Reopening Outdoor Spaces After Flooding | RRA | EHS

cdc.gov/nceh/ehs/rra/reopening-outdoor-spaces-after-flooding.html

Learn more about how to assess the level of risk posed by microbial contamination after a flood event.

Flooding can contaminate the ground, soil, and other outdoor areas with both bacteria and viruses, but limited guidance exists on how to determine when these areas are safe to use. Increased levels of microbes in floodwaters increase the risk of human exposure and the likelihood for infection.

Flooding can spread contaminants that can cause illnesses.

Flooded area in front of a playground

Floodwater can overflow from wastewater treatment plants, sewer lift stations, sewer collection systems (e.g., manholes and sewer mains), and individual or community septic systems into human use spaces like ball fields, playgrounds, and residential yards. These floodwaters may spread bacteria, viruses, protozoa, and other microbial contaminants that can cause illnesses ranging from mild stomach upset to serious diseases such as dysentery, infectious hepatitis, and severe gastroenteritis (*1*). Typically, it takes 2–3 months for enteric bacteria to significantly reduce in soil, with certain exceptions. But due to different microbial responses to the environment, providing universal guidance is difficult.

Note: This guidance does not address chemical contamination issues associated with flood events. Get information about chemicals released during a natural disaster.

Assess Risk With a Systematic Approach

Different microbes can survive in a variety of different environmental conditions, so providing universal guidance is difficult. Instead, health authorities should use a risk-assessment approach* that considers all variables to characterize potential health exposure risks on a case-by-case basis.

Microbe concentration in floodwater depends on several factors:

- How many and what kind of **sources** contributed to the contamination
- Volume of **contaminants** released
- Degree of **dispersion** in the environment
- Level of **treatment** of wastewater at treatment facilities before the flooding (*2,3*)

Hazard identification: Can any of the contaminants found affect human health?

- Identify potential sources of contamination.
- Determine likelihood of microorganisms in the water.

Dose-response assessment: Are contaminants found at a level that can affect health?

- Estimate the concentration of microorganisms and their ability to cause illness.
- Consider the extent and duration of flooding and effects on surrounding areas.
- Consider location of potential contamination sources and proximity to flooded areas.

Exposure assessment: Who may be exposed, for how long or how frequently, and how much?

- Consider environmental conditions such as soil drying out, sunlight, and temperature.
- Conduct a site assessment and environmental sampling to determine the degree of soil saturation, debris, etc.

Risk characterization: What can you conclude about human risk?

- Consider all information gathered in previous steps and determine the magnitude of the public health problem.
- Identify potential contamination sources, determine factors that may influence microbial concentration and survival, determine the potential effect on exposed populations, and consider the intended use for flooded outdoor areas.
- Consider the effect of remedial action on human health and the environment, including risks to plants and animals.

Decision and actions or interventions: What are the first priorities?

- Determine whether to allow occupancy of flooded areas.
- Decide if intervention or other precautionary actions are necessary (promote personal hygiene, add signage, take remedial actions, etc.).

Reduce Public Health Risk With Key Steps

It can take up to several months for microbes to naturally die off in contaminated soil, so personal hygiene is key to reducing the risk to public health. Cleaning up the contamination and educating the public will help reduce the risk of disease spreading from floodwaters.

You may need to manage pests before safely reopening public spaces.

- Floods can displace rodents and other vectors.
- Standing water and sewage can harbor flies and mosquitoes.

Educate the Public on Keeping Safe and Healthy

Signs can help discourage use of potentially hazardous areas and raise awareness about public health and safety concerns.

- Warn to avoid standing water, areas with visible debris, and areas where floodwater has accumulated.
- Emphasize proper handwashing and the need to provide adequate washing and drying supplies and equipment in restrooms and facilities.

Clean or Throw Away Anything That Came in Contact with Floodwater

Floodwater can cause illness if items are not cleaned or discarded.

- Pay attention to areas where young children are likely to play.
- Consider replacing soil, mulch, sand in sandboxes, and wood chips around outdoor playground equipment.

Clean Small Areas of Heavy Contamination (for example, sewage with visible solids)

Hydrated lime can control and remediate microbial hazards in affected areas.

- Consider treatment with hydrated lime (also called slaked lime).

- Use lime safely to prevent health hazards and damage to personal property (*4,5*). Wear protective clothing and eye protection.

Consider Other Remedial and Control Options

- Spread new soil on top of the affected soil, and compact it down, plant new grass, etc.
- Water heavily to flush organisms out of upper soil layers.
- Improve grading and drainage to avoid standing water.
- Apply dust-suppressant products if waters leave behind sand and silt that can blow in wind.

Frequently Asked Questions

How common are microbial contaminants in floodwater in levels that can directly affect public health?

Floodwaters commonly contain microbial contaminants and can directly affect public health.

- After Hurricane Katrina, elevated microbial contaminants, specifically fecal coliforms, were consistent with levels detected in previous stormwater discharges in the area (*6*).
- During the Midwest flooding of 2001, researchers identified increased incidence of gastrointestinal illness (*7*).
- Municipal water system supplies (for example, groundwater wells and surface water) have a higher probability of being compromised during and shortly after flood events (*2*).

Why is it difficult to determine when microbes are no longer surviving in soil?

Microbial survival in soil and the resulting potential for human exposure is difficult to predict because of natural variability in environmental factors and varying microbial susceptibilities. This reinforces the need to implement a risk-assessment approach that considers all variables that could influence potential exposure.

- Environmental factors such as temperature, soil desiccation, pH, soil characteristics, and sunlight influence microbial survival and persistence (*3,8–11*).
- Intensity of sunlight exposure, level of soil desiccation, and ambient temperatures necessary to effectively kill all microbes within a specified time vary among microbes. Certain microbes can get into stable soil, which may help them survive longer. And, some nutrients in the soil may help microbes survive and even multiply in some cases.

What do we know about specific pathogens surviving in the soil?

Survival characteristics for microbes under specified conditions have been reported, but microbial responses differ.

Here’s what we know:

- *Shigella* has survived in soil at room temperature for 9–12 days (*12*).
- *Cryptosporidium* oocysts may survive in a moist environment for 60–180 days (*2*).
- Spore-forming microbes such as coccidioides, a fungus in semiarid southwestern U.S. soil (*13*), and anthrax spores can survive in soil for many years (*14*).

What pH is necessary to treat sewage sludge for land application?

The U.S. Environmental Protection Agency (EPA) (*15*) requires the following:

- To kill microbes: a pH of 12 for at least 2 hours.
- To deter vectors: a pH of at least 11.5 for an additional 22 hours or more.

*Steps adapted from Risk Assessment in the Federal Government: Managing the Process (National Research Council 1983).

Want More Information?

- After a Flood
- Clean Up Safely After a Natural Disaster
- Cleaning and Sanitizing with Bleach after an Emergency
- Response and Recovery Activities for Environmental Health (RRA)

Suggested citation: Centers for Disease Control and Prevention. Reopening outdoor public spaces after flooding. Atlanta: U.S. Department of Health and Human Services; 2021.