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# After the Storm: Health risks from damp, moldy homes



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The risks from heavy rains and flooding don't pass with the storms. Buildings exposed to flooding are left wet, damaged, and potentially harmful to health. Dampness can support the growth of mold and other organisms—contributing to poor indoor air quality and a range of potential health problems. Remedying water damage to reduce health risks is an important part of storm recovery.

As flood risks increase due to climate change, more people are vulnerable to health problems from damp, moldy homes after the storm. Communities across the United States are increasingly vulnerable to damaging floods due to more intense storms and rising sea levels—all exacerbated by climate change.

This research brief provides background information and summarizes Climate Central's analyses on weather and climate trends that influence flood risk. These resources can help explain and report on the health risks from poor indoor air quality after floods, and the connection to climate change.

## Climate change is increasing the risks of damp, moldy homes after storms.

Heavier precipitation, more intense storms, and rising sea levels—all driven by a warming climate—contribute to [increasing vulnerability](#) to [floods](#) and associated health risks.

[Extreme weather events associated with climate change](#) can cause water damage in homes and other buildings. The resulting damp environments provide ideal growing conditions for [molds](#) (types of fungi) and [other harmful microbes](#). In just [two or three days](#) after a storm or flood, mold can grow on absorbent materials such as carpets, drywall, paper, and furniture in exposed buildings.

Damp, moldy homes pose risks to respiratory health and potentially contribute to other illnesses. The [World Health Organization Guidelines for Indoor Air Quality](#) (2009) summarized research on health impacts from dampness and mold, and recommended minimizing exposure to protect public health.

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## EXTREME PRECIPITATION AND MORE INTENSE STORMS INCREASE THE RISKS OF FLOODING.

[Extreme rainfall events](#)—which bring an amount of rain well above normal for the time and location, over a period of hours or even minutes—[have been on the rise](#) in the U.S. since the 1980s. These intense bursts of rainfall can increase risk of both [inland and coastal flooding](#).

Extreme weather events, such as hurricanes and [atmospheric rivers](#), bring [risks of heavy rains and flooding](#). Although extreme weather has multiple contributing factors, climate change can boost conditions that make these events more likely or more intense.

See Climate Central's resources on extreme precipitation and weather events:

- Analysis of [hourly rainfall intensity](#) trends since 1970 in 150 U.S. locations
- Climate Matters bulletin on [atmospheric rivers](#)
- Extreme Weather Toolkit: [Tropical cyclones](#)

## COASTAL CITIES ARE MORE VULNERABLE TO STORM SURGES DUE TO SEA LEVEL RISE.

Globally, sea levels have risen about seven inches since the beginning of the 20th century due to melting glaciers and ice sheets and the expansion of seawater as oceans warm.

This rising water level is worsening coastal floods during both regular high tides and coastal storms. [Storm surges](#) produced by coastal storms are affecting larger areas in many U.S. cities because of rising seas.

- See Climate Central's [assessment of 23 U.S. cities vulnerable to coastal flooding](#).
- Map localized vulnerability to sea level rise and storm surges using Climate Central's [Coastal Risk Screening Tool](#).

## Damp, moldy buildings pose risks to human health.

Dampness indoors can support growth of mold and other harmful microbes—contributing to [poor indoor air quality](#) and potential health issues. Molds (and the [toxins or allergens](#) they can release) can be [harmful to some people](#), depending on factors such as individual sensitivity and the amount or kinds of mold.



Studies have found a range of [acute and chronic health](#) effects associated with dampness and indoor mold exposure, from mild [allergic reactions](#) to severe illness and [new-onset asthma](#). In the U.S., [millions of worsened asthma](#) cases and up to [20% of common respiratory infections](#) may be attributed to dampness and mold.

## HEALTH RISKS MAY INCREASE AFTER STORMS.

Following a number of [extreme weather](#) events in recent years, studies have shown [high mold levels](#) in exposed buildings, and sometimes an associated increase in health problems. [Children](#) and people with respiratory issues or [weakened immune systems](#) may be especially vulnerable to health problems from [mold exposure after flooding](#).

The [Superstorm Sandy Child and Family Health Study \(2015\)](#), for example, linked mold exposure after the storm with an increased likelihood of asthma (in adults) and mental health distress (in both children and adults).

A review of [studies related to flooding and respiratory disease](#) found strong associations between extreme weather events and increased risks of certain respiratory diseases, such as [asthma](#), as well as worsening of pre-existing respiratory conditions. The analysis further suggests that exposure to mold and damp homes following flooding could be a key contributor.

## MORE RESEARCH IS NEEDED TO UNDERSTAND POTENTIAL HEALTH RISKS FROM MOLD.

Health risks from mold exposure can vary greatly from person to person, depending partly on individual sensitivity to the kinds and amounts of mold present. Some health risks of mold are better understood than others. [More research is necessary](#) to understand how mold affects health—particularly in [connection with extreme weather events](#)—and to identify potential associations with other issues, such as fatigue, neurologic symptoms, or gastrointestinal tract problems.

### Box 1. The smell of mold may be more than just unpleasant.

The [musty odor](#) many people associate with mold can be attributed to volatile organic compounds (VOCs)—chemicals released into the air by molds and other microbes. This smell may be more than just unpleasant for some people—exposure has been linked to a range of symptoms, including headaches and nausea. These potential health effects aren't yet clearly understood, but scientists are [studying mold VOCs](#) to understand how they might be harmful to human health.

## Testing for mold indoors

### BEYOND BLACK MOLD

There are many different kinds of molds that may grow indoors—some of which are potentially harmful to humans.

Stachybotrys chartarum is one species that's been reported as hazardous "black mold" or "toxic mold." But mold species can vary in color and texture, and potential health effects cannot be determined by appearance alone.

There is no standard threshold for an acceptable or potentially harmful amount of mold indoors. According to government agencies such as the U.S. Environmental Protection Agency and Centers for Disease Control and Prevention, testing to identify the kinds or amount of mold is unnecessary, unhelpful, or impractical—especially if there is already visible mold or a musty odor. Fixing indoor moisture problems and remediating mold growth should take priority.

### A RESEARCH TOOL FOR MEASURING AND STUDYING MOLD IN BUILDINGS

Although homeowners should prioritize treating mold, no matter the type, it is important for researchers to expand their understanding of mold impacts. The U.S. Environmental Protection Agency developed a research tool for estimating mold contamination called the Environmental Relative Moldiness Index (ERMI). Researchers can analyze mold DNA in dust samples and compare findings to the ERMI scale to assess the amounts and kinds of mold in a building. The results can help scientists better understand associations between mold and health effects.

## Managing mold risks after the storm

If a home or other structure has been flooded, it's important to take appropriate measures to minimize risk. These safety precautions include:

- Wearing protective gear when entering or cleaning a moldy home.
- Using [appropriate cleaning supplies](#).
- Making informed decisions about [when to contact a professional](#).

The [U.S. Environmental Protection Agency](#) and [Centers for Disease Control and Prevention](#) offer more detailed guidance for flood cleanup.

### REDUCING EXPOSURE

When returning home after being displaced by a severe storm or flood, it's important to take appropriate measures to minimize risk. These safety precautions include:

- Sealing off moldy areas until they can be cleaned.
- Discarding wet, moldy items
- Using adequately sized portable high-efficiency particulate air (HEPA) [filters](#) in living spaces and (especially) bedrooms to improve air quality before mold remediation.

The [U.S. Environmental Protection Agency](#) and [Centers for Disease Control and Prevention](#) offer more detailed guidance for flood cleanup.

### ONGOING PREVENTION MEASURES

At least [20% of buildings in the U.S.](#) may have dampness problems—it can become an issue even without a significant flood or storm.

Actions to mitigate risks from damp homes include:

- Maintaining [indoor humidity between 30-50%](#).
- Preventing ongoing water intrusion through [proper exterior drainage and home maintenance](#).
- Cleaning [air conditioners and HVAC systems](#) regularly.

The [U.S. Environmental Protection Agency](#) offers more detailed guidance on mold and indoor air quality.

Ultimately, cutting greenhouse gas emissions is the most meaningful way we can slow the rate of global warming, minimize the increase in frequency and intensity of extreme weather events, and protect human health in a changing climate.

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[Climate Central](#) is an independent group of scientists and communicators who research and report the facts about our changing climate and how it affects people's lives.

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