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Air Management to Control Disease Causing Pathogens

The ability of infectious microbes to initiate and spread infection and disease depends on several factors. These factors include survivability, infectivity and susceptibility of the potential host. The traditional pathogen control matrix used by the building industry does not put enough emphasis on the airborne transmission of infectious agents.

Much emphasis is placed on the sterility of surfaces in buildings as well as instruments and the general patient location in medical facilities. Yes, in medical facilities patient isolation is considered but normally only in cases of highly transmittable infectious diseases such as Tuberculosis. Very little consideration and care is given to the actual air circulating around the building occupant. Consider the fact that approximately 845 H1N1 cells placed end to end would span a distance less than the diameter of an average human hair.

The average adult breathes approximately 25,000 liters of air a day. Inherent in the infection and disease process initiated by the inhalation of infectious droplet nuclei is the area of deposition within the respiratory tract. This deposition is influenced by hygroscopicity, which causes an increase in the size of inhaled particles through moisture take-up as they move within the airways.

The initiation of the disease process may require only small infective doses because the agents have an affinity for specific tissue and possess one or more potent virulence factors that render them resistant to inactivation. Infection from Francisella tularensis is reported to result from a single organism whose virulence is associated with a cellular capsule. Only a few cells of Microbacterium tuberculosis are required to overcome normal lung clearance and the inactivation mechanisms in a susceptible host.

All infectious agents come from a source, whether human, animal, a surface material or a process. Sources can be managed, either through removal, such as mold contaminated building materials, or modification, such as purging hot water systems to eliminate Legionella species. Patients with active TB can be housed in negative-pressure rooms, required to wear respiratory protection and/or placed in laminar-flow beds until confirmed as non-infectious. Normal occupants of normal commercial buildings are not so lucky and can be exposed easily. Ensuring that a building or section of a building is utilized for the activity it was designed for will reduce or eliminate infections and disease. Buildings and furnishings need to be designed so they can be effectively inspected, cleaned and maintained. Design intervention is important when designing new facilities or additions and renovations to existing facilities. Design intervention may include special exhaust ventilation or the addition and inclusion of U.V. lights for microbial contamination control.

Unquestionably the most overlooked part of traditional infection control practice is in fact the HVAC system including its associated air delivery components. By its very nature the HVAC system handles dirt, dust, moisture and vast amounts of air which contains oxygen. It is essentially a large laboratory culturing medium for the proliferation of disease causing fungi, bacteria, yeasts and viruses.

Even though all pathogens are not toxigenic most are at the very least, allergenic. What you feel is not the direct pathogen but the bodily response to it. Those responses may manifest themselves as itchy eyes, runny nose, ear, nose and throat infections, listlessness, rashes and even memory loss. Clear water is not necessarily safe. Food that smells good is not necessarily safe. The air we breathe is not necessarily safe simply because it is the right temperature or humidity level. What we cannot see can in fact harm all of us.

Bacteriological as well as viral cell size will evade capture by modern HVAC filtration materials and methods. Residential and commercial buildings are particularly susceptible. So called HEPA filters are not true HEPA filters as used in a clean room environment. A true HEPA filter is of the thickness and material consistency that will not allow a normal HVAC fan system to push or pull air through it without causing fan cavitation and system failure. The proper prophylactic management of the air side component in the pathogen control process begins with a proper, thorough bioaerosol sampling protocol. It is critical that the

person or persons conducting this sampling protocol have extensive knowledge of not only the biological side of the equation but also an extensive hands-on background in HVAC. The use of an all-natural anti-pathogenic solution is highly recommended.

It must be properly applied via means of the building's HVAC system(s) for maximum effectiveness with minimum time and labor output. For maximum effectiveness it must be utilized in conjunction with properly engineered and properly applied U.V. Germicidal irradiation. An understanding of how the facility components meld together and affect each other comes only from the perspective of a professional who sees the pathogen control problem as a "systems" problem. It is a process of measuring (sampling), managing (application of proper methods and materials) and monitoring through consistent follow-up.

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