CREATING TEMPORARY ISOLATION ZONES WITH EMERGENCY RETROFITS OF HOSPITAL WARDS

As hospitals do their best to accommodate the sudden increase in demand, the need to address the shortage of isolation units is paramount.

The challenge is that effective respiratory-protection systems must be in place to ensure that the general patient population and healthcare workers, in other parts of the hospital, are adequately protected. There is still a limited understanding of how COVID-19 is transmitted, but knowing that airborne infections may enter and pass through regular HVAC systems, simply creating separate spaces for infected patients may not be enough.

Recent experience in China, along with existing research and guidelines, indicates that it is possible to convert regular wards into large, temporary negative-pressure isolation zones that are effective. With the right modifications, these temporary zones can offer a safer alternative for hospitals that either currently lack negative-pressure isolation zones or require more. These same principles can be applied to create emergency field hospitals using existing buildings.

RWDI has strong expertise in engineering ventilation systems for biohazardous laboratories and hospitals. We are available to quickly deploy resources to assist hospitals in creating effective isolation spaces to meet the demand for COVID-19.

THE GOAL

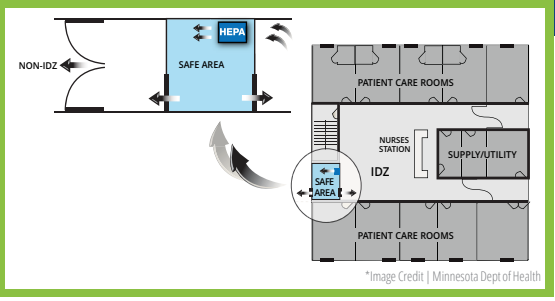
Housing and treating large numbers of patients with droplet and airborne infectious diseases is challenging. When dealing with surge capacity, the goal is to provide temporary areas for COVID-19 patients with safeguards to protect healthcare workers and other patients from exposure.

There are different ventilation and airflow management approaches possible to emergency retrofit hospital wards and convert buildings into field hospitals. COVID-19 zones can be effectively created to provide airborne isolation zones for large numbers of patients. To implement these spaces requires engineering ventilation expertise that considers the specific layout and requirements of the facility being converted.

SOLUTIONS

CREATE SAFE AREAS

SAFE AREAS that act as buffer zones should be created between the COVID-19 zone and the rest the facility. A portable HEPA/UV unit can be used to pressurize the SAFE AREA, providing pressure management to ensure airflow cascades from the clean area through this buffer and then into the COVID-19 zone. Ideally, airtight seals would be made for all connections, but if this is not possible, it can be managed with the airflow controls.



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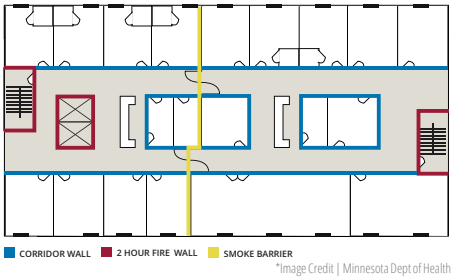

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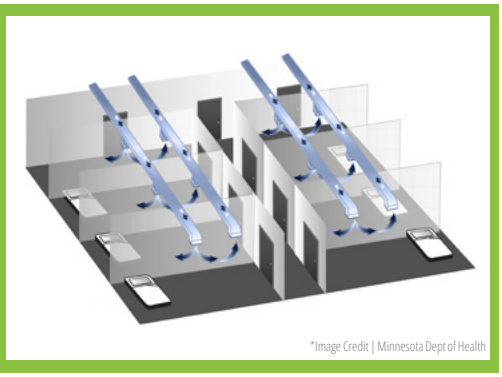
UTILIZE SMOKE ZONES

Existing smoke zones can be used as a perimeter of a COVID-19 zone. Smoke zones are designed to contain smoke if there is a fire. These zones can be independently pressurized and exhausted. The airtight barriers between smoke control zones include fire-rated doors that close, and exhaust capabilities that can effectively create an isolated COVID-19 wing, suite, or space. Filtered air can be discharged through a window or into the exhaust air system.

MODIFY EXISTING HVAC SYSTEMS

It is also possible to modify exhausts on existing HVAC systems to allow specific wings or areas to be converted into COVID-19 zones. Large zones can be depressurized with modifications to the supply airflow or exhaust, or both, while ensuring that the contaminated air is taken outside and away from public access and air intakes. Some facilities may only require changes to their Building Automation System (BAS). In many cases, minor reconfigurations and commissioning can be effective with the bulk of the changes required occurring on the rooftop where the HVAC equipment is located.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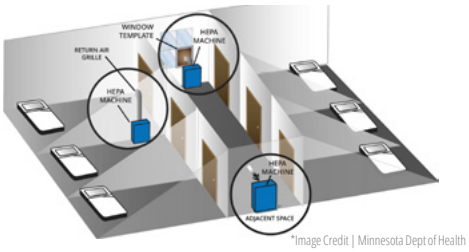

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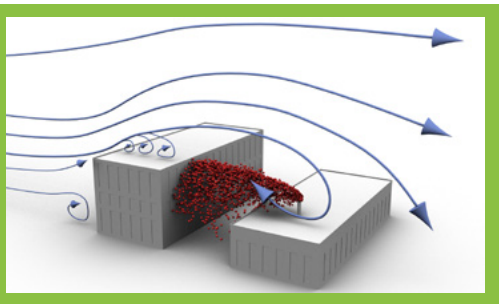
INTRODUCE PORTABLE HEPA/UV MACHINES

A COVID-19 area can be created using portable or custom-built HVAC machines that use a HEPA and/or UV filter. When applied correctly, such filters can effectively create an isolation environment. Systems might maintain negative-pressure isolation by discharging filtered exhaust air through a window, adjacent space, or via an existing exhaust air system.

MINIMIZING EXHAUST RE-ENTRAINMENT

The filtration, location, air volume, and velocity of exhaust to the outdoors is critical to prevent re-entrainment and achieve safe and effective exhaust dispersion. Exhausted “dirty” air from COVID-19 zones must not recirculate to “clean” zones, or to any point of vulnerability, including neighboring buildings. Proper assessment of the wind flow around buildings is needed to ensure that the exhaust disperses and avoids re-entrainment.



RAPID ENGINEERING SUPPORT

RWDI has a rapid-response engineering team available to develop ventilation strategies for temporary COVID-19 isolation zones and to evaluate their performance. Where needed, RWDI can deploy real-time dispersion modelling, or periodic exhaust source testing to verify performance, and provide commissioning of the HVAC systems.

Redefining possible.

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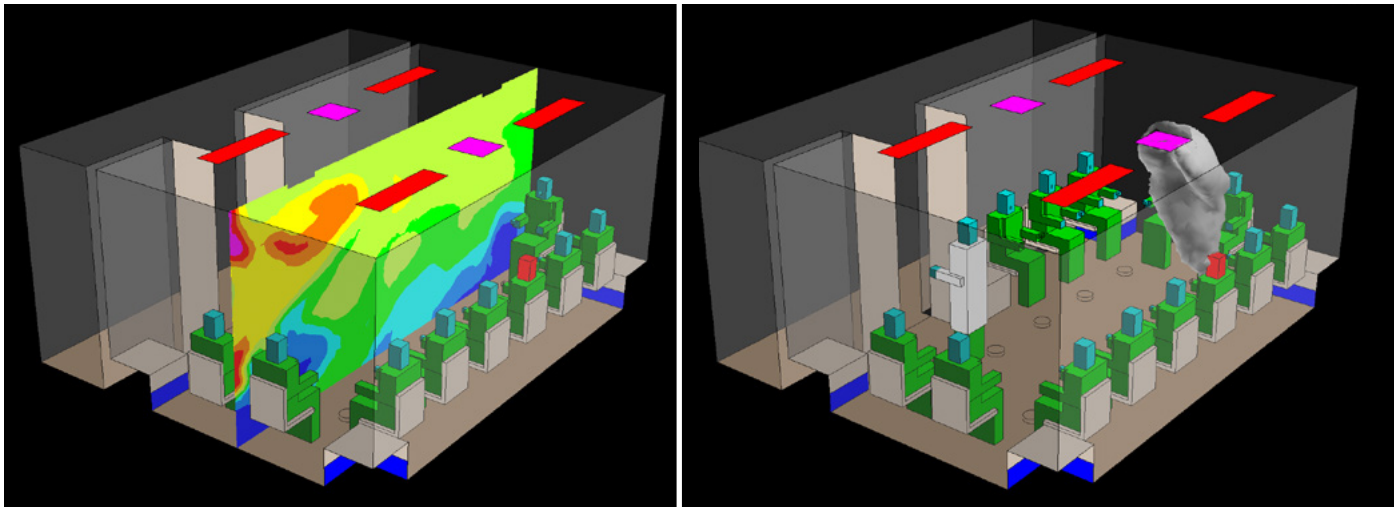
References:
1. Anderson, J., A. et al “Minnesota Department of Health Office of Emergency Preparedness. Airborne infectious disease management: methods for temporary negative pressure isolation. St. Paul, MN.” (2007). [*Image Credits] https://www.health.state.mn.us/communities/ep/surge/infectious/
2. Miller, S L. et al “Implementing a negative-pressure isolation ward for a surge in airborne infectious patients.” American journal of infection control 45, no. 6 (2017)

QUALIFIED PARTNER

The RWDI approach is one of partnership. It takes a team to deliver practical solutions to the most challenging problems, and this is what is needed right now.

From operating rooms to research laboratories to isolation rooms, we have successfully consulted on the design of their ventilation systems, optimizing their efficiency in reducing the spread of infection. We are ready to deploy this expertise to achieve large, temporary negative-pressure isolation zones.

With deep knowledge and experience gained through prior projects, our experts can quickly assess the performance of existing ventilation systems in hospitals and identify practical solutions to be implemented immediately.



In the above example of our work, a CFD model of a waiting room illustrates how a high-performance ventilation system can reduce the risk of infection. When the infected individual (with the red head) coughs, the spread of the airborne particles is restricted by the displacement ventilation system and the contaminated air is lifted towards the exhaust at the ceiling. The ventilation system effectively carries the particles away from the other people, rather than mixing them throughout the room.

Our team is available to deploy our resources to help facilities effectively manage COVID-19 requirements. By leveraging close partnerships with leading healthcare designers, engineers and contractors across North America, we can meet the immediate demands.

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