

A Field Guide for Flooded Home Cleanup

September 2019



Acknowledgements

In 2019, the [National Center for Healthy Housing](#) (NCHH) and [Enterprise Community Partners](#) collaborated to update and republish *A Field Guide for Flooded Home Cleanup* (previously entitled *Creating a Healthy Home: A Field Guide for Clean-Up of Flooded Homes*). The guide was published in 2006 in the wake of hurricanes Katrina and Rita, as described below. Since then, the guide has been accessed thousands of times by people assisting with the clean-up of homes affected by coastal and river flooding. With the support of the [Centers for Disease Control and Prevention](#) and the [National Environmental Health Association](#), we have updated the guide in 2019 to reflect current best practices across a variety of housing types.

We wish to thank the following experts who served as advisors:

[Terry Brennan, Camroden Associates](#)
[Ginger Chew, Centers for Disease Control and Prevention](#)
[Scott Damon, Centers for Disease Control and Prevention](#)
[Armand Magnelli, Livable Housing Inc.](#)
[Claudette Reichel, Louisiana State University AgCenter](#)
[Laurie Schoeman, Enterprise Community Partners](#)

Between October 2005 and March 2006, three national housing organizations – Enterprise Community Partners, the National Center for Healthy Housing, and [NeighborWorks® America](#) – teamed with [Neighborhood Housing Services of New Orleans](#) to investigate how to safely and affordably decontaminate flooded homes in the Gulf Coast region post-hurricanes Katrina and Rita. Funding was provided by the Robert Wood Johnson Foundation. These organizations wish to thank the four homeowners who volunteered their homes for this work.

The following individuals and organizations made important contributions to the original guide:

- Researchers at [Columbia University's Mailman School of Public Health](#) and [Tulane University's Center for Applied Environmental Public Health](#).
- [Little Sisters of the Assumption Family Health Services, Inc.](#)
- [Microecologies, Inc.](#)
- Robert Santucci of Urban Renovation Consultants (URC), Inc.
- Dennis Livingston of Community Resources.

Disclaimer

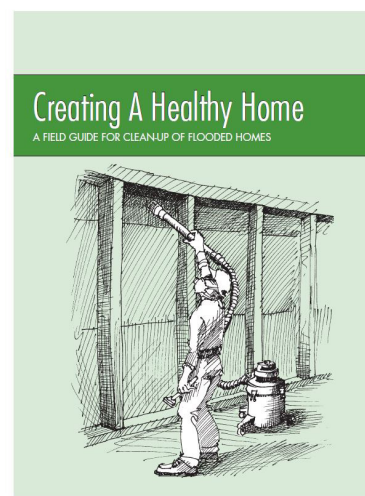
The information contained in this field guide was compiled to serve as a general informational guide for flood cleanup and is not intended to address specific conditions that may be present at individual properties or to replace the services of a professional. Persons who believe that their premises may contain mold, sewage effluent, or hazardous materials should engage professional consultants.

As each user's circumstances vary, you (the reader) understand that this field guide is solely for informational purposes. The advice offered in this field guide addresses some of the more general hazards resulting from mold. In no event shall any party that has contributed to this field guide, its underwriter, or any other party be liable for damages of any nature (including, without limitation, incidental and consequential damages, personal injury, or wrongful death) resulting from the use of or inability to use this field guide.

No contributor to this field guide claims any rights in the trademarks, registered and otherwise, of the specific brand-name products that are referenced in this guide, nor does any contributor represent or warrant such products in any respect. All products mentioned are referenced solely for informational purposes.

En Español

La información presentada en esta guía práctica también está disponible en español y está disponible en http://bit.ly/NCHHFloodGuide_Espanol



Who Should Use This Guide?

This guide is meant for do-it-yourselfers and contractors who need to address mold in flooded homes following a major flooding event before starting to build or renovate. This book tells how to clean up after flooding but does not describe how to rebuild.

What Can You Do Yourself and When to Hire a Professional

Trained Mold Remediation Professionals

Agencies of the U.S. government advise that it is best to hire mold remediation professionals when possible. Mold cleanup can be difficult and dangerous.

Here are tips for hiring mold remediation professionals:

- Know the rules of your state about using licensed mold remediation professionals. Some states require licensing. Do not hire unlicensed professionals in those states.
- Use restoration industry websites to seek certified professionals:
 - The American Council of Accredited Certification (www.acac.org)
 - The Institute of Inspection, Cleaning and Restoration Certification (www.iicrc.org/)
 - The Restoration Industry Association (www.restorationindustry.org)
- Do not hire contractors who recommend fogging or spraying chemicals instead of mold removal as the way to clean up. Moldy materials must be removed from the building.
- If possible, seek quotes from more than one company.
- Ask each contractor to give references on similar jobs and check to see if the references were satisfied with the jobs done.
- Require each contractor to give a written estimate that includes:
 - A detailed scope of work.
 - A detailed plan for how you and other residents, your belongings, and the workers themselves will be protected during the work.
 - An agreement that you will hold the final payment until the work passes an inspection by a professional. The inspection should show

PERSONAL PROTECTIVE EQUIPMENT (PPE)



Be sure to wear the necessary personal protective equipment (PPE) and follow the work practices and procedures described in this guide for a safe and effective mold cleanup.

People with asthma, mold allergies or other respiratory conditions, people with weakened immune systems, children, and pregnant women **SHOULD NOT** do this work and **MUST** remain out of these homes until the work is complete.

there was no visible mold and no mold odors. Use a highly qualified person for the final inspection.

- To get the most protection for the work, ask the contractor to give proof that the contractor has commercial general liability, contractual liability, and pollution (mold) liability insurance.

Other Professionals

Asbestos must be removed by a certified professional (www.asbestosguide.org/asbestos-removal-companies/). Seek Lead-Safe Certified contractors to address lead-painted surfaces (<https://cfpub.epa.gov/flpp/pub/index.cfm?do=main.firmSearch>). In most states, contractors who apply borate solutions for pest control purposes need to be licensed pest control operators.

Residents and Volunteers

In emergencies and special situations, residents and volunteers may perform mold cleanup that would normally be done by trained mold remediation professionals. No matter who performs the mold cleanup, **be sure to wear the necessary personal protective equipment (PPE) and follow the work practices and procedures described in this guide for safe and effective mold cleanup.**

People with asthma, mold allergies or other respiratory conditions, people with weakened immune systems, children, and pregnant women **SHOULD NOT** perform this work and **MUST** remain out of these homes until the work is complete. They are especially vulnerable to the hazards found in flooded homes.



The information presented in this field guide is also available online as interactive step-by-step guidance. To learn more about the eLearning course, register at...

<https://elearning.nchh.org/>



ADDITIONAL RESOURCES

Other resources are available to help address the flood cleanup and restoration process...

For renters/owners:

- *Homeowner's and Renter's Guide to Mold Cleanup After Disasters* [Link: http://bit.ly/CDC_HomeownersAndRenters] (CDC, EPA, FEMA, HUD, NIH) - Contains reference to guidance from the Smithsonian on cleaning personal items
- *Protect Yourself from Mold* [Link: http://bit.ly/CDC_Protect] (CDC)

For owners:

- *Rebuild Healthy Homes* [Link: http://bit.ly/HUD_Rebuild] (HUD)
- *Repairing Your Flooded Home* [Link: http://bit.ly/FEMA_Repairing] (FEMA/ARC)

Preparing for future flood events:

- *Homeowner's Guide to Retrofitting* [Link: http://bit.ly/FEMA_Homeowners] (FEMA)

What Are the Major Health Risks When Working on Water-Damaged Homes?

Structural Problems

If the building has been pushed off its foundation, DO NOT enter it yourself. Only trained construction professionals should work in these dangerous conditions.

- If you plan to enter a house that has been under water for a long time or has remained wet, be sure that the floor has not rotted through. Test for rotten areas by hitting the floorboards with the end of a 2" x 4" piece of lumber.

Mold

What are the health effects associated with exposure to mold?

Exposure to mold can lead to asthma attacks, eye and skin irritation, and allergic reactions. It can lead to severe infections in people with weakened immune systems.

What are the symptoms?

Severe reactions:

- Breathing difficulties or shortness of breath
- Fever

Other reactions:

- Stuffy nose
- Wheezing
- Red or itchy eyes
- Itchy skin
- Sore throat

Lead Dust

Many homes built before 1978 have paint that contains lead. As the building dries and paint flakes and peels

from the walls, lead dust can be a danger to people who perform the cleanup. Demolition and renovation can make large amounts of dust that people in the home or workers can inhale or get on their clothes, hands or food. By the time a person shows symptoms, the lead poisoning has already happened.

What are the symptoms?

Lead poisoning often shows no symptoms at all. Signs and symptoms of lead poisoning in adults exposed to high levels over a short period may include abdominal pain, constipation, fatigue, headaches, irritability, loss of appetite, memory loss, pain, numbness, or tingling in the hands and/or feet, and/or muscle weakness.

Asbestos

Homes built between 1900 and 1980 may include building products that contain asbestos. When these products are disturbed or damaged, the asbestos fibers can be released into the air. Exposure to asbestos can increase your chances of developing lung disease or cancer. Symptoms may take many years to develop.

Carbon Monoxide

Carbon monoxide (CO) is an odorless, colorless gas that can cause sudden illness and death. Burning fuels, such as gas, oil, kerosene, wood, or charcoal, produce CO. No fuel-burning equipment, including portable generators or pressure washer engines, should be used inside or within 20 feet of flood-damaged homes.

Cuts and Punctures

Broken glass, boards, exposed nails, and other hazards are common in flood- and storm-damaged homes. Floodwaters may contain germs or viruses that can enter the skin through cuts and scrapes.

- Wear protective equipment to prevent serious injuries. Take special care to protect your hands and feet.



RESPIRATORY PROTECTION OPTIONS

N95 or N100
paper or cloth



Powered air
purifying respirator



Half-face negative-
pressure respirator



Contractors must follow the rules for an OSHA respirator program.

Eyes

- Wear goggles, safety glasses with side shields, or a full-face shield. Sun/glare-protective lenses may be needed in some work settings.
- Wear a cap with a brim to prevent dust from falling behind the glasses.
- Always keep a bottle of eyewash solution (available at drugstores) on the job in case you get something in your eye.

Ears

- Use earplugs/earmuffs in high-noise work areas where chainsaws or heavy equipment are used. At most cleanup sites, the earplugs are not needed.

Feet

- Wear work boots with steel shank, toe, and insole.
- DO NOT wear tennis shoes or sneakers; they will not prevent punctures, bites, or crush injuries.

Head and Body

- Wear coveralls with a hood, a soft hat with a brim, or other protective head cover. Wear an American National Standards Institute (ANSI)-rated hard hat if there is any danger of falling debris or electrical hazards.

- Verify that you and your workers have received tetanus vaccinations within the last 10 years before working in flooded areas.
- If a cut or puncture occurs, wash the cut immediately and treat with an antiseptic iodopovidone ointment (such as Betadine or Povidine).

Electric Shocks

Electric shocks can kill. There is a danger of electric shock from any electrical device that has been flooded. Rubber boots and gloves do not always protect from electric shock.

Turn off the electricity *at the breaker* before starting work if you do not know the condition of the wiring behind walls. Turning off electricity at a wall switch is not a guarantee of safety. Be careful that any power cords running from generators do not sit in water.

How to Protect Yourself from Environmental Health and Safety Threats

Lungs (Respiratory System)

Unless you wear a respirator, you are at high risk of breathing mold, lead dust and other construction dust.

- For most flood clean-up work, use a NIOSH-approved half-face negative-pressure respirator with HEPA filters. These respirators have canisters on the sides of your mouth to filter out dust and mold. HEPA filters are magenta colored. Combination cartridges for particulates and organic vapors can be useful to decrease particles and odors. Mold and bacteria odors can be airway irritants.
- Use paper or cloth respirators labeled N95 or N100 if you plan to be in the home for short periods (less than 15 minutes) and will not disturb much mold. The best N95/N100 dust filters have a valve in the middle and two straps to hold the mask securely on the head. Do not reuse disposable masks that are visibly dirty. Do not use the same mask for more than eight hours.
- If you plan to work in many houses with high mold and dust levels, you may want to buy a powered air purifying respirator (PAPR), which has a fan that blows filtered air into the hood. These are especially helpful if you have a beard and cannot get a tight fit from other respirators or masks. PAPRs provide the highest level of protection but at a cost over \$500 are hard for most homeowners to afford.
- Follow the manufacturer's instructions supplied with the respirator or mask carefully. Respirators and masks must fit properly to work correctly.

Hands

- Use heavy, cut-resistant, waterproof gloves.
- Always wash your hands and face before eating, drinking, smoking, or applying sunscreen or lip protection to limit how much mold and dust gets into your body.

Protecting the People You Go Home To

- Take actions to prevent hazardous substances (such as mold spores, contaminants from flood waters, and lead dust) from remaining on shoes, clothes, or equipment after you leave the work site.
- Wear disposable coveralls and boot covers to stop the spread of dust containing hazardous materials and microbes from the work area to other clean areas, to your vehicle, or to another home. Remove and throw away after use.
- Clean reusable protective clothing and equipment by following the manufacturer's recommendations for exposure to mold and other potentially hazardous chemicals.
- Wash all nondisposable clothing in detergent separately from other clothes.
- Shower to remove dust and mold from your hair and skin.



PERSONAL PROTECTIVE EQUIPMENT (PPE)



1. PREWORK INSPECTION

Open doors and windows for 30 minutes before working in the home. This will reduce odor levels and allow for dilution of airborne contaminants.

Basic Safety Inspection

Is there structural damage?

- If YES, do not enter the home until a professional has inspected it and determined it is safe.

Has the electrical system been inspected?

- If NO, have an electrician or the utility company inspect the service before using it. Make sure the main electrical switch (breaker) is turned off. DO NOT enter an area of the home that has standing water until the power has been shut off.
- If YES, but the electrical system is not rated safe, DO NOT use the system. Plan on renting or buying a generator for cleanup work. Do not use open flames for lighting or heat.

Has the natural gas system been inspected?

- If NO, have the utility company inspect the service before using it. See Section 2, "Before Work

Begins" (page 8), for guidance about shutting off gas after flooding.

Do you smell natural gas?

- If YES, move away from the building immediately and then call the local gas company or 911.

Are the toilets and sewer pipes free of holes, cracks, or leaks? Do they drain well?

- If NO, do not use plumbing until a plumber has fixed the pipe.

Are water pipes, faucets, sinks, and tubs free of holes, cracks, or leaks?

- If NO, turn off the water that leads to the pipe/fixture to stop water leaks and further moisture damage. Plan on having a plumber repair the damage.

Minimum PPE Required

Wear at least:

- a cap
- safety glasses
- an N95-N100 respirator

- If YES, do not drink or use water for cooking, washing food, or bathing until the water utility or public health department says that it's safe to use.

Was the heating and air conditioning system flooded, or are there signs of mold?

- If YES, do not use the system until cleanup is complete and an HVAC (heating, ventilation and air conditioning) professional can inspect and either clean or replace the system.

Flood/Storm Damage Inspection

Is there an active roof leak or other damage to the house that would let water in?

- If YES, cover the roof or other damaged area with a tarp until it can be fixed. There must be a temporary water- and wind-tight roof before beginning storm damage repair.

Is there standing water in the home?

- If YES, decide whether the water must be pumped out or can be mopped. Plan to rent or buy a pump if needed. See Section 2, "Before Work Begins" (page 8), for proper methods to pump out flooded basements. Wear boots before entering water and make sure all electricity to the area has been turned off at the panel.

Can the flood contamination be limited to certain rooms? For example, did the second floor have no water damage and no signs of mold?

- If YES, then it may be possible to section off areas for use for storage. See Section 3, "Site Preparation" (page 9), for guidance about how to section off parts of the home.



PHOTOGRAPH DAMAGED MATERIALS

Contact your insurance company immediately, but do not wait for the claims adjuster to come to the home before removing wet and moldy materials.

Take photographs of damaged materials before disposal for insurance purposes.

Assume that building interiors are seriously contaminated with mold if:

- The building was under water or was wet for more than 48 hours.
- You see more mold growth than what was present before the flood.
- You see signs of water damage or mold or smell strong mold or mildew odors.

How high is the mold or water damage on the walls?

- If less than 18 inches and the walls are gypsum wallboard (i.e., drywall), it may be safe and cost effective to remove drywall up to the four-foot line. See Section 7, "Selective Tear-Out and Preparation Before Restoration" (page 17), for instructions on how to partially remove drywall.

Was the home built before 1978?

- If YES, assume that the home has lead-based paint and follow lead-safe work practices carefully when disturbing this paint (see HUD's *Lead Paint Safety* field guide: http://bit.ly/HUD_LeadPaintSafety).

Was the home built between 1900 and 1980?

- If YES, the home may contain asbestos. Most large square flooring tiles manufactured between 1920 and 1960 contain asbestos. Asbestos may also be present in building materials such as pipe insulation, wall or attic insulation, acoustic ceiling tiles, and textured paint. If any of these materials are broken or easily crumbled, you may need the help of an asbestos specialist to remove them. See <https://www.epa.gov/asbestos> for more information.

Is there damage to doors, trim, or windows? Is there damage to cabinets and cabinet doors? Were the large appliances flooded?

- All of these components can be saved if not badly damaged. In choosing whether to save or replace, think about how much they are now worth and how much it will cost to restore these items compared to the cost of replacing them. If you do not think you can remove all mold and other contaminants from building components and appliances, replacement is the better option. Do not try to preserve pressboard cabinets or hollow-core doors that have mold growth. When appliances have been flooded, they can rarely be saved.

Can any of the furnishings and belongings in the home be saved?

- In general, do not try to save moldy, porous items (items that absorb water).
- The following items need to be thrown away when you can see or smell mold and/or if the materials have been under water:
 - Carpet, carpet padding, and rugs
 - Upholstered furniture
 - Microwave ovens, window A/C units, and other electronics/appliances that have fans and were housed in moldy rooms.
 - Computers (for security, remove hard drives prior to disposal)



SAVE OR REPLACE?

When deciding whether to save items, remember that it will take a lot of cleaning time to remove mold and flood contamination to make them safe for reuse. For many items without sentimental value, replacement may be better. This is especially true if items are covered by insurance.

- Papers and books
- Food items, including canned foods that were in contact with floodwaters.
- Items that can typically be saved include the following:
 - Nonporous items like china, glass, jewelry, porcelain, and metal
 - All-wood non-upholstered furniture with mold growth but in good condition otherwise
 - Some electronics and small appliances (if they do not have fans and were not damaged by water)
 - Photographs, books, and valuable or important legal documents with minor levels of mold growth
 - Artwork, textiles, and clothing that are not physically damaged.

If you plan to save your belongings, think about how much storage space you will need. If they cannot be stored at home, make plans for moving and storage at another location. Clean all personal belongings from mold-contaminated areas before moving them to storage areas. See Section 8, “Restore Possessions (page 18), to learn how to clean your belongings.

Air out building

Before leaving the building after the inspection:

- Open windows as long as the weather is dry.
- Open all the windows on the lower floor that you can safely keep open. Some windows may be left partially open. For safety, secure the window in an open position putting a screw in the window frame.
- Open interior doors, especially to closets and interior rooms, to let air reach all areas of the building. Where necessary, take interior doors off their hinges to help the air flow.
- If the home has attic windows or skylights, open them to increase ventilation.
- DO NOT run the central air system.
- If the power is on, put a fan in a window to blow mold-filled air to the outdoors. DO NOT use fans if the house is contaminated with sewage because the air movement could spread germs into other parts of the house.

2. BEFORE WORK BEGINS

Purchase and order tools and supplies

Make a list of all supplies you will need, including personal protective equipment and order them ahead of time. See Appendix 1 for a checklist of supplies and materials.

Plan for trash removal

Know how your community is handling the pick-up of flood-damaged debris. If debris left on the curb will not be hauled away by the community, make plans to rent a dumpster or have a contractor haul the waste for you. Where debris piles are an approved practice, mark piles with caution tape.

Set up a storage area for items to be saved

If belongings will be saved, determine how much storage you need for those items. If they cannot be stored at the home, make plans for moving and storage at another location. Personal belongings that come from mold-contaminated areas must be cleaned *before* moving to another location.

Set up electricity

Set up portable generators outside the home if the electrical system was flood-damaged and there is no other electrical source nearby. Portable generators should be placed at least 20 feet away from windows, doors, and air vents. Generators can create carbon monoxide hazards when used inside the home or too close to the home. If the home has electricity, hire an electrician to install one outlet box for construction, then shut off all the other electricity running through the house. You may also see if the local electric utility company can install an electric outlet box on a street pole that all the surrounding houses can use.

Secure the outside of the home from weather

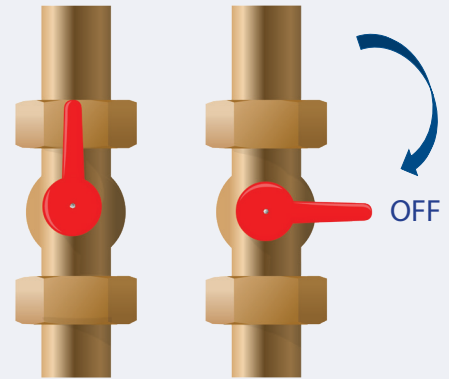
To avoid ongoing problems with mold, take measures to prevent rain from entering the home.

- Roof: If roofing is damaged, attach a heavy tarp securely.



GAS LINES

Before any work is started, be sure all gas lines are in the off position.



off your gas at the meter. Many utilities advise that only professionals should shut off gas. Other utilities acknowledge that at times of overwhelming demand, it may be necessary for owners to shut off their gas at outdoor meters when gas appliances have been flooded. The gas is shut off when the valve head is perpendicular (crosswise) to the pipe. *Once shut off, ONLY an authorized professional should turn gas back on and relight pilot lights on applicable appliances.*

Bathroom access

You must have a working bathroom. If the bathroom in your house is not usable and there is no public bathroom nearby, rent a portable toilet. The portable toilet can be shared by several neighbors. Set up a safety and cleanup area next to the toilet.

- Exterior siding: Cover missing siding with tear-resistant housewrap. Layer housewrap from the bottom of opening to the top so rain will run off the covering. Attach with cap nails. Seal seams and edges with construction tape to keep rain out.
- Windows: Cover broken windows with heavy (6 mil) plastic sheeting. Secure edges with wood strips.

Pump Out

If more than six inches of standing water is in the basement or crawl space, prepare a water removal plan. Assume that the water is contaminated and wear proper personal protective equipment. Ventilate the area well and make sure the electricity is turned off at the electrical panel. Wait until outdoor floodwaters have receded.

Pump out one foot of water, mark the water line, and wait overnight to see whether water returns. The basement walls can collapse if there is a lot of water in the ground outside of basement and the basement water is pumped out too quickly. If the water level does not rise, pump out *half* of the remaining water and wait overnight. Again, if the water level does not rise, it is safe to pump out the remaining water. When there is less than six inches of water, water may be pumped out or vacuumed out in one day. See <https://www.fema.gov/news-release/2003/07/22/fema/sema-after-flood-home-maintenance-series-1-be-careful-when-pumping-out> for more information.

If you have natural gas, contact your utility company

Follow guidance from your natural gas service provider about whether you, as the homeowner, should shut

3. SITE PREPARATION

Set up a safety and cleanup area

Set up a safety and cleanup area outside the home that includes the following:

- First aid kit
- Fire extinguisher
- Cleanup buckets
- Eye wash station
- List of emergency phone numbers
- Drinking water

Use the cleanup area as a place to wash before taking a break. In hot weather, take breaks every hour to avoid dehydration and heat exhaustion. Have bottled water on-site and drink it regularly. Use the safety and

cleanup area to treat minor accidents, such as cuts and punctures.

Put on your personal protection equipment

Put on your personal protective equipment (or “PPE”): coveralls, boots, gloves, respirators, eye protection, and head protection. If possible, have partners help you in and out of your coveralls and help you adjust your respirators. Make sure the respirator is working: Cover the filters with your hands completely and attempt to inhale; the respirator is working if no air enters.

Minimum PPE Required

Wear at least:

- a cap
- safety glasses
- an N95-N100 respirator

Keep all of your PPE on when in the home. For breaks, leave the home and remove your PPE in the cleanup area. Wipe or wash your hands and face before eating, smoking, or engaging in other activities. Remember to put your PPE back on before re-entering the home.

Keep clean areas separate from work areas

Separate storage or living space from the rest of the work area by hanging sheets of clear plastic polyethylene sheeting ("poly"). Second floors that have no water damage or mold may be good places for storage. DO NOT store moldy items in the home. Dispose of these items or take them to a separate cleaning area.

Set up a table for things to be saved

Set up a table outside of the house where you can store small objects until you can decide whether they can be cleaned and saved.

Lay a plywood path

Set up a plywood pathway throughout the house if there was major damage to floorboards or if there is the possibility that they are not safe to walk on (not structurally sound). Cut plywood into two-foot by eight-foot sheets (2' x 8') to build the pathway. If the entrance has steps, nail the plywood in place as a ramp to cart wheelbarrows with debris out of the home.



PUT ON YOUR PPE



PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Hat or hood
- Respirator
- Breathable polypropylene coveralls with elastic wrists and ankles
- Gloves
- Shoe covers (nonskid), or high-top shoe covers



CLEANUP STATION





CLEAN-ROOM CONTAINMENT SYSTEM

1 First, cover the opening with 6-mil plastic. Reinforce the top two corners with duct tape and staples, then seal the perimeter with masking tape. It's important to make several folds so that the plastic is not taut.



2 Next, duct tape the bottom to the floor and staple the corners.



3 For passage, cut a slit in the plastic beginning about six inches (6") above the floor to about six inches below the door header.



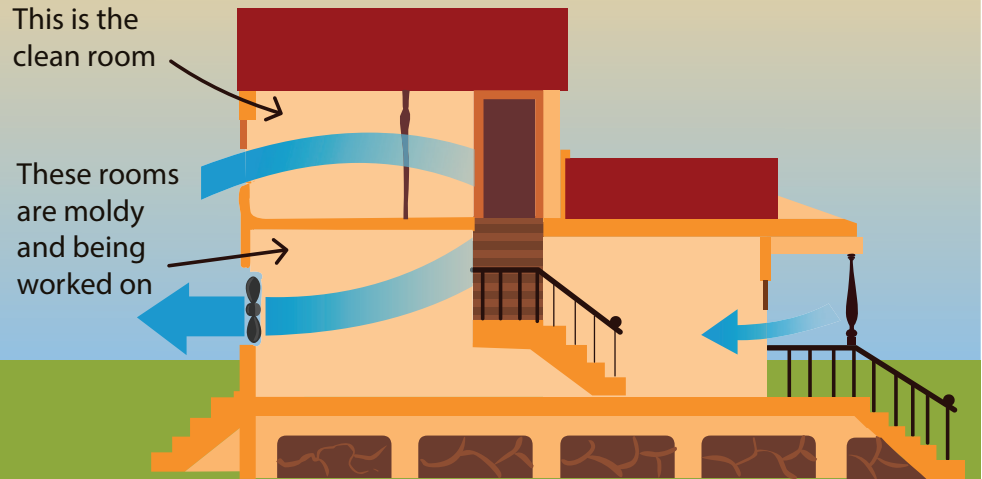
4 Finally, tape a sheet of plastic, as wide as the opening, to the door header (not to the sides or bottom). Let the sheet hang a couple of inches from the floor (this works better if it's thin plastic). Attach this flap to the clean-room side; the air current will blow from the clean-room side, pressing it against the cut opening.





CLEAN-ROOM SETUP

Set up a strong window fan in a first-floor window blowing out. Set up the clean-room containment system on the doors of the second-floor rooms. (It would be dangerous to put this system at the top of the stairs).



4. CLEAN-OUT

If you are saving items, move them to the restoration area as you work (see Section 7 for restoration procedure).

Air out

If the building has not been opened, open most windows and doors and leave the property for at least 30 minutes before beginning work. Remove any drapes or curtains to allow air and light to get into the home.

Muck out

If the home contains mud and silt, shovel it out before it dries and hardens. In cases where mud has hardened, wet the debris with a hose to assist with removal. Use as little water as possible.

Remove small furniture and objects on floor

Place smaller items in heavy-duty trash bags to reduce the release and spread of mold spores.

Remove large furniture

Move large furnishings to the curb or dumpster. If you have access to dollies or wheelbarrows, use them to lessen muscle strain. When lifting, remember to lift with your legs and not your back to avoid back injuries.

Remove appliances

Tape or tie refrigerators shut before removal to avoid

spilling old food containing mold and bacteria. Make sure refrigerator doors stay tied or wired shut securely to keep children from playing in them.

Cut and remove wall-to-wall carpet

Remove wall-to-wall carpeting that is wet. Dry carpeting can remain on the floor as a “tarp” when you remove building materials from the walls and ceilings. The carpeting will protect the flooring under the carpet. Using a carpet cutting knife, slice carpeting into pieces before removing.

Clean out closets, shelves, storage areas, and kitchen cabinets

Pots, dinnerware, buckets, and other containers filled with floodwaters may contain dangerous bacteria. Remove them carefully. Again, place smaller items in heavy-duty trash bags to reduce the release and spread of mold spores.

Minimum PPE Required

Wear at least:

- a cap
- safety glasses
- half-face negative pressure respirator

Also wear:

- rubber boots
- water-resistant gloves

5. GUT TEAR-OUT PROCEDURE

Many damaged homes contain valuable historic materials (such as doors, trim, and stairs). These materials are usually of higher quality than what you can buy as a replacement. Try to save historic materials that are in good condition and can have the mold removed. Solid wood can normally be cleaned and restored. It may also be possible to dry and clean plaster in good condition if it covers an open wall cavity without insulation. However, remember that it may be cheaper to dispose of building parts that have been damaged by the flood or mold growth. If you choose selective tear-out, see Section 7 (page 17).

Minimum PPE Required

Wear at least:

- a cap
- safety glasses
- half-face negative pressure respirator

Also wear:

- rubber boots
- water-resistant gloves

Remove and dispose of cabinets, shelves, doors, and trim

Remove interior doors and either store them for cleaning or throw them out. Pull cabinets and trim from walls. Remove the trim first, then the drywall. Bend over all protruding nails when you remove trim to avoid puncture wounds. (Note: If you have not received a tetanus shot within the last 10 years, you'll need to see a medical professional for a vaccination.) Dispose of long boards by laying them on a piece of rope and then tying them into a bundle.

Remove drywall from walls

Score drywall with a utility knife along the four-foot mark where the top and bottom pieces of drywall were taped together when the wall was built. Then pull out the drywall with the hook of the crowbar.

Remove drywall in the largest pieces possible to create less dust. Two people can work together to pull sheets from the wall. Once you've opened an inside wall, push the drywall into the next room. Remove any nails and screws still protruding from the studs.

Tear down drywall or plaster ceiling

If you cannot see mold growth on either side of the ceiling, it may be possible to save the ceiling. If you plan to tear the ceiling down, work from a ladder that is almost as tall as the ceiling; this stops the ceiling from coming down on top of you. Keep your head above the ceiling surface and push downward with a crowbar.

Remove plaster from walls

If electricity and a reciprocating saw are available, cut through the plaster and lath between studs. Using a pry bar, pull the plaster and lath away from studs. Two people working on either end of cut laths makes this much easier. Before cutting, make sure electricity in the wall is not on.



TEARING DOWN A PLASTER OR DRYWALL CEILING

Additional PPE Required

Also wear:

- a hard hat

Work from a ladder that allows you to have your head above the ceiling while also standing at least two treads from the top of the ladder. Using a crowbar, push the ceiling down from above. Have a second person serve as a spotter when you do this work, standing immediately behind your ladder.



If a saw and electricity are not available, use a pry bar to punch through walls and pull down lath and plaster. Most of the removed lath should fall on top of the removed plaster. Bundle the lath separately and remove it. Then shovel the plaster into large cans for disposal in a dumpster or heavy-duty bags for curbside pickup.

Remove insulation

Place insulation in heavy-duty trash bags and dispose of it.

Assess and remove layers from floor, when necessary

When nonporous flooring (such as ceramic tile, non-paper-backed linoleum, or wood plank) is attached to a concrete subfloor, leave the flooring in place. If this type of flooring has separated from the concrete, removal is generally required. When this flooring is not damaged and can be dried, it may be possible to salvage it for reinstallation.

Most vinyl, laminate, or engineered wood flooring has paper or composite wood backing and must be replaced. Remove any carpet and padding. Inspect

ASBESTOS FLOOR TILES



Large square floor tiles (e.g., 9" x 9" or 12" x 12") in pre-1980s homes may contain asbestos. Under normal conditions, these tiles should be removed by licensed asbestos workers. It may be a violation to remove these tiles other than as part of an asbestos project. Whenever possible, leave tiles that may contain asbestos in place; however, if you cannot avoid disturbing these tiles during the interior cleanup, understand that water-soaked tiles will release lower levels of asbestos than dry tiles. Try to remove the tiles intact. Avoid breaking or cutting the tiles. After removal, vacuum the area with a HEPA vacuum (see below) before sweeping.

the subfloor; remove composite subflooring, such as oriented strand board (OSB). Subflooring made of plywood or solid-wood planks that are not badly water damaged can be dried and saved. When subflooring is removed, inspect the structural floor for its stability.

6. PRE-CONSTRUCTION CLEANING AND TREATMENT

Prepare surfaces

Remove any remaining nails and screws from studs and ceiling joists.

Clean all surfaces

Prepare a non-phosphate multipurpose cleaner or detergent in a bucket following the instructions on the cleaning product label. (See page 16 for information about cleaners.) Starting at the ceiling, wipe with a scrub brush, sponge mop, or hand sponges until all visible dirt and stains are removed.

During wet cleaning, use the least amount of water possible to avoid soaking the building materials. Should the wood become very wet, let it dry completely before taking the next steps. Wet surfaces that do not dry completely may grow new mold.

Vacuum all surfaces

After wet cleaning is complete, let the surface dry and let any airborne dust and mold spores settle. Clean all surfaces with a vacuum equipped with a high-

efficiency particulate air (HEPA) filter to remove the settled dust and mold spores. This is an important step if lead-based paint or asbestos may have been disturbed.

Disinfect all hard (nonporous) surfaces

Nonporous surfaces that have been exposed to floodwaters may be contaminated with bacteria. Mold spores may have also settled on these surfaces. Prepare a disinfectant following the instructions on the label. (See page 16 for section about disinfectants and a special note about the use of household bleach.) Never mix disinfectants with other chemicals. For example, household bleach and ammonia create a toxic gas, and other chemicals can render the disinfectant ineffective.

Minimum PPE Required

Wear at least:

- a cap
- safety glasses
- half-face negative pressure respirator

Also wear:

- rubber boots
- water-resistant gloves

Apply the disinfectant with a microfiber cloth or mop. Allow the disinfectant to stay in contact with the surface for *at least the minimum time* specified by the label. For example, the standard minimum contact time for household bleach on nonporous surfaces is 10 minutes. Also review the label for guidance on whether the disinfectant should be wiped off the surface at the end of the contact time or if air drying is acceptable.

Treat porous wood surfaces with a borate solution

Products with borate salts can help prevent mold from reemerging on porous surfaces. The borate salts soak into the wood and create a less favorable environment for mold to settle and grow.

Manufacturers recommend applying the product when the wood is not totally dry. A wetter surface helps the wood absorb the borate salts. Treat the open wall cavities with a penetrating borate solution prepared to the manufacturer's directions. Products that contain the ingredient *disodium octaborate tetrahydrate* (borate salt) have been demonstrated to be effective. For best coverage, apply borate solutions with a pump tank sprayer. A paint brush, paint roller, or trigger spray bottle may also be used.

Dry out the building

Make sure that the home is allowed to dry completely before beginning restoration. Depending on how dry the home is before the cleanup begins, natural ventilation may produce a dry home in a couple of weeks or a few months. If electricity is available, use fans, dehumidifiers, and window air conditioners to speed the drying process.

Have the contractor who will restore the home check the moisture content of wood framing to be sure it's dry before enclosing walls or finishing flooring. Wood studs or framing with less than 15% moisture content are considered dry.

Treat remaining wood studs with fungicidal coating (special cases)

Before beginning reconstruction in areas where repeated exposure to water is likely or in homes with an occupant that is highly sensitive to mold, paint dried wooden studs and beams with a low-toxicity, vapor-permeable fungicidal protective coating as a final treatment to prevent mold growth. Note that treating wet wood can lead to wood rot. Fungicidal coatings are not normally recommended.



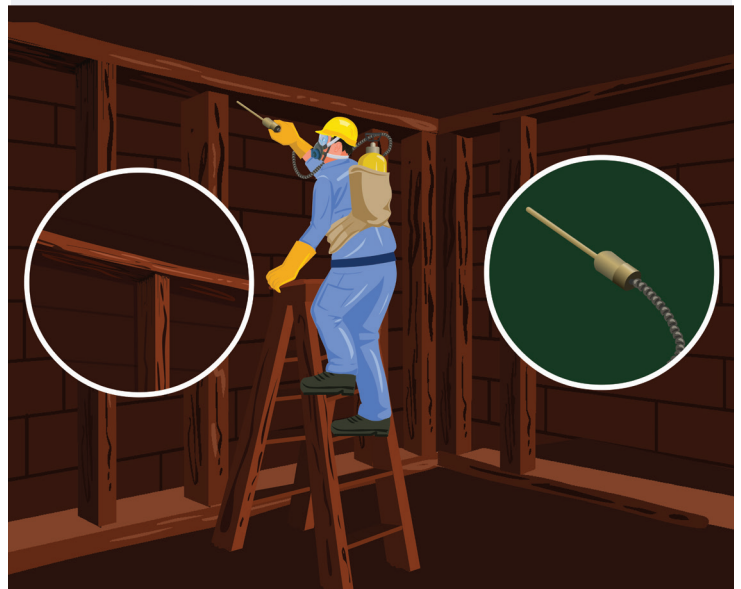
VACUUM ALL SURFACES

After wood framing is thoroughly brushed or scraped, carefully vacuum all surfaces. Use a corner tool to access tight spaces.



BORATE TREATMENT

The borate treatment will last many years if applied correctly, protecting the house from mold, termites, and wood rot. Many of the most important spots to treat are the hardest to reach. This is particularly true of the end-grain of structural members that butt against another structural member (for example, studs against top and bottom plates).





A SPECIAL NOTE ABOUT CLEANING, DISINFECTING, AND HOUSEHOLD BLEACH

REMEMBER - Cleaning and disinfection are TWO separate steps.

1. **CLEAN THE SURFACE:** Cleaning is the process of removing dirt and mold from a surface. Use cleaning products that are most effective at separating the dirt from the building material. **BLEACH IS NOT A CLEANER.** Disinfectants are much less effective when the surface is dirty. Clean first, then disinfect.
2. **DISINFECT THE SURFACE, WHEN NEEDED:** Disinfectants are used to kill harmful microorganisms like bacteria, viruses, and mold. Disinfectants are not necessary when a surface is porous or inaccessible to residents after a rebuild (such as inside a wall cavity). Disinfectants are only recommended for use on nonporous surfaces (such as countertops, bathtubs/showers, and sinks) and are less effective on porous surfaces (such as wood and drywall).

For the “10 Steps for Safe and Effective DIY Mold Removal,” see pages 51-52 of HUD’s *Rebuild Healthy Homes* [link: http://bit.ly/HUD_Rebuild].

Cleaning Products

Effective cleaning products contain a cleaning agent (also known as *detergent* or *surfactant*) that helps separate the dirt from the surface. Products labeled as all-purpose cleaners or multisurface cleaners are generally effective for post-flood cleanup. They are readily available. They tend to have ingredients that increase their pH levels. Higher pH cleaners help clean oily/greasy surfaces. Dish detergents are also cost-effective cleaners but are chemically neutral. Do not buy cleaners with phosphates, because phosphates can harm the environment. Avoid cleaners with added disinfectants. They aren’t needed at this stage and don’t help clean.

Disinfectants

Disinfectants are used to kill harmful organisms like bacteria, viruses, and mold. Disinfectants attack all organic substances. Remove organic matter, like dirt from decayed animals or plants, before using disinfectant to kill bacteria or mold. Disinfectants are less effective on porous surfaces like soft wood. Choose products that are registered with the U.S. EPA as disinfectants for bacteria. Household bleach is commonly used, but it has risks (see next panel). Some federal agencies encourage the use of alternatives to bleach. Guidance on reading disinfectant product labels is found below.

Household Bleach

Household bleach is the product used most often for flood cleanup. When mixed according to directions, it is one of the most powerful and least costly disinfectants; however, it must be used with caution:

- It is an irritant. Wear your PPE, including eye protection, and *never spray bleach*.
- It can create a toxic gas if mixed with ammonia. *Do not mix bleach with other products.*
- It is corrosive to metals, including electrical wiring.
- It loses effectiveness once mixed with water; discard any unused bleach solution at the end of the day.

Understanding a disinfectant product label

When selecting a disinfectant, always read the label in detail. Use an EPA-registered product with the demonstrated ability to disinfect (kill) bacteria often found in floodwaters including *Escherichia (E. coli)*, *Salmonella*, *Shigella*, and *Staphylococcus*. A label reviewed and approved by the EPA should specifically say the product is a disinfectant and state that “This product has been tested and found effective against the following microorganisms.” The label will also state whether the product should be mixed with water and if so, the proper ratio to act as a disinfectant. Finally, the label should state the minimum time the product must be on the surface to be effective; this is known as the *contact time*.

Mold: Manufacturers that claim their product kills mold and keeps a surface free of a type of mold for at least seven days need to submit test data to EPA. These products are labeled fungicides. In 2012, EPA issued draft guidance that manufacturers did not have to submit test data in order to claim their products inhibited mold growth. Products that reduce or inhibit mold growth are labeled *fungistats* or *mildewstats*. Some products are fungicidal for athlete’s foot fungus but not for surface molds like *Aspergillus niger*. Always follow the directions to use chemicals properly and apply the product for the minimum contact time.

Products may contain different active ingredients (such as quaternary ammonium compounds, phenols, bleaches, essential oils, acids, or alcohols) to disinfect. All ingredients have risks; follow the label directions for safety.

7. SELECTIVE TEAR-OUT AND PREPARATION BEFORE RESTORATION

Clean up as you go

Every piece of moldy material you encounter can recontaminate the work you have done. As you work, remove large objects from the building and place smaller objects in heavy-duty trash bags.

Open attic

Ventilate the attic if you plan to save a plaster or drywall ceiling. If there is no access hole, cut one into the ceiling in a closet.

Open crawl space/basement

If outdoor humidity is not high, air out crawl spaces and basements. At a minimum, create openings at the opposite ends of the crawl space. If electricity is available, set up a fan to blow air out of the opening at one end; this will pull air through the space. If a commercial dehumidifier is available, it can be kept running in the crawl space/basement until the space is dry. A dehumidifier is the best option when outdoor humidity is high. Because this space may be contaminated, wear maximum protection whenever you have to enter it.

Drywall

Paper-backed drywall that has been underwater must be removed. If the floodwaters were high or mold damage is extensive, remove all of the drywall to the ceiling.

If there has been less than 18 inches of flooding and there is no insulation in the wall cavity, drywall may be removed to the four-foot line. Drywall is sold in four-foot sections. NO MOLD must be visible above the four-foot line on both the inside and outside of the wall for this option to be safe.

Plaster walls

If the plaster is sound on the walls facing the outside and there is no insulation in the wall, try to save the plaster walls. To dry wall cavities, remove the baseboard, then remove plaster to just below the top of the baseboard. This will allow the repairs to remain hidden by the replacement trim.

Wood paneling

Remove paneling. If intact, it can be cleaned and reinstalled later.

Insulation

All flooded and moldy fibrous and open-cell foam insulation must be removed. Dispose of insulation in heavy-duty trash bags. Closed-cell foam insulation that can be cleaned and dried may be salvageable.

Kitchen cabinets and countertops

Kitchen cabinets made of pressboard or other composite boards that have gotten wet are not salvageable. Cabinets, especially top cabinets, made of plywood or wooden boards may be saved. You can save and reuse the countertop, kitchen sink, working fixtures, and plumbing when you replace the base cabinets.

Kitchen and bathroom fixtures

Use a disinfectant to kill any remaining mold and other contaminants on hard surfaces that will stay in the home. Damp wipe all surfaces including tubs, bath and kitchen fixtures, countertops, and vinyl or tile floors with a disinfectant.

Wood flooring

Hardwood floorings can be saved if the underside can be dried out. Remove all overlayment material as quickly as possible to allow the top surface to dry. Consult with a flooring expert when dealing with tongue-and-groove flooring.

Ceramic flooring

Ceramic flooring laid directly onto cement/concrete slabs may require only cleaning, followed by disinfection. Remove and dispose of any ceramic flooring installed on plywood or presswood subflooring that is now damaged.

Wood windows, doors, and trim

Wet scrape all wood to be saved or scrub it with a wet abrasive sponge to remove loose paint. Follow [lead-safe work practices in pre-1978 housing](#).

Scrub the surface with a cleaning solution. Vacuum the surface and let it dry completely.

Minimum PPE Required

Wear at least:

- a cap
- safety glasses
- half-face negative pressure respirator

Also wear:

- rubber boots
- water-resistant gloves

Treat doors and windows in this way:

- Remove doors if they are swollen and heavily damaged. Doors in older buildings made from old-growth lumber are valuable and can usually be saved; have these doors professionally restored.
- Secure the top window sash to the window frame by screwing a metal bracket or block of wood under the top sash to hold in place. Paint the sash as part of exterior surface. Bottom sashes may need to be removed and restored before hanging against new window stop molding.

Heating, ventilation, and air conditioning (HVAC) systems

Consult an HVAC professional before the system is used. In most cases, it is best to leave the restoration

of HVAC systems to professionals. In homes with ductwork, ask that the professional follows the guidelines described in the [National Air Duct Cleaners Association's ACR: The NADCA Standard for Assessment/Cleaning/Restoration of HVAC Systems 2013](#).

Remove and discard all insulation and filters in ductwork and air handling equipment that was under water. Other components should be disinfected or replaced. In addition:

- Inspect the inside and outside of air handlers and ducts that were not under water for signs of mold.
- Clean the ducts to remove mold spores and other debris.

8. RESTORE POSSESSIONS

Wood furnishings

Use a soft sponge or cotton rag with clean water to remove visible dirt and mold, then blot away all excess moisture with clean cloths or paper towels. Next, wash the furniture using a wet cleaning solution. Allow the wood furnishings to air dry. If the upholstered furniture or bed frames are valuable, pull out all tacks and staples, remove and discard all the cloth and padding, and then treat wood according to these guidelines.

Clothing, drapery, and other cloth materials

Clothes should generally be thrown away after flooding. If clothing and other cloth materials will be saved, remember that they may contain mold or other contaminants from the floodwaters. Wash clothing in a washing machine, not by hand. Wash clothes with chlorine bleach according to label instructions for colorfast fabrics or use a color-safe bleach alternative. Dry cleaning may also be used, especially for special fabrics, such as wool and silk.

China, glass, jewelry, porcelain, and metal possessions

Damp wipe these items with a wet cleaning solution or clean them in a dishwasher to remove dust and superficial mold. Soak or wipe items with a disinfecting solution and rinse after five minutes. Do not use bleach solutions on metal, because bleach is corrosive. Wipe the items dry, and be sure that they

have dried completely before moving them to storage. Pots, dinnerware, buckets, and anything else that was filled with floodwater can contain harmful bacteria and need to be removed carefully.

Electric appliances

Unplug appliances and leave open to dry. Have them inspected by a competent appliance repairperson before reusing.

Small valuables

Photos and papers may be frozen in zippered plastic freezer bags and stored until a professional restoration expert can recommend what to do with them. Valuable artwork can be HEPA-vacuumed to remove surface mold, then wiped with damp paper towel and air dried. A tack cloth may be used to hasten drying.

For additional guidance, refer to FEMA's [Salvaging Water-Damaged Family Valuables and Heirlooms](#).

Minimum PPE Required

Wear at least:

- a cap
- safety glasses
- an N95-N100 respirator

Also wear:

- rubber boots
- water-resistant gloves

APPENDIX: SUPPLIES AND MATERIALS

Worker Protection

- N95 or N100 respirator with exhaust valve
- Half-face negative pressure respirator with HEPA filter canisters or powered air hood respirator
- Heavy-duty, cut-resistant waterproof gloves
- Nonwoven polypropylene disposable coveralls (with attached hood and foot cover)
- Goggles or safety glasses with side shields
- Cap with brim
- Nonskid shoe covers (300 to a case)
- Personal cleanup station
 - Two 16-ounce eye wash bottles
 - First aid kit (OSHA-compliant for four workers)
 - Fire extinguisher
 - Three two-gallon buckets
 - Pump pressure sprayer
 - Pump soap
 - Case of bottled drinking water
 - Paper towels
 - Toilet paper
 - Emergency phone number sheet

Tools

- Carpet cutter with extra blades
- Utility knives
- Front-end nipper (to pull nails)
- Large crow bar
- Long-handled flat bar
- Short flat bar
- Staple gun
- Cat's paw nail puller
- Mop wringer bucket
- Three five-gallon buckets (one as a rinse bucket, two as mixing buckets for borates)
- Two 2.5-gallon pump sprayers for borates
- Mop handle for 32-ounce mophead
- Broom and dustpan
- Bright flashlight

- Tool belt/apron and tool belt tools (including hammer, measuring tape, scratch awl, flat-blade Phillips screwdrivers, carpenter's pencil, utility knife, et cetera).
- Sawhorses
- Crosscut hand saw
- Brace and bits (where there is no electrical service)
- Drywall saw
- Moisture meter

Supplies

- Contractor trash bags
- Heavy-duty trash bags
- Extra bags for vacuum cleaner
- Two large heavy-duty garbage cans with caster
- Roll of 10-foot wide 6-mil plastic sheeting
- Staples for staple gun
- Rolls of duct tape
- Scrub brushes
- Carbon blade scrapers
- Cardboard boxes to store cleaned objects
- Spray mist bottles
- Replacement utility knife blades
- Reflector lamp and 100-watt light bulbs
- Box of disposable gloves
- 32-ounce mopheads
- Nonphosphate detergent or all-purpose cleaner
- Disinfectant
- Borate product (with disodium octaborate tetrahydrate)

Equipment

- Portable generator
- 20-foot extension ladder
- 8-foot A-frame ladder
- Dehumidifier
- Window fan
- Lock box
- Shop vacuum with HEPA filter

**National Center for
HEALTHY HOUSING**



This field guide was made possible through a contract between the National Environmental Health Association and the National Center for Healthy Housing, funded through cooperative agreement between CDC's National Center for Environmental Health and the National Environmental Health Association (CDC-RFA-OT18-1802: Strengthening Public Health Systems and Services through National Partnerships to Improve and Protect the Nation's Health).

The contents of this document are solely the responsibility of the authors and do not necessarily represent the official views of the National Environmental Health Association or the Centers for Disease Control and Prevention.

As noted in the acknowledgements, we continue to be grateful to supporters of the original work including The Robert Wood Johnson Foundation, NeighborWorks® America, and the Neighborhood Housing Services of New Orleans.