

Aeromicrobial Control in an Extensively Damaged Hospital

Background

In January 1990, just prior to the scheduled opening of the Arthur G. James Cancer Hospital and Research Institute on the campus of Ohio State University, a major water pipe froze and ruptured at the roof level of the building.

All twelve floors of the completely furnished building were flooded with an estimated 500,000 gallons of water. The water flowed down stairwells, elevator shafts, utility service shafts and spread out over and under each floor. Water moving over the floors wicked up into the wallboard and insulation and soaked the carpeted areas in offices, patient rooms and hallways. The water running on the undersurface of floors dropped onto the acoustical ceiling tile below. In some areas the weight of the water broke the acoustical tile insets and the water fell onto upholstered furnishings and equipment below.

Ceilings, walls, carpeted floors and upholstered furniture were either wet or exposed to high humidity due to the moisture in the building throughout the days following the flood. Removal of water and drying of surfaces was an immediate priority. It was also recognized that a conventional approach with water removal, drying, cleaning and repair would not restore the microbial integrity of the facility. To properly restore the building for its intended use as a cancer treatment facility we had to accomplish two basic objectives. Number one eliminate the natural microbial reservoirs in building materials that had been activated by the wetting, and two-control the proliferation of fungi during demolition and reconstruction.

Pre-Treatment Aeromicrobial Sampling

Microbial sampling began early in the restoration process, and by day seven the facility was developing a distinct musty odor. By week three there were gross fungal colonies on exposed surfaces and behind vinyl wall coverings. The lower floors were most visually contaminated with active fungal growth on most surfaces. This resulted from both the spread of water as it moved down and through the building, and from scheduling of the initial treatment and restoration of the upper floors. Aeromicrobial sampling with an Anderson two stage sampler and a New Brunswick high volume sampler retrieved >2800 colony forming units of fungus per cubic meter of air on most floors of the facility. This despite high efficiency filtration (HEPA) and widespread use of chlorine based disinfectant fog throughout the facility. Large numbers of water-associated bacteria such as *Acinetobacter* sp. as well as fungi were in the carpets.

Treatment

The day following the flood, a specialist in microbial restoration was brought to the facility and a new microbial contamination prevention plan including antimicrobial treatment was implemented. The product chosen was Shield Antimicrobial. Shield antimicrobial is an EPA approved anti-fungal and anti-bacterial silane antimicrobial. The product chemically reacts with surface molecules, transforming them into continuously active antimicrobial surfaces. Treated materials such as nonwoven surgical drapes, textiles, foams and mill-supplied carpeting have

all been demonstrated to provide effective microbial control. Shield antimicrobial has been shown to control both microbial colonization of surfaces and to control airborne microbial contaminant levels within treated areas as well. This treatment was used as an on site application to reduce microbial populations and continuously maintain them at very low levels. This product was chosen for its unique ability to continuously control microbial contaminant levels and for its unique safety profile. In addition, the product was attractive because it is odorless, colorless, tasteless, and insoluble in common cleaning agents. The silane antimicrobial, Shield, met all of the requirements and was appropriately supported by publications in the scientific literature. The combination of comprehensive antimicrobial treatment with physical restoration of a facility had not been previously tried. Yet, this approach offered the best opportunity to abort the burgeoning fungal population and to provide ongoing decontamination throughout the restoration period and beyond.

Treatment was undertaken by spray application in water solution to target surfaces throughout the building. Various concentrations and wetting agents were used, depending on the characteristics of the target surfaces. Quality checks for uniformity and concentration were taken throughout the process. All surfaces that were accessible (ceilings, floors, walls, wall cavities, above ceiling space, chases, furnishings, etc.) were treated. Areas not accessible (cavities behind bathrooms, cabinets, etc.) were sealed at all penetrations and at floor and ceiling levels as part of a containment strategy.

Results

Continuous re-evaluation of the air quality in the facility was performed during the seven months of reconstruction. As a prerequisite to opening, a level of 15 colony forming units per cubic meter of air (but under 20 CFUs) was found on the first floor. The first floor consists of the lobby where there are two doorways to the outside and an open hallway into the adjacent building. Outside retrieval data suggest that this openness contributed to the elevated counts on the first floors, those areas that tested positive were positive at low levels and no larger reservoirs of fungus were detected.

The facility is presently free of odor and has a new appearance unaffected by the extensive application of a surface antimicrobial. All renovations or reconstruction in the facility are strictly controlled and all newly added or modified surfaces are treated with the silane antimicrobial. Re-evaluation for airborne fungi and surface microbial contamination will continue yearly.

Summary

The natural contamination of a building environment with fungal spores and bacteria and the escalation of that contamination with wetting can be reversed and controlled by the extensive surface application of a silane antimicrobial. The findings show that this unique treatment is an important interdictive measure for the reduction of colonization and aerosolization of fungal flora. This unique control strategy provides an exceptional level of continuing microbial protection and should be considered as part of infection prophylaxis in medical care facilities.