International Water Management Institute

Guidelines for the Community on the Safe Interim Use of Contaminated Drinking Water and Cleaning of Contaminated Drinking Water Wells in the Post-disaster Sri Lankan Context

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International Water Management Institute (IWMI). 2026. *Guidelines for the Community on the Safe Interim Use of Contaminated Drinking Water and Cleaning of Contaminated Drinking Water Wells in the Post-Disaster Sri Lankan Context*. International Water Management Institute (IWMI).

Cover photo: Drinking water intake at Hulannuge village, Ampara (*photo*: Mohamed Aheeyar/IWMI)

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Acknowledgements

This work was funded by the United Kingdom's Foreign, Commonwealth and Development Office (FCDO) under the Climate Action for a Resilient Asia (CARA) program, through the British High Commission in Sri Lanka. This study was undertaken as part of the Emergency Rehabilitation and Water Quality Assessment of Community Groundwater Drinking Water Sources in the areas of the Ampara District, Sri Lanka, affected by Cyclone Ditwah. We would like to thank Mr. Dimuthu Malalgoda, Dr. Lal Mutuwatte, Dr. Nishadi Eriyagama, Dr. Niranga Alahacoon and Ms. Dilmi Sithara Gamage for their contributions to the project.

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Introduction

Every day, globally more than 1,000 children under 5 die from diseases related to inadequate water and sanitation, resulting in a total of 1.4 million deaths each year (UNICEF 2025). Safe water is essential to prevent waterborne diseases, mitigate chronic kidney diseases of unknown etiology (a deadly kidney condition that is not caused by traditional factors like diabetes, high blood pressure, or infections, but believed to be multifactorial caused by a mix of environmental and work-related hazards) prevalent in the dry zone of Sri Lanka, and combat severe bone and dental fluorosis caused by high levels of fluoride and water hardness.

Access to safe drinking water becomes even more crucial during emergencies, such as floods, as it is vital for preventing waterborne diseases and related health risks. Floodwater can carry suspended solids, hazardous chemicals, and disease-causing microorganisms from damaged sanitation systems, animal waste, agricultural runoff, and poorly managed solid waste. These contaminants may enter wells, taps, and other drinking water sources, rendering the water unsafe for household use. Bacteria, viruses, and parasites in contaminated water can cause illnesses such as diarrhea, dysentery, typhoid, hepatitis A, and leptospirosis, especially among vulnerable groups.

Water that appears uncontaminated may still contain microorganisms and toxins that are not visible to the naked eye. Using this water for drinking, cooking, hygiene, or food preparation can rapidly spread infections in disaster-affected communities. Therefore, preventive measures, such as boiling, filtration, and chlorine-based disinfection, should be prioritized. Public health messages should clearly communicate these risks and promote safe water handling during and after flooding.

Maintaining water safety requires meeting established quality standards that limit the presence of contaminants, pathogens, and harmful chemicals. These standards help protect public health and reduce exposure to waterborne hazards. Safe drinking water can be consumed with minimal health risks.

Sri Lanka Standards (SLS) for drinking water

SLS 614:2013, aligned with WHO guidance, sets the maximum permissible limits for key drinking-water quality parameters. These include physical, chemical, and microbiological criteria used to assess whether the water is safe for consumption. Table 1 summarizes the main parameters in the standard and provides reference points for water quality monitoring and for public health protection.

Table 1: Maximum permissible drinking water quality parameters as per SLS 614 standards

Water Quality Parameter	Sri Lanka Standards
Physical Parameters	
Color	Maximum 15 true color units
Turbidity	Maximum 2 Nephelometric Turbidity Units (NTU)
Taste and odor	Unobjectionable to customers
pH	6.5-8.5
Chemical Parameters	
Nitrate	≤50 mg/ L
Phosphate	<2 mg/ L
Fluoride	<0.6 mg/ L to 1.5 mg/ L
Total Hardness (as $CaCO_3$)	≤250 mg/ L as $CaCO_3$
Total dissolved solids	500 mg/ L
Total alkalinity (as $CaCO_3$)	200 mg/ L
Iron	≤0.3 mg/ L
Calcium (as Ca)	100 mg/ L
Sodium (as Na)	200 mg/ L
Sulphate (as SO_4^{-2})	250 mg/ L
Bacteriological Parameters	
Total coliform	Absent in any 100ml sample
Fecal coliform and E. coli	0 per 100 ml of sample

Source: SLS (2013)

Objectives

Education and awareness are critical for safe water handling. This guide provides practical steps to help communities maintain access to safe drinking water during emergencies, such as floods, with a focus on the safer use of traditional water sources and reducing the risk of waterborne diseases.

The guide is organized into two parts: (1) household water treatment and safe storage during emergencies, and (2) cleaning and disinfection of contaminated wells for skilled operators, including post-cleaning actions.

Part 1

Use of water in emergencies

During emergencies, tap water and water from contaminated wells may be unsafe. It is recommended to use bottled water or other verified safe sources until regular supplies are confirmed to be safe. Disaster-affected water should not be used for the following purposes:

- Drinking
- Cooking
- Brushing teeth
- Making ice
- Washing dishes
- Bathing

How does household water become contaminated?

Household water can become contaminated at the source, during collection, transportation, storage, and use. Community education on hygiene and safe storage practices further reduces the risk of consuming contaminated water (Gizachew et al. 2020). Therefore, a multi-barrier approach is adopted in water treatment to ensure safe drinking water. This approach includes source protection (barriers that prevent contaminants from entering water at the source), safe water transportation (barriers that prevent contaminants from entering water as it is transported from the source to a user's home), water treatment, and safe storage (barriers that keep water safe from recontamination). Thus, safe water handling requires hygiene at every stage. Drinking water used in households can become contaminated in multiple ways:

- Structural failures, such as leaking septic tanks or latrines, can introduce harmful pathogens into water sources.
- Polluted surface runoff can enter and contaminate the water sources.
- Using unwashed hands or dirty containers to collect water can transfer microorganisms into clean water.
- Animals near the source and foreign objects falling into the water can further increase the risk of contamination.
- Transporting water in dirty containers
- Storing water in open or unclean containers at home
- Handling water with unclean hands or utensils during household use

Handwashing with soap after using the toilet and before handling water or food is essential to interrupt fecal-oral transmission.

Aspects of drinking water quality

1 Microbial - contaminated water can primarily contain four different types of microbes: viruses, bacteria, protozoa, and helminths (e.g., pinworms, hookworms, guinea worms).

2 Chemical - water sources can contain naturally occurring or man-made chemical elements or compounds such as metals (iron, manganese, calcium), heavy metals (mercury, lead, copper), salts (dissolved salts like sodium, magnesium), inorganics (arsenic, fluorides, nitrates), organics (pesticides, pharmaceuticals), disinfectants, and coagulants and flocculants (alum, ferric chloride). The health effects of chemical pollutants are often more gradual and long-term compared to those of microbiological pollutants.

3 Acceptability - factors that influence the appearance, smell, or taste of water affect drinking water quality by changing consumer preference. Pollutants can give water different colors, such as organic materials (brown/yellow), silt and clay (red/brown), iron (red/orange), manganese (black), algae (green), and bacterial growth (black or other colors). Similarly, there are various causes for the taste and smell of water. For example, algae and some bacteria can cause unpleasant taste and smell, while the presence of sulphate in water can create a bitter or rotten egg smell. Additionally, mineral concentration, the presence of iron, and high amounts of chlorine can affect the smell and taste of water.

Key action points for safe water handling and storage

- Collect water hygienically and transport it in clean containers.
- Use clean and covered containers or containers with a tight-fitting lid and narrow opening to store water, which is easy to clean and has a stable base.
- Handle water with clean hands and utensils during household use.
- Promote education on safe water handling and storage practices.

Water source protection

Protecting community water sources from fecal contamination and environmental pollutants is essential. Common risks include inadequate source protection, lack of fencing or diversion ditches, proximity to latrines or animals, blocked drainage channels, and stagnant water around collection points. Sanitary inspections and prioritizing high-risk sources can help target resources effectively.

Unprotected sources often have higher levels of fecal coliforms and Escherichia coli than protected sources, highlighting the importance of safeguarding water points and restricting open defecation and livestock access. Therefore, safe animal management and proper disposal of animal waste within household compounds can further reduce the spread of infectious diseases. Proper household waste disposal and prevention of latrine seepage into water sources can help reduce contamination.

Key action points for water source protection

- Install fencing around the water sources.
- Divert surface runoff away from the water points.
- Manage household waste properly.
- Prevent leakage from latrines.
- Restrict animal access to the water sources.
- Maintain drainage around the collection points.

Steps for household water treatment during emergencies

Water treatment is a physical, chemical, or biological process used to improve water quality. Household water treatment is a temporary measure until the usual water source is restored to safe standards. The selected method/s should be effective against pathogens and be accessible to vulnerable people (elderly, pregnant, and children). For household water treatment to be effective, the household should use appropriate treatment method/s for the given water source, all household members should use treated water at all times of the day, and consumption of treated water should not be discontinued for any reason, for example, not using the treated water at school or outside the house.

In water treatment, a multi-barrier approach is adopted to ensure safe drinking water. There are three main steps in household water treatment (IFRCS 2008):

1 Sedimentation: Raw water is allowed to stand in a container for 3–4 h to allow suspended solids to settle. This helps large particles settle and reduces turbidity. Carefully pour the clearer upper layer into another clean container. However, further treatment and disinfection are required.

2 Filtration: Pour muddy water through a clean, fine cotton cloth to remove suspended solids and insect larvae (Figure 1). Wash the cloth after each use. Straining does not make water safe to drink, but it improves the effectiveness of subsequent treatment.

FIGURE 1: Simple technique to strain water

Filters remove dirt from water by physically blocking it while allowing water to flow through. Filters are not commonly used in emergencies. However, a DIY (Do It Yourself) filter using easily found materials can be used in households for daily use. Different coarse and fine layers, as illustrated in Figure 2, help trap impurities, particles, and contaminants. Activated carbon removes impurities and improves taste. When using sand filters, water flow will naturally decrease over time as sediment builds up. When this happens, households need to drain the excess water, gently scrape off the top 1 to 2 cm of clogged sand, and wash it or replace it with clean sand. The entire filter sand should be replaced every 3 to 5 years to maintain maximum filtration effectiveness.

FIGURE 2: Typical sand filter

3 Disinfection: Disinfection kills or inactivates most viruses, bacteria, and parasites. Households can use three simple methods to achieve this.

a. Boiling: Bring water to a rolling boil. Boil for at least 1 minute at low elevations and 3 minutes above 6,500 feet (1981 m) to inactivate disease-causing organisms (Figure 3). Boiling hard water removes temporary hardness (calcium/magnesium bicarbonates) by converting them into solid, insoluble calcium carbonate (limescale).

FIGURE 3: Simple method of rolling boiling

b. Solar disinfection (SODIS): Direct sunlight can inactivate many disease-causing organisms. Use a clear glass bottle filled with water and place it on a roof for about five hours as illustrated in Figure 4, preferably around midday to expose full sunlight. Extend the exposure time under cloudy conditions.

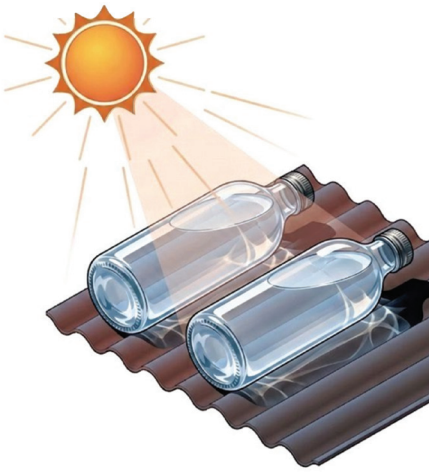

FIGURE 4: Solar disinfection (SODIS)

c. Chemical treatment: Chlorine compounds are the most common disinfectants used for household water treatment. When water is clear, low doses with approximately 30 min of contact time can inactivate most enteric bacteria and viruses. A 1% chlorine stock solution should be prepared by trained personnel or informed community members using sodium hypochlorite, calcium hypochlorite, or high-test hypochlorite solutions. If chlorine tablets are unavailable, household bleach can be used. Do not add bleaching powder directly to water; first prepare a 1% chlorine solution and then add the required dose.

Because household bleaching powder contains about 33–34% available chlorine, mix 30–40 g of bleaching powder with 1 liter of water to prepare a 1% chlorine solution. Place the measured powder in a suitable container, preferably plastic, add enough water to form a smooth paste, and stir with a wooden stick to remove lumps. Then add the remaining water to reach the required volume and mix thoroughly. Allow the sediment to settle and use the clear liquid as the disinfectant. Use the solution as soon as possible after preparation. One liter of 1% chlorine solution is sufficient to treat 10,000 liters of water.

Prolonged storage reduces chlorine potency; therefore, the amount required varies with the age of the chemical. Excess chlorine can also cause unpleasant taste and odor, which may reduce user acceptance of the water.

If chlorine tablets are distributed during the emergency, follow the instructions provided with the tablets.

Treated water can be re-contaminated during storage. Keep it in clean, narrow-mouthed, covered containers, and pour or dispense it without dipping hands or utensils into the water.

Key action points for household water treatment

- Clear water: disinfect by boiling, solar disinfection, or appropriate chemical treatment.
- Turbid water: Sedimentation, straining, filtration, and disinfection.
- Heavily contaminated water: avoid use.

Part 2

Cleaning and disinfecting a contaminated well

Although literature does not provide a single standard protocol for well cleaning, it identifies general principles and effective procedures for contaminant removal and disinfection. Cleaning should begin only after the floodwater has receded and the pump can be operated safely.

Source assessment, protection, and control

Identify potential contamination sources and structural weaknesses in and around the well. Inspect the wellhead and surrounding areas for signs of fecal contamination and entry points for surface water or other pollutants. These problems should be corrected before disinfection to reduce the risk of recontamination.

Physical cleaning

Remove debris, sediment, biofilm, and organic matter by flushing and mechanical cleaning. Pump water through an external tap until it runs clear.

Chemical disinfection

After physical cleaning, apply chlorine or another approved disinfectant at an effective concentration and contact time to inactivate remaining pathogens. Chlorine-based disinfection, particularly free chlorine solutions in the range of 250–1,000 ppm, is widely used because of its broad-spectrum effectiveness. Select the type and quantity of disinfectants according to the well depth and water volume.

Table 2 shows the approximate amount of unscented household bleach required to disinfect a bored or dug well. In a 20-liter bucket, mix the specified bleach dose with 12–19 l of water. Pour the mixture into the well and circulate it thoroughly using a clean hose connected to an outside faucet. Rinse the inside of the well casing with a hose or bucket for 5–10 minutes.

If the well is connected to domestic plumbing, circulate the disinfected water through the entire system until chlorine is detected at all outlets. Open all indoor faucets and run the water until a strong chlorine odor is present, then close the faucets and leave the solution in the well and plumbing for 12–24 hours to allow adequate contact time.

Table 2: Approximate amount of bleach for disinfection of a drilled or driven well

Depth of Water (in meters)	Diameter of Well (in meters)					
	0.15	0.3	0.6	0.9	1.2	1.5
3	118 ml	414 ml	1.66 L	3.78 L	6.62 L	10.41 L
6	236 ml	828 ml	3.32 L	7.56 L	13.24 L	20.82 L
9	354 ml	1.24 L	4.98 L	11.34 L	19.86 L	31.23 L
12	472 ml	2.49 L	6.64 L	15.12 L	26.48 L	41.64 L
15	590 ml	3.72 L	8.30 L	18.9 L	33.10 L	52.05 L

Notes: 1 Use only unscented household chlorine bleach
2 Bleach concentrations are generally between 5-9%.
3 The quantities listed in this table are approximate and rounded to the nearest practical measurement. Amounts given are calculated in accordance with reaching a chlorine concentration of >100 mg/ L

Source: CDC (2025)

After 12 hours, connect a hose to an outdoor faucet and discharge the chlorinated water onto a non-vegetated area, such as a driveway, until the chlorine odor dissipates. Do not discharge the water into streams, ponds, or other open water bodies. Then run all indoor faucets until the chlorine odor is no longer detectable.

Repeated cleaning and disinfection cycles

Cleaning and disinfection should be repeated as needed to achieve the required reduction in target pathogens.

After cleaning and disinfection, flush the well thoroughly to remove residual disinfectants and detached contaminants. Direct the discharge away from septic systems and sensitive vegetation.

Post-cleaning actions: regular maintenance and ongoing monitoring

- Once cleaning is complete, test the water through a certified laboratory to confirm that remediation was successful and that no viable pathogens remain.
- Wait at least 7–10 days after disinfection before testing to improve the accuracy of the results.
- Continue using bottled or boiled water until laboratory results confirm that the water meets safety standards.
- Replace all water filters and inspect any treatment systems for damage caused by floodwater or the disinfection process.
- Users should be educated on hygienic practices, and routine inspection and maintenance should be continued to reduce the risk of future contamination.
- Well cleaning is not a one-time activity; ongoing monitoring and maintenance are required to prevent the recontamination of water.

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