



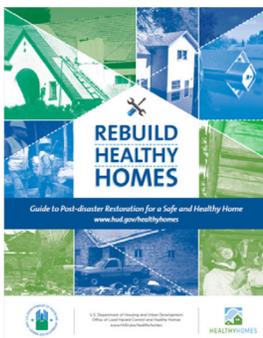
Safe and Healthy Recovery and Rebuilding: A Guide for Caribbean Homes

Puerto Rico Edition

This booklet is a summary of a longer guide to keeping or restoring a home after a natural disaster for families located in Puerto Rico. This guide is a helpful

introduction for stakeholders to protect and restore homes after a natural disaster. It includes how-to methods, tips and ideas for safe recovery, restoration, and rebuilding that will result in a healthier home for the families you assist and serve. You can access the full guide to this summary booklet at: hud.gov/info/disasterresources

Other helpful guides for your agency:



Rebuild Healthy Homes: Guide to Post-disaster Restoration for a Safe and Healthy Home. This is a 74-page booklet published by the U.S. Department of Housing and Development that expands on the methods and procedures for post-disaster recovery of dwellings. Website: <https://bit.ly/3gayCeJ>

Keep Safe: A Guide for Resilient Housing in Island Communities. Published by Enterprise Community partners, this book is 480 pages and is an extensive resource for agencies and communities on disaster preparedness, recovery, and rebuilding. Website: <https://bit.ly/3geCTxM>



Types of Natural Disasters Causing Damages to Homes

- Floods: the most common natural disaster, damage includes mold, contaminated water, structural damage and collapse, damage to finishes and furnishings.
- Hurricanes and Tropical Storms: produces extreme rainfall, storm surges, sustained very high winds with flying debris; damage may be widespread and affect thousands of buildings especially roofs, walls, windows, and entire building collapse, severe water damage.
- Earthquakes: sudden and violent ground movement leaving moderate to major structural damages. They can also result in landslides, floods, fires and tsunamis; damages may include structure collapse, shifting of buildings, and explosion from gas leaks.
- Wildfires: damages range from destruction by fire, to smoke, ash and soot deposits and/or charring of materials; firefighting efforts can result in water damage.
- Tsunamis and Storm Surges: coastal flood events from hurricanes and earthquakes, and they produce similar damages.
- Extreme Heat and Drought: can cause soil shrinkage, resulting in uneven settling and foundation cracks, leading to structural damage of walls, floors and roofs.
- Mudslides/ Debris Slides: usually happen after a long period of rain or an intense storm; damages range from modest damage to foundations and roofs to complete destruction.

Creating a Plan for Safe Cleanup, Repair and Restoration of Homes

An important first step in the recovery process is to plan ahead before starting any cleanup and recovery operations. Your work sequence should progress in the following phases.

1. Protect yourself first and foremost.
2. Assess the damages and hazards.
3. Create a work plan.
4. Prepare the worksite.
5. Clean, remove damaged materials, and decontaminate.
6. Restore and improve the home.

1. Protect yourself - safety and Personal Protection Equipment (PPE)

Most important of all, take care of yourself and your health and safety first, throughout the process of cleaning up and restoring a damaged home. Don't hesitate to seek medical attention for any signs of illness, infection or injury after a disaster and during clean-up.

You should choose personal protective equipment (PPE) to protect each part of the body that might be exposed to hazards:

Eyes: goggles or safety glasses with side shields, or a full-face shield.

Ears: earplugs or earmuffs in high noise work areas.

Feet: rubber boots (in wet areas) or disposable non-skid shoe covers over work boots that have a steel toe and thick, hard sole.

Head: a cap with a brim or other protective head cover. Wear a hard hat if there is a chance of falling debris, bumping your head, and when working on the roof or tall ladders.

Hands: strong, waterproof gloves designed to protect hands from cuts, chemicals, temperature extremes, and abrasions.

Body: disposable coveralls preferably with elastic wrists and ankles. If you can't obtain disposable coveralls, bring a set of work clothes and shoes to the site. Change into them before entering the work area, and remove them before going home. Wash work clothes, including shoes, separately from other clothes.

Nose and lungs: a respirator (not a dust mask!) rated for the types of hazards you may encounter. A NIOSH-approved rubber half-face respirator with a High Efficiency Particulate Air (HEPA) filter rated N100 or P100 is highly recommended.



A good tip is to buy these items before the disaster and place in secure storage that can survive the disaster.

Special Concern: Mosquito-Borne Viruses

Mosquito-borne diseases are those spread by the bite of an infected mosquito. Diseases that are spread to people by mosquitoes include Zika virus, West Nile virus, Chikungunya virus, dengue, and malaria. Recovery agency personnel and all other workers on site (including the families occupying the home) should protect themselves from diseases spread by mosquitoes. Although people may not become sick after a bite from an infected mosquito, some people have a mild, short-term illness or (rarely) severe or long-term illness. Severe cases of mosquito-borne diseases can cause death.

The Centers for Disease Control (CDC) has the following recommendations to reduce exposure to mosquitos and related illnesses:

- Use EPA-registered insect repellents (<https://www.epa.gov/insect-repellents>) with one of these active ingredients: DEET, picaridin (known as KBR 3023 and icaridin outside the US), IR3535, oil of lemon eucalyptus (OLE), para-menthane-diol (PMD), or 2-undecanone. Find the right insect repellent by using EPA's search tool (www.epa.gov/insect-repellents/find-repellent-right-you).
- If also using sunscreen, apply sunscreen first and insect repellent second.
- Permethrin can be applied to clothing and gear.
- Wear clothing that covers hands, arms, legs, and other exposed skin.
- Remove standing water to reduce places where mosquitoes lay eggs.
- Workers who develop symptoms of a mosquito-borne disease should report this promptly to their supervisor and get medical attention.

2. Assess the damages and hazards

Right after the disaster is diminished enough to start recovery operations, personnel should begin assessing the damage to the region, town, and individual homes. When assessing damages and hazards, consider documenting structural stability, safety risks and hidden health threats. Specialists may be needed (engineers, architects, building code officials) to conduct inspections and make the home safe to enter and restore.

- Assess Structural Stability.
- Inspect for Creatures, Chemicals and Bio-Hazards.
- Inspect Utilities: Electrical, Gas and Water Supply.
- Assess and Reduce Health Hazards During Recovery, Repair, Rebuilding, and After.

As the cleanup and recovery operations begin around and inside the homes, you will possibly encounter many toxins and unsafe conditions that you should avoid or work around. Some of these health hazards will still be in and around the home AFTER initial recovery operations are complete. Familiarize yourself and the clients you serve with the Eight Principles of a Healthy Home. These principles guide disaster recovery, repair, restoration, and rebuilding.

- **Keep it Dry**
- **Keep it Contaminant Free**
- **Keep it Pest Free**
- **Keep it Safe**
- **Keep it Clean**
- **Keep it Well Maintained**
- **Keep it Well Ventilated**
- **Keep it Temperature Controlled**

Learn about the common toxins and hazards that are often present during cleanup after disasters, repair and rebuilding operations, and sometimes after the home is occupied by the family.

- Lead
- Mold and Moisture
- Pests
- Asbestos
- Carbon Monoxide
- Toxic Chemicals

To avoid being exposed to deadly carbon monoxide, never use a generator, pressure washer, or any gasoline-powered engine inside a home or less than 20 feet from any window, door, or vent. Use an extension cord that is more than 20 feet long to keep the generator at a safe distance! When using a generator, use a battery-powered or battery backup Carbon Monoxide detector in the home!

3. Create a work plan

Plan tasks, supplies, professional services, disposal methods, site layout, and power sources. Get supplies and tools in advance. They may be easier to find outside the disaster area.

Be sure to obtain all required permits and approvals - including from building code offices, local, territory, and federal agencies – before construction begins! If exterior materials are damaged or missing, temporary weather barriers should be installed as soon as possible to prevent water intrusion that could cause further damage.

A good plan includes the following information:

- Supplies and Materials
- Electricity
- Storage Areas
- Disposal Areas
- Site Planning

The full guide has a handy checklist to use in creating a thorough work plan.

4. Prepare the worksite

A planned work site will help you and other workers be productive and stay safe. This includes:

Install temporary weather barriers: If the roof, exterior walls, windows or doors are damaged or missing, cover with temporary weather barriers or tarps as soon as possible to prevent further damage from water entry. If any siding, masonry, or panels are missing, cover the damaged section with a tear-resistant weather barrier (housewrap). Wrap it across the damaged wall in layers from the bottom to the top of the wall so the layers overlap shingle-fashion. Secure the weather barrier with nails and seal seams and edges with a compatible construction tape or caulking.

Provide basic necessities:

- Non-contaminated water supply for washing and drinking.
- Wet wipes for cleaning hands and face.
- Toilet.
- A fire extinguisher rated ABC minimum.
- Cleanup station.
- A place to take breaks away from the work area.
- Secured location for power for tools, lights and equipment away from water and moisture.
- A generator (placed outside because of the carbon monoxide hazard) unless electricity is safe to use in the home.
- Work lights.

Set up a containment area: Seal off work areas to isolate them from other areas. Keep clean areas separate from the work areas to minimize the risk of spreading contaminants and hazardous materials. Set up barriers, such as plastic sheeting, in doorways, over vents and other openings to create a containment area between the current work area and all adjacent clean areas. The containment area should have a window or other opening to the outdoors. Seal off air vents and any other openings into clean rooms with plastic sheeting or other disposable material and tape.

5. Clean, remove damaged materials, and decontaminate

Depending on the types and level of damage, the full process may need to be completed in phases. Use safe work practices that avoid releasing and spreading health hazards; protect you, your employees assisting

you; and the home's residents and their property. Training or qualified professionals are **required** for lead, asbestos and major mold hazards. For more information on the federal laws governing hazardous building materials (asbestos and lead) refer to these HUD guides:

- Asbestos: hud.gov/sites/documents/IEPWG_ASBESTOS_WORKER.PDF
- Lead: hud.gov/sites/documents/IEPWG_LEAD_WORKER.PDF

Steps for Demolition, Decontamination, and Cleaning:

1. If flooded, pump out water in stages (very slowly).
2. Remove damaged contents. Shovel out mud and silt before it dries.
3. Remove damaged, non-restorable building materials.
4. Eliminate or mitigate home hazards and toxins from the disaster.

Food: Throw away food that may have come in contact with flood or storm water; perishable foods that have not been refrigerated properly due to power outages; and those with an unusual odor, color, or texture.

Water: Do not use or let a family member use water that you suspect or have been told is contaminated to wash dishes, brush teeth, wash and prepare food, wash your hands, make ice, or make baby formula. Safe water for drinking, cooking, and personal hygiene includes bottled, boiled, or treated water. The local or island territorial health department can make specific recommendations for boiling or treating water in your area.

Clean and sanitize food-contact surfaces that have been flooded: Throw out wooden cutting boards, baby bottle nipples, and pacifiers if they have come in contact with flood waters because they cannot be properly sanitized.

Clean and sanitize food-contact surfaces: Wash with soap and hot, clean water. Rinse with clean water. Sanitize by immersing for 1 minute in a solution of 1 cup (8 oz/240 mL) of unscented household chlorine bleach in 5 gallons of clean water. Allow to air dry.

6. Restore and improve the home

Resilient homes are buildings that are intentionally built, repaired, and restored to be safer and stronger than conventional construction methods. Resilient buildings resist the forces of natural disasters, so that the home is much less likely to be damaged or destroyed by earthquakes, hurricanes, floods, or fire. Resilient construction is also durable to not only disasters, but the toll that normal rain, sun, heat, cold, and insects take on a home and a family's expenses for repair. Resilient homes are longer lasting than conventional homes and most are more energy-efficient and sometimes more environmentally sustainable.

Foundations: Before making any changes to a foundation, it is wise to hire a qualified professional to evaluate, and make suggestions on ways to repair and reinforce foundation walls to withstand the pressures of flooding, and the seismic forces of earthquakes. Cracked or settled foundations may require anchors, shoring, or underpinning. Best foundation improvements are systems that increase the stability of the footings from floods and settlement and are well connected to the building, have lateral bracing, and some flex and adjustability.

Wood treatment (borate): Borate treatments are a safer, eco-friendly alternative to toxic pesticides and wood preservatives. They can provide long-term protection from decay and destructive insects, including termites. Borate compounds can also deter mold growth while waiting for wood to dry after cleaning. Walls that have to be opened up due to removal of damaged drywall or siding presents a good opportunity to treat structural wood not normally accessible.

Backflow Prevention: Install a sewage backflow valve in the sewer line to protect the home and health of the family.

Damage-resistant materials: Restore with flood-resistant replacement materials, which also tend to be less vulnerable to mold. Examples include:

Floorings: Ceramic tile, solid vinyl tile or inlaid sheet vinyl with no paper backing; waterproof adhesives and mortars; decorative concrete, solid hardwood planks (not coated with an impermeable finish); and exterior grade plywood subflooring.

Interior walls: Paperless (fiberglass mat-faced) gypsum drywall with a moisture resistant core; removable wainscoting made of solid wood, plywood or fiber-cement panels; removable or composite trim. (Note: avoid using vinyl wallpaper since it can trap moisture in walls and lead to hidden mold.

Exterior wall cladding: Masonry; fiber-cement, vinyl, aluminum, or high-tech moisture-resistant composite sidings and trim with long warranties.

Openings (doors and windows): Metal or fiberglass-skin doors with closed cell insulation cores and composite framing; metal, fiberglass or vinyl frame windows.

Plumbing, Appliances and Equipment: Elevate appliances, equipment, wiring and outlets above the potential flood level. Place water heaters and exterior cooling and ventilation equipment on sturdy platforms. Wall ovens and front-loading laundry equipment should be placed high enough off the floor to protect them from shallow floods. Install flexible connections and piping for gas and water lines.

Walls: Use flood-resistant exterior materials, such as masonry (cinder block) or cement siding.

Roofs: If reroofing, remove all of the existing roof covering (above structure) and use a high-wind resistant metal (for sloped roofs) or waterproofing membrane (fluid or stick-on adhesive).

Structure (Continuous Load Path): If walls and roofs are open from rebuilding, add metal straps, anchors, and clips to strengthen connections of the wall to the foundation, to the roof or trusses, and between levels. When building or repairing damage, make sure the foundation and structural materials and connectors comply with local seismic building codes. Have a building code official, a licensed engineer or architect evaluate and design repairs and reinforcements of the foundation, wall and roof framing, structure and connections that hold them together. Unreinforced masonry walls are especially vulnerable to earthquakes.

Windows: Install wind-borne debris protections such as impact-rated shutters, removable panels or impact-rated window and door systems. If replacing windows, choose units with at least one pane of tempered glass.

Weather Barriers: When replacing windows, doors, siding or any wall penetration, upgrade the flashing system. Make sure everything is layered shingle-fashion with no gaps or tears. Use high performance caulks and sealants to reduce wind-driven water leaks.

Additional Resources

Territorial Information

Puerto Rico Bureau of Emergency and Disaster Management

PR Road #1 Km. 24.5 Barrio Quebrada Arenas, San Juan, PR 00926
787-724-0124 <http://manejodeemergencias.pr.gov>

American Red Cross – Puerto Rico Chapter

José Celso Barbosa Street Puerto Rico Medical Center Río Piedras, PR 00935
787-758-8150
<https://www.redcross.org/local/puerto-rico/conocenos/contactos.html>

Puerto Rico State Historic Preservation Office

787-721-3737
<http://www.oech.pr.gov/Pages/default.aspx>

AARP Puerto Rico

654 Muñoz Rivera Avenue Suite 901 San Juan, PR 00918
866-542-8169 E-mail: aarppr@aarp.org
<https://states.aarp.org/puerto-rico/>

Office of Ombudsman for Elderly Persons

Ponce de León Avenue – Stop 163rd Floor 1064 Building San Juan, PR 787-721-6121
<http://www.agencias.pr.gov/agencias/oppea/Pages/default.aspx>

General Disaster Recovery Information

HUD — U.S. Dept. of Housing and Urban Development Disaster Resources hud.gov/info/disasterresources

Disaster Assistance Improvement Program www.DisasterAssistance.gov

IBHS — Insurance Institute for Building & Home Safety www.DisasterSafety.org

NFIP — National Flood Insurance Program www.FloodSmart.gov

FLASH — Federal Alliance for Safe Homes www.flash.org

FEMA — Federal Emergency Management Agency www.fema.gov

Puerto Rico Department of Health Asthma Program

Centro Médico Norte Calle Periferal Interior Bo. Monacillos
787-765-2929 Ext. 4145 proyectoviaspr@gmail.com
<http://www.proyectoasmapr.com/proyecto-v-as.html>

ASEM Puerto Rico Poison Center

(787) 777- 2770 EXT – 2771, 2772, 2773, 2774
Fax :787-777-2775 Toll Free: 1-800-222-122

Puerto Rico Power Authority

PO Box 364267 San Juan, PR 00936-4267 787-521-3434 787-521-3050 TDY
<https://aepr.com/es-pr/Paginas/default.aspx>

Puerto Rico Water and Sewer Authority

PO Box 7066 San Juan, PR 00916-7066
787-620-2482 <https://www.acueductospr.com/>

American General Contractors - Puerto Rico Chapter

787-781-2200 <https://www.agcpr.com/>

Puerto Rico Builders Association\

787-751-1471 <https://www.constructorespr.com/>

FEMA information on Safe Rooms www.fema.gov/safe-rooms

FEMA — Federal Emergency Management Agency website for households www.ready.gov

For all of the above you can also access federal agency telecommunication services for people with speech and hearing disabilities: www.gsa.gov/fedrelay

American Red Cross www.RedCross.org

National Association of Home Builders – Disaster Recovery <https://www.nahb.org/Advocacy/Industry-Issues/Emergency-Preparedness-and-Response/Disaster-Recovery>

Citizen Corps www.ready.gov/citizen-corps

U.S. Dept. of Housing and Urban Development Disaster Resources — Worker and Employer Guides (also contains links to Spanish versions of these guides below):

- Asbestos: hud.gov/sites/documents/IEPWG_ASBESTOS_WORKER.PDF
- Lead: hud.gov/sites/documents/IEPWG_LEAD_WORKER.PDF
- Mold: hud.gov/sites/documents/IEPWG_MOLD_WORKER.PDF

Key Hotlines

All the phone numbers below may also be reached by people who are deaf or hard of hearing, or who have speech disabilities, by teletype at 711.

FEMA Helpline (800) 621-3362

Poison Control Centers (800) 222-1222

HUD and EPA National Lead Information Center (800) 424-LEAD, (800) 424-5323

EPA Safe Drinking Water Hotline (800) 426-4791

National Pesticide Information Center (800) 858-7378

FDA, Food Safety Information Service Hotline (888) SAFE-FOOD, (888) 723-3663

Acknowledgements

Funding for this booklet is provided through the U.S. Department of Housing and Urban Development – Office of Lead Hazard Control and Healthy Homes (OLHCHH). Project Coordination by Kitt Rodkey, Senior Outreach Specialist, HUD Office of Lead Hazard Control and Healthy Homes; Michael Goldschmidt and Dr. Kandace Fisher-McLean, University of Missouri – Healthy Homes Partnership.



hud.gov/healthyhomes
healthyhomespartnership.net

November 2020