

5 Ways Real-Time Construction Air Quality Monitoring is a Game Changer for the Healthcare Industry



EXECUTIVE SUMMARY

Airborne contaminants can take a tremendous toll on patient health and safety. Each year, approximately 5,000 deaths occur in relation to construction, renovations and maintenance activities in healthcare settings. While healthcare facilities and construction teams have made tremendous strides in improving construction containment to reduce this risk, there remains a need for more readily identifying contamination risks.

Today, construction and facilities professionals may use air quality monitoring tools to identify potential construction containment breaches. However, these traditional air quality monitoring tools rely on manual measurements. As a result, teams may not know contamination has impacted patient areas until a measurement is taken — or patient health is impacted.

With Environmental Health & Engineering's (EH&E) automated [24/7 construction air quality monitoring](#) system, hospital construction stakeholders receive immediate notification regarding a potential construction containment breach. This enables teams to take immediate action to mitigate risk, keeping patients safe and construction projects on time and on budget.

In this white paper, you'll discover strategies for maximizing the advantages available from automated 24/7 construction air quality monitoring systems and examples about the hospitals already using these powerful tools.



INTRODUCTION

Construction projects of any size risk exposing hospital patients to dust that may carry mold spores, which are ubiquitous to all environments. Noise and vibrations generated by construction activity can elevate patients' stress levels and have been [shown to increase heart rate and blood pressure](#). Odors and chemicals can also be emitted by construction projects. Even when appropriate containment measures are in place, there's a risk that inappropriate pressurization or ventilation might carry environmental contaminants into sensitive patient care areas.

Air quality monitoring has long been used to identify the risk of contamination. However, traditional air quality monitoring methods are slow, inefficient, and rely on hospital staff who may have limited time and competing priorities — often providing data too late to respond in real-time. Automated 24/7 monitoring gives key stakeholders peace of mind knowing that if containment measures fail there is immediate notification. This allows stakeholders to take immediate corrective actions and minimize impact to patients.

EH&E's automated 24/7 construction air quality monitoring system goes beyond other solutions by continuously tracking parameters that include dust and differential pressure, as well as temperature and humidity, carbon monoxide, volatile organic compounds, and noise and vibration. Its data interpretation algorithm is designed to precisely identify an issue when action is needed, without adding to alarm fatigue. When a threshold is met, stakeholders are notified in real-time via text and email alerts, enabling an immediate response. A secure web-based dashboard provides ongoing insight into data as it's collected.

This combination of features provides healthcare teams with several powerful advantages:

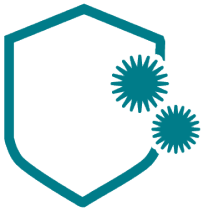
1. It enables a faster response to mitigate containment issues to prevent fungal infections.
2. It reduces the risk of construction project delays.
3. It can reduce construction and staffing costs.
4. It can simplify compliance.
5. It can help identify causes of environmental contamination beyond construction activity.

Below, we'll break down how healthcare facilities can easily leverage new technologies to enhance their response to protect patient safety.

1. ACCELERATE RESPONSE TO BETTER PROTECT PATIENTS

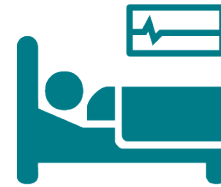
Healthcare professionals know that what's in the air matters when it comes to patient health and safety. Environmental contamination is strongly connected to the transmission of healthcare associated infections (HAIs), and the risk of contamination is highest during construction and renovation activities. Research indicates that about [5,000 deaths occur each year from construction](#), renovations and maintenance activities in healthcare settings. Even a small construction containment breach can increase a facility's infection risks.

More than half of HAIs related to *Aspergillus* are caused by construction activities in hospitals.¹



During **ten months of construction**, one medical center identified **31 cases of HAIs** due to mold.²

Mortality associated with hospital construction and renovation activity-related fungal infections has been reported as high as **50%**.³



Proactive construction air quality monitoring can characterize a baseline of indoor air quality. This baseline lets healthcare facility stakeholders identify potential contamination risk at the earliest sign of a problem.

Because EH&E's system integrates real-time environmental monitoring and web-based dashboards with email/text alerts, project stakeholders have instant access to and continuous communication around critical air quality information. In the event that a containment element breaks down and contaminants are released, construction teams will be immediately alerted via text and email. This enables construction teams to fix containment issues before they impact adjacent sensitive patient populations or spaces, such as operating rooms, bone marrow transplant/cancer care units, or pharmacies, among other areas. Healthcare facilities and infection prevention professionals are also alerted to potential environmental hazards so they can take immediate steps to mitigate potential hazards.



CASE STUDY: Rapid Alert Keeps Neonatal ICU Safe

EH&E's 24/7 construction air quality monitoring system was deployed during a construction project at a pediatric hospital. It detected a dust release immediately after a penetration was made on an exterior wall. The alert prevented contamination in the neonatal intensive care unit, protecting vulnerable, sensitive patients while saving time, money, and liability risk.

2. REDUCE RISK OF CONSTRUCTION DOWNTIME

Using traditional construction air quality monitoring methods, construction teams may not recognize there's a problem until after contamination has negatively impacted patient areas. That's because traditional methods of monitoring air quality might include manually spot-checking air quality every few days or weeks. As contamination continues to occur unabated, it becomes more difficult to identify the source of the problem. While infection control teams work to identify the source of contamination, construction activities are put on hold.

Mechanical systems are common sources of and pathways for infection-causing contamination resulting from construction activities. If left unchecked, construction dust and debris can travel via HVAC systems to compromise critical environments. Pressurization of areas adjacent to, above, and below a construction site may also be overlooked, or the pressurization strategy may not be designed correctly or robustly enough. Ignoring these areas can lead to transmission of contaminants. Investigating each of these areas for contamination risks can shut projects down for weeks.



CASE STUDY:

Real-Time Monitoring Puts Project Back on Schedule

The construction team at a Northeast hospital knew they had to perform pressurization monitoring on the first floor when they began renovating their atrium. Yet construction dust still found its way to a second-floor chemotherapy pharmacy. While the team worked to identify a solution, construction was shut down for weeks — leading to significant schedule delays and cost overruns.

An investigation determined that an adjacent negatively pressurized space had created a pathway through which construction dust was able to move. From the first evidence of a problem until the issue was addressed, construction suffered a four-week setback.

Once the issue was addressed, the construction team put 24/7 dust monitoring in place. Thanks to the new system, there were no shutdowns for the remainder of the 24-month project. Real-time monitoring meant additional contamination issues were all investigated and addressed within minutes to hours, not weeks.

3. LEVERAGE TECHNOLOGY TO LOWER COSTS

Faster identification of construction contamination can prevent delays to project schedules and their associated cost overruns. However, automated air quality monitoring delivers other potential cost savings, too.

Facilities and Construction Departments Have Options When It Comes to Air Monitoring

- Facilities and Construction departments have the option of dedicating a team member to performing routine air quality spot checks that capture “snapshots in time.” Or, they can implement automated monitoring for around-the-clock coverage and reassign that team member to more valuable activities.
- EH&E programs its continuous air quality monitoring systems to deliver the right level of sensitivity in identifying potential risks — without triggering constant unwarranted alarms. Eliminating false alarms can save valuable time (and headaches) for hospital personnel.
- In the event that there is a containment breach, healthcare facilities face high costs related to remediation and liability. Treating patients impacted by contamination also adds to costs. [CDC research](#) has estimated that hospitalizations related to *Aspergillus* infections alone have cost the healthcare industry more than \$1.2 billion a year.

Automated Monitoring Provides Stronger Support at a Lower Cost

A large building was being demolished, and the hospital next door was concerned about the risk of dust-laden mold and infection spreading to oncology and transplant patients within their facility. The hospital asked EH&E to provide interim support until they could hire a full-time industrial hygienist (IH) to support them with routine dust monitoring. After a risk assessment, EH&E proposed 24/7 remote dust monitoring. The monitoring, in combination with “as needed” consulting support from EH&E, would eliminate the need — and significant added cost — for hiring a full-time internal IH. Better still, it would remove the cost of acquiring the IH equipment required for a multiyear project.

Not only does 24/7 construction monitoring for airborne dust, pressurization, and vibration lower costs — but its alert system provides facilities with a more robust solution.



4. STRENGTHEN COMPLIANCE WITH REAL-TIME DATA

Air quality monitoring isn't just a convenience — it can also support compliance. To minimize the dangers of contamination during construction activities, the CDC requires hospitals to perform an Infection Control Risk Assessment (ICRA). While many of the details of how risk is assessed may be left to construction teams, air quality monitoring is now an established best practice. Ignoring industry-wide best practices opens organizations to liability in the event environmental contaminants are spread.

Among other factors, the American Society for Health Care Engineering's (ASHE) [ICRA 2.0 toolkit](#) recommends facilities professionals use a four-step process to identify and mitigate infection risks that may arise during construction activities. This process recommends dust monitoring as a best practice on all higher risk ICRA projects. However, dust monitoring can be complex to implement. It takes expert knowledge to establish a baseline measurement and set up sensors with the right level of sensitivity to identify potential risks without triggering constant false alarms. When performed manually, dust monitoring provides only scattered snapshots in time, making it more difficult to identify clear trends. EH&E's continuous air quality monitoring system helps remove the guesswork.

ASHE also advises use of at least periodic air sampling to identify evidence of environmental contamination, without defining "periodic." EH&E recommends performing at least weekly audits of the construction site to ensure compliance with ICRA standards. Continuous risk monitoring systems provide peace of mind between these routine inspections and are far superior to the snapshot-in-time provided by periodic monitoring.

5. PINPOINT SOURCE OF ENVIRONMENTAL CONTAMINATION

EH&E's multi-sensor continuous environmental monitoring has been found to deliver useful information to help determine whether or not an exceedance or contamination is the result of construction activity.

Because EH&E's system performs pressurization and dust monitoring together, construction teams can more readily identify whether a dust issue is likely caused by construction versus by other activities taking place inside, or outside, the facility. Together, this information can trigger investigations that may identify broader site containment issues. It can also identify transient elevated dust levels that may be due to routine (non-construction) cleaning activities.

Continuous construction monitoring can also provide essential context into spikes in dust levels. For example, a spot measurement of airborne dust conducted during a walkthrough might reveal unusually high levels of contaminants — but it won't identify the cause. The availability of continuous data on a visual dashboard makes it possible to identify the cause of spikes in dust levels. That high level of dust could be part of a 20-minute peak that results from a specific activity, such as nearby cleaning. We have even seen clear evidence of wildfire smoke impacting indoor hospital particle levels. This level of intelligence can help teams more clearly understand when high readings are "normal" versus reason to take a construction project-specific action.

CONCLUSION: SAFEGUARD YOUR HOSPITAL WITH AROUND-THE-CLOCK MONITORING

Risk is an inherent part of healthcare construction and renovation projects. Continuous air quality monitoring provides added assurance that containment is effective. By adopting proven technologies, healthcare construction and facilities teams gain confidence that every possible step has been taken to keep patients healthy and safe.

To explore how continuous air quality monitoring can help safeguard your hospital or medical facility, [watch our video](#) on 24/7 air quality monitoring or [contact EH&E](#).

SOURCES

- 1: Amjad Kanj, MD, Yuqing Gao, MD and Ayman O. Soubani, MD. "What are the risks to inpatients during hospital construction or renovation?" Cleveland Clinic Journal of Medicine, October 2019, <https://doi.org/10.3949/ccjm.86a.19008>
- 2: Hanumantha R Pokala, David Leonard, Jennifer Cox, Pat Metcalf, John McClay, Jane Siegel, Naomi Winick. "Association of hospital construction with the development of healthcare associated environmental mold infections (HAEMI) in pediatric patients with leukemia." Pediatric Blood & Cancer. February 2014. <https://doi.org/10.1002/pbc.24685>.
- 3: Hajime Kanamori, William A. Rutala, Emily E. Sickbert-Bennett, David J. Weber. "Review of Fungal Outbreaks and Infection Prevention in Healthcare Settings During Construction and Renovation." Clinical Infectious Diseases, Volume 61, Issue 3, <https://doi.org/10.1093/cid/civ297>.

Environmental Health & Engineering (EH&E) is a trusted, nationwide firm leveraging nearly 40 years of experience to help organizations overcome indoor environmental and building systems challenges, and navigate complex regulatory frameworks. Serving the healthcare, life sciences, higher education, and commercial sectors, our diverse expertise spans environmental health, biosafety, industrial hygiene, hazardous materials management, microbiology, building systems engineering, and data analytics. EH&E empowers owners, managers, developers, and their AEC teams by using a unique holistic approach to examine challenges, delivering complete solutions that mitigate risk, minimize disruption, and foster safer, healthier, and more productive environments for long-term success.



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