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Mold Remediation with Heat

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There is a debate raging in the field of mitigation and remediation of bacteria, viruses, mold and other indoor biological contaminants, such as insects. That debate focuses on the two main treatment methods: heat or traditional remediation.

Structural heating, also known as structural pasteurization, is a process that essentially pasteurizes a building, or a portion of the building. This is a chemical-free process, and is much more complex than simply applying heat to a structure or an architectural element. In general, the process heats a structure either directly, via propane-fired heaters, or indirectly via boilers outside the structure that provide a heated medium to heat exchangers placed within the structure. In addition to heating, the process employs a large number of fans and ducting to evenly distribute heated air within the building and/or treatment area, and heat-tolerant fan units equipped with high-efficiency particulate air (HEPA) filters to scrub the air clean and physically remove biomass and aerosols.

Treats Different Size Areas

Structural pasteurization is very scalable, i.e., it can be used on small areas, such as under a kitchen cabinet where a dishwasher's waterline popped loose, or it can be used to heat entire structures (e.g. a single family dwelling) or individual floors of structures (e.g. a multi-story health-care facility or multi-family building).

Structural pasteurization has the ability to heat interstitial and inaccessible spaces, and penetrate into architectural elements, drying and killing biological organisms in their place, something that conventional mold abatement methods cannot do. It is best used in conjunction with the gross removal of contaminated architectural elements, the cleaning of accessible surfaces, and leaving sound elements in place and inaccessible surfaces undisturbed. Once gross removal and surface cleaning is complete, the treatment will dry moist building materials, oxidize odors, kill most biologicals, and physically remove significant amounts of aerosols and biomass associated with the event that caused the mold to initially colonize and grow.

Conventional physical remove-and-replace methods often demolish and throw out significant quantities of non-damaged building materials in order to access inaccessible and un-occupied spaces, such as wall cavities, in the

quest to scrub and remove minor mold colonization. While this may be warranted for building materials that have become unsound due to excessive moisture and loss of integrity, there is, more often than not, a large quantity of building materials that are marginally affected by moisture and mold colonization, and are therefore otherwise sound and aesthetically acceptable. In these areas, surface cleaning and restoration is warranted. Structural pasteurization can mitigate the remaining moisture that is promoting biological growth and kill the colonization without the expense of removal, rebuilding, and the inherent loss of use.

High Temperatures Kill Indoor Biological Contaminants

Structural pasteurization is based on the age-old science that as you increase temperature, the number of viable organisms decreases. This is why we cook our food, pasteurize our milk, and keep cooked foods above 140F at the buffet line.

Recently, Dr. Ralph Moon of HSA Environmental provided Association of Specialists in Cleaning and Restoration members with a presentation on thermal remediation. Dr. Moon presented the approximate upper limit for survival of fungi at 132F to 140F. In a related article, Dr. Harriet Burge of EM Labs recently stated that available literature reports that a temperature of 160F for duration of 4 to 6 hours is appropriate for whole-house treatment of fungi.

Most microorganisms that inhabit our structures live within a specific range of temperatures that is conducive to their growth and amplification, and it generally resembles temperatures similar to what we humans like – the mesophiles.

Structural Pasteurization is a Complex Process

In structural pasteurization, the key is reaching a target temperature, sustaining that temperature for a specific amount of time, and maintaining an equal distribution uniformity of that temperature throughout the structure or portion of the structure being treated. Reaching and maintaining a temperature of 160F for several hours is a complex task that requires highly skilled technicians. It requires a thorough knowledge of the heating equipment, treatment processes, building components, and thermal dynamics. Certified heat technicians must be thoroughly trained and experienced in heating structures.

Buildings are complex and use a variety of building materials of varying physical properties, thermal mass, and conductivity. Some building components and contents are not tolerant of pasteurization temperatures, and must therefore be protected or removed prior to heating. Safety for the structure, its contents, and the technicians applying heat is always a concern. The process requires a specifically engineered process applied in a safe and diligent manner that will vary according to the building, the environment, the target organism and extent of growth, distribution uniformity, air pressures, HEPA-filtration requirements, temperature sensing, thermal imaging, humidity, moisture content, and a host of other relevant criteria.

What About Efficacy?

Does structural pasteurization kill mold? Yes. Will it kill all the mold in all the spaces of a building and remove all the biomass associated with mold growth and amplification? No! But neither will conventional mold remediation methods or processes.

Can structural pasteurization meet the same level of clearance as conventional mold remediation? Yes. The current standard of care for achieving clearance (i.e. a condition fit for re-occupancy) is based on the comparison of indoor mold spore concentrations to outdoors. There

are hundreds of projects conducted by consultants and laboratories providing post-treatment analysis of remediation projects using structural pasteurization, and most clearance results demonstrate that the process achieved lower concentrations of both viable and nonviable microorganisms, and resulted in lower concentrations of airborne biomass, than did traditional remediation.

Some consultants question the efficacy of the process for the mitigation of allergens and mycotoxins. These are both complex issues. Mycotoxins are chemicals (e.g., fungal metabolites), and although high temperatures will oxidize some of them and air filtration will remove some of them, pasteurization temperatures will not mitigate all of them. Pasteurization temperatures will also impact allergens, reducing some but not all of them.

It is interesting to note that this issue is not of great concern with all remediation methods. Few, if any, specifications exist that require mycotoxins and/or allergens to be reduced to specific levels, and neither are mycotoxin nor allergen concentrations typically found in clearance standards. Yet these issues have become a major item of debate for critics of thermal remediation.

It is important to look at the structural pasteurization technology as an additional tool, not as a replacement method. In situations where the best available control technology is needed, the addition of structural pasteurization to traditional remediation will provide significantly increased value and benefit. Whenever possible or practical, gross remediation should be used to remove accessible biomass. The reality is that everyone and every method leaves biological materials behind all the time; no living space is sterile post-abatement. Knowing this, we measure the acceptability of occupancy by evaluating the indoor concentration of aerosols in air, or on surfaces, and compare results to practical standards. If indoor air concentrations are acceptable, we ignore what is left behind. This is logical because mold is ubiquitous and we cannot, nor would we want to, eliminate it in entirety; it is not practical to do so. Moreover, structures that have had thermal remediation often have a much lower concentration of viable spores left behind.

Structural pasteurization: another weapon to consider in the remediator’s battle with mold.