

The health consequences of inadequate water and sanitation services include an estimated 4 billion cases of diarrhea and 1.9 million deaths each year, mostly among young children in developing countries. Diarrheal diseases lead to decreased food intake and nutrient absorption, malnutrition, reduced resistance to infection, and impaired physical growth and cognitive development. Since 1996, a large body of work has been published that has examined the health impact of interventions to improve water quality at the point-of-use through household water treatment and safe storage (HWTS). Five interventions – chlorination, solar disinfection, ceramic filtration, slow sand filtration, and PUR – have been proven to reduce diarrhea in users in developing countries and improve the microbiological quality of stored household water and are discussed below. The most appropriate HWTS option for a location depends on existing water and sanitation conditions, water quality, cultural acceptability, implementation feasibility, availability of HWTS technologies, and other local conditions. For more information, contact [safewater@cdc.gov](mailto:safewater@cdc.gov). Photos courtesy: PSI, PFP, HydrAid, EAWAG, P&G.

### Household Chlorination

Household chlorination includes water treatment with chlorine solution at the point-of-use, storage of water in a safe container, and behavior change communication. Users add one cap of solution to their storage container. Diarrhea reduction is 22-84%. Product cost is 0.01-0.05 US cents per liter treated. Benefits are residual protection against contamination, acceptability to users, ease-of-use, scalability, and low cost. Drawbacks include potential user taste and odor objections, and lower protection against some organisms and in turbid water. [www.cdc.gov/safewater](http://www.cdc.gov/safewater)



### Ceramic Filtration

Ceramic filters depend on mechanical processes to remove contaminants. Users simply pour water through the filters. Diarrhea reduction is 60-70% in commercially manufactured filters in conjunction with safe storage. Product cost is 0.034-0.14 US cents per liter treated. Benefits include user acceptability because of ease-of-use, long life if the filter remains unbroken, and potential for local production. Drawbacks include unknown effectiveness against viruses, lack of residual protection that can lead to recontamination, the need for user education to keep the filter and receptacle clean, and slow flow rates. [www.pottersforepeace.org](http://www.pottersforepeace.org)



### Slow Sand Filtration

The Slow Sand Filter (SSF) is a sand filter adapted for household use. To use the SSF, users simply pour water into the SSF, and collect finished water out of the outlet pipe into a bucket. Diarrhea reduction is 44-47%. Product and program costs over a 10 year life span is 0.068 cents per liter treated in one NGO program. Benefits include turbidity removal, high flow rate, ease of use, long-life, low maintenance requirements, and local production. Drawbacks include unknown effectiveness against viruses, lack of residual protection that can lead to recontamination, the need for user education to keep the filter and storage container clean, and heavy weight. <http://www.cawst.org>



### Solar Disinfection – SODIS

SODIS uses increased temperature, UV light, and oxidative chemistry to inactivate disease-causing organisms. Users are trained to place bottles in the sun for 1-2 days, depending on climate. Diarrhea reduction is 9-86%. Aside from initial bottles, SODIS is a zero-cost option. Benefits include acceptability to users because of the minimal cost and ease-of-use. Also, recontamination is unlikely because water is consumed directly from the bottles in which it is treated. Drawbacks include the need for pretreatment of turbid water, limited volume of water that can be treated at once, length of time required to treat water, and the plastic bottles supply required. [www.sodis.ch](http://www.sodis.ch)

### Flocculant / Disinfectant Powder - PUR Purifier of Water™

Procter & Gamble developed the combined flocculant/disinfectant PUR® for sale at no-profit to users and NGOs. To use, one sachet is added to 10 liters of water, and users stir, let the solids settle, strain the water through a cloth, and wait 20 minutes. Diarrhea reduction is 16->90%. Product cost is 1 cent per liter treated. Benefits include high quality water due to dual process treatment even in turbid waters, residual protection against contamination, and visual improvement in the water. Drawbacks are multiple steps for correct use, the need for users to have two buckets, a cloth, and a stirrer, and the higher relative cost per liter of water treated. <http://www.pghsi.com/pghsi/safewater/>

