AEROMICROBIAL CONTROL IN AN EXTENSIVELY DAMAGED HOSPITAL USING A LONG LASTING, SURFACE ACTIVE, SILANE ANTIMICROBIAL [(1)]

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ABSTRACT

Just prior to the opening of a cancer hospital and research institute, a major water pipe froze and ruptured at the roof level of the building, flooding all twelve floors with an estimated 500,000 gallons of water. Ceilings, walls, carpeted floors and upholstered furniture were either directly wet or exposed to high humidity. Localized odors began to develop in the building and sampling of wet carpet showed heavy growth of water associated bacteria.

Aeromicrobial sampling produced >2800 CFUs of fungus per cubic meter of air on most floors despite traditional techniques of surface disinfection and high efficiency air filtration. The lower floors, which had greater water damage and a longer delay in moisture control, developed visible colonies of fungi on damaged surfaces.

Restoration of this building to its intended use as a cancer treatment center required the elimination of microbial reservoirs and the control of fungi on all exposed surfaces. A long-active silane modified organofunctional antimicrobial (ÆGIS™, 3-trimethoxysilyl propyldimethyloctadecyl ammonium chloride by ÆGIS Environmental Management, Milford, Ohio) was selected to treat all surfaces throughout reconstruction. This product is odorless, colorless, non-volatile and may be applied to all environmental surfaces. Antimicrobial activity continues for several years.

Re-evaluation of the facility at 7 months following restoration showed 45% of the facility environment to be free of airborne fungi; 36% with fewer than 5 CFUs per cubic meter of air, 8% with fewer than 10 CFUs, 5% with fewer than 15 CFUs and 6% with over 15 CFUs.

Presently the facility is free of odor and has the appearance of a new building. These data show that this surface-active antimicrobial can be used successfully for Aeromicrobial control of a water damaged building without harm to the building environment or furnishings or health risks to patients or personnel.

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 fell onto upholstered furnishings and equipment below.

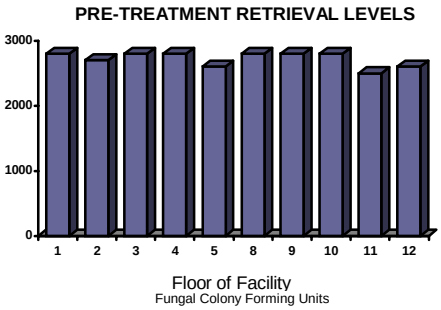
Ceilings, walls, carpeted floors and upholstered furniture were either wet or exposed to high humidity due to the moisture in the building throughout the days following the flood. Removal of water and drying of surfaces was an immediate priority. It was also recognized that a conventional approach of 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: (1) eliminate the nature microbial reservoirs in building materials that had been activated by the wetting, and (2) 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 air sampler retrieved >2800 colony forming units of fungus per cubic meter of air on most floors of the facility (Figure 1). This despite high efficiency air filtration

Figure 1



(HEPA) and widespread use of a 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

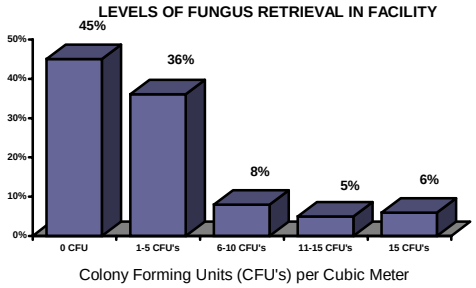
The day following the flood, a specialist in microbial restoration was brought to the facility and a new microbial contamination prevention plan including antimicrobial treatment was implemented. The product chosen for extensive use in the facility was ÆGIS™ Antimicrobial, (formerly Sylgard® Treatment from Dow Corning Corporation). ÆGIS™ 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. ÆGIS™ Antimicrobial has been shown to control both microbial colonization of surfaces as well as control airborne microbial contaminant levels within treated areas. 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 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, ÆGIS, 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 a 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 was established. Of the six hundred and one sites that were sampled, 45% were negative for fungi, 36% had fewer than 5 colony forming units per cubic meter of air, 8% had fewer than 10 CFUs, 5% had fewer than 15 CFUs and only 6% of the facility had greater than 15 CFUs (Figure 2).

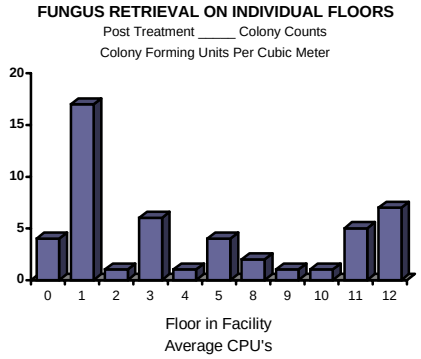
Figure 2



The 6% of the facility that the >15 colony forming units per cubic meter of air was found on the first floor (Figure 3). The first floor consists of a 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 floor. For all other floors, those areas that tested positive were positive at low levels and no larger reservoirs of fungus were detected.

Figure 3



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 his 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.

(1) This paper was presented at the oral session of the 18th Annual Educational and International Conferences of the Association for Practitioners in Infection Control, Nashville, Tennessee on May 7, 1991.