WONDER MAKERS ENVIRONMENTAL

Information Series

#135, October, 2000

AN OVERVIEW OF *STACHYBOTRYS* MOLD

Stachybotrys is a type of mold that has jumped into the public consciousness during the past few years. This awareness has been driven by media stories, legal cases, medical research, and a growing body of anecdotal stories. This document is a summary of information currently available from reputable sources. It is divided into sections to allow the reader with specific questions to quickly pick out an area of interest, while providing an overview for individuals that are just starting the education process.

Description

Stachybotrys is a specific family (genus) of mold that is present in the environment. Out-of-doors *Stachybotrys* molds help to decay organic matter. One particular species known as *Stachybotrys atra* (sometimes known as *Stachybotrys chartarum*) is prone to growth indoors. This mold is normally dark brown or black in color. It can look slimy, sooty, or even like grayish white strands, depending on the amount of moisture available and the length of time it has been growing. It is important to remember that many other common indoor molds can look similar to *Stachybotrys* (including *Cladosporium*, *Aspergillus*, *Alternaria*, and *Drechslera*), so testing is critical to conclusively identify *Stachybotrys* in a building.

Stachybotrys mold needs the proper conditions in order to grow, including moisture, a nutrient source, temperature, and time. Standing water or a relative humidity of 90% or higher is necessary for *Stachybotrys* to start germination and grow. However, once the *Stachybotrys* begins to grow it can continue to propagate even if the surface water source dries up and the relative humidity falls to 70%. The nutrient sources that best support *Stachybotrys* are those with high cellulose content. As such, *Stachybotrys* thrives on natural materials such as hay, straw, and wood chips, as well as building materials such as ceiling tile, drywall, paper vapor barriers, wallpaper, insulation backing, cardboard boxes, and paper files. *Stachybotrys* survives a wide variation in temperature and grows most proficiently in temperatures that humans consider warm to moderately hot. It tends to develop more slowly than many other molds—one to two weeks after moisture intrusion, as compared to one to two days for molds like *Aspergillus*, *Penicillium*, or C*ladosporium*. Despite its slow start, *Stachybotrys* usually develops into the dominant mold if the conditions are favorable, eventually crowding out other mold types that may have colonized the material first. It is often found in conjunction with, or is preceded by, *Chaetomium*.

Like many other molds, *Stachybotrys* can spread both through the generation of spores and the growth of root-like tendrils called mycelia. *Stachybotrys* spores grow in clusters at the end of stem-like structures known as hyphae. The spores do not easily disperse into the air if the colonized material is wet, as the spores are held together by a sticky/slimy coating. Distribution through the air is possible when the mold dries out or is disturbed. Because of the danger of airborne dispersion of spores, all cleaning and removal of *Stachybotrys* mold should be done using appropriate controls.

Health Effects
In general, exposure to mold spores and pieces can result in allergic reactions, infections, or toxic (poisonous) effects. These health effects are the result of exposure by skin contact, ingestion, or breathing the mold. *Stachybotrys* has been studied for a number of years, with most of the early studies done on animals.

Stachybotrys exposure is linked to allergic reactions. People in buildings with active *Stachybotrys* growth generally experience symptoms that include irritation and watering of the eyes and nose. Coughing and skin irritation are also allergic reactions commonly associated with *Stachybotrys* exposure.

Animal studies clearly show that *Stachybotrys* exposure, even at low levels, suppresses the immune system. Anecdotal data clearly supports this immuno-suppressive capability in humans. As such, exposed individuals are often susceptible to bacterial and viral infections such as the flu.

The reason *Stachybotrys* is of such concern is that medical evidence has proven that this mold has toxic properties. *Stachybotrys* produces a mycotoxin (*i.e.*, poison from a fungus) named trichothecenes. When inhaled or ingested *Stachybotrys* can cause:

- Sore/hoarse throat
- Cold and flu symptoms (headaches, slight fever, and muscle aches)
- Nosebleeds
- Tingling or burning of nose, mouth, and perspiration areas (under the arms or between the legs)
- Chronic fatigue
- Dizziness
- Nausea/vomiting
- Memory loss
- Attention deficit/concentration problems
- Personality changes such as irritability or depression
- Neurological disorders such as tremors
- Hair loss
- Coughing with blood
- Bleeding in the lungs (hemosiderosis)
- Damage to internal organs including blood, liver, kidneys, and lungs

Although not supported by definitive studies at this point, there are some concerns about *Stachybotrys* exposure promoting cancer.

The symptoms and health effects related to *Stachybotrys* depend on an individual's pre-existing health situation, length of exposure, and the amount of *Stachybotrys* in the environment. It has also been shown that the level of mycotoxins produced by *Stachybotrys* mold varies over time and depends on the environmental conditions present at the growth site. Because of this, different people in the same situation, even family members, may experience different sets and severity of symptoms.

Medical Tests
No single medical test can pinpoint the level of exposure or body damage caused by *Stachybotrys*. Proper medical care and professional decision-making are necessary to assure that the affected individual is

treated properly. Many physicians believe that the following tests are appropriate in conducting a medical screening for *Stachybotrys*:

- Complete medical exam
- Chest x-ray
- Pulmonary function test
- Complete red and white blood cell count
- Blood sedimentation rate
- *Stachybotrys* specific RAST antibody test
- Immunoglobulin panel
- Immune competence tests

Doctors should be encouraged to discuss the environmental situation with the industrial hygiene professionals who have conducted sampling in the building in question.

Environmental Sampling

Two primary methods of sample analysis can be used to detect *Stachybotrys* on surfaces or in the air. Samples can be cultured so that the material collected grows and can be identified. Other samples are examined microscopically and the material collected is categorized based on the color, size, and shape of the spores.

Cultured samples are considered to be more definitive than those analyzed by microscopy alone, as the process not only allows identification of the general family (genus) of mold but can pinpoint the specific species as well. This "speciation" is not as critical when dealing with *Stachybotrys* since that genus of mold has one primary species that grows indoors. However, the distinction between species can be important when dealing with other indoor molds such as *Aspergillus* or *Penicillium*. Cultured samples do have some drawbacks. Since the process involves growing the mold, a seven- to ten-day turnaround time on samples is normal. Growing the mold also requires that the proper collection material (*i.e.*, media or agar) be selected for the type of mold that is suspected. For *Stachybotrys* a selective agar such as cellulose or cornmeal is recommended. One laboratory has recently patented a *Stachybotrys*-specific agar (SSA) which is reported to significantly improve the collection efficiency of *Stachybotrys* from air samples. Another significant drawback for cultured samples in *Stachybotrys* contamination situations is the fact that only viable or living parts are counted. Hyphal fragments, sanitized spores, and other parts of the mold that can be contributing to health problems are not included in the count.

Samples analyzed by microscopy can be advantageous in the case of suspected *Stachybotrys* contamination as the spores are easily identifiable. Faster turnaround time, including the possibility of on-site analysis, is a feature of microscopy samples. In addition to counting both the viable and non-viable mold, microscopic analysis can identify other allergens and contaminants such as pollen, dust mites, dust, and fibers.

Regardless of the analysis method, mold samples can be collected in a variety of ways. Bulk samples can be sealed in a zipper-lock plastic bag or other sealed container and submitted to a laboratory. Clear cellophane tape is often used to lift a surface sample to be mounted on a microscope slide, although such samples may not be representative of the entire depth of material. Sterile sponges and swabs can be wiped across surfaces. Air samples are collected with a vacuum pump. The air is directed over a petri dish with media (Anderson N-6 sampler), onto a greased slide (Burhkardt or Allergenco units), or into a

plastic cassette (Air-O-Cell). With the cassette it is also possible to collect surface samples with a process known as microvacuuming. Open dishes of nutrient media that are left exposed for one to four days, known as settled dust collectors, are not well respected in the inspection industry as a means of sampling for *Stachybotrys*.

Generally, sampling for *Stachybotrys* involves a combination of surface sampling and air sampling. This is matched with a thorough visual inspection to search not only for mold but evidence of water intrusion as well. Many professionals start with bulk or swab samples, progress to cassette air samples, and follow with cultured samples where the media has been selected based on the bulk or cassette sample results.

It is important to remember that air samples represent only a short window of time and that *Stachybotrys* spores do not become airborne as easily as other molds. Therefore the general consensus is that few, if any, such spores should be found in indoor air.

Samples should be collected by, or under the direction of, knowledgeable professionals. Improper collection practices can endanger the individual conducting the sampling, spread the contamination, and lead to false results. *Stachybotrys* in particular is prone to a wide variability in measured airborne levels.

Risk Assessment

Providing general guidelines on interpreting medical tests or sample results is difficult due to the large variety of factors that influence *Stachybotrys* growth and spread, as well as the variability of symptoms between individuals. Because of its toxic potential most experts recommend that all *Stachybotrys* exposure be avoided by immuno-compromised individuals. This includes infants, individuals with significant lung disease, people undergoing chemotherapy or other cancer treatment, many of the elderly, and people who are HIV positive. Other mold types with toxic potential that should be avoided are *Trichoderma*, *Chaetomium*, *Memnoniella*, and *Fusarium*.

Whatever the health status or symptom level, exposure to suspected *Stachybotrys* should be minimized as much as possible. While certain situations do demand building evacuation prior to corrective activities, oftentimes temporary solutions can be employed. When determining the best course of action in a *Stachybotrys* case the parties involved should consider the number of people involved, extent of the exposure, description of symptoms, sample results, history of the problem, location of the mold, type of activity in the building or area of contamination, type of air handling system, and public relations. In all situations the best information should be used to develop a plan of action that protects the building occupants without creating unnecessary panic until the mold and underlying source of moisture are corrected. Interim plans to reduce immediate risk until permanent repairs can be made may involve:

- Isolation of the area or room where mold was found by shutting the door(s) and sealing around the jamb with painter's tape.
- Isolation of the affected surfaces with plastic sheeting and tape.
- Isolation of supply and/or return air vents in the area where mold is present.
- Shut down of the heating, ventilation, and air conditioning (HVAC) equipment that serves the area impacted by *Stachybotrys* with necessary heating or cooling provided by alternate or temporary sources.
- Rearrangement of work/leisure activities away from the affected areas.
- Utilization of air cleaning devices that integrate high efficiency (HEPA) and activated charcoal filters.

- General cleaning using a vacuum with HEPA filtration.
- Installation of pleated filters on the heating or ventilation system.
- Use of an N-95 filtering face piece when disturbing any items in the area where mold is visible (see next section for information regarding precautions for actual mold cleanup).
- Temporary evacuation.

The choice of any actions to deal with *Stachybotrys* on an interim basis should be made with the ultimate goal of mold cleanup also in mind so that duplicative or counterproductive actions can be avoided.

Control of *Stachybotrys* Contamination

Currently no single set of regulations, rules, or even industry guidelines exist which clearly define mold remediation procedures. Nevertheless, there is considerable consensus in the healthcare community and restoration industry regarding the:

1. Importance of eliminating active mold growth inside buildings.
2. Necessity of using trained and experienced professionals for the remediation of extensive mold growth or mold contamination in high-risk situations such as hospitals, nursing homes, air conditioning ductwork, etc.
3. Need for work practices that minimize the spread of contamination during the cleanup/ removal process.
4. Removal of porous building materials (ceiling tile, drywall, etc.) that have been water saturated and now support mold growth.
5. Use of personal protective equipment by individuals conducting the cleaning or removal activities.
6. Isolation of the work area or removal of occupants while the remediation work is in progress.
7. Benefit of sophisticated engineering controls such as negative pressure enclosures, air filtering machines, isolated entry chambers, upgraded respiratory protection and the like for large scale mold remediation projects.
8. Importance of proper application of mold killing cleaners (fungicides) and encapsulants.
9. Need for a complete cleaning of the work area so that it is visibly clean of all debris and dust.
10. Value of post-work visual inspection prior to the reinstallation of drywall or other finish components.

Despite this general consensus of ideas, the specifics of implementation must be determined for each project. Before starting any mold control activity, particularly one that disturbs *Stachybotrys*, a number of important questions should be addressed:

1. Who will conduct the mold control project?
2. Are pre-work samples necessary?
3. What criteria will be used to determine a successful conclusion to the project?
4. What engineering controls will be employed?
5. What form of isolation, if any, will be used?
6. What cleaner will work effectively?
7. What materials are to be removed?
8. How is debris going to be packaged? Disposed?
9. What cleaning techniques will be employed? In what sequence?
10. What tools, supplies, and equipment are necessary?

Individuals involved in a *Stachybotrys* remediation should refer to the following documents for guidance in developing a work plan:

1. **Standard and Reference Guide for Professional Water Damage Restoration**, Institute of Inspection Cleaning and Restoration Certification (IICRC), 2715 East Mill Plain Blvd., Vancouver, Washington, 98661, (360) 693-5675, www.iicrc.org.
2. **Guidelines on Assessment and Remediation of Fungi in Indoor Environments**, New York City Department of Health, Bureau of Environmental & Occupational Disease Epidemiology, (212) 788-4290.
3. **Bioaerosols, Assessment and Controls**, American Conference of Governmental Industrial Hygienists (ACGIH), Kemper Woods Center, 1330 Kemper Meadow Drive, Cincinnati, OH 45240-1634, (513) 742-6163, fax (513) 742-3355, e-mail: comm@acgih.org, www.acgih.org.
4. **Fungal Contamination: A Comprehensive Guide for Remediation**, Wonder Makers Environmental, P.O. Box 50209, Kalamazoo, MI 49005, (269) 382-4154, info@wondermakers.com, www.wondermakers.com.

People who choose to address small projects without the assistance of a professional contractor may find prepackaged mold control kits (*e.g.*, Mold-Away by Wonder Makers Environmental) to be useful as supplies and instructions are included.

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