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# CONSULTANTS

# PERSPECTIVE

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## BIOAEROSOLS: FUNGI AND BACTERIA BUILDING CONTAMINATION

by

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Claims of illness attributed to indoor air containing high concentrations of air borne contaminants from fungi and bacteria such as mold and mildew are increasing rapidly. Nearly every major insurance claims industry conference this year has one or more sessions devoted to the discussion of mold and mildew claims. NBC Dateline, ABC 20/20, headlines in the news, studies conducted by public and private agencies; homes, schools and commercial buildings found contaminated with mold. Even the cruise line industry faces problems involving bioaerosols from inadequately maintained hot tubs and hot water systems. Common names of these bioaerosols include *Stachybotrys chartarum*, *Aspergillus fumigatus*, *Legionella pneumophila*, *Pseudomonas aeruginosa*, and gram-negative bacteria. These fungi and bacteria can produce allergens, mycotoxins and pathogens and through chronic exposure can cause a range of respiratory illness that are as innocuous as sinusitis or as deadly as pneumonia or Legionnaire's Disease.

How do these bioaerosols proliferate? Where do the exposures occur? Are all bioaerosols a health hazard? How do you identify a contaminated building? What are the remediation alternatives? These are questions that we hope to answer for you, at least on an introductory level, with this article.

### The Source of the Problem

Environmental fungi and bacteria is a natural phenomenon that has existed since the beginning of life. Without fungi and bacteria our world would not exist, as we know it today. However, when concentrated in an indoor environment, fungi and bacteria can create a potential health risk. Fungi and bacteria need three essential ingredients to proliferate indoors:

- A food source which can include but not limited to water, soil, dust, building materials, food stuffs and plants or a human host.
- A moisture source which can include but is not limited to plumbing leaks, roof leaks, concrete slabs without vapor barriers, unprotected crawl spaces and relative humidity in excess of 55%.

- An appropriate temperature because the growth of certain types of fungi and bacteria are dependent on temperature for growth.

Combine these elements with a greater amount of time our society spends indoors and the opportunity for a significant exposure/dose to occur that leads to illness increases. Other contributing factors include suppressed immune systems due to medications, existing illness or stress; preexisting conditions such as allergies, sinus problems, and asthma; or other airborne exposures that may include cigarette smoke, cleaning fluids, pesticide treatments and off-gassing chemicals from furnishings and/or building materials.

Water is the trigger for most indoor environmental fungi and bacteria problems. Plumbing, HVAC condensate drip line and roof leaks are a very common source of water damage. Buildings that have sustained flood, tornado or hurricane damage will have water damage. Facilities that have undergone asbestos abatement using wet methods are likely to have water damage. Less obvious sources of moisture infiltration include poorly performing HVAC systems that cannot maintain relative humidity below 55% during peak summer months, poor curtain wall design that allows unseen water damage to occur, aging window and door frame systems that allow condensation and/or weeping and indoor fountains. Although one would think the older the building the greater the risk of bioaerosol contamination, there are cases where newly constructed buildings have been contaminated due to the use of wet building materials or substandard building practices. Climate and geographical location can also influence the role of moisture in creating an ideal environment for fungi and bacteria growth. The Southeast, especially the Gulf Coast States are prone to have greater risk of indoor bioaerosol problems due to high humidity and the use of air conditioning.

Once the moisture is present and left unchecked the growth cycle can begin. The problem can be compounded by poor building design and/or construction, improperly sized HVAC systems, poor building maintenance and inadequate property management. The design and construction problems generally involve the roof system, foundation drainage and exterior wall design, e.g. EFIS. HVAC problems can include an inadequate amount of outside air e.g. at least 20 cubic feet per minute per building occupant, poor outside air source including proximity to cooling towers, e.g. source of legionella bacteria, condensate drip pan clogs/leaks and infrequent filter changes. Buildings or residences not properly maintained create problems from inadequate routine cleaning, deteriorated caulking, and poor roof drain/gutter maintenance that affect the performance of the roof and causes potential foundation water infiltration. Property management issues not only involve timely response to building

maintenance and repair but also occupant density and distribution within the facility. Overcrowded offices and classrooms, even though within NFPA Life Safety Codes, can create a significant reservoir of human shed bacteria that can cause a rash of symptoms and illnesses. How often have you witnessed an illness spread through an office population within a matter of days? The increased human contact also makes proper custodial care, building maintenance as well as good personal hygiene even more important.

### **Investigating the Claim**

Once a claim is filed implicating fungi and bacteria contamination, the response should be timely. The facts regarding the claim can become distorted as the issue is discussed among building occupants, homeowners and tenants. Routine illnesses, allergy symptoms and illness clusters become associated with perceived building conditions and are no longer routine but seen as a result of the building environment. The investigation team should include professionals that are experienced in dealing with fungi and bacteria contamination in buildings. These professionals can include certified industrial hygienists, microbiologists, professional engineers and medical doctors. Duct cleaning companies, HVAC contractors and remediation firms should be considered after the investigation is complete and a remediation plan is established.

The investigation begins with interviews of the claimant(s) to determine symptoms and conditions as they relate to the claim and potential bioaerosol contamination. A review of building plans, if available, and discussions with maintenance personnel should then be conducted to familiarize the investigator with building design and condition. A walkthrough of the building should focus on sources of potential moisture ranging from roof leaks to HVAC performance, e.g. relative humidity. Signs of water damage and mold growth should be noted and the source of moisture identified. Location of mold growth relative to air streams is important in understanding whether or not fungi and bacteria have a mechanism to become airborne and transported to the area of concern. For example, a contaminated HVAC condenser coil has an obvious airborne pathway to building occupants whereas an isolated moldy wall in a storage closet does not. Once the locations of potential bioaerosol contamination have been identified a sampling strategy is then developed.

Sampling may include swab, vacuum, tape, water and bulk samples of suspect materials. Air monitoring may also be considered as a part of the sampling strategy. This air monitoring can include respirable bioaerosol sampling for fungi and bacteria, spore sampling, and endotoxin sampling, e.g. byproduct of gram-negative bacteria. Location of the air samples should include at minimum the symptom area, a control area where no symptoms have been reported, and outdoors. In the case of potential cross contamination from one sample area to another, aseptic techniques should be used, e.g. sterilizing sample instrument with alcohol swab before sampling in new area. In evaluating swab, bulk or air samples the culture medium that these samples are tested on is also important. For example corn malt extract agar (CMA) provides a better medium for the culturing of *Stachybotrys chartarum* than rose bengal agar (RBA). *Stachybotrys* does not compete well with other fungi on RBA. Therefore, if *Stachybotrys chartarum* is identified on RBA then follow-up sampling with CMA is highly recommended. Results are generally reported in colony forming units (CFU) per area sampled for swab and wipe samples, in CFU per gram of material for bulk samples and CFU per cubic meter for air samples. The microbiological laboratory used for analysis should be accredited in the Environmental Microbiology Laboratory Accreditation Program (EMLAP) and participate in the Environmental Microbiology Proficiency Analytical Testing (EMPAT)

program sponsored by the American Industrial Hygiene Association, (AIHA). Typical turnaround for swab, bulk and air samples that require culturing is 10 to 14 days.

### **How Much is Too Much**

Once the analytical report is obtained, careful evaluation of the results is required. Currently, there are no legal, regulatory standards available for comparison to for determining whether or not a building is contaminated with bioaerosols at this time through the Occupational Safety and Health Administration (OSHA) and/or the Environmental Protection Agency (EPA). Although, it should be noted that OSHA's technical manual does have guidelines for which an area is consider suspect of contamination. These guidelines are as follows:

- 1,000 viable colony-forming units in a cubic meter of air
- 1,000,000 fungi per gram of dust or material
- 100,000 bacteria or fungi per milliliter of stagnant water or slime

OSHA's Technical Manual further states that: *Levels in excess of the above do not necessarily imply that the conditions are unsafe or hazardous. The type and concentrations of the airborne microorganisms will determine the hazard to employees.*

The American Conference of Governmental Industrial Hygienists (ACGIH) does offer some publications that provide guidelines for evaluating bioaerosols in the indoor environment. With no exact standards to compare to the professional must rely on comparison of bioaerosol concentrations from the symptom area, the non-symptom control area and outdoors. This comparison not only should take into account the total concentration of bioaerosols but also the species of fungi and bacteria and the presence of a particular species within the symptom area that is excluded from the control and outdoor samples. For example, the total concentration of bioaerosols in the symptom area is less than or equal to that measured in the control area and outdoors may lead to the conclusion that there is no indoor amplification of fungi and/or bacteria, e.g. symptom area should be greater than non-symptom and outdoor samples for contamination to be suspect. However, closer examination of the results may indicate that *Aspergillus fumigatus*, a known fungal pathogen that can cause respiratory illness, was found in the symptom area and not in the other locations. This scenario would indicate that there is potential contamination of the symptom area with this species of fungi. This evaluation should not only involve the primary investigator but also the analytical laboratory microbiologist and a qualified physician. If the claim involves an illness an effort to determine if there is a factual medical link between the findings of the investigation and the diagnosis of illness should be attempted.

### **Abatement Methods**

Abatement of bioaerosol contamination can be simple or complex. Where obvious water damage has occurred the disinfection of the contaminated area with a 10 percent bleach solution and repair of the water source may be all that is needed. However, when the interior insulation lining the ductwork of the HVAC system is the source of bioaerosol amplification, the abatement may involve the total removal and replacement of the ductwork and HVAC system. Currently, there are products for topical disinfection of these duct linings, but generally these do not eliminate the hazard and the odorant they use to mask the musty odor of mold can be more of a nuisance and/or hazard than the

bioaerosols themselves. Also the disturbance of the fiberglass insulation may create a potential dust exposure hazard that may require further abatement. In other words, quick fixes are not the best answer for remediating building bioaerosol problems. Other remediation issues besides the clean-up of the contamination source itself, may involve but are not limited to the repair of roof systems, sealing of curtain walls, window/door frame replacement, crawl space ventilation, vapor barrier installation and foundation repair.

**Who Will Pay For All This?**

Subrogation of a bioaerosol claim could involve a multitude of parties when a high-rise commercial building is involved or just a few if the claim involves a residence. Depending on the circumstances of the bioaerosol contamination, the architect, the general contractor, specialty contractors, project management companies, material suppliers, and engineering companies just to name a few could all have some responsibility for the problem.

A full discussion of the topic of subrogation resulting from mold and mildew claims cannot be covered in the remaining space available in this newsletter. For more details on the subject we suggest that you try to attend the National Association of Subrogation Professionals conference on November 11<sup>th</sup> through 14<sup>th</sup> in Reno, Nevada where this will be one of many important topics discussed.

**MORE ARTICLES**

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**For addition information about future seminars in your area or to set up a private seminar for your firm, please contact Bob Dwyre at 1-800-436-7266**

May 14 COMMERCIAL VEHICLE ACCIDENT RECONSTRUCTION SEMINAR presented by Stephen B. Chewning for CSX Corporation at their Annual Risk Management, Loss Control & Safety Meeting, Orlando, FL.

FORCON will be an exhibitor at the annual meetings listed below.

April 1-4 SPRING ATA SAFETY & LOSS PREVENTION MANAGEMENT COUNCIL CONFERENCE, Grand America Hotel, Salt Lake City, Utah, Booth #33.

April 8-10 SOUTHEASTERN CLAIM EXECUTIVES ASSOCIATION (SCEA) Spring Meeting, Westin Innisbrook Resort, Palm Harbor, FL.

April 29 39th RIMS ANNUAL CONFERENCE & EXHIBITION, Georgia World Congress Center, May 5 - Atlanta, GA, Booth #1440.

June 3-5 5<sup>th</sup> ANNUAL FLORIDA LIABILITY CLAIMS CONFERENCE, Caribe Royale Resort Suites & Villas, Lake Buena Vista, FL. Please visit our Booth and register for our door prize.

Aug. 14-16 2001 RIMS FLORIDA CHAPTERS JOINT EDUCATIONAL CONFERENCE & TRADESHOW, Ritz Carlton, Naples, FL. Please visit our booth and

register for our door prize.

Sep. 23-26 FALL ATA SAFETY & LOSS PREVENTION MANAGEMENT COUNCIL CONFERENCE, Nashville, TN.

Oct. 4-6 Virginia Association of Defense Attorneys Annual Meeting, Norfolk, VA

Oct. 4-7 Virginia State Claims Association Convention, Portsmouth, VA.

Oct. 7-9 5<sup>th</sup> ANNUAL CLAIMS EXPOSITION & CONFERENCE (ACE), Marriott Hotel & Tampa Convention Center, Tampa, FL.

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Bill Ver Eecke and the "SubroGATOR" in front of FORCON's booth at the National Association of Subrogation Professionals (NASP) Conference in Orlando, Florida last November. Over 700 subrogation professionals attended the conference. Bill is on the NASP Board of Directors and is the chairman for the 2001 conference schedule for November 11<sup>th</sup> through 14<sup>th</sup> in Reno, NV.

For more information go to [www.subrogation.org](http://www.subrogation.org)

May 23 COMMERCIAL VEHICLE ACCIDENT RECONSTRUCTION SEMINAR presented by Stephen B. Chewning for American Freightways, Harrison, AR.

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