
Flooding Aftermath and Children's Health

Summary of Key Points

- Children are different from adults. They may be more vulnerable to chemicals and organisms they are exposed to in the environment because:
 - Children's nervous, immune, digestive, and other bodily systems are still developing and are more easily harmed.
 - Children eat more food, drink more fluids, and breathe more air than adults in proportion to their body size, so it is important to take extra care to ensure the safety of their food, drink, and air.
 - The way children behave – such as crawling and placing objects in their mouths – can increase their risk of exposure to chemicals and organisms in the environment.
- Adolescents are also still in the formative part of their lives when they are more vulnerable to environmental hazards than are adults.¹ Their brains, lungs, endocrine systems, and other parts of the body are still developing and are, therefore, more vulnerable to chemical, physical, and biological toxicants that they can encounter in their environment.

Hurricanes, flooding, and other extreme weather events are becoming more common and more severe due to climate change. In the aftermath of these disasters, there are special considerations when caring for infants, children, and adolescents.

Families are encouraged to read the guidance below to help prevent or reduce exposure to contaminants caused by flooding and/or to guide discussions with their pediatrician or [regional Pediatric Environmental Health Specialty Unit \(PEHSU\) staff](#).

How Should I Cleanup After a Flood?

Places that have been flooded – open lots or building of any type – should be considered as hazardous sites. These places may contain chemicals, mold, damaged building materials that are structurally unsafe, vermin, including poisonous snakes, and other hazards. Depending on the post-flood weather, specifically temperature and humidity, there are risks of hypo- or hyperthermia (body temperatures that are too low or too high). Adults working at such sites must be properly trained to deal with the potential hazards and must wear appropriate personal protective equipment.

Many chemicals cross the placenta from a pregnant person to the fetus. Moreover, should a pregnant person become ill or injured as a result of working in a hazardous cleanup environment, the health of the fetus may be compromised. In addition, it may be difficult to

provide pregnant people with well-fitting personal protective equipment. For all these reasons, it is strongly recommended that pregnant people not participate in cleanup activities.

While civic organizations, religious organizations, or schools may want to provide children and adolescents with opportunities for community service, disaster cleanup should not be an option. The adults who supervise children and adolescents rarely receive adequate training about cleanup of hazardous sites. Often, appropriately sized personal protective equipment (PPE) cannot be provided for the children and adolescents who would be involved. Children, and many adolescents, will not have the judgment capacity to determine what is safe for them to do as they move through a post-disaster cleanup site.

Toxic materials can often be brought home to a volunteers' (or workers') home and family on their hair, skin, clothing, and/or shoes.^{2,3} To protect their families, adult workers should have PPE which they put on before entering the site and remove before returning home. Workers need to be able to leave their shoes at the worksite.

How Should Mold be Cleaned?

After homes have been flooded, moisture can remain in drywall, wood furniture, cloth, carpet, and other household items and surfaces and can lead to mold growth. Exposure to mold can cause hay fever-like reactions (such as stuffy nose, red, watery or itchy eyes, sneezing) as well as asthma attacks. It is important to dry water-damaged areas and items promptly to prevent mold growth. Buildings that are wet for more than 48 hours will generally contain visible and extensive mold growth.

Some children are more susceptible than others to mold, especially those with allergies, asthma, and other respiratory conditions. To protect a child from mold exposure, clean smooth, hard surfaces such as metal and plastics with soap and water and dry thoroughly. Flood water-damaged items made of more absorbent materials cannot be cleaned and should be discarded. These items include paper, cloth, wood, upholstery, carpets, padding, curtains, clothes, stuffed animals, etc.

If there is a large amount of mold, hiring a professional to clean up the mold can be considered. If a homeowner decides to do the cleanup, they should:

- Clean and dry hard surfaces such as showers, tubs, and kitchen countertops.
- If something is moldy, and cannot be cleaned and dried, throw it away.
- Use a detergent or use a cleaner that kills germs.
- Do not mix cleaning products together or add bleach to other chemicals.
- Wear an N-95 respirator, goggles, and gloves so that skin does not come into contact with mold. Also wear long pants, a long-sleeved shirt, and boots or work shoes.

Homes, apartments, child care centers, schools and other buildings that have sustained heavy water damage will be extremely difficult to clean and will require extensive repair or complete remodeling. It is strongly advised that children not stay in these buildings.

Can I Use a Portable Generator?

Due to loss of electricity, gasoline- or diesel-powered generators may be used in the aftermath of floods. **NEVER use portable generators indoors! Place generators outside and as far away from buildings as possible.** Do not put portable generators on balconies or near doors, vents, or windows and do not use them near where people are sleeping. Likewise, charcoal grills and kerosene cooking devices should not be used indoors for heating or cooking; and gas ovens should not be used for heating purposes. These devices release **carbon monoxide**, a colorless, odorless, and deadly gas. Simply opening doors and windows or using fans will not prevent carbon monoxide buildup in the home or in partially enclosed areas such as a garage.

If children or anyone else in a family starts to feel sick, dizzy, or weak or experiences a headache, chest pain, or confusion, get to fresh air immediately and seek medical care as soon as possible. Fetuses and infants are especially vulnerable to the life-threatening effects of carbon monoxide.

Install a carbon monoxide detector that is approved by a **Nationally Recognized Testing Laboratory** (NRTL). These are generally available at local hardware stores. Carbon monoxide is lighter than air, so detectors should be placed closer to the ceiling. Detectors should be placed close enough to sleeping areas to be heard by sleeping household members.

What if the Drinking Water is Contaminated?

While all people need safe drinking water, it is especially important for children because they are more vulnerable to harm from contaminated drinking water. If a tap water source is potentially contaminated with flood waters, children, pregnant people, and nursing parents should drink only bottled water. Bottled water should also be used to mix baby formula and for cooking. It is also recommended that children are sponge bathed children with warm bottled water until it is certain that tap water is safe to drink.

Children may not show symptoms or become ill from swallowing small amounts of contaminated drinking water. Symptoms can vary by contaminant. If your child drinks water contaminated with disease-causing organisms, he/she/they may experience symptoms similar to the “stomach flu.” These include stomach ache, nausea, vomiting, and diarrhea, and possibly **dehydration**.

Some contaminants, such as pesticides and gasoline, may cause the water to smell and taste strange, and others such as lead and disease-causing organisms may not be detectable. Drinking water contaminated with chemicals such as lead or gasoline may not cause immediate symptoms or cause a child to become ill but could still potentially harm a child’s developing brain or immune system.

Tap water, from either private wells or city water, should be professionally tested or certified as safe by local officials before resuming normal usage.

Private Wells: If there is a flooded well, do NOT turn on the pump, and do NOT flush the well with water. Contact local or state health department or agriculture extension agent for specific guidance on disinfecting your well. [View more information on how to manage a flooded well.](#)

Public/City Water Supply: A public water system or local health agency will inform residents if they need to boil water prior to using it for drinking and cooking. [View additional information about emergency disinfection of drinking water.](#)

Tap water that has been brought to a rolling boil for at least 1 minute will kill disease-causing organisms. Boiling will not remove many potentially harmful chemicals and may actually increase concentrations of heavy metals (including lead), which can be harmful to a child's developing brain. Chemically treating tap water with either chlorine or iodine will kill many disease-causing organisms but will not remove harmful chemicals or heavy metals.

For more detail on disinfecting contaminated drinking water by boiling or by using liquid chlorine bleach consult [this guidance from the Washington State Department of Health](#).

What if Items in the Household are Contaminated?

As mentioned above in the Mold section, some flood water-affected items can be salvaged, while others should be thrown away.

Drinking Water Containers: Clean thoroughly with soap and water, then rinse. For gallon-sized containers, add approximately 1 teaspoon of bleach to a gallon of water to make a bleach solution. Cover the container and agitate the bleach solution thoroughly, allowing it to contact all inside surfaces. Cover and let stand for 30 minutes, then rinse with purified and/or uncontaminated water.

Kitchenware and Utensils: In general, metal and glazed ceramic that are thoroughly washed and dried can be sanitized and kept. Follow local public health guidance on effective and safe sanitation procedures. Wood items must be thrown away, as these items can absorb contaminants or grow mold from the exposure to flood water and they cannot be properly sanitized.

Children's Toys and Baby items: Throw away ALL soft or absorbent toys because it is impossible to clean them and they could harm a child. Throw away ALL baby bottles (unless glass bottles are sterilized), nipples, and pacifiers that have come in contact with flood waters or debris.

Other Flood Topics

Bleach: Household bleach contains chlorine, a very corrosive chemical which can be harmful if swallowed or inhaled. It is one of the most common cleaners accidentally swallowed by children. Children – especially those with asthma – should not be in the room while using these products. Call Poison Control at (800) 222-1222 immediately in case of poisoning.

Formerly Flooded or Debris-filled Areas: Children in these areas may be at risk of exposure to dirt and debris that may have been contaminated with hazardous chemicals like lead, asbestos, oil, and/or gasoline. Children can be exposed by direct contact through their skin, by breathing in dust particles or fumes, or by putting their hands in their mouths.

Mosquitoes and Disease-Causing Pests: Receding flood water may increase the number of mosquitoes and other disease-causing pests. To protect children, ensure that they use insect repellents containing up to 30% DEET (N,N-Diethyl-meta-toluamide), Picardin, or Oil of Lemon Eucalyptus. The American Academy of Pediatrics (AAP) recommends that DEET not be used on infants less than 2 months of age and that Oil of Lemon Eucalyptus not be used on children

under 3 years of age. Other ways to protect children include staying indoors while the sun is down, wearing light-colored, long-sleeved shirts and pants, covering baby carriages and playpens with mosquito netting, clearing areas of standing water, and emptying water from flower pots and other containers so that mosquitos cannot breed there.

References

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2. Zirschky, J. (1996). Take-home toxin pathway. *Journal of Environmental Engineering*, 122(5), 430-436.
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About PEHSU

The Pediatric Environmental Health Specialty Units (PEHSUs) are a source of medical information and guidance on prevention, diagnosis, management, and treatment of environmental conditions that influence reproductive and children's health. PEHSUs work with health care professionals, parents, schools, community groups, as well as federal, state, and local agencies to address reproductive and children's environmental health issues where families live, learn, play, and congregate. For more information on PEHSUs and available resources, please visit: <https://www.pehsu.net/>.

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