Asthma and Damp Buildings: Making the Connection

With the alarming and widespread increase in the incidence of asthma, especially among children, the race is on to find out why and eventually stop this epidemic. Although clear patterns exist, the specific causes of asthma are far from straightforward. Until recently, the condition was divided into two clearly defined types of asthma: extrinsic (allergic) asthma and intrinsic (non-allergic) asthma. As more has become known, asthma has been further divided into a number of additional different types, including exercise-induced, nocturnal, occupational and steroid-resistant asthma (Lung Disease Focus 2005). What is known is:

- Ninety percent of people with asthma have allergic asthma, which is triggered by substances capable of causing an allergic reaction (allergens).
- Asthma affects 8 percent to 10 percent of the US population and takes an enormous physical and economic toll (see Asthma By The Numbers sidebar).
- There is no single trigger or event that precipitates the onset of asthma or an asthma attack for all people, although family history of allergy and asthma is a predisposing factor.
- Exposure to airborne particles and allergens, along with environmental tobacco smoke and other combustion-related products, air pollution and pesticides, influence the biological processes that trigger attacks and increase the severity of symptoms (USEPA 2005).
- Minimizing or eliminating exposure to known triggers can reduce the number of asthma attacks and their severity.

One of the most intriguing avenues of research with respect to indoor environmental triggers focuses on damp buildings and indoor mold growth associated with these buildings.

Researchers now have clear evidence that damp buildings and exposure to mold bioaerosols are a risk factor in developing asthma – *not* just in exacerbating symptoms. Results of other studies demonstrate that current protocols for indoor air sampling and analysis for mold may only be catching just a small amount of airborne material that can trigger asthma attacks. Also, exposure risks may be greater than previously thought.

These landmark results have enormous implications for building owners and facility managers, especially when considering that people spend more than 90 percent of their time indoors. Children are at greater risk than adults, because they breathe in more air with respect to their body mass and as a result have a greater exposure to indoor environmental contaminants.

Asthma By The Numbers
Twenty million people in the US have asthma, nine million of which were children. Ten million people have allergic asthma.*
From 1980 to 1994, the proportion of Americans with asthma increased by 75 percent. In children under the age of five, the proportion grew by 160 percent.*
More than 50 percent of people with asthma also have allergies.**
Asthma prevalence is 39 percent higher in African Americans than in Caucasians.*
In 2003, the prevalence of asthma in women was 35 percent greater than the rate in men.* More women die of asthma than men, and women account for nearly 65% of asthma deaths overall.**
If only one parent has asthma, chances are 1 in 3 that each child will have asthma. If both parents have asthma, chances are 7 in 10 that their children will have asthma.**
In 2003, there were 12.7 million physician office visits and 1.2 million outpatient department visits due to asthma. In 2002, there were 1.9 million asthma-related visits to hospital emergency rooms.*
There are approximately 5,000 deaths from asthma each year.*
Asthma accounts for approximately 24.5 million missed workdays* and 14 million missed school days annually and is the top cause of missed school days.**
Direct health care costs for asthma in the United States total more than $11.5 billion annually; indirect costs (lost productivity) add another $4.6 billion for a total of $16.1 billion. Prescription drugs represent the largest single direct medical expenditure at more than $5 billion.*
The value of reduced productivity due to death represented the largest single indirect cost related to asthma, approaching $1.7 billion.*
* As reported in the Media Resources Media Kit, Asthma Statistics, AAAAI 2005. ** As reported in the Allergy and Asthma Facts and Figures. AAFA 2005.

This paper takes a closer look at these studies and what their results might suggest for minimizing damp buildings and indoor mold growth risk factors.

Sampling, Analysis Techniques See Only The Tip Of The Iceberg

Presently used indoor air sampling equipment and protocols are designed to capture intact mold spores and culturable pieces of the mold colony, from which investigators can estimate the extent of indoor mold growth by counting cultured colonies and identifying and counting spores. While this information is helpful, it does not tell the whole story.

Rafał L. Górney and his colleagues suspected that airborne fungal spores might not be the only agents causing people to become sick in damp indoor environments. They studied mold growing on culture agar and on ceiling tiles and measured the particles coming off the ceiling tiles in an environmental chamber using pure air. The results revealed three different sources of airborne mold material:

- Intact spores and hyphae
- Pieces of dead parts of the mold colony
- Digested bits of the substrate on which the mold grew

The results also showed a 320 to 1 ratio, meaning that for every one intact spore there are also more than 300 other particles released, which are indicative of mold growth. Further, the researchers discovered that mold fragments released into the air with the spores and even substrate particles can carry the substance (antigen) that trigger immune system reactions (Górney et al 2002).

Brett Green and his colleagues took the Górney study one step further. Not only did they confirm that spores and these tiny pieces of mold carry antigens, they also showed that these pieces also carry allergens, which trigger allergic reactions (Green et al 2005). A useful analogy is grains of grass pollen, which can break apart when hit by raindrops while blowing through the air during a thunderstorm. A much smaller component part of grass pollen grain – the starch grain – can still carry the grass allergen. Because the starch grain is so much smaller than the entire grass pollen grain, it can be inhaled deeper into the lung where the allergen may cause an asthma attack. The same is true for mold.

These studies clearly demonstrate that the conventional ways investigators have been measuring mold bioaerosols yields just the tip of the iceberg. Consequently, it is not surprising that health-based exposure levels for mold in indoor environments have not been determined, because the present air sampling protocols only look for intact mold spores or culturable pieces of mold. What is not measured are the much smaller inert particles, which make up the majority of the particles that can carry the mold antigens, allergens and other immune system triggers.

Making the Connection: Damp Buildings, Indoor Mold Growth and Asthma

Two studies released earlier this year provide the first solid evidence that damp buildings and exposure to mold bioaerosols is a risk factor for developing asthma and not just in making asthma symptoms worse. Jouni J.K. Jaakkola and his colleagues followed 1,984 children living is Espoo, Finland from birth for six years of age (1,916 children were included in the study results) and began before the children developed asthma (Jaakkola et al 2005). Jean M. Cox-Gasner and her colleagues followed 356 adults for a full year. The study participants worked in a multi-story office building, with a history of moisture problems and water intrusion (Cox-Gasner et al 2005).

The results of these two studies indicate that there is clear connection between damp buildings, associated indoor mold growth and the development of asthma. The risk for developing asthma

appears higher for, but is not limited to, people who are sensitive to mold allergens or who have parents with asthma (Jaakkola et al 2005, Cox-Ganser et al 2005).

These studies carry a lot of weight, because many of the earlier studies did not follow children or adults from a time prior to their developing asthma until sometime after, nor did they independently assess the indoor environments in which the study participants lived and worked before and after they developed asthma. Another factor in their favor is they relied on medical diagnosis of the respiratory symptoms not just on interviews or surveys with adults who reported on their or their children's symptoms.

The Jaakkola and Cox-Gasner studies also update the often-quoted 2004 Institute of Medicine report, *Damp Indoor Spaces and Health*. This report offered a comprehensive review of the scientific literature on asthma, mold and other factors related to damp conditions in homes and buildings. The Committee on Damp Indoor Spaces and Health concluded that there is sufficient evidence that mold and damp conditions can cause asthma symptoms in people with asthma who are sensitive to mold, and to coughing, wheezing, and upper respiratory tract symptoms in otherwise healthy people. The committee at that time did *not* find sufficient evidence to establish a clear, causal relationship for the development of asthma, however these two studies were not then available (IOM 2004). With respect to mold, this report reaffirmed the findings of a 2002 Institute of Medicine report, *Clearing the Air: Asthma and Indoor Air Exposures* (IOM 2002).

In addition, the Jaakola and Cox-Gasner studies support the premise that cleaning up and preventing indoor mold growth by eliminating moisture and water intrusion is a critical factor for reducing the number of people who develop asthma and the frequency and severity of attacks among those who do have asthma.

An Ounce of Prevention is Worth A Pound of Cure

Building owners and managers have a unique opportunity to reduce the risk of those who live, work or go to school in their buildings and are sensitive to mold antigens, allergens or other immune system triggers from developing asthma. By taking preventative action, they can reduce their risk of costly litigation and bad publicity. Catching a moisture and indoor mold growth problem early is by far the most powerful and most effective means of making sure buildings do not pose a health risk and for minimizing damage and cost, but there has been little consensus surrounding how building owners and facility managers should properly prevent and remediate mold.

GREENGUARD Environmental Institute (GEI), a non-profit organization that develops and promotes standards for indoor air quality, recently announced its intent to develop a national standard on the prevention of mold during the design, construction and occupancy of buildings. The uniqueness of GEI's efforts is that 1) its standard covers practices throughout buildings' lifecycles and 2) it will certify that the buildings comply with these practices. The GREENGUARD Environmental Institute is presently piloting this standard and expects to finalize it early next year (2006).

Visit us at www.aqs.com to learn more about how the AQS Building Consulting Group can help you assess your building for moisture and mold and develop a plan to prevent conditions conducive to indoor mold growth, or call us at (770) 933-0638. Also visit the GREEENGUARD Environmental Institute at www.greenguard.org and the AQS Aerias IAQ Resource Center to learn more about how mold and other indoor contaminants affect people with allergies and asthma. Aerias may be accessed from the AQS website or at www.aerias.org.

Citations

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