New Orleans Area Environmental Quality Test Results

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Mold

Health Effects of Mold

Mold is the common name used to describe various types of fungus that can be found growing both indoors and outdoors, especially in moist warm environments. Exposure to mold in outdoor air can cause a number of health effects including allergic reactions, asthma attacks, and even infections in people with immune system problems. Mold can be a dangerous indoor air contaminant and its presence in residential and occupational settings usually requires prompt attention and cleanup.

Mold growing on damp surfaces releases spores that become airborne and can be inhaled, leading to a host of respiratory problems. Some molds also produce chemicals (mycotoxins that may be toxic to humans if inhaled. Mold exposure can cause congestion, sneezing, runny or itchy nose, and throat irritation; more serious symptoms include major allergic attacks, cough, asthma attacks, and hypersensitivity pneumonitis (a pneumonia-like illness with symptoms including difficulty breathing and fevers). Some studies have shown that outdoor levels of mold spores are directly associated with childhood asthma attacks requiring a visit to an emergency room. Studies that have reported links between outdoor mold spore levels and childhood asthma attacks have found these respiratory effects even in areas where the daily airborne spore counts were relatively low (around 2,000 spores per cubic meter). Mold in the home environment has been extensively studied. The National Academy of Sciences has concluded that there is sufficient evidence of a causal link between indoor mold and the following health effects: nose and throat symptoms, coughing wheezing, asthma symptoms in sensitized people, and hypersensitivity pneumonitis in susceptible people.

Some people have reported a wide range of other symptoms associated with mold exposure -- including headache, difficulty concentrating, memory loss, skin rashes, diarrhea, and pulmonary hemorrhage in infants -- but these health problems are currently less well-established scientifically. Invasive fungal pneumonia almost never occurs in healthy people, but can be a very serious threat to people with weak immune or lung function. The long term effects of exposure to mycotoxins in humans are unknown and remain of high concern.

The health hazard posed by mold is usually assessed through a description of the quantity of fungal spores and a description of the different types of mold present. It is generally accepted that increasing levels of airborne spores represent an increased health risk and

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spore counts in problem areas are often compared to background levels. Of the thousands of types of molds found in indoor and outdoor environments, adverse health effects associated with spores from species of *Alternaria, Aspergillus, Cladosporium, Penicillium, and Stachybotrys* have been well documented.

There are no U.S. regulatory standards for either indoor or outdoor levels of mold spores in the air. In the indoor environment, the standard practice is to compare the mold concentrations, and the specific types of mold present, with outdoor concentrations at the same location. If the indoor levels are higher, or if the dominant mold species are significantly different, that indoor environment is considered to have a mold problem that requires attention. Some organizations have set more specific cut-offs for mold in the environment. The National Allergy Bureau of the American Academy of Allergy and Immunology has set general nationwide definitions for mold spore counts in the outdoor environment (see Table 1). These guidelines are especially useful for people with allergies, asthma, or other respiratory conditions. Various organizations have set definitions for mold concentrations in indoor air. However, in most cases these use a different measurement method, colony-forming units instead of spores. One colony-forming unit originates from one living spore; however, both living and dead spores may produce undesirable health effects. Colony-forming units are difficult to compare with spore counts. However, some authors have recently devised criteria for cut-offs to differentiate "clean" from "moldy" residential buildings. These criteria are presented in Table 2.

Table 1
National Allergy Bureau Outdoor Mold Counts

0	Absent
1-6,499	Low
6,500-12,999	Moderate
13,000-49,999	High
> 50,000	Very High

Note: numbers are in daily average spore counts per cubic meter
Source: American Academy of Allergy and Immunology
http://www.aaaai.org/nab/index.cfm?p=reading_charts

Table 2
Indoor Mold Classifications: Residential Buildings

Total Spores
< 1,200 - Clean
> 1,300 - Moldy

Aspergillus/Penicillium
< 750 - Clean
> 900 - Moldy

Ascospores/Basidiospores
< 1,200 - Clean
> 1,300 - Moldy

Note: numbers are in spores per cubic meter
Source: Baxter et al. J Occup Environ Hygiene, 2005

How We Sampled for Mold

We collected air samples for mold spore analysis at two different times in a total of 17 outdoor locations spread across the New Orleans area, including Uptown/Carrollton, Mid-City, the French Quarter, Lakeview, Gentilly, the Lower Ninth Ward, Bywater, New Orleans East, Chalmette, Metairie and Mandeville. Twelve of these locations had been significantly flooded; two were near flooded areas but were not themselves flooded; and three were in areas further from the flooding. We also sampled in eight indoor locations (in Broadmoor, Mid-City, Lakeview, the Lower Ninth Ward and New Orleans East). All of the indoor locations had been flooded, but some had been partially remediated. Our sampling was done from October 17-19 and November 13-16, 2005.

We collected continuous volumetric samples using a Burkard Continuous Recording Air Sampler with a flow rate of 10 liters per minute for 6 to 24 hours. The results were extrapolated to estimated average 24-hour mold spore concentrations expressed as spores per cubic meter of air. The instrument has greater than 90 percent removal efficiency of particles with an aerodynamic diameter of 5 µm and above. Fungal spores were counted and identified by Dr. Mervi Hjelmroos-Koski of INSTAAR, University of Colorado at Boulder.

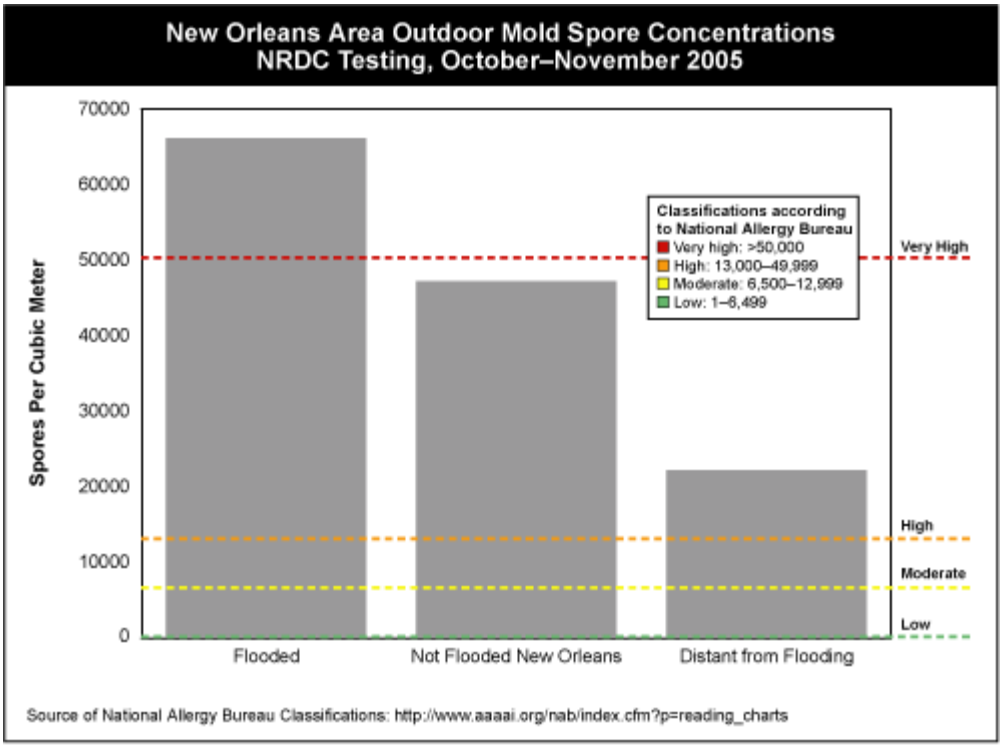
Results of Mold Sampling

The levels of mold spores in the air in New Orleans were extremely high, and could pose a serious health threat especially to anyone who is allergic to molds, and to people with asthma and other respiratory disease. We found elevated levels of mold spores both inside homes and outside, especially in flooded areas.

Outdoor Air

Our testing revealed a significant mold problem in outdoor air in most of the flooded areas of the city. Mold spore counts in most flooded neighborhoods -- including New Orleans East, the Lower Ninth Ward, Bywater, Gentilly, Chalmette, Uptown/Carrollton and Mid-City -- were classified as "Very High," with estimated average daily spore counts over 50,000 spores per cubic meter. Levels in Lakeview were "High," according to the standard classifications of the National Allergy Bureau. These outdoor mold spore concentrations could easily trigger allergic or asthmatic reactions in sensitive people. Our sampling in the French Quarter and Uptown in streets that were not flooded also showed high levels of mold, but these areas are close to flooded areas and mold spores are known to travel significant distances in the air. In contrast, more distant comparison sites in Metairie and in Mandeville on the north shore of Lake Pontchartrain had significantly lower mold spore concentrations. Figure 1 shows the average spore concentrations at 12 outdoor sites in the flooded areas of Orleans and St. Bernard Parishes compared to the average spore concentrations at two sites in areas of Orleans Parish that were not directly flooded (the French Quarter and part of Uptown). The third column represents two samples taken in Metairie, Jefferson Parish, further upwind of the flooded areas and one sample taken on the north shore of Lake Pontchartrain in a non-flooded area.

Figure 1

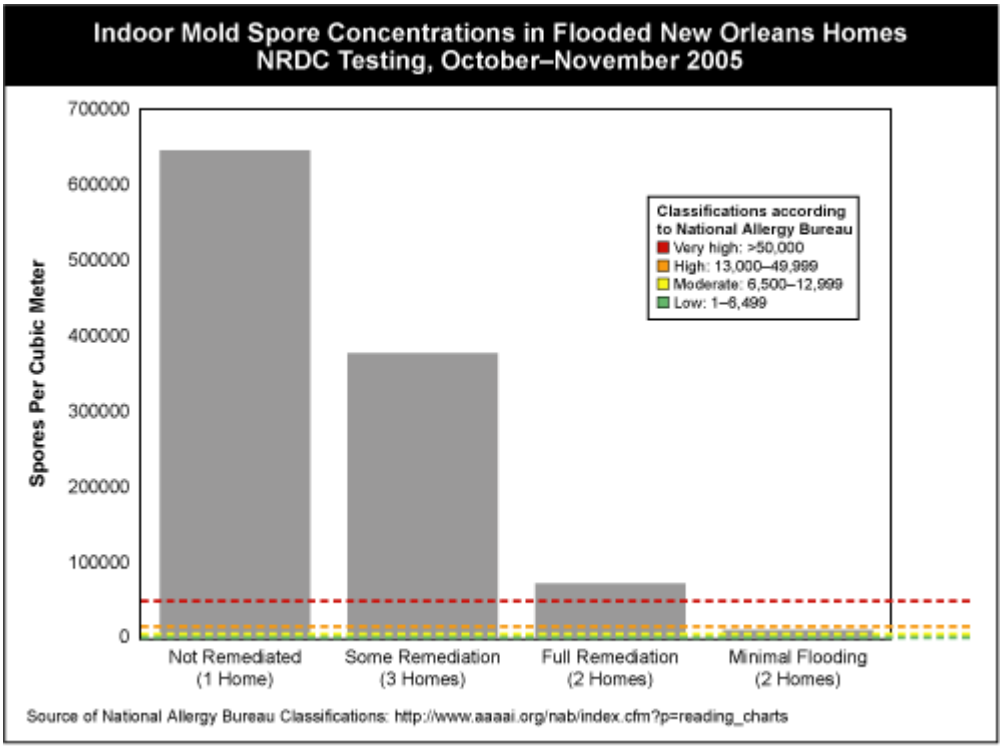


Natural Resources Defense Council, 2005

Indoor Air

Mold spore levels were extremely high in the flooded and not yet remediated indoor locatior we tested (moldy furniture, carpets and drywall still in place). This home had mold spore concentrations of 650,000 spores per cubic meter (spores/m3), which would render it dangerously uninhabitable by any definition. We tested three homes that had undergone some remediation (removal of contaminated furniture and carpets, some removal of drywall). These had average mold spore concentrations of 377,000 spores/m3, which was still dangerously high. Two of the homes we tested had been fully remediated (removal of all furniture, carpets and drywall down to the studs, airing and mold treatment). These homes had average mold spore counts of 72,000 spores/m3, which was nearly the same as the outdoor air at the same locations. Two homes in Leonidas (Uptown) and Bayout St. John (Mid-City) that had suffered only minimal flooding (flooding of the crawl space, or less than three inches of water for a brief period in the living space) averaged only 11,000 spores/m3 in the indoor air, which was considerably lower than outdoor air samples taken at the same locations.

Mold, Figure 2



Natural Resources Defense Council, 2005

By far the most common types of mold that were detected in our sampling were Cladosporium and Aspergillus/Penicillium species. Outdoors, in flooded areas, Cladosporium species accounted for about 20 percent to 50 percent of spores found, and Aspergillus/Penicillium species comprised about 20 percent to 70 percent of spores at any given location. In combination, these two species accounted for about 60 percent to 90 percent of all of the spores found. In the non-flooded sites, the dominant species was Cladosporium (70 percent to 75 percent), and Aspergillus/Penicillium was far less common. These molds are known to cause respiratory problems in humans, including allergy, asthma and infections (in immunocompromised people or people with underlying lung disease). In addition, some species of Aspergillus and *Penicillium* which are typically found in damp indoor environments produce fungal toxins (mycotoxins) that may contribute to both short-term and long-term health effects. Indoors, in flooded homes, the dominant species was Aspergillus/Penicillium, which comprised more than 70 percent of the fungal spores. The fully remediated homes and less-flooded homes had fungal spore distributions that were similar to those in the outdoor air. However, in four of the flooded homes (including one of the fully remediated homes) we also detected airborne spores of Stachybotrys species, which is also known as "black mold" or "toxic mold." Stachybotrys is known to produce mycotoxins that can cause flu-like symptoms and other respiratory problems. This is a highly controversial type of mold that some researchers have associated with a variety of neurological effects, immune suppression and with infant pulmonary hemorrhage.

Based on our sampling results, people working in the flooded parts of the city, especially if there is building or demolition work going on nearby, and anyone entering any buildings, should be sure to wear respiratory protection -- specifically, an N95 dust mask/respirator. A regular dust mask or bandana is not sufficient to protect against these levels of mold contamination.

Mold Results by Neighborhood

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