Simulating Air Flow Patterns to Reduce the Spread of Airborne Germs
At its most fundamental level, a heating, ventilation, and air conditioning (HVAC) system includes heat exchangers that heat or cool the air within a facility. Once the air is conditioned by the heat exchangers, the system forces it through a ducting system that distributes it to various locations within a facility. While maintaining a set temperature throughout the building, a negative side effect of this process is that the forced air can also spread germs. The severity of diseases caused by airborne pathogens, including Covid-19 and the flu, has caused many companies to ask if their HVAC systems are negatively impacting the health of the building’s occupants, and if they are, what can be done to fix the problem.

To determine and optimize airflow, leaders of hospitals, corporate offices, and other facilities are turning to Computational Fluid Dynamics (CFD), the visual depiction of design performance using numerical methods. This technology empowers organizations to simulate the airflow in their facilities and quickly gain insight into the corresponding germ migration.

To perform these critical airflow analyses for customers, Rand Simulation teams with Ansys, a leading developer of engineering simulation software used to predict how designs behave in real-world environments. Examples of these simulations that utilize Ansys software tools include optimizing negative pressure in healthcare room designs to minimize risk of infectious particles escaping the room envelope, the decontamination of virus-positive patient rooms as well as basic airflow, temperature and humidity performance.

Gaining this insight is a fundamental step required to identify:

► Current ventilation design flaws
► Root causes of flaws
► Identify modifications necessary to optimize:
  ■ Employee safety
  ■ HVAC effectiveness
  ■ Utility cost control

**Simulating Airflow with CFD Analysis**

CFD analysis uses numerical simulation technology to allow visualization of airflow and temperature performance to confirm ventilation effectiveness before construction, equipment purchase, and system implementation. Whether designing the HVAC system for a new building or optimizing one in an existing building (retrofits), a CFD analysis will dramatically speed the process, reduce costs, and improve the results. Companies no longer need to make their best guess about HVAC system performance and later perform costly downstream rework to meet needs, performance guarantees and/or OSHA safety standards. Instead, before construction begins, facilities professionals can sit down with HVAC design experts, whether in-house or external consultants, and use simulation software to test and perfect the HVAC design by:

1. Modeling the airflow through buildings
   ► Use BIM data
   ► Simulate a cough or sneeze
   ► Track the particle progress through the room
2. Determining factors that affect the transmission of airborne contaminants, such as:
   ► Supply and return locations
   ► Pressurization within the space
   ► Equipment/furniture locations
   ► Stagnant air zones and air changes per hour (ACH)
3. Testing options, such as:
   ► Number and location of HEPA filters
   ► Layout of personnel and equipment within the room
   ► Location of low-wall returns, which can prevent “dead zones” and recirculation
4. Identifying the occupant safety and cost solutions
   ► Balance ventilation performance with sustainable design and aesthetics
   ► Maintain occupant comfort and safety across all environmental conditions
   ► Mitigate local thermal discomfort factors—drafts, temperature variations, and humidity
5. Substantiating recommendations to stakeholders and decision makers with visual performance predictions ahead of construction documentation (CD) and equipment procurement

A Proven Solution to a Growing Concern

When many people initially think of the importance of HVAC systems, they think of temperature and humidity control. Despite these prevailing thoughts, the use of HVAC systems to direct airflow is not new. Airflow modeling helps ensure that systems in hospitals keep germs away from patients, workers, and visitors; and ensure that exhaust fumes in their parking garages move away from people. This change in thinking is occurring in buildings beyond the medical profession where building owners believe that investments in strategic air distribution are the right business decisions to protect and maintain the health of the people using these facilities.

Today, more and more businesses are starting to think of their HVAC systems in terms of safety:
   ► As large spaces that have been closed for lengthy periods, such as shopping malls, movie theaters, and stadiums, start to welcome the public back in, an optimized HVAC system can reassure people worried about entering
   ► When someone at an office building, school, or store tests positive for Covid-19, the flu, or other airborne illnesses, the system can help limit exposure to others in the building
Summary

Recognizing that a threat exists to people’s health, the organization’s reputation, and bottom line, more facilities are working to mitigate the airborne transfer of germs from person to person. Many germs can live in the air for long periods and can travel long distances. Facility HVAC systems have become an even more critical component in the mitigation process. CFD analysis makes it possible to analyze the airflow quickly, accurately, and cost-effectively—all before actual construction and implementation.

When deciding to move forward with CFD analysis, it’s essential to team with a provider that has the knowledge and experience to deliver a solution that ensures the most effective decisions around equipment selection and design layout early in the process.

A company has a choice:

1. **Purchase the software and use in house experts to complete the analysis** - At Rand Simulation, our experts can assist with selecting the right software for your in-house team.

2. **Work with a collaborative consultant** - When you partner with Rand Simulation, our CFD experts handle the analysis process, while your design experts continue the design process.

Sharing core competencies encourages continuous collaboration and bi-directional flow of information, which ensures that all design guidance and ideas exchanged fit within your constraints for timing, cost, and capabilities.

About Rand Simulation

Rand Simulation is focused on helping organizations bring their product vision to reality through incorporating engineering simulation technology into the product development process. Rand Simulation caters to product development organizations looking to compress the design process, maximize innovation, strengthen competitive differentiation and grow bottom-line profitability. Rand Simulation serves as both a North American reseller of ANSYS engineering simulation software and as a trusted design consultant offering insights gained on over 3,000 design projects using engineering analysis software to balance design performance with size, cost, DFM and aesthetics.

simulation@rand.com  |  RandSIM.com  |  888.483.0674