



Trinity Consultants is a leading global environmental consulting firm that brings 50 years of experience providing services and solutions in the EHS Regulatory Compliance, Built Environment, Life Sciences, and Water & Ecology markets. Trinity has the technical expertise and acute industry knowledge to provide optimal solutions to highly complex pharmaceutical development, process, safety, and facility design challenges.

Computational Fluid Dynamics

Computational fluid dynamics (CFD) modeling is an essential component of modern engineering and facility design. Advent Engineering, part of Trinity Consultants' Life Sciences division, has over 20 years of expertise in the application of CFD to support our clients in a variety of applications, including hospitals, pharmaceutical manufacturing, and data centers. Using the latest state-of-the-art modeling tools and methods, our engineering simulations can predict behavior and eliminate or reduce the need for experimental work.

CFD Applications Inside Hospitals

In hospitals, CFD models the dispersion of airborne pathogens, ensuring that ventilation and other systems effectively minimize infection or pollution risks. By simulating different scenarios, engineers can design systems that work efficiently, protect patients and healthcare workers, and meet regulatory requirements.

Use cases in the hospital setting include:

- Operating room ventilation: Designing ventilation systems that minimize airborne pathogens
- HVAC system design: Ensuring even temperature and humidity distribution to create comfortable and compliant healthcare environments
- Regulatory compliance: Plan for and evaluate options for compliance with regulations triggered by new construction, significant updates to HVAC or room layouts, outbreaks or infection control issues, accreditation inspections, and cleanroom/pharmacy expansion

CFD Applications Outside Hospitals

Near-field air dispersion analysis is a subfield within CFD that involves detailed simulation of how pollutants or particles disperse in the immediate vicinity of their source. This type of modeling helps practitioners understand and predict how air, heat, contaminants,

or particles will move, spread, and interact with surfaces and obstacles—important considerations in mission-critical environments like hospitals. Advent uses CFD modeling to conduct near-field air dispersion analysis in hospital settings, including many military hospitals. We use ANSYS CFX and Fluent GPU software and follow industry best practices. CFD modeling can:

- Capture 3D wind pattern flow around buildings and local structures which may influence pollutant concentration levels
- Simulate exhaust dispersion from backup generators to prevent air contamination around hospital intakes and prepare mitigation strategies for audits
- Model atmospheric logarithmic boundary layer
- Model thermal inversions
- Provide pollutant concentration levels at any point of interest, e.g. HVAC inlets, open windows
- Capture buoyancy effects from hot exhaust
- Model ground heat flux, e.g. ground at different temperature than air

Advent Engineering, a Trinity Consultants team, has expertise in the commercialization of biopharmaceutical processes. We provide a wide array of engineering services and project management supporting the entire product life cycle. Our engineers bring many years of experience along with a complete understanding of industry regulations and requirements. We provide project engineering and design, automation, commissioning, and compliance-related services for clients across the U.S. and in Canada, Europe, and Asia.

CONTACT OUR TEAM!

For more information about how we can help your organization, please contact us.

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