency cause IEQ problems? We've learned from the past that; air-tightening buildings for energy efficiency can cause IEQ problems and "sick buildings" when fresh air is reduced. The importance of fresh air is well known and understood. Well designed HVAC systems dilute CO₂ and effectively capture particulate. Operable windows in low traffic areas can provide fresh air.

Ozone? Ozone is hard to remove from indoor environments. High ozone levels are often transportation related. In theory, filters with sorbent materials, such as activated carbons can remove some ozone. Photocatalytic oxidization materials (PCOs) can breakdown ozone through very complex chemical reactions. Molecules from ozone reactions can form new chemical compounds when molecules from chemical reactions reassemble. Ozone is an indicator proxy of the end result of chemical reactions.

Pittsburgh, PA is one of the top ten worst cities for PM 2.5 in the US.

UV lights? Germicidal ultraviolet lights were widely used during COVID. 222 Nano UV light is used to sanitize entire rooms. 254 Nano UV lights installed on upper sanitize the air. LED bulbs can be used. When the phosphor wears off of some bulbs; the UV bandwidth changes.

Heat Extremes? Due to the high percentage of US properties that are air-conditioned; the US has more and better resistance to heat extremes than much of the rest of the world (e.g. Europe, Asia and Middle East). We can prepare better for heat extremes by designing buildings which are airtight, have good insulation, incorporate external shading, blackout curtains, which mitigate solar heat gain, as well as well-designed HVAC systems.

Thermal comfort? The human body's thermal sensation differs for air and surface temperatures. Air movement changes the sensation. Air of the same temperature feels better when it blows on us. Fans blowing on us increase evaporation creating a cooling sensation. High humidity reduces thermal comfort, maintaining the indoors at 40%-60% RH improves comfort. Most heat pumps give a dehumidification function.

Biophilic building design? The term biophilic, is a psychology term. Bringing nature indoors is known to increase human comfort, productivity and happiness. Dense building materials such as wood, clay, adobe help modulate RH indoors. Many studies demonstrate that the biophilic effect is real.

Visual- closer to nature, wood, bamboo, plants, fake plants (plastic plants may emit VOCs)

Audio- sounds of birds, waterfalls, crackling fire, ocean, bubbling brooks, etc.

Olfactory- Controversial as aromas contain VOCs. Not all VOCs are bad, it depends how they are produced. Naturally extracted oils are preferred. Use warmers or wood reeds to diffuse fragrance oils into the air.

- Do not put fragrance oils in humidifiers, as this application has not been adequately studied.
- Do not use fragrant candles.
- Do not ingest fragrant oils.

Leafy plants as air cleaners? Leafy plants have been oversold as air cleaners. Indoor plant walls have been studied for their ability to remove VOCs, results are good but negligible compared to air purifiers or HVAC systems. Plants assist in mental health.

- Keep plants out of bedrooms. Plants produce CO₂ at night.

ROUNDUP

- ASHRAE's Control of Infectious Aerosols Standard is a significant achievement. It raises awareness and provides guidance and solutions.
- Equivalent Air Changes (E-ACH)- ASHRAE "...based on the concept that within limits ventilation, filtration, and air cleaners can be deployed flexibly to achieve exposure reduction goals subject to constraints that may include comfort, energy use, and costs."
- Current projects- Delos Labs is monitoring Air Quality Standards, Setting Benchmarks and Baselines, Raising awareness of problems. Baselineing is the first step for meaningful improvement.
- Low cost sensors- accuracy is less important than practicality. Raising awareness is more important.

Z-Man signing off

Trivia- Name the inventor of the first protective mask containing a charcoal-based filter which removed more harmful gases than previous masks?

Answer: John Stenhouse, 1854

Answered by:

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