Mold Remediation with Heat - Does a Better Job!

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Recently there has been considerable attention to high temperature, structural drying and the concept of structural pasteurization (i.e., ThermaPureHeat, a patented process) for the mitigation and remediation of bacteria, viruses, mold and other indoor biological contaminants such as insects.

ThermaPureHeat is a process of structural heating that essentially pasteurizes a building, or a portion of the building. ThermaPureHeat is a process, and it is much more complex than simply applying heat to a structure or an architectural element. In general, the ThermaPureHeat process heats a structure either directly, via propane-fired heaters, or indirectly via boilers outside the structure that heat a transfer fluid that is plumbed and piped to heat exchangers placed within the structure. In addition to heating, the ThermaPureHeat process employs a large number of fans and ducting to evenly distribute heated air within the building and/or treatment area, heat-tolerant fan units equipped with high-efficiency particulate air (HEPA) filters to scrub the air clean and physically remove biomass and aerosols, heat sensors to record the process of heating and cooling, and highly-trained technicians to set-up, execute, and manage the process to ensure efficacy. ThermaPureHeat is most often used at 160F (57C) and the heated area is kept at that temperature for a minimum of two hours, preferably four hours or more.

ThermaPureHeat is Scalable

ThermaPureHeat 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). ThermaPureHeat can be scaled to heat at lower temperatures for longer durations if the project warrants drying (i.e., moisture removal or "Dry-Out"), if the project warrants the removal of volatile organic compounds (i.e., accelerate off-gassing or "Bake-Out"), or if the project involves heat sensitive materials, finishes, or equipment that cannot tolerate typical pasteurization temperatures. ThermaPureHeat can also be scaled to heat to higher temperatures where the benefits of controlling harmful human pathogens exceed that of marring and defacing of architectural elements from the exposure to elevated temperatures. In summary, ThermaPureHeat is very flexible in application and execution.

ThermaPureHeat Reaches Inaccessible Spaces

One of the biggest benefits of ThermaPureHeat is its ability to heat interstitial and inaccessible spaces, and penetrate into architectural elements, therefore drying and killing biological organisms in their place; something that conventional mold abatement methods cannot do. While conventional mold abatement is premised on physical removal, it cannot remove all sources of mold, nor does it actively dry architectural elements to stop biological growth. ThermaPureHeat is best used in conjunction with the gross removal of

contaminated architectural elements, cleaning accessible surfaces, and leaving sound elements in place and inaccessible surfaces undisturbed. Once gross removal and surface cleaning is complete, ThermaPureHeat treatment will dry-out moist building materials, oxidize odors, kill most biologicals, and physically remove aerosols and biomass associated with the event that caused the mold to initially colonize and grow.

ThermaPureHeat Does Not Use Harmful Chemicals

Another benefit of ThermaPureHeat is its ability to kill and control biological organisms without the use of toxic chemicals. Chlorine, chlorine dioxide, sulfuryl fluoride, and methyl bromide represent some of the toxic chemicals currently used to control biological organisms. In occupied structures, it seems ironic that harmful molds are often "cleaned and killed" using harmful chemicals prior to the structure being deemed "safe" for re-occupancy. ThermaPureHeat avoids the use of harmful chemicals and any attendant reporting requirements.

ThermaPureHeat Does a Better Job at a Lower Cost

Significant additional benefits to ThermaPureHeat include greatly reduced costs of remediation (as compared to conventional physical removal methods), shortened loss of building use, less structural damage, and less damage to non-structural elements. Conventional physical removal and replacement methods often demolish and throw-out significant quantities of non-damaged building materials in order to gain access to inaccessible and un-occupied spaces, such as wall cavities, in the quest to scrub and remove minor mold colonization. Conventional physical removal methods often require great quantities of labor to demolish architectural elements and scrub and clean. 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 only marginally affected by moisture and mold colonization, and are therefore otherwise sound and aesthetically acceptable. In these areas, surficial cleaning is warranted and ThermaPureHeat can mitigate the remaining moisture that is promoting biological growth and kill the colonization; all without the expense of removal, rebuilding, and the inherent loss of use.

ThermaPureHeat – Structural Pasteurization

ThermaPureHeat 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. The ThermaPureHeat process uses this foundation, along with modern equipment (direct and indirect fired heaters, heat tolerant HEPA units, thermal imaging sensors, etc.) and highly trained technicians, to achieve a level of cleanliness heretofore unavailable, until now. Typical and common mold abatement methods that do not use ThermaPureHeat to mitigate moisture, kill biological organisms in inaccessible spaces, oxidize odors, and otherwise pasteurize the structure, are akin to an asbestos abatement method that does not use an encapsulant to lock-down fibers. It is almost negligent not to heat once gross removal is accomplished.

ThermaPureHeat is the best available control technology (BACT) at the moment for mitigating biological contaminants; and it does so without the used of harmful chemicals.

ThermaPureHeat does have limitations. It cannot sterilize a structure. To reach sterilization levels, autoclave temperatures of 250F (121 C) held for 60 minutes are necessary. Even at these temperatures, some thermophilic microorganisms may survive (e.g. anthrax spores); they are amazingly hardy creatures. Moreover, if thermal remediation is not performed diligently, some areas may not be sufficiently heated, and if left at reduced temperatures (e.g., 110F) conditions may be such that mold growth will be promoted. However, much like cooking chicken, undercooked chicken has the possibility of containing harmful salmonella bacteria, but, that does not keep us from cooking chicken and eating it; we must be diligent in the kitchen. Similarly, ThermaPureHeat is a process using highly-trained technicians who are diligent, and who completely and effectively heat (cook) the area being treated in order to kill, not promote, microorganisms. Sterilization is not the intent of the ThermaPureHeat process. ThermaPureHeat is structural pasteurization, and is performed to reduce target organisms by acceptable orders of magnitude to substantially reduce the concentration of harmful biological organisms, reduce the damaging effects those organisms may have on the structure, and improve indoor air quality for occupants.

High Temperatures Will Kill Indoor Biological Contaminants

Recently, Dr. Ralph Moon of HSA Environmental provided the Association of Specialists in Cleaning and Restoration (ASCR) members with a presentation on thermal remediation and subsequently has developed a series of articles in Cleaning and Restoration magazine describing the benefits of structural pasteurization. Dr. Moon presented the approximate upper limit for survival of fungi at 132-140 F. In a related article, Dr. Harriet Burge of EM Labs recently stated that available literature reports that a temperature of 160F for a duration of 4-6 hours is appropriate for whole-house treatment of fungi. Soil science research provides significant literature that demonstrates the support for thermal death of various mesophilic fungal species; many of which are harmful, produce mycotoxins, and infect foodstuffs. There is considerably more data available that demonstrates mesophilic fungi thermal death rates that fall within the range of ThermaPureHeat's structural pasteurization process.

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. Certainly there are thermally tolerant species (i.e., the thermophiles) but they don't generally share occupancy with us nor are they as harmful or as prevalent as the mesophilic microorganisms. There is considerable literature reporting findings for thermal treatment of sewage materials. These studies have application to water-loss events in structures where sewage lines break, leak, or overflow from stoppage; with accompanying floodwater pathogens. Additionally, agricultural research in grain management technology provides information on thermal death of insects. There are numerous applications in which high temperatures are used to manage biological growth, be it

molds, bacteria, viruses, insects, etc. Although many of these studies were performed for other purposes, the application of this knowledge to the thermal treatment of structures is valid.

Structural Pasteurization is a Complex Process

There is considerable effort in accomplishing 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. Heat technicians are 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. ThermaPureHeat 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 is the Efficacy of ThermaPureHeat?

Does ThermaPureHeat kill mold? Yes! Will ThermaPureHeat kill all the mold in all the spaces of a building and remove all the bio-mass associated with the mold growth and amplification? No! Neither will conventional mold remediation methods or processes. Can ThermaPureHeat 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 completed by consultants and laboratories providing post-treatment analysis of remediation projects using ThermaPureHeat, and most clearance results demonstrate that the ThermaPureHeat process is more effective than traditional remediation, it achieved lower concentrations of both viable and nonviable microorganisms, and it resulted in lower concentrations of airborne biomass

Some consultants question the efficacy of ThermaPureHeat for the mitigations 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 of them, but not all of them. The research is preliminary and ongoing, and effective temperatures, durations, and order of magnitude reductions are not known due to the broad scope and type of substances that are considered allergenic. It is interesting to note that these two

issues aren't of great concern to all remediation methods, and few, if any specifications exist that require mycotoxins and/or allergens to be reduced to specific levels, nor are mycotoxin or allergen concentrations typically found in clearance standards. Yet, these issues have become a major item of debate for critics of thermal remediation. If we actually monitored and measured mycotoxin and/or allergen concentrations, it is probable that we would find lower quantities in the ambient air following ThermaPureHeat treatment because of the aggressive and turbulent air movement within the treated area combined with intense aerosol management and attendant gross removal of the biomass; which is not accomplished using conventional remediation methods.

It is important to look at the ThermaPureHeat technology as an additional tool, not as a replacement method. In situations where the BACT is needed, the addition of this technology to traditional remediation will provide significantly increased value and benefit. Whenever possible or practical, gross remediation should still be used to remove accessible biomass. The reality is that everyone and every method leave biological materials behind all the time, i.e., no living space is sterile post-abatement. We do this with knowledge and we measure the acceptability of occupancy by evaluating the indoor concentration of aerosols in air and compare results to practical standards. If the indoor air concentrations are acceptable, we ignore what we 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 have a much lower concentration of viable spores left behind, and in the event that a subsequent water event occurs, the growth and amplification of mold colonization will be less than without thermal remediation. The benefits of thermal remediation are multiple. The benefits of ThermaPureHeat are profound.