

BY MICHELLE ERVIN

CONSTRUCTION SIDE EFFECTS CARRY DEADLY RISKS AT HOSPITALS

Experts prescribe mitigation strategies for dust, odour, noise and vibration as many Ontario healthcare facilities undergo expansion

Excavation can unearth *Aspergillus* fungus, which is found in soil and can cause fatal infections in people with weakened immune systems.



Living through construction may be a fact of life for city dwellers, but living through construction can be a fact of life and death for hospital patients.

That's why it's so important to curb the side effects of expansions and renovations, which include fugitive dust, diesel odour, noise and vibration, especially when these projects occur outside of existing healthcare facilities. So said John Alberico and Kyle Hellewell while presenting at IIDEX on reducing the environmental impacts of construction at hospitals, a

timely topic given the amount of this activity taking place in the province.

"There's a lot of expansion in Ontario right now with the P3 projects," said Alberico, principal at RWDI. "We're seeing a lot of existing facilities being added onto."

The prescribed method of measuring existing conditions, modelling environmental impacts and mitigating problem areas applies equally to fugitive dust, diesel odour, noise and vibration, but each side effect has its own unique considerations.

FUGITIVE DUST

Fugitive dust is subject to air quality

standards under Ontario's Environmental Protection Act, which sets a limit of 120 micrograms per cubic metre for particulate matter, based on a 24-hour averaging period.

"That's basically a tablespoon of salt in a swimming pool," said Alberico. "The ministry recognizes that you can't meet the standard at a construction site, so what they expect you to do is minimize the impacts or emissions of dust to the best extent possible."

In order to minimize the impact of fugitive dust, all of its sources, which can include demolition work, truck traffic and wind erosion, need to be identified. Alberico called particular attention to excavation, which releases the *Aspergillus* fungus that lives in soil and can cause fatal infections in people with weakened immune systems.

He said on-site monitoring is the most accurate way to measure the emissions from each source of fugitive dust, but he added that it's costly and time-consuming. Another option is to consult data captured in a U.S. Environmental Protection Agency document called the AP-42: Compilation of Air Emission Factors, or "the Bible of dust emissions," as Alberico described it.

"We know how much is leaving the space," he said. "We want to know how much is actually going to get inside the hospital."

Dispersion modeling, which can be done numerically or, most accurately, through a wind tunnel study, helps to identify the pathways fugitive dust will take into the facility.

Alberico said that, taken together, this information makes it possible to target mitigation strategies based on the highest sources of emissions and the most

vulnerable entry points to the hospital.

Some emissions can be reduced significantly right at the source. Paving unpaved roads — which Alberico pointed to as a major culprit of fugitive dust on most construction sites — can reduce emissions by around 90 per cent, he said. Complementary mitigation strategies can include lowering the speed limit and providing a tire wash for trucks traveling on and off high-traffic sites.

Emissions can also be lowered by as much as half by lengthening the pathway between the source of emissions and their entry point into the facility. Alberico cited an example of this strategy at the University of Guelph, which redirected an inlet to air intakes with ducting up to the roof.

There are further opportunities to reduce the impact of emissions at their entry point into the facility by affixing temporary high efficiency particulate air (HEPA) filters to air intakes. Alberico cautioned that this can strain older HVAC systems, but this issue can be addressed by adding a temporary air intake with a supplemental fan, although it comes at a significant cost and requires adequate space to be available.

DIESEL ODOUR

Alberico said the impetus to reduce diesel odour emanating from construction at hospitals generally comes from perceived indoor air quality issues, as it rarely poses real health concerns unless located close to an air intake. Ontario sets a cutoff threshold of the point at which 50 per cent of people can detect the scent, which is measured through lab testing.

In theory, ‘no idling’ policies are one way to reduce diesel odour levels, but in reality, they may not be the most effective way to mitigate unpleasant emissions.

“Diesel equipment works such that if it’s a cold day and you turn it off, and it was really hot, they have to wait until it cools off to turn it on again, so they don’t like to turn it off, particularly in the wintertime,” Alberico explained. “Unless you have someone sitting there policing this, it often doesn’t happen, so we don’t like to see this as your primary source of mitigation.”

Another option is to equip the exhaust stacks on trucks with purifiers, which can halve diesel odours and cost only a couple thousand dollars per unit. Alberico has seen this strategy specified in contracts, where he has also seen requirements to use biofuels, which produce a less offensive odour.

Temporary carbon filters can be installed on air intakes to prevent diesel odour from entering facilities. However, Alberico noted that this solution may need to be accompanied by additional fan power because, like the temporary HEPA filters, it can strain existing HVAC systems.

NOISE

Hellewell, a senior engineer at RWDI, said that construction noise can cause a range of indirect consequences for hospital patients and staff alike. He pointed to the potential for medical errors made due to distraction and worse health outcomes due to sleep interruptions in sensitive spaces such as intensive care units and operating rooms.

The World Health Organization’s standards for noise levels in hospitals offer guidance, prescribing averages of 30 to 35 decibels, depending on time of day.

Hellewell said studies suggest hospitals have baseline noise levels of between 40 and 70 decibels. If construction noise added up to three decibels, that would be considered an insignificant increase, he said. By comparison, volumes of four to five decibels higher would be considered noticeable and six to nine decibels higher significant.

Hellewell said the ideal way to mitigate construction noise is to prevent it, which means targeting the source, whether that’s a particular activity or piece of equipment. In some cases there may be a quieter method for achieving the same result, such as drilling rather than pile driving, or modifying equipment with a silencer. In other cases, where noisy work is unavoidable, Hellewell said it may be possible to mask the sound by, for example, scheduling the activity to coincide with rush hours at facilities located in urban cores.

Another way to mitigate construction noise is to block its path into facilities by enclosing equipment or erecting

hoarding, although Hellewell said this may not be the most practical option as work proceeds across a site.

“If you’re got construction next to a 10-storey patient tower, a barrier’s never going to shield something that tall,” he added.

Hellewell noted that some of the other strategies for mitigating noise need to be planned upfront. They could include relocating patients within a facility, permanently upgrading its windows or temporarily reinforcing them with plexiglass or plywood.

Hellewell said that on-site monitoring makes it easier to identify the source of the unacceptable sound levels, but remote monitoring can be effective with good communication and records.

VIBRATION

“The concern with a structure-borne sound path is not only is it making additional noise in the interior space, but it can be physically shaking things that may be vibration sensitive,” said Hellewell.

He cited MRI machines as an example, describing how vibration can not only cause images to come out blurry, but can also void the warranty of the equipment.

Hellewell said measuring the impact of vibration is preferable to modelling based on data as the structure-borne sound causes and responds to changes in soil as it travels underground.

As with air borne noise, construction scheduling, particularly staging, and equipment selection are some of the most effective ways to minimize vibration, said Hellewell, but he added that this environmental impact is difficult to mitigate. Trenching is another option, but Hellewell said it may not help much and the cost could be considerable.

That’s why monitoring construction occurring outside of existing healthcare facilities for each environmental impact is so important. Whether limits are prescribed by the law or by the owner, tracking fugitive dust, diesel odour, noise and vibration levels at project sites helps to detect exceedances causing conditions that should bring work to a halt for investigation and mitigation.

“If we do have issues, we want to stop and figure out what they are,” said Hellewell. | **CFM&D**