Hurricanes, Floods, and Mold: A Federal Perspective

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Human Activity affects airborne levels of fungi

Adapted from: Lehtonen and Reponen, Int. Biodet & Biodeg. 1993

Moldy bread into garbage can

Concentration of culturable spores (CFU/ cubic meter)

Time (minutes)

Adapted from: Lehtonen and Reponen, Int. Biodet & Biodeg. 1993
Mold levels before, during, and after gut-rehab* in three homes in New Orleans

*Gut-rehab = Removal of all water-damaged building materials down to the studs

Is 4 feet removal enough?

Photo credit: Ginger Chew
New recommendations after Hurricane Katrina
“If the water level < 2.5 feet, wall material should be removed to a height of 4 feet (to facilitate reinstallation of full sheets of drywall)…
greater than 2.5 feet…removed to 8 feet or ceiling.”

This recommendation was derived from Hurricane Katrina research

What happened to the blue home?
Downstairs water line and mold

Upstairs carpet with dirt and mold tracked in
Cleaning station outside of house

Photo credit: Ginger Chew
## Dampness and Mold Intervention Studies

<table>
<thead>
<tr>
<th>Reference</th>
<th>Study population</th>
<th>Type of intervention</th>
<th>Mold exposure assessment</th>
<th>Did mold decrease?</th>
<th>Did asthma improve?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sauni et al., Cochrane Database of Systematic Reviews 2011</td>
<td>Meta-analysis of 8 studies (n=6,538 participants)</td>
<td>Cleaning, Limited structural changes, Thorough remediation</td>
<td>Trained inspectors, self-report, and mold measurements</td>
<td>Not assessed for this analysis</td>
<td>Yes (for children) Yes (for adults)</td>
</tr>
</tbody>
</table>
| Barnes et al., Allergy Asthma. Proc. 2008 | Children (ages 2-17) n=181 homes | Cleaning | -Culturable fungi  
- Spore counts  
- Antigens | -No  
- Yes  
- No | Yes |
| Lignell et al., J Environ Monit. 2007 | Two schools ~ 600 children each year of follow-up | Cleaning, mechanical ventilation installed | Culturable fungi | Yes | Yes |
| Burr et al., Thorax 2007 | Current asthma (ages 3-61) N=164 homes | Cleaning, fan installation | Visual inspection | Yes | Yes |
| Kercsmar, et al., EHP 2006 | Children (ages 2-17) n=62 homes | Thorough remediation | Fungal PCR | Yes (but no difference between intervention and control groups) | Yes |

Hurricane and flood remediation studies not included because active remediation can increase symptoms. (Hoppe et al, Indoor Air, 2012)
Cleveland Mold Intervention Study

Kercsmar, Dearborn, Schluchter, Xue, Kirchner, Sobolewski, Greenberg, Vesper, and Allan. *Environmental Health Perspectives.* 114:1574-1590. 2006

**Objective:**
To assess if a major mold intervention in the home decreased symptoms more than a standard asthma intervention alone (clinical asthma management)

* Median cost of remediation = $3,182
  (Costs ranged from $535 to $6,550)
News signs after Hurricane Irene
(September 2011, New York)

Photo credit: Ginger Chew
Hurricane Sandy

Photo credit: Ginger Chew
Fire damage
Asbestos cladding?

Photo credit: Ginger Chew
Several layers of flooring (cleaning recommendations?)

Photo credit: Ginger Chew
Cleaning agents
(different strengths of bleach)
Other hazards

Photo credit: Ginger Chew
Quickly followed remediation protocols

Photo credit: Ginger Chew
Could not quickly follow the remediation protocols

mold growth on wooden studs

Photo credit: Ginger Chew
Severe wood rot

Photo credit: Ginger Chew
Many people tried to get rid of mold on their own or hired professionals or other contractors to clean up. But many people did not have the knowledge, tools or equipment to properly remove mold, which frequently returned. Mold also resurfaced after some contractors completed their work.”
The White House Hurricane Sandy Task Force (formed in 2013)

HOMEOWNER’S AND RENTER’S GUIDE TO MOLD CLEANUP AFTER DISASTERS

Messages that spun-off the harmonized guide

8 Tips to Clean up Mold
- Spanish
- Arabic
- Chinese
- French
- Haitian Creole
- Tagalog
- Vietnamese

https://www.cdc.gov/mold/cleanup.htm
This message was sent via social media

8 TIPS TO CLEAN UP MOLD

- **Protect Yourself**
  
  Put on personal protective equipment (gloves, mask, goggles) to protect your eyes, nose, mouth, and skin.

- **Toss!**
  
  Take it out! Anything that was wet with flood water and can’t be cleaned and dried completely within 24 to 48 hours should be taken outside. Take photos of discarded items for filing insurance claims.

- **Air it out**
  
  Open all doors and windows when you are working, and leave as many open as you safely can when you leave.

- **Circulate**
  
  When electricity is safe to use, use fans and dehumidifiers to remove moisture.

- **Don’t mix cleaners**
  
  If you use cleaning products, do not mix cleaning products together. DO NOT mix bleach and ammonia because it can create toxic vapors.

- **Scrub surfaces**
  
  Clean with water and a detergent. Remove all mold you can see. Dry right away.

- **Don’t cover it, remove it**
  
  Painting or cauiking over mold will not prevent mold from growing. Fix the water problem completely and clean up all the mold before you paint or caulk.

- **Dry it up**
  
  Dry your home and everything in it as quickly as possible – within 24 to 48 hours if you can.

http://www.cdc.gov/mold/cleanup.htm

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Hurricane Sandy
(Battery charging station)
In 2017, 127,000 were sent to hurricane-affected areas
This message was sent via social media and 20,000 copies were sent to disaster recovery centers in 2017.
Ongoing challenges facing residents

Debris piles

Discarding belongings

Downsizing and living in temporary housing
Thank you

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA  30333
Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348
E-mail: cdcinfo@cdc.gov  Web: http://www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
Back-up slides
(for clarification)
Why do we have a 24-48 hour drying recommendation?

- Starting the drying process at 24-48 hours is not the recommendation.
- Mold growth can occur overnight (e.g., moldy bread)
- How fast can materials be dried?

“Exterior rooms with excellent ventilation can take 2-4 weeks to dry, depending on the temperature and relatively humidity.”

### Summary of Moisture Reading Results for Wood Framing Materials

<table>
<thead>
<tr>
<th>Moisture Reading</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 20%</td>
<td>Wet - no good</td>
</tr>
<tr>
<td>15 - 20%</td>
<td>Partially dry - caution</td>
</tr>
<tr>
<td>&lt; 15%</td>
<td>Dry - OK</td>
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</tbody>
</table>