



Episode 651 | January 14, 2022 | 12:00 PM EST

Kishor Kahnkari, PhD FASHRAE Computational Fluid Dynamics & Indoor Environmental Quality

This week on IAQradio we explored how computational fluid dynamics (CFD) can help visualize indoor environmental quality (IEQ) with a widely respected proponent of the science Dr. Kishor Kahnkari.

Dr. Kishor Khankari is the president and founder of AnSight LLC. He is a specialist in Computational Fluid Dynamics (CFD). Kishor has several years of experience in providing consulting services that have resulted in optimized solutions to a wide variety of engineering problems. A noted expert in his field, he has a Ph.D. in CFD from the University of Minnesota and has regularly published in several technical journals.

Dr. Khankari is an ASHRAE Fellow and Distinguished Lecturer who has made over 100 presentations on behalf of ASHRAE worldwide. He has received the ASHRAE Distinguished and Exceptional Service Awards and is past President of ASHRAE Detroit Chapter. He is also currently serving on the ASHRAE Board of Directors.

Nuggets mined from today's episode:

What is CFD and how does it work? (CFD) is the process of using mathematical modeling of a physical phenomenon involving fluid flow and solving it numerically using the computational prowess. CFD is based on the laws of physics. The highly efficient Dyson vacuum cleaner was designed using CFD. Wind tunnels were used to improve vehicle mileage, now CFD is used. CFD is also used to make vehicles quieter. CFD is being used to design heart valves. Indoors, air is the main carrier of heat and air pollutants. We can't see air movement patterns. CFD is of value during the design phase of a building.

Using CFD modeling, Dr. Kahnkari compared the infection probability of 2 identical rooms the only difference being the number of HVAC supply and returns. He referred to what he recommended as “aerodynamic containment”. He demonstrated that in the cases of both supplies and returns that TWO were better than ONE. While pandemic awareness is up, infection indoors is a problem as the air in many rooms is poorly mixed. We need to study and monitor air in the occupants’ breathing zones. Plexiglass barriers stop droplets and create undesirable turbulence. Airflows play an important role in IEQ, airflow modeling should be mandated.

How much does CFD cost? The design cost of a building is \$1. The construction cost is \$10. The operational cost \$100. The people cost is \$1,000. Using CFD only adds 10 cents to the cost and provides savings on the \$1,000 human cost.

The thermal comfort dilemma. When we go out for a meal, we’ve all experienced being either too hot or too cold due to being seated under a supply register. We put on a jacket rather than complaining. Unless people complain, thermal comfort problems don’t get fixed. ASHRAE Standard 55 specifies conditions for acceptable thermal environments and is intended for use in design, operation, and commissioning of buildings and other occupied spaces.

Compassionate design. By designing buildings as though they will be occupied by their families, architects and building designers will design better buildings.

Who are your typical clients? They are either visionaries or people in deep pain.

Is thermal comfort measurable? Thermal comfort is a state of mind which like happiness cannot be measured. There is a science to thermal comfort which measures how the body responds to heat, temperature, humidity, airflow.

Other comments from Dr. Khankari:

- Buildings are for the people.
- Clean air is a fundamental human right.
- In the dark, a flashlight can show the way. A flashlight is not a GPS.
- Be a good engineer first and then be a good engineer who uses CFD!
- The physics don’t lie.
- No CFD simulation is absolute.

- Learn from each project and implement the lessons learned in each future project.
- CFD is a tool like a thermometer, it doesn't cure you it does tell you if you are sick or not?
- Passionate about health, comfort and human well being.
- Do everything to improve: comfort and IEQ.
- Put compassion into the system.

Dr. Khankari's final comment:

Educate everyone: the designers, architects, engineers, contractors, workmen and the occupants. Don't take IEQ for granted. Demand it. Then demand proof they've done it.

Z-Man signing off

Trivia:

Name the scientific subdiscipline that studies the motion of air?

Answer: aerodynamics

Answered by: Neil Zimmerman