

Hygiene Promotion for HWTS in emergencies

Introduction

It is now well accepted that despite source water being safe, water can be contaminated during transportation and storage and the hygienic handling of water during transport, storage and use is an important aspect of hygiene promotion in all WASH interventions.

In an emergency, it may not always be possible to ensure that the source water is clean (within the existing budget or time constraints) and household treatment of water is an important response option. As with the introduction of any hardware, this will only succeed if the users are considered in the selection, operation and maintenance of the treatment option and intensive hygiene promotion will be required to encourage correct and consistent use.

The promotional aspects of the following water treatment methods that are most commonly used in emergencies will be considered:

1. Boiling
2. Chlorination (including tablets or liquid)
3. Flocculation/disinfection sachets (including PuR® and WaterMaker®)
4. Natural filtration and flocculation methods (sedimentation, cloth filtration, moringa seeds, alum)
5. Ceramic filtration (including pot- and candle-style filters)
6. Membrane filtration

An existing technical brief (TB4) provides information on the technical household water treatment and safe storage (HWTS) options but has limited detail on the promotional aspects that are required. This short briefing paper is aimed at hygiene promoters and engineers who are working with communities on HWTS. It may also be useful for managers to understand how to ensure the effectiveness of HWTS interventions. It should be read in conjunction with TB4.

Safe water collection and storage

Household water treatment will not always be required if it is possible to provide an alternative safe water supply for consumption, but promotion will always need to consider how water will be transported, stored and used in the household. Even if household drinking water is treated, it may still become recontaminated through storage in dirty or uncovered containers or through contact with dirty hands and utensils. Chlorination can help to reduce recontamination if residual chlorine levels are kept at a reasonable level and it is important to try to understand how long people store drinking water in the household when providing chlorine. All other household water treatment methods (HHWT) risk recontamination.



Figure 1: Contamination of water in household

Handwashing

Improved handwashing can help to ensure that water does not become contaminated and must form an important aspect of any hygiene intervention. Current recommendations suggest that it is better to simplify the promotion as much as possible by focusing on only two key times for handwashing (before eating and after defaecation) and promoting a simple message such as 'wet, lather, rub and rinse' rather than including too many steps in the handwashing process¹. An Oxfam briefing paper is available on handwashing.

¹ See <http://tinyurl.com/7xdl6lt> for more information

Collection and storage containers

Sphere recommends that “each household has at least two clean *water collecting* containers of 10-20 litres, plus enough clean *water storage* containers to ensure there is



Figure 2: Oxfam bucket with spigot

always water in the household.” The containers should either have a lid or be narrow necked to limit environmental contamination.

If containers are not clean then consideration could be given to distribution or to regular mass

cleaning of the containers. This is usually carried out at water collection points but could also be done in neighbourhood groups. The steps for cleaning are²:

1. Drain the container
2. Scrub the inside of the container using an abrasive (soft bristles or small stones) and a cleaning agent (solution of chlorinated water or soap and water).
3. Clean the exterior of the container with a cloth and soap or chlorine solution, paying particular attention to the area around the neck and lip of the container
4. Rinse container with clean drinking water to remove cleaning agent residue

In addition to regular cleanings, in camps or densely populated settings, Oxfam recommends periodic super chlorination of all receptacles, an example of which is presented in the box opposite.

In some cultures large water containers (20 litres or more) are rolled along the ground. This poses no risk of contamination if the lip of the container does not touch the ground and avoids the backbreaking work of hauling water back to the household.

Using / drawing water in the household

It is important to avoid contaminating drinking water with hands when using a cup or scoop. Ideally water should be drawn from a tap or spigot that is kept off the ground. If this is not

Case study 1: Chlorine disinfection campaign in Darfur

In June 2004, an outbreak of shigellosis was confirmed in Abou Shouk camp in the Northern Darfur province of Sudan. As water testing at the source showed no contamination, it was assumed that post-collection contamination was happening. The decision was taken to launch a programme of mass disinfection of all water containers in order to break the contamination cycle.

Five percent chlorine solution was used to clean containers. Approximately 100–150 millilitres were added to every container, along with some small stones. The container was shaken vigorously if it was closed or scrubbed with a local straw broom if open.

Diarrhoea figures from the clinics showed a fall in cases following the disinfection campaign. Although it is difficult to collect statistically rigorous data, it does appear that the campaign had an impact on the prevalence of watery and bloody diarrhoea.

Source Walden 2005

available then water should be poured from the storage container or a separate, dedicated scoop or cup should be used. Again this must be kept off the ground.

Promotional methods for HWTS

Whilst the mass media (e.g. television, radio and leaflets) can be used to promote a specific household water treatment method, it is important that interpersonal methods such as training and demonstrations are also used, especially in emergency settings where the risks to health are high and people need to be enabled to act quickly.

If a specific household water treatment is to be introduced, try it out yourself before designing the promotional materials. Then if possible test your materials on a small number of participants to obtain feedback and adapt them before large-scale promotion.

Successful uptake of HWTS is less likely if there are any more than 2 steps in the instructions. Think twice before introducing more complex treatment methods.

² Taken from Technical Briefing Paper Number 4

Key messages and information for each treatment method are provided in the respective section.

Interpersonal Methods

Interpersonal methods allow participants to ask questions and clarify misconceptions and, where populations can be accessed safely, these methods should always be included in the response. However, interpersonal methods are resource and time intensive and scaling up will require the identification, training and support of outreach networks.

Follow up home visits by community mobilisers are a vital part of promoting the optimal use of household water treatment methods.

Demonstrations

Demonstrations can be carried out at distribution or water points or in small local gatherings. Volunteers can be trained to carry out the demonstrations within their communities. It is a useful strategy to be prepared to sample the clean water produced in front of the audience so that they are convinced of its safety – especially when using packaged products such as PuR® or WaterMaker®.

Training

Training will need to be kept short and should focus on the practical skills required for water treatment, making use of both demonstrations and the opportunity to practice the skills learned. Volunteer networks and community leaders can be trained to train others in the use of the water treatment method. Training of trainers should include an action plan detailing what will happen after the training and how many people will be reached by future training. Follow up for ToT participants will need to be scheduled so that they can discuss any problems they face in training others.

Discussion groups

HWTS can be included in discussions with a variety of groups but should identify and prioritise those responsible for carrying out

the water treatment or care of drinking water. This will usually be women or young girls. Discussion groups can include demonstrations but should also aim to explore any barriers to use.

A new approach to selecting HWTS methods known as SDM (structured decision making)³ could also be used in a simplified form. This approach encourages participants to identify the key criteria for using a specific water treatment method (or other practice) such as ease of use, cost (time), taste, colour, safety etc. and to compare different water treatment methods such as boiling water or using PuR® using these criteria. Symbols can be used for the different criteria selected and a voting system using stones or seeds could be used to score each method. The benefit of using such a method is that it can generate discussion and analysis and help to identify the specific concerns of users. In emergencies, it could be adapted and used when monitoring the intervention. Other visual aids using pictures or symbols could also be used to generate discussion.

Home visits

Networks of volunteers or mobilisers can visit households to provide information on

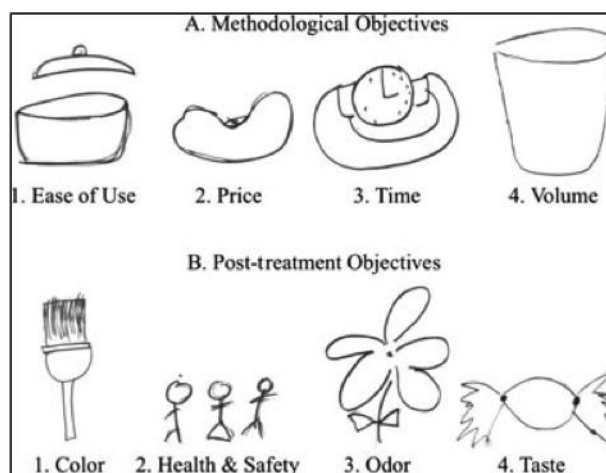


Figure 3: Criteria used to rank different HWTS methods

treatment methods. There may already be outreach workers attached to the local hospital or health centres and the involvement of local health staff to identify and support such outreach workers will be critical. Follow up home visits are crucial in ensuring that the water treatment method is being used effectively.

³ See <http://onlinelibrary.wiley.com/doi/10.1111/j.1539-6924.2011.01675.x/full>

Motivational interviewing techniques can be used to encourage uptake in households where resistance is high. This entails using specific person centred counselling techniques. Open-ended questions, affirmations and summarising techniques are used to encourage the person to consider their own internal motives for change and the facilitator 'nudges' them towards engaging in 'change talk' and action⁴.

Mass media

Mass media can reach large numbers of people quickly and can therefore be very useful in an emergency. However the use of the mass media will need to be combined with more interactive methods to be effective. Where possible interaction that gives people a chance to ask questions should be encouraged.

Television and radio

Whilst television and radio can reach large numbers of people, it must be remembered that the specific target audience may not have access to such media. For example the household may own a radio but only the male head of household listens to it or the radio slot may be broadcast at a time when the participant groups are busy doing other things. Ensure that any broadcasts are organised in co-ordination with the government and other agencies working in the area. The government may be entitled to free airtime from the broadcasting company.

Leaflets

It is important to consider the literacy level of the target audience and the language(s) used in the leaflet. Existing leaflets may be available from previous social marketing campaigns on HWTS. The provision of a leaflet is not a substitute for demonstrations of use.

Remember to:

1. Consult and collaborate with WASH experts and government bodies.
2. Ensure that discussion with communities has taken place to determine acceptability and the most user friendly instructions e.g. type of container to be used, type of chlorine

(e.g. household bleach, pre-packaged solutions etc.), potential problems with acceptability

3. Provide clear steps and illustrations where possible (see example leaflets)
4. Carry out a rapid pretesting of the leaflet
5. Monitor subsequent household use

It is also useful to translate back into the original language (using a second translator) in order to identify misunderstandings.

Posters and leaflets

Posters can be useful reminders of how to do something or when to do it. The instructions on how to use a household treatment method should be distributed with the product in leaflet or poster form, with the suggestion that these are put on the wall near to where the treatment is being carried out. They could also be stuck on the sides of water

Other ideas for promotion

- Labels with instructions for treating water or maintaining the filter can be stuck on storage containers
- Calendars or small posters with information about keeping water clean to hang near to where water is stored
- Comics or games that focus on keeping drinking water clean for use with children or in schools

containers.

Preparing posters or instruction leaflets from scratch can take some time but existing instructions for some products may already exist and will just need adapting.

Mobile Phones

In recent years more interest has been shown in using mobile phones for hygiene promotion. Instructions for water treatment methods can be sent on the phone and people can even have their questions answered. This method shows great promise especially for remote populations or where insecurity prevents access.

Social marketing in an emergency

⁴ See <http://mi.fhi.net/> for more information

Social marketing is an approach that uses marketing principles to promote something that has a social value such as clean water or mosquito nets. There are numerous examples of social marketing in relation to household water treatment but it will be difficult to do the necessary formative research during an acute emergency. However, existing materials could be quickly adapted and the available customer research may shed light on beliefs and values even following the disruption of an emergency. The *principles* of social marketing also remain valid in an emergency and audience segmentation and trying to understand the motivations of the different target audiences are useful techniques that can still be applied.

Motivational Messages

Recent interest and research on motivation has shown that ‘the promise of better health’ may not be the main motivating factor for many people and alternative motivational factors should be identified where possible. For example social norms (what is expected in a certain situation or what other people do) can be a powerful motivation for change. Disgust or the need to nurture one’s family can also be strong motivations. This means that messages should not just stress the health benefits but could also appeal to these alternative motivations. For example a motivational message might be: ‘Don’t get left out – everyone is using the new candle filter’ or ‘Good mothers know what is best for their children – they use XX water treatment’.

Distribution of household water NFIs

If distributing sachets (e.g. PuR® and WaterMaker®), it is usual to distribute one sachet per day for a family of five persons⁵ – so long as they are encouraged to prioritise the water for drinking rather than other household uses. Most projects also distribute buckets, stirring rods and cloths for initial straining where needed.

Even if only water collection containers are to be distributed, it is a good idea to use the opportunity to inform people about their optimal use. Street theatre, songs, puppets and other entertainment can be used at distribution points whilst people are waiting

but make sure that the method used is as interactive as possible by asking the audience questions to cross check what they have learned. See the Oxfam briefing paper on NFIs for more information.

Communication strategy and plan

As with any hygiene promotion intervention, it is important to identify a strategy for intervention and to draw up a communication plan that details the objectives, indicators, target audiences, means of communication and how the intervention will be monitored.

Monitoring and follow up

Regular follow up and monitoring is crucial to the success of HWTS interventions. Involving the community in monitoring can mean that this aspect of the intervention also helps communities, as well as Oxfam, to learn how to do things better.

When distributing products with detailed instructions such as Aquatabs®, PuR® and WaterMaker®, it is common for the instructions to be misinterpreted and frequent and dynamic monitoring will be required.

If chlorine products are being distributed, monitoring residual chlorine levels at the household is a useful way to monitor effectiveness. Community members and/or mobilisers can be taught how to use and interpret ‘pool testers’ and they should be supplied with monitoring forms to record the information. Monitoring should be undertaken at least weekly. For example, ten random households per mobiliser could be identified for water testing. However, ad hoc testing during home visits can also be a useful way to help motivate change.

Communities can also be involved in demonstrations when using equipment such as the delagua kit.

Feedback is required on the following key areas:

1. **The distribution** – was it fair and well done? How could it be done better next time?
2. **The product** – is it being used correctly? How is the taste? Is it easy to use? What are the barriers to use?
3. **Communication methods** – have people attended a demonstration and

⁵ Lantagne, D and Clasen T (2009) PoUWT in emergencies page 43

had the opportunity to ask questions? Do people understand the written/broadcast information? Do staff members communicate respectfully?

Feedback can be sought through individual observations and discussions during home visits or from focus group discussions. The latter is especially useful when seeking information about barriers to change and what improvements are needed in project design.

Household water treatment methods

Boiling

In many places boiling water may not be a practical option as it can be an expensive and environmentally damaging practice. In addition it is time consuming and can take those responsible (often women) away from other productive work.

However, in areas of the world with a good fuel supply, boiling can be cost effective compared to alternative HWTS options and may be well accepted by communities.

Oxfam recommends that boiling should only be promoted in areas where it is widely accepted or where other HWTS options are limited.

Key messages

1. **Water should be heated until it reaches 'a rolling boil'** (WHO) Some organizations, such as the CDC, recommend a continuous boil of one minute, in order to ensure that users do not stop heating the water before the boiling point is reached.
2. **Boiled water should be stored in the container in which it was boiled, preferably a closed container with a lid.**
3. **Care must be taken to avoid scalds and burns – keep children away from fires and boiling water**

Chlorination

For domestic use, chlorine remains the simplest and most effective chemical disinfectant for treatment of water. It is easily available in a number of forms and is effective in killing all types of bacterial and

viral water-borne pathogens except helminths and protozoa such as giardia. In addition, the residual chlorine usually protects treated water from recontamination for at least 24 hours⁶. However, depending on the level of contamination or recontamination due to using dirty, open or poor quality containers, the residual chlorine will eventually get used up and the water will be at risk of further contamination again.

There are 3 forms of chlorine which are widely used in emergencies:

1. Mother solution (1% sodium hypochlorite solution made from calcium hypochlorite or bleach)
2. Dilute sodium hypochlorite especially packaged for water treatment in bottles (e.g. WaterGuard or Sûr'Eau)
3. Tablets of sodium dichloroisocyanurate (e.g.

Case study 2: Cholera outbreak in Northern Uganda

Oxfam worked to train community health volunteers (CHVs) to add Aquatabs® to jerry cans at each hand pump in the camp. Later, due to a shortage of Aquatabs, the CHVs were trained to safely make mother solution and administer doses of chlorine solution to each jerry can. Although the campaign was largely successful, the challenges included:

- Compliance issues with mass chlorination, as people objected to the unfavourable taste;
- The common perception that eating Aquatabs would protect people from cholera
- A lack of storage space in the house out of the reach of children
- The difficulty in treating quantities of less than 20 litres with Aquatabs.

The last challenge was addressed by having only the CHVs add the Aquatabs or mother solution to the water to ensure the correct dose and prevent ingestion. When the programme transferred to using mother solution, CHVs were able to adjust the dose for the container size.

Source: Technical briefing paper 4

messages, boiling and chlorination standards work group framing document, CDC internal document

Aquatabs®)

Ideally, chlorine on its own should only be used where the water is relatively clear and transparent and very turbid water (dissolved and undissolved solids in the water that make it look cloudy), is not suitable for treatment (see TB4). A contact time of at least 30 minutes is required for the chlorine to be fully effective. According to WHO, minimum target concentrations for chlorine at point of delivery are 0.2mg/litre in normal circumstances and 0.5mg/litre in high-risk situations.

Aquatabs® are supplied in strips of ten tablets of varying strengths according to the amount of water to be treated. The instructions usually tell users to add one tablet (2 mg/L) to clear water (or two tablets - 4-6mg/L - to turbid water) in a standard-sized container, and wait 30 minutes before drinking.

Given the variability of tablet strength it is preferable to distribute the same strength tablets in one locality only so that people do not get confused.

All chlorination products will require the establishment of a supply chain to provide sufficient supplies for ongoing use.

Key Messages

Care is needed to ensure the **right amount** of liquid or tablets for the **size of the collection container** and to wait **the right amount of time** (30 minutes) before drinking.

1. Use the product as directed e.g.

Waterguard solution is packaged in a bottle with directions instructing users to add one full bottle cap of the solution to clear water (or two caps to turbid water) in a standard-sized storage container, agitate, and wait 30 minutes before drinking.

2. All products must be kept out of reach of children

3. Products must be diluted before consumption

Bucket chlorination

This is a useful method to use (see case study 2) in the acute phase of an emergency. Bucket chlorination can take place at water points or at home and either chlorine tablets or a 'mother' solution of chlorine can be used. Community mobilisers can be involved in

carrying out the chlorination and in providing information and monitoring.

Flocculation and disinfection

A particular challenge for many household-based water treatment technologies is high turbidity. Solids in the water will use up the free chlorine (and reduce the protection from the chlorine residual) or other chemical disinfectants and cause the premature clogging of filters.

While turbidity can often be managed by pre-treatment or even simple sedimentation (such as the three pot method; see page 8), flocculation/coagulation using common substances such as 'alum' or crushed moringa seeds can be an effective and relatively low-cost option, where people are familiar with these methods. Such forms of assisted sedimentation have been shown to reduce the levels of certain microbial pathogens, especially protozoa that may otherwise present a challenge to chemical disinfectants. However, disinfection is still required in most cases for complete microbial protection (see TB4 for more information).

Some manufacturers have combined flocculation and time-released disinfection into a single product that is sold in sachets for household use (e.g. PuR® and WaterMaker®). PuR® has been shown to remove the majority of bacteria, viruses and protozoa and also removes the majority of heavy metals such as arsenic and some pesticides. PuR® is packaged in 4g sachets and each sachet will treat 10 litres of water. WaterMaker® comes in two preparations: 5g to clean 20 litres of water and 2.5g to make 10 litres of clean water.

Key Messages

1. Use the product as directed: e.g.

To treat water with PuR®:

- Open the sachet,
- Add the contents to an open bucket containing 10 litres of water,
- Stir for 5 minutes
- Let the solids settle to the bottom of the bucket
- Strain the water through a cotton cloth into a second container
- Wait 20 minutes for the hypochlorite to inactivate the microorganisms

- Bury the residue in a pit or dispose of it safely in the latrine as it can be harmful to children and wildlife.

2. All products must be kept out of reach of children



Figure 4: Instructions for use of PUR

Optional message:

Straining dirty water through a cloth before treatment can make the product more effective.

Natural filtration methods

In order to effectively chlorinate turbid water, it is useful to either let the water settle or filter it through a cloth. Settling and decanting the water (often known as the three pot method) is an effective way to reduce turbidity and to reduce the demand for chlorine but requires at least 2 containers.



Figure 5: Cloth filtration in Kenya, source: CDC, R. Quick

Aluminium sulphate and moringa seeds are two naturally occurring flocculants. In many countries ‘alum’ can be bought as a block of white stone that is stirred in turbid water. This causes the solids to clump together and then they will then settle out, allowing the cleaner water to be decanted. However using too

much alum can affect the taste of the water and make it unpalatable.



Figure 6: An alum chunk Source: CDC, D. Lantagne

Ceramic Filtration

Locally manufactured ceramic filters have traditionally been used throughout the world to treat household water and there are numerous examples of filters being distributed in emergencies. Both pot and candle filters have been used. However, recent evaluations⁷ have suggested that they should not be distributed in acute emergencies where people are living in emergency shelters.

Ceramic filters can provide safe water for users for up to 2 years without the need for replacement candles but should not be used if a simpler method is available and acceptable. Consideration should also be given to the availability of replacement candles and taps. Significant training and follow up will be needed if people are not familiar with the filters. Turbid water may need to be filtered through a clean cloth first. Because of the lack of residual protection, it is important that users be trained to properly care for and maintain the ceramic filter and

Tips for maintenance of candle filters

1. Clean the candles when the flow rate starts to slow down
2. Use a separate cloth to clean the top and bottom containers
3. Take care that you do not scrub the candles too vigorously
4. When cleaning put the wing nut and washer (that provides a tight seal for the candle) in a safe place
5. Replace the candles when they become worn or break

⁷ Palmer (2005)

receptacle.

Candle Filters

The Stefani candle filter is available from the Oxfam equipment catalogue as:

1. A complete set with a bucket, 2 candles, a tap, and a pictorial leaflet (Code FHF/1)
2. A set for when a local container is available, including three candles and a tap (Code FHFCT/1).

Key Messages

1. **To use:**
 - If water very dirty, filter first through a clean piece of fine cloth
 - Fill the top receptacle or the ceramic filter itself with water
 - Wait at least one hour (you should have approximately one litre of clean water available to drink)
 - Turn the tap on the lower container to access the clean water
2. **Remember to clean your filter and candles regularly with separate cloths**



Figure 7: Cleaning of ceramic candles source: IFRC

Clean the candles by **gently** scrubbing with a soft brush and rinsing with water. You will also need to clean out the top receptacle. Cleaning is required when the candles clog up and the water flow slows down.

A common problem is that people often clean the candle and then clean the bottom container with the same cloth. The outside of the candle is likely to be contaminated and this will then contaminate the clean water in the bottom container. The candles will also need to be replaced periodically but should last for at least a year.

Pot filters

Pot filters work in a similar way to candle filters but the top receptacle itself is ceramic and acts as the filter. It is important that any filters used have passed microbiological testing and quality control checks.

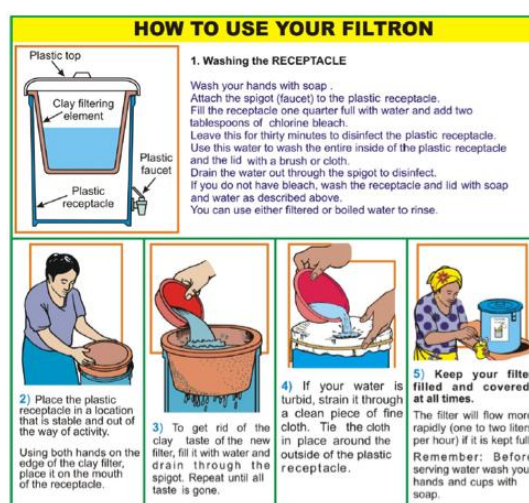


Figure 8: Instructions for use of pot filter

Membrane filtration

Oxfam has been trialing a number of new products that use membrane filtration in various emergency situations. These work through reverse osmosis where the membrane allows water molecules to pass through but not larger molecules such as bacteria and viruses.

The advantages of membrane filtration are that it eliminates viruses as well as bacteria. They are usually quite easy to use as they employ a single stage system that produces water immediately rather than having to wait. However, the membrane filter will need washing and can get clogged up quite easily. The Lifestraw is one such product but to date it has not proved a viable option as users do not like it and it spreads contamination on the mouthpiece. Work is underway to develop an effective household level membrane filter.

Hygiene promotion for HWTS December 2012

The briefing paper will be updated as more information becomes available on this water treatment method.

HHWT options, key messages and issues

Advantages	Potential promotional issues	Key messages
<p>relatively low protection against parasitic cysts lower disinfection effectiveness in turbid waters contaminated with organic and some inorganic compounds potential user taste and odour objections necessity of ensuring quality control of solution understanding about the effects of chlorination products concern over the potential long term carcinogenic effects of chlorine by-products</p>	<ul style="list-style-type: none"> ○ Can be in solution or tablet form ○ Need to stress the importance of contact time ○ Important to monitor HH residual chlorine levels ○ Many people cannot tolerate the taste or smell in high doses – need to work with engineers and population to adjust dosage ○ Some people may be aware of possible long-term carcinogenic effects but in emergencies the benefits of short-term chlorine use far outweigh the potential side effects. Recent research⁸ has shown that trihalomethanes (THM) levels in point of use water treatment methods do not exceed the WHO guideline values. ○ Given the variability of tablet strength it is preferable to distribute only same strength tablets in one locality so that people do not get confused 	<p>1. Use Watergr... cap of t... contain...</p> <p>2. All</p> <p>3. Dil</p> <p>4. Ma</p> <p>Vigoro...</p> <p>Water...</p>
<p>multiple steps are necessary to use the product, which requires a demonstration to teach new users need for users to have, employ, and maintain buckets, a cloth, and a stirring device higher relative cost per litre of water treated compared to other household water treatment options some resistance to colour/taste residue is difficult to dispose of in flood-affected areas</p>	<ul style="list-style-type: none"> ○ Needs careful follow up to ensure people are using it correctly ○ There may be objections to the taste so will need to be trialled before use even where product is familiar 	<p>1. Use</p> <ul style="list-style-type: none"> ○ ○ ○ ○ ○ ○ ○ <p>2. All</p> <p>Option</p> <p>3. Str</p>
<p>lower effectiveness against viruses lack of residual protection can lead to contamination if treated water is stored unsafely variability in quality control of locally produced filters filter breakage over time, and need for spare parts filters and receptacles need to be regularly cleaned, especially when using turbid source waters low flow rate of 1-3 litres per hour unlikely to be appropriate in first phase emergency response due to need for user education, follow-up supply chain establishment</p>	<ul style="list-style-type: none"> ○ Users will need help in setting up product ○ Expensive item that people may feel they would rather sell 	<p>1. To</p> <ul style="list-style-type: none"> ○ ○ ○ <p>2. Re</p>

⁸ Lantagne, D et al (2010) Am. J. Trop. Med. Hyg, 00(0), 2010, pp. 000–000 doi:10.4269/ajtmh.2010.09-0431

<p>difficult to transport people need space in their homes to accommodate them</p>		
<p>often not acceptable in terms of the time required high cost of fuel lack of residual protection against recontamination does not remove suspended or dissolved compounds lack of epidemiologically confirmed health impact potential for burn injuries and increased risk of respiratory infections from indoor stoves or fires essentially high cost of carbon based fuel source (with concurrent deforestation risk) and the opportunity cost of collecting fuel potential user taste objections (boiled water tastes flat because the carbon dioxide has been removed) potential for incomplete water treatment if users do not bring water to full boiling temperature</p>	<ul style="list-style-type: none"> ○ Only to be used where government promotes this method and people find it acceptable ○ Aeration (by vigorous shaking) can improve the taste ○ The addition of a pinch of salt to each litre of water can also improve the taste ○ Could be promoted for most vulnerable such as children under five years and elderly. 	<ol style="list-style-type: none"> 1. Wa 2. Bo pre co 3. Ca an
<p>needs frequent backwashing some individual designs can transmit infection</p>	<ul style="list-style-type: none"> ○ Information not yet available 	<ul style="list-style-type: none"> ○ Inf

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