

AerosolSense Sampler helps verify containment of SARS-CoV-2 at an essential Field Hospital in Massachusetts

Situation

At the peak of the COVID-19 pandemic, the UMASS Memorial DCU Field Hospital was created to provide care for acute COVID-19 patients who did not need intensive care. Since its inception, the Field Hospital has admitted over six hundred patients.

Throughout this time, staff providing patient care worked in areas with a high presence of SARS-CoV-2 in the environment. Based on infection control practices, air lock systems are designed to contain in-air pathogens from escaping containment areas; however, without an in-air pathogen surveillance solution, quantitative metrics are not available. This means that the proper functionality of air lock systems cannot be verified.

Due to the high transmission areas, the UMASS Field Hospital wanted to accomplish the following:

1. Monitor for the presence of SARS-CoV-2 in cold zones (not containing COVID-19 patients) of the Field Hospital, such as staff break rooms and gown rooms.
2. Help verify that the air lock containment system is efficiently keeping SARS-CoV-2 in the hot zone (containing COVID-19 patients).
3. Oversee the effectiveness of staff safety protocols during transit from the hot zones to the cold zones.

Solution

The Thermo Scientific™ AerosolSense™ Sampler, our new pathogen surveillance solution, is designed to deliver timely and highly reliable insight into in-air pathogen presence for monitoring and improving facility safety protocols. This solution was provided to the UMASS Field Hospital to



support their monitoring goals while helping to protect staff and maintain operational continuity.

The AerosolSense Sampler collects air samples through an omnidirectional inlet. A cartridge installed into the sampler contains the collection substrate. The air sample is directed toward the collection substrate through an accelerating slit impactor. Particles are trapped on the collection substrate as the air is drawn through the sampler. After the sampling cycle, the sample cartridge is removed and sent to a testing laboratory.

The set-up:

- Four AerosolSense Samplers were placed in eleven different locations within the Field Hospital for four weeks.

- Samplers were placed in the hot zone, warm zone, and cold zone areas. See Figure 1. The sampler locations within the hot zones varied to accommodate for density of patients and degree of illness. Samplers were not placed inside rooms with patients.
- Air samples from each location were collected at different time points (4, 6, 8, and 12 hours).
- Collected samples were sent to a Thermo Fisher Scientific laboratory partner for results within 24 hours.

Results

In-air SARS-CoV-2 presence was not detected in warm or cold zones, validating the efficacy of current facility safety protocols and indicating the absence of pathogen transmission throughout the field hospital facility. In-air SARS-CoV-2 presence was detected in multiple hot zones, demonstrating the criticality of infectious control measures and the necessity to diligently follow safety protocols.

A positive result outside of contained areas (cold zones) could have triggered several actions, including staff testing, staff absence, room or wing closures, additional cleaning

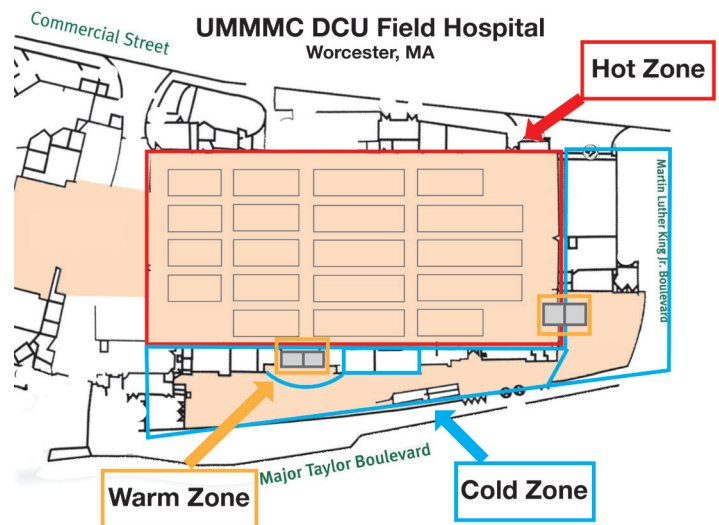


Figure 1 Field Hospital zone map

measures, air handler checks, air flow checks and/or replacement of HEPA filters. These actions are disruptive to daily operations; therefore, having the confirmation of negative results in cold and warm areas provided a peace of mind. It also provided a willingness to continue using the AerosolSense Sampler, especially in staff break rooms and gown rooms for operational continuity.

UMASS Memorial DCU Field Hospital (50,000 sq. ft.)		
Cold zone	Warm zone	Hot zone
<p>Outside air lock</p> <ul style="list-style-type: none"> • Staff break rooms • Staff gown rooms 	<p>Air lock rooms</p> <ul style="list-style-type: none"> • Air lock room #1: Located next to the hot zone • Air lock room #2: Located next to the cold zone <p>*Each air lock room has specific safety protocols in place.</p>	<p>Shared spaces</p> <p>A highly controlled negative air pressure area with air handlers in the ceiling filter and the use of HEPA filters for expelled air. The hot zone is subdivided into five areas, based on degree of illness and density of patients (the main factors contributing to viral load).</p> <p>Coughing and some respiratory treatments are the main causes of aerosolization of viral particles (even with a mask on) and contribute to the viral load in the environment. Patients are required to use a surgical mask when they walk around the Field Hospital. Inside their rooms, patients usually wear a surgical mask over an oxygen delivery device.</p>
Staff only	Staff only	Staff and Patients

Table 1 Field Hospital zone identification

There is some degree of variability with hot zone results. Multiple factors contribute to local viral load in a specific period of time. These factors include degree of illness, density of patients, coughing levels, unequal distribution of aerosolized viral particles in the air, amount of time patients are not wearing a surgical mask and even the shape of their face for mask fit effectiveness. In addition, SARS-CoV-2 patients expel different viral load levels depending on the stage of the infection.

Other factors to consider are the infectious control measures in the hot zone including the negative pressure. As the Field Hospital Director expressed:

“If results were uniformly positive everywhere in the hot zone, I would be concerned as that may imply negative pressure is not working”.

Regardless of the airflow variations, the AerosolSense Sampler performed as expected and confirmed that the negative pressure was working.

Conclusion

AerosolSense Sampler exceeded the expectations of the UMASS Field Hospital Director. It demonstrated that existing infection control measures were working, helped verify that cold zones did not have the presence of SARS-CoV-2 (therefore mitigating operational impacts) and gave the entire staff confidence in their safety protocols.



Figure 2 AerosolSense Sampler

Moving forward, they see the greatest benefit in continuing the use of AerosolSense Samplers in cold zones (surgical rooms, staff break rooms and gown rooms). Hospitals have experienced entire unit closures after a staff member tests positive, but they see the AerosolSense Sampler as a surveillance system helping to avoid full unit closures.

“Just the presence of the sampler has given our staff a lot of confidence because they feel we care about their safety and that we are taking the risk on getting a result that we may not like. This type of action and attention in situations like a pandemic is what people remember in the hospital system.”

- Field Hospital Director