

Particle monitoring program during construction at an outpatient cancer care clinic

Application Note



Testing Functions Case Study

Though it's hardly rare, new construction at a major health care facility is anything but 'business as usual.' A building project can disrupt normal safeguards, create stress and open pathways for infection.

When an outpatient cancer care clinic embarked on a six-floor expansion in June 2005, health and safety and infection control professionals worked closely to develop and implement a detailed program to monitor and control airborne particulates.

Aspergillus species are ubiquitous in the outdoor environment and we are exposed to them daily. However, conditions such as water intrusion can allow growth inside buildings and within wall cavities. The greatest danger to immunocompromised patients is the potential for exposure to spores released during the construction process. Exposure can result in aspergillosis, a disease that can be fatal to such patients.

"We consider all the patients to be at risk," says Debbie Shiozaki, director of Environmental Health & Safety (EH&S). If *Aspergillus* infects an immunocompromised patient, she says, "the mortality rate is unfortunately around 50 to 70 percent."

Shiozaki is a member of a team of infection control specialists, industrial hygienists, project managers, planners, and contractors engaged in the construction project.

Maintaining a healthy environment during a ten-month construction project is a round-the-clock job for Shiozaki, Industrial Hygienist Sylvie Adam and the contractors. Frequent particle monitoring at the work site and in occupied areas nearby was conducted at night during construction work and during the day when the clinic was in operation.

Project scope

The clinic provides chemotherapy, radiation and other treatments for patients with a variety of cancers. As the patient base grew the clinic added more services and decided to proceed with the build out of a 12,000 square foot clinic on the third floor as well as a 56,000 square foot, six floors building addition.

Once the shell is complete the interior will be built out over the next three to five years.

Monitoring and controlling construction dust

Construction projects can generate a wide variety of airborne particles: sheetrock and fiberglass dust, welding fumes, sawdust, dirt and more. To minimize problems, the team focused on three key areas:

- **Preventing moisture intrusion.** The first line of defense is to prevent the conditions that support mold growth.

Measuring tools: Fluke 983 Particle Counter

Operator: Industrial Hygienist, Sylvie Adam

Tests conducted: Particle counts, temperature, humidity, air pressure



Collecting airborne particle counts in the occupied space using the Fluke 983.

Openings in the building shell must be carefully sealed against the weather. If building materials such as sheetrock get wet, they are quickly dried or removed.

- **Containing and filtering airborne particles.** Two feet inside the exterior wall on the addition side, contractors have erected an airtight temporary sheetrock containment wall. The containment wall helps prevent construction contaminants from entering the clinic spaces. In addition, air in the occupied space is pressurized, ensuring that air movement is from clean to dirty in the event of a leak or breach in the containment. In addition, any work performed within the clinic takes place in an enclosure maintained under negative pressure. The team also requires contractors to operate air scrubbers using high efficiency particle air (HEPA) filters inside the containment areas to reduce particulate concentrations.

- **Monitoring airborne particle numbers.** Oversight of environmental conditions is a cornerstone of the infection control program. Several times each day, the team collects airborne particle counts using the Fluke 983. Counts are taken from three to five locations on each of six floors in the occupied building. In addition, air samples are collected every two weeks using an Andersen one stage impactor. These samples are sent to an analytical lab for viable fungal culture. They also record temperature and relative humidity, measure the level of negative pressure within the containment areas and conduct smoke tests to ensure that air pressure relationships are correct. Visual inspections of the containment walls and seals provide a crucial quality check. "We visit the site two to four times a day to ensure that the fire and infection control safety measures are sound," says Shiozaki.

A total team approach

The infection control program requires involvement from everyone engaged in the construction project. Planning, the contractors, environmental health and safety, infection control are working as a team to get the project done safely, on schedule, and within budget" says Shiozaki.

EH&S worked with infection control experts from the clinic to develop the Infection Control and Construction Policy that drives job site requirements. Contractors review the policy, conduct a risk assessment using tools from the policy, and submit an Infection Control and Construction Memorandum of Understanding and Agreement that details the type and schedule of work, as well as the controls to be implemented.

EH&S reviews the proposed controls and may require additional measures if necessary before all members of the team sign-off on the agreement.



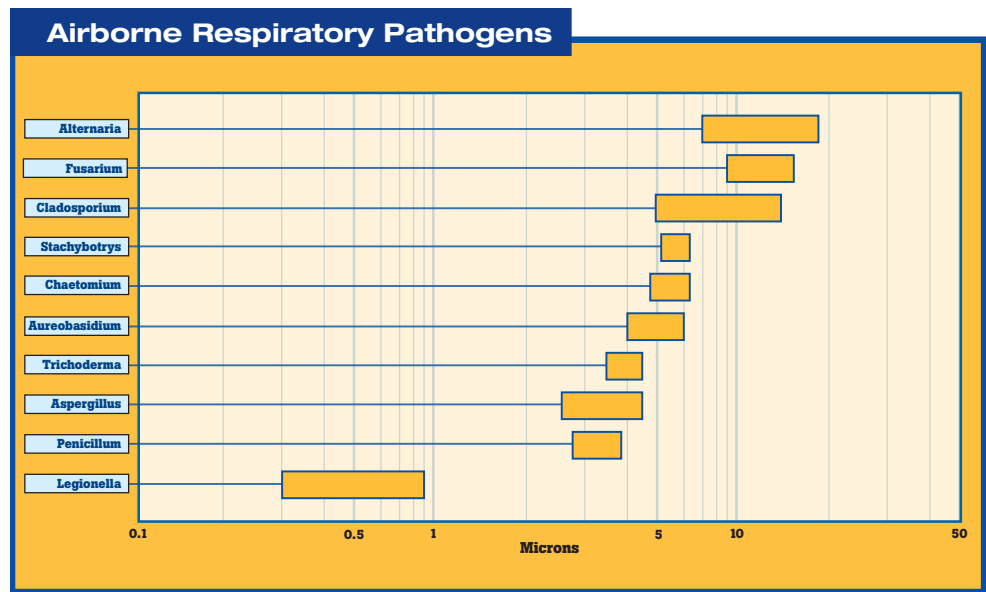
Checking particle counts in an air scrubber's supply air using the Fluke 983 Particle Counter.

Simplicity and speed

The air filtration, containment and air pressure differentials that keep *Aspergillus* out of the patient spaces will also keep construction dust, odors and volatile organic compounds (VOCs) away.

The Fluke 983 Particle Counter is used to measure particle counts to indicate when there may be a breach in containment or problems with filtration. The Fluke 983 counts particles in six size ranges, from 0.3 microns to ten microns, and includes a variety of user-defined sample sizes and counting modes.

To confirm the presence of *Aspergillus* or other biological agents requires air samples to be sent to a laboratory where they are cultured and identified. So Shiozaki and Adam measure particulates more frequently using the Fluke 983, watching for elevated counts which would trigger an investigation.



Findings

Taking particulate counts with the Fluke 983 was helpful in monitoring the performance of HEPA-equipped scrubbers and of negatively pressurized temporary infection control containments. The Fluke 983 was also instrumental in helping the team characterize background concentrations of the three building ventilation systems (100 percent supply and exhaust on two floors, HEPA filtration supply on three floors, and 90 percent

efficiency filtration on two floors). Elevated counts on a modified HEPA-filtered floor opened up a thorough dialogue between EH&S and Facilities and resulted in a better understanding of the subtleties of the ventilation system on that particular floor.

Particulate counts and results of the cultured fungal samples demonstrate that the infection control measures implemented during the construction work effectively to maintain acceptable indoor air quality.

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