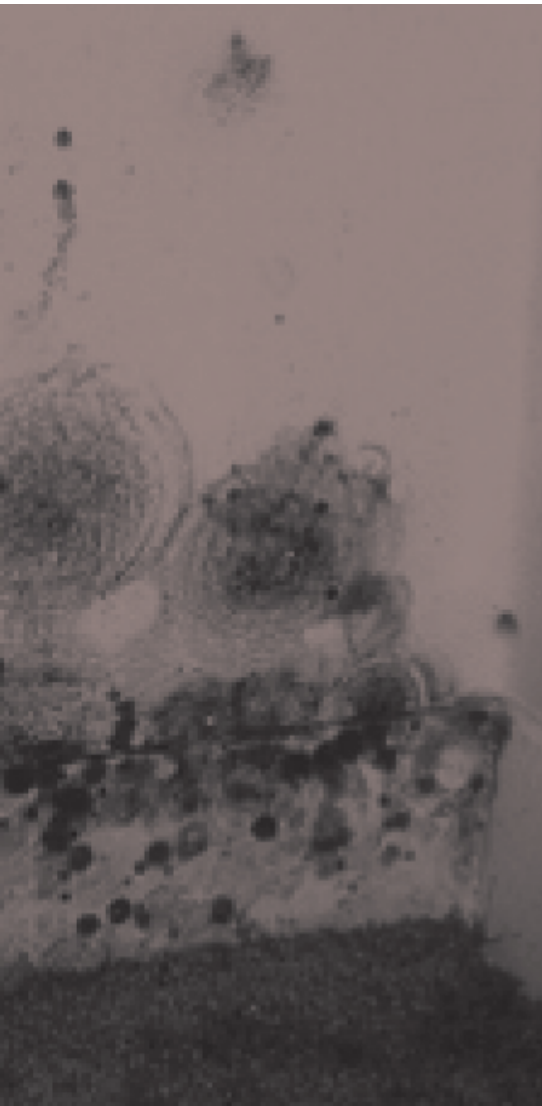




National Institutes
of Health



MOLD: WORKER AND EMPLOYER GUIDE TO HAZARDS AND RECOMMENDED CONTROLS



Water damage inside buildings after disasters contributes to the growth of mold. Workers exposed to mold during disaster recovery and cleanup may experience a variety of health problems. Removing mold growth and correcting the underlying source of water responsible for the mold contamination can help to reduce mold exposures and related health symptoms.

This safety and health reference guide summarizes basic procedures for mold remediation for workers involved in home rebuilding and rehabilitation after disasters. When disaster recovery activities require significant mold remediation or when workers are inexperienced in this type of task, refer to more detailed guidance on how to safely and effectively remove and clean up mold. Several resources, including some that describe how to train workers performing mold remediation, are provided in the Additional Resources section of this guide.

WHAT IS MOLD?

Molds are the most common forms of fungi found on the Earth. There are many of different types of mold that can grow anywhere moisture is present. Water during and after natural disasters—including floods, hurricanes, and tornadoes—can lead to growth of mold and contamination of building materials.

WHAT ARE THE HAZARDS OF MOLD?

Exposure to mold contamination in an indoor environment may lead to:

- Itchy, runny, or stuffy nose;
- Sneezing;
- Itchy or watery eyes;
- Itchy or sore throat;
- Cough;
- Wheezing;
- Severe allergic responses (e.g., rhinitis, asthma, and hypersensitivity pneumonitis); and
- Infectionsⁱ.

Some symptoms have been attributed to poisonous substances released by some molds.

Most people experience no health effects from exposure to the molds ordinarily present in normal indoor or outdoor air. However, some individuals with allergies may be more sensitive to molds.

WHERE DOES MOLD COME FROM?

Molds can grow on just about any substance, as long as moisture and a food source are available. Excessive mold growth may occur when moisture accumulates in buildings or on building materials, including carpet; ceiling tile; insulation; paper; wallboard; drywall; wood; surfaces behind wallpaper; under window sills; or in heating, ventilation duct work, and air conditioning (HVAC) systemsⁱⁱ

Homes and other buildings that are left in disrepair after a disaster may also develop excessive mold growth from other sources of moisture, including plumbing, roof and window leaks; condensation on cold surfaces (e.g., pipe sweating); drain pans; and wet foundations due to landscaping or gutters that direct water into or under the building. Water vapor from unvented or poorly vented kitchens, showers, combustion appliances, clothes dryers or steam pipes can also promote mold growth.

MOLD REMEDIATION

Moisture control is a key strategy for preventing and reducing mold growth. If possible, prevent water from coming into a home before flooding and water infiltration occurs. If water does enter a home, damp or wet building materials and furnishings should be removed, cleaned and/or dried within 24 to 48 hours to prevent the growth of mold.ⁱⁱⁱ

If mold growth is present, visually survey the types of materials and the size of the area affected. A moisture meter may be used to determine moisture levels in building materials (e.g., carpet, wallboard, wood, brick, and concrete) and moisture content following water damage. Meters also can be used to monitor progress in drying wet materials. In addition, an infrared survey can be performed for understanding the extent of water damage. Although sampling for mold is not usually necessary, it may help in guidance of mold remediation activities.

Materials that cannot be dried and fully cleaned should be removed using methods that minimize occupant and worker exposure to spores. Drying can involve the use of fans, blowers and/or dehumidifiers. However, the more humid the air, the less effective the blowers will be. It is often more cost-effective to remove and replace the building materials, e.g., fiberglass batting, than to dry and clean mold-contaminated materials.

Mold may also grow on hidden surfaces, such as the back side of drywall, wallpaper, or paneling, the top of ceiling tiles, the underside of carpets and pads, etc. Other possible locations of hidden mold can include pipe chases and utility tunnels (with leaking or condensing pipes), walls behind furniture (where condensation forms), condensate drain pans inside air handling units, porous thermal or acoustic liners inside ductwork, or roof materials above ceiling tiles (due to roof leaks or insufficient insulation). Mold may present an odor and require removal of building materials, such as wall paper and drywall.

TYPES OF MATERIALS: NON-POROUS, SEMI-POROUS, OR POROUS (WATER PENETRATES READILY)

Non-porous materials (e.g., metal, glass, hard plastics, etc.) can be dried out, fully cleaned and reused. Clean hard and non-porous materials using a detergent (e.g., dishwashing liquid or laundry detergent). After cleaning with a detergent, surfaces can be rinsed, if necessary, with a disinfectant made of 1/2 cup liquid household bleach mixed into one gallon of water (**Caution: DO NOT mix bleach with cleaning products that contain ammonia, DO NOT use a higher concentration of bleach to water than recommended, and DO NOT use bleach on metal materials**).

Semi-porous materials (e.g., wood and concrete), if structurally sound, can be cleaned with detergent and if necessary, disinfected with bleach

Porous materials (e.g., drywall, carpets, insulation, ceiling tile, etc.) are very difficult to fully clean because water and mold penetrate into them. As a general rule, if a porous material has been wet for over 48 hours, it is best to remove and replace it.

WORK PRACTICES FOR DIFFERENT SIZE AREAS

Small Areas of Mold Contamination (i.e., less than 10 square feet)

- As a general rule, small areas of water damage require less control when remediating.
- The work area should be unoccupied; removing people from adjacent spaces is not necessary but is recommended for infants, persons recovering from surgery, immune suppressed people, or people with asthma, hypersensitivity pneumonitis and severe allergies.
- Containment of the work area is not necessary.
- Cover surfaces in the work area with secured plastic sheets to exclude spores, dust and debris to prevent the spread of mold to these surfaces.
- Leave area clean, dry, and free of visible debris.

Medium Areas of Mold Contamination (i.e., 10-30 square feet)

- The work area should be unoccupied; removing people from adjacent spaces is not necessary but is recommended for infants, persons recovering from surgery, immune-suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
- Containment of the work area is not necessary. Cover surfaces in the work area with secured plastic sheets to exclude spores, dust and debris and prevent the spread of mold to these surfaces.
- Use dust suppression methods, e.g., misting (not soaking) surfaces prior to remediation.
- Clean and/or remove materials as noted in the “Types of Materials” section on the previous page; seal materials being removed in plastic bags.
- The work area and areas used by remediation workers for egress should be cleaned with a damp cloth or mop and a detergent solution.
- Leave area clean, dry, and free of visible debris.

Large Areas of Mold Contamination (i.e., 30-100 square feet)

- The work area and areas directly adjacent to it should be unoccupied.
- Cover surfaces in the work area with secured plastic sheets to exclude spores, dust and debris and prevent the spread of mold to these surfaces.
- Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.
- If remediation procedures are expected to generate a lot of dust (e.g., abrasive cleaning of contaminated surfaces, demolition of plaster walls) or where mold growth is heavy (i.e., blanket versus patchy coverage) follow the extensive contamination procedures and guidelines for protecting workers listed below.
- Leave area clean, dry, and free of visible debris

Extensive Contamination (i.e., greater than 100 square feet)

- Develop a suitable mold remediation plan. The plan should address: work area isolation, the use of exhaust fans with high-efficiency particulate air (HEPA) filtration, and the design of airlocks/decontamination room, and negative pressure enclosures, if applicable.
- Leave area clean, dry, and free of visible debris.

PROTECTING WORKERS DURING MOLD REMEDIATION

Worker protection during mold remediation involves engineering controls, work practices and personal protective equipment (PPE). Inhalation is the route of exposure of most concern to cleanup workers, even though mold can enter through cuts and abrasions causing fungal infections.

Engineering Controls

- Re-wet materials with a mist of water to reduce spores, dust and debris being released into the air.
- Use wet vacuums to remove water, and blowers to dry floors.
- Double-bag materials contaminated with mold in plastic bags or plastic sheeting and secure with duct tape to reduce the spread of spores.
- Provide natural (open windows) or exhaust ventilation (fans blowing to the outside) during all cleaning steps.
- Ensure electrical safety when working in wet conditions.

Work practices

- Do not eat, drink, or smoke in work areas.
- Avoid breathing dusts.
- After an area has been cleaned and is completely dry, vacuum the area with a HEPA vacuum. HEPA vacuums are also recommended for cleaning up dust that may have settled on surfaces outside the work area.
- Work areas and exits should be cleaned with a damp cloth or mop and a detergent solution, and dried. Set up a decontamination area.
- Leave the work area clean, dry, and free of visible debris.
- After working, wash thoroughly, including hair, scalp and nails.

Personal Protective Equipment (PPE)

- Respirators:
 - For areas smaller than 100 ft², use a NIOSH-approved respirator; at a minimum, either a half-face or full-face respirators equipped with N95, R95 or P95 filters.
 - For areas greater than 100 ft², areas where mold growth is heavy (blanket versus patchy coverage), or areas where substantial dust is generated during cleaning or debris removal (e.g., abrasives are used to clean surfaces); use a NIOSH-approved, respirator; at a minimum, a half-face air purifying respirator equipped with N100, R100 or P100 filters. A full-face air purifying respirator with similar filters may offer greater protection.
 - Charcoal-impregnated filters may be used for nuisance odors.
- Non-vented goggles.
- Long gloves (e.g., overlapping the sleeves) made of an impermeable material that will protect workers from chemicals used for surface cleaning and skin contact with mold.
- Long hard-toe rubber boots.
- Protective clothing (e.g., disposable coveralls) to prevent contamination and skin contact with mold and chemicals. For additional protection, especially in areas greater than 100 ft², ensure that protective clothing covers entire body including head and feet.

PROTECTING WORKERS FROM MOLD HAZARDS DURING DEMOLITION

While workers involved in demolition are unlikely to be involved directly in mold remediation, most demolition work after a major flood can still pose health hazards from exposure to mold growing on buildings and furnishings. Demolition work can also lead to exposure to lead, asbestos, silica, and other hazardous chemicals. Workers operating heavy equipment may be protected by air-filtering cab enclosures. Workers on the ground may require appropriate respiratory protection, such as an approved NIOSH N95 or more protective respirator to minimize exposure to airborne contaminants.

OTHER SAFETY AND HEALTH HAZARDS

Recovery workers involved in mold remediation may face additional hazards on the job site. Common hazards include downed electrical wires, carbon monoxide and electrical hazards from portable generators, fall and “struck-by” hazards from tree limbs or working at heights, working in unprotected excavations or confined spaces, burns, lacerations, musculoskeletal injuries, being struck by traffic or heavy equipment, and encountering contaminated water during cleanup and recovery efforts.

ADDITIONAL RESOURCES

- Occupational Safety and Health Administration (OSHA) Safety and Health Topics page on Molds: <http://www.osha.gov/SLTC/molds/index.html>
- National Institute for Occupational Safety and Health (NIOSH) Indoor Environmental Quality page on dampness and mold in buildings: <http://www.cdc.gov/niosh/topics/indoorenv/mold.html>
- New York State Department of Health Disaster Recovery Information, <http://www.health.ny.gov/environmental/emergency/weather/hurricane/faq/docs/faqs.pdf>
- National Center for Healthy Housing, “Creating a Healthy Home: A Field Guide for Clean-Up of Flooded Homes” http://www.nchh.org/Portals/o/Contents/FloodCleanupGuide_screen_.pdf
- OSHA Respiratory Protection standard (29 CFR 1910.134) at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716

ASSISTANCE FOR EMPLOYERS

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site Consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management systems. To locate the OSHA On-site Consultation Program nearest you, call 1-800-321-OSHA (6742) or visit <http://www.osha.gov/dcsp/smallbusiness/index.html>.

This guidance document creates no new legal obligations. It contains recommendations as well as descriptions of OSHA safety and health standards. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available by the OSHA Office of Communications to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

- i. Brown, C., Burkhardt, J., Burton, N., Cox-Ganser, J., Damon, S., Falk, H., ... & Weissman, D. (2006). *Mold Prevention Strategies and Possible Health Effects in the Aftermath of Hurricanes and Major Floods*. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Available online at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5508a1.htm>; Pope, A. M., Patterson, R., & Burge, H. (Eds.). (1993). *Indoor allergens: assessing and controlling adverse health effects*. Washington, D.C.: Institute of Medicine, National Academy Press. Available online at <http://books.nap.edu/catalog/2056.html>; Institute of Medicine [IOM]. (2004). *Human health effects associated with damp indoor environments*. In *Damp Indoor Spaces and Health* (pp. 183-269). Washington, DC: Institute of Medicine, National Academy Press.
- ii. World Health Organization [WHO]. (2009). *WHO Guidelines for Indoor Air Quality: Dampness and Mould*. Geneva, Switzerland: World Health Organization. Available online at: <http://bit.ly/1EktkmY>; National Institute for Occupational Safety and Health [NIOSH]. (2012). *Preventing Occupational Respiratory Disease from Exposures Caused by Dampness in Office Buildings, Schools, and Other Nonindustrial Buildings* (DHHS (NIOSH) Publication Number 2013-102). Washington, D.C.: U.S. Department of Health and Human Services. Available online at: <http://www.cdc.gov/niosh/docs/2013-102/pdfs/2013-102.pdf>.
- iii. Occupational Safety and Health Administration [OSHA]. (2003). “A Brief Guide to Mold in the Workplace.” Safety and Health Information Bulletin (SHIB 03-10-10). Washington, D.C.: U.S. Department of Labor. Available online at <http://www.osha.gov/dts/shib/shib101003.html>.