

OR design & construction

Preventing infection during OR construction

Maintaining air and water quality during a surgery department construction project is a big challenge. OR managers have special responsibilities to reduce the chances that patients will develop an infection during their stay.

How many surgical site infections are due to facility construction is not known.

"I have never seen a study that estimates the number of deaths from surgical infections as a result of construction projects," says Larry Lee, a certified industrial hygienist with Pacific Industrial Hygiene, a Kirkland, Wash.-based company that consults with hospitals on infection control. But no one would argue about the importance of maintaining a healthy environment during construction.

Developing an ICRA

Once a decision is made to initiate a construction project, hospitals should conduct an Infection Control Risk Assessment (ICRA).

An ICRA is a determination of the potential risk of transmitting biological agents in the facility. Based on the ICRA, the facility owner develops specific recommendations for mitigating infection risks during construction. The owner also should monitor the effectiveness of the risk-mitigation plans as the project progresses.

The Centers for Disease Control and Prevention (CDC) recommends an ICRA in its 2003 *Guidelines for Environmental Infection Control in Health-Care Facilities*. An ICRA also is part of the *Guidelines for Design and Construction of Health Care Facilities* published by the American Institute of Architects (AIA) (sidebar). The Joint Commission on Accreditation of Healthcare Organizations and more than 40 states reference the AIA guidelines in their requirements for licensure or accreditation of health care facilities. A new edition of the AIA guidelines was scheduled to be issued in July 2006 (www.aia.org). The ICRA section is in Chapter 1.5.

OR manager's responsibilities

Judene Bartley, MS, MPH, CIC, an epidemiologist and vice president of Epidemiology Consulting Services, Beverly Hills, Mich, who helped develop and promote inclusion of an ICRA in the AIA guidelines, says OR managers have 2 major infection control responsibilities as part of the construction team:

- Participate in the ICRA.
- Monitor Life Safety Code issues once construction begins. (Information on the code can be found on the American Society for Healthcare Engineering web site at www.ashe.org/ashe/codes/nfpa/codes.html.)

"OR managers first need to understand the regulations for their state," Bartley says. "They also should provide input to the team about the importance of maintaining a clean and moisture-free environment."

Bartley notes there are a few changes in the 2006 AIA guidelines that pertain to infection control. One expected addition is a closer assessment of finishes and surfaces and the role they play in infection control as well as the overall efficiency of cleaning and prevention of fungal problems.

"Walls in procedure rooms must be smooth and seamless," she says. "Managers should consider moisture-resistant materials when selecting furniture and equipment. These are issues you have to address when conducting an ICRA."

Working with the contractor

In monitoring OR construction projects, Jayne Byrd, RN, MSN, director of surgical services at Rex Hospital, Raleigh, NC, says her biggest challenge is to make sure contractors understand how to work safely in a hospital setting. Rex Hospital is involved in an OR construction project to replace the inpatient surgery area by building a new OR suite and remodeling the old one.

"Part of our job is to make sure contractors and construction workers understand the rules we have developed under the contract," Byrd says. "We offer education and remediation on an ad hoc basis to the foreman and employees."

By implementing an ICRA, construction managers and their subcontractors have a tool to determine what levels of infection control are needed throughout the new or existing facility, says Lee.

"A lot of my clients are learning about ICRA as they begin projects," Lee says. "A big advantage of conducting an ICRA is to use the plan to negotiate obligations for infection control with contractors."

Lee says the construction contract can require compliance with the ICRA. "You can build the construction schedule around the ICRA. You can also write in penalties if a contractor does not follow the rules," he says.

Blowing the whistle

"If we spot something wrong, we blow the whistle, and they stop," Byrd says. "But you have to be creative in how you do it because you don't want to blow your schedule."

For example, Byrd says jack hammering outside OR walls disturbs surgical cases. "As the foundation work begins, and parking lots get removed, there is significant structural vibration," Byrd says. "Our existing ORs are aligned against this outside wall. We make decisions daily regarding which rooms are best suited for which cases, but not all of our rooms are of a reasonable size for every specialty. Neurosurgery, for example, cannot function in a small room, and many of these cases are microscope dependent. Clearly, vibration and noise are non-negotiable aggravations."

When necessary, she calls the construction foreman and asks that jack hammering stop for a time. "It has worked well due to the mutual respect of the OR team and the construction team," she says. "However, it is a huge issue for surgeons. All we can do is work with them and remind them that if we 'blow the whistle' every day, we will never meet our schedule."

Byrd also works closely with infection control professionals during an OR project. "They have a higher level of participation and make sure the rules are enforced," she says.

While the Life Safety Code is primarily the responsibility of infection control directors and facility managers, "OR managers need to understand these issues and be prepared to educate construction staff about safe egress in and out of the OR area," Bartley says.

"The most critical thing for OR directors are the barriers," she notes. "The company may say it understands that patients are at risk. But how do they put those walls up without creating dust, and how do they do that without creating Life Safety issues?"

OR managers need not be experts in barriers, she says. "What they should look for is solid barriers (not plastic, though plastic can be used temporarily to protect areas while solid barriers are installed), a tight enough seal, and proof that the barrier is functioning properly," she says. There needs to be some type of monitor or test to see that air is flowing into the work site and from the work site out into the corridor.

OR managers should also make sure barriers are installed during nonsurgical times, and cleanup is done carefully to ensure the OR area is not affected, she adds.

A resource on barriers is the audiotope, *Infection Control During Construction*, by Wayne Hansen (HCPro, 2004, www.hcmarketplace.com).

Registering complaints

OR managers should know the procedure for filing complaints or getting information during construction.

Typically, managers should report problems directly to hospital safety officers. "But if you see an immediate problem, you need to take corrective action," Bartley says.

Byrd says she is most concerned about construction workers walking through restricted OR areas.

"We need to ask the construction supervisor directly if the workers understand hospital infection control rules," she says. "Sometimes patients go through construction areas. We need to make sure workers understand patient confidentiality rules."

Depending on the pace of the project, Byrd recommends daily walk-throughs of the construction area. One of the first things she notices is whether the air is flowing toward the construction area—the so-called negative air pressure requirement—as it should be.

"We look for obvious infectious materials, plastic barriers that are compromised, walls or duct systems that have gaps or rips, dust mats that are properly placed, and make sure there are no leaks in the water supply or heating and AC systems," she says.

Dust and water control

Dust control is one of the biggest problems for ORs, Lee says. For example, making sure dust mats are properly placed at the construction entrance is important, he says. Tacky mats or walk-off mats, which have an adhesive surface, are commonly placed directly outside construction areas to trap dust on workers' feet and equipment wheels. Sometimes a dampened dust mat (rubber-backed carpet) is used instead. "But it is extremely important to HEPA-vacuum the carpet when soiled and dry the carpet at the end of the day to prevent microbial growth," Lee says. Though it may seem obvious, workers need to be trained to step on the mats because they don't want to leave dirty footprints, he says.

Demolition of walls and ceilings can aerosolize settled mold spores, he says. Inhaling spores produced by mold species such as *Aspergillus fumigatus* or *Aspergillus flavus* can cause life-threatening infections in persons with compromised or debilitated immune systems.

"Surgical patients are especially at risk from exposure to fungus," Lee says.

Other construction dusts can also affect indoor air quality. For example, glass fiber from fiberglass pipe insulation and ceiling tile are irritants that can cause skin rashes; gypsum and cement dusts are irritants; and exposure to welding fumes, paint aerosols, and smoke can annoy patients and employees. In addition, delivery of construction equipment and supplies from outdoors can introduce unfiltered air containing pollen, mold spores, and other outdoor particulate matter into the building.

Air and water sampling

Regular air and water sampling is important, but cost is an issue in how often it is done. "Few hospitals do environmental sampling before construction projects for cost reasons," Byrd says. "Sampling during construction is a very good idea."

Lee comments, "My chief concern is that not enough hospitals do fungal air sampling to test for dust generation. The CDC doesn't recommend it, but I believe it should be in the overall infection control program."

There are several ways to monitor and sample air quality. "You can test for bacteria or total particulates," Bartley notes. "Some people recommend total particulate sampling. The trouble is, we don't have standards for hospitals. We have to develop relative standards."

One way to test is called "rank ordering." Electronic particle counters can easily measure air quality outside of the facility for total particle counts where contamination is the highest. Then air is measured inside the OR as a comparison.

"Measure where you know you have the highest filtration, compare the percent

drop in particle counts related to the filtration level, and you can determine if the air system is functioning well," Bartley says.

Contractors should be required to build air-flow gauges into the barriers to make sure the air is going toward the construction site, she says. "It is costly sometimes, depending on the size of the project, but the risk is great when things go wrong."

Lee agrees. "You try to isolate construction areas by doing things like placing the construction area under negative air pressure," he says. "Each construction enclosure is placed under negative pressure using HEPA-filtered negative-air machines to prevent dusts and vapors from moving outside the construction areas."

Control water to prevent mold growth

Control of water is another infection control issue. Water can leak from broken pipes, unattended hoses, or sprinklers. If areas are not promptly cleaned and dried, mold can grow on materials such as gypsum wallboard, ceiling tile, or spray-applied fire-proofing, Lee says.

During demolition of older walls, hidden mold is often discovered. Mold abatement and cleaning are conducted both as an infection control and an indoor air quality measure.

"There are so many places in construction where water can cause problems," he says. One construction project he worked on had a major water leak when a new heating system freeze plug burst.

"We had 7,000 gallons of water flood an area, and we needed to take immediate steps to dry things out. Others (contractors) might try to hide the fact because it might impact their schedule. You need to keep an eye on accidents like this," he says. ♦

—Jay Greene

Jay Greene is a freelance writer in Thompson, Conn.

An ICRA Checklist is available at www.ordesignandconstruction.com.

Infection Control Risk Assessment

An ICRA is a multidisciplinary process that focuses on reducing risk from infection throughout facility planning, design, and construction (including renovation) activities. A multidisciplinary team considers:

- the environment
- infectious agents
- human factors
- the impact of the proposed project.

The team includes, at a minimum, experts in infectious disease, infection control, patient care, epidemiology, facility design, engineering, construction, and safety, as circumstances dictate.

Source: American Institute of Architects. Guidelines for Design and Construction of Health Care Facilities, 2006. www.aia.org.
