

Water and  
Sanitation in Asia  
Pacific

# *Household Water Treatment and Safe Storage in Emergencies*

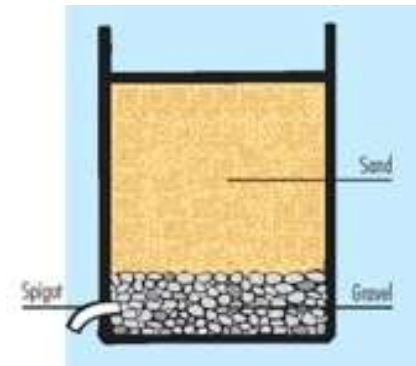
## **Emergency WASH in Asia Pacific**

## Today's agenda

- What is household water treatment and safe storage (HWTS)
- What is multi-barrier approach
- What different methods are available for HWTS
- How and when to roll out a HWTS programme
- Further resources

## *What is household water treatment?*

Household water treatment is any activity to improve water quality undertaken at the household level



## *What is safe water storage?*

Safe water storage is the use of clean containers with covers AND good hygiene behaviour that prevent contamination during water collection, transport and storage in the home



## *Point-of-use vs. semi-centralised water supply and purification*

	<b>Point-of-use water supply and purification</b>	<b>Semi-centralised supply and purification</b>
<b>Principles</b>	End-users (households and communities) are trained to apply simple multi-barrier methods based on the HWTS approach.	After and during an emergency, a mobile water treatment unit is brought close to the water source and installed and operated by trained staff.
<b>Technologies</b>	Sedimentation, coagulation, disinfection, boiling, SODIS	Treatment units
<b>Advantages</b>	Low-cost	Ready-to-use, very effective
<b>Disadvantages</b>	High responsibility of end users	Expensive, knowhow for O&M

## *Pros and cons of HWTS*

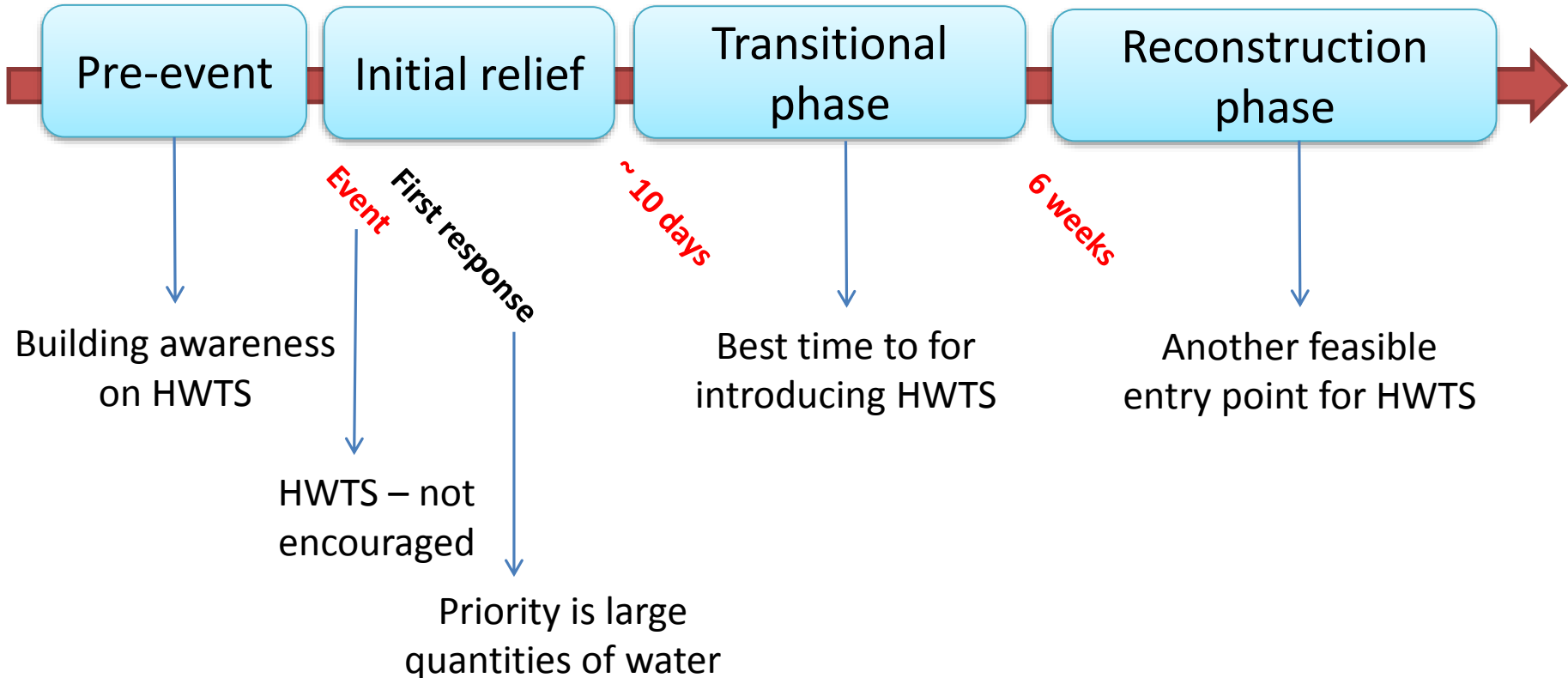
### Pros

- Relatively inexpensive
- Independent from institutional set-up or centralised systems
- Can be rapidly deployed and taken up by vulnerable populations
- Improves microbial water quality and reduces contamination risk between treatment and use
- Wide range of simple, low-cost technologies available

### Cons

- High self-responsibility required from households
- Difficult to monitor correct O&M of technologies
- Each households should be provided with knowledge on O&M of the system
- Treated water may be lower quality than that offered by a well-designed, operated and maintained community system

# When do we roll out HHWT



# HWTS and Sphere

## Water supply standard

### Access and water quantity



$\geq 15$  litre/p/d



$< 500\text{m}$



Queuing time  $\leq 30$  minutes

### Water quality

- ~~×~~ faecal (thermotolerant) coliforms
- ~~×~~ negative effect on health
- ~~×~~ outbreak of water-borne or water-related diseases
- Water treatment options used are effective in improving water quality, accompanied by appropriate training, promotion and monitoring
- All affected people drink water from a protected or treated source



## *HWTS and Sphere*

### Water supply standard

#### Water facilities



- $\geq 2$  clean water collecting containers; 10–20 L/HH (storage & transportation)
- Narrow necks and/or covers for buckets or other safe means of storage

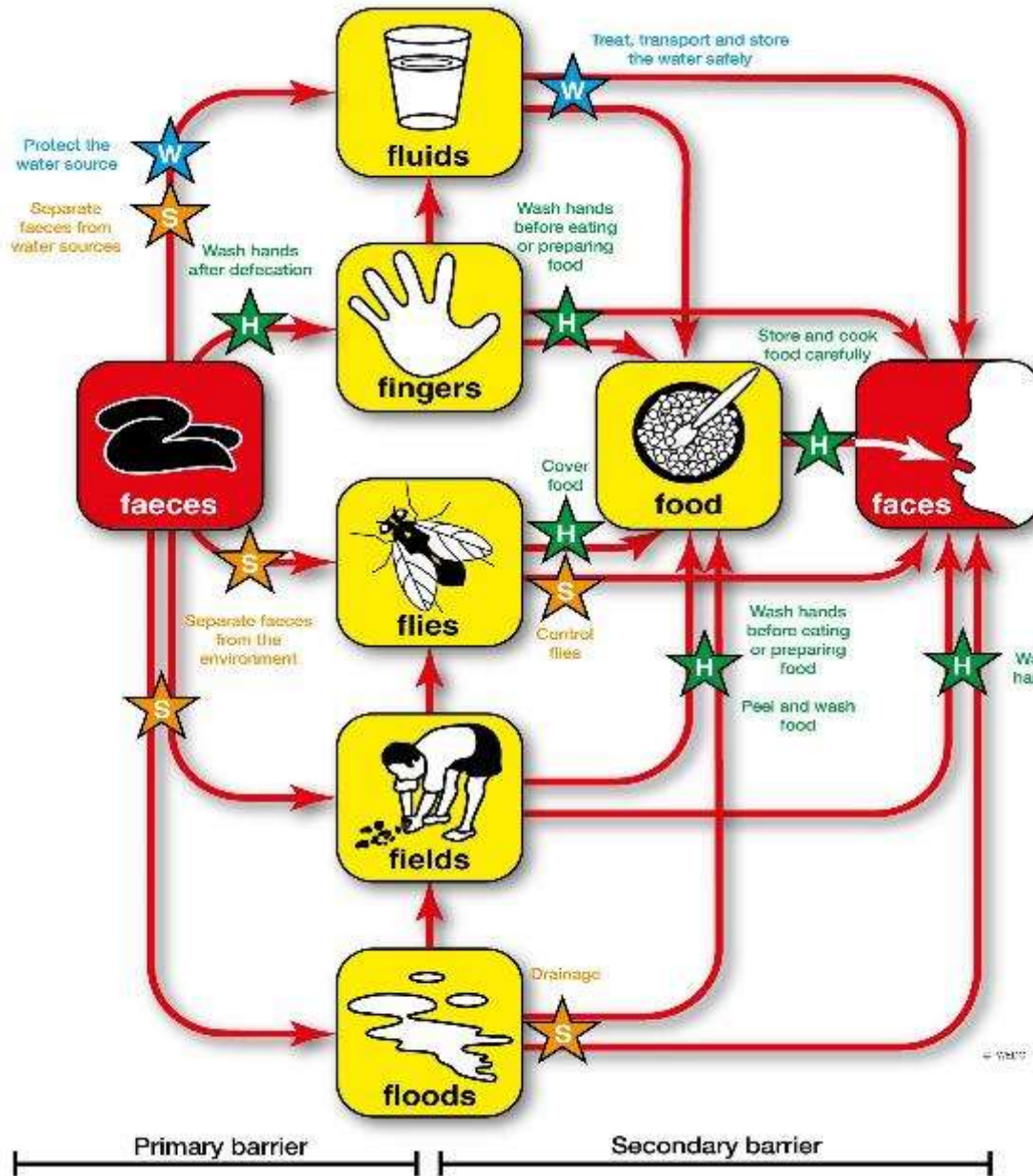


- $\geq 1$  washing basin per 100 people and private laundering and bathing areas available for women with enough water
- Water at household level is free from contamination at all times
- All people are satisfied with the adequate facilities they have for water collection, storage, bathing, hand washing and laundry
- Regular maintenance of the installed systems and facilities is ensured and users are involved in this where possible

**NO DISTRIBUTION  
WITHOUT  
TRAINING!!!!!!!**



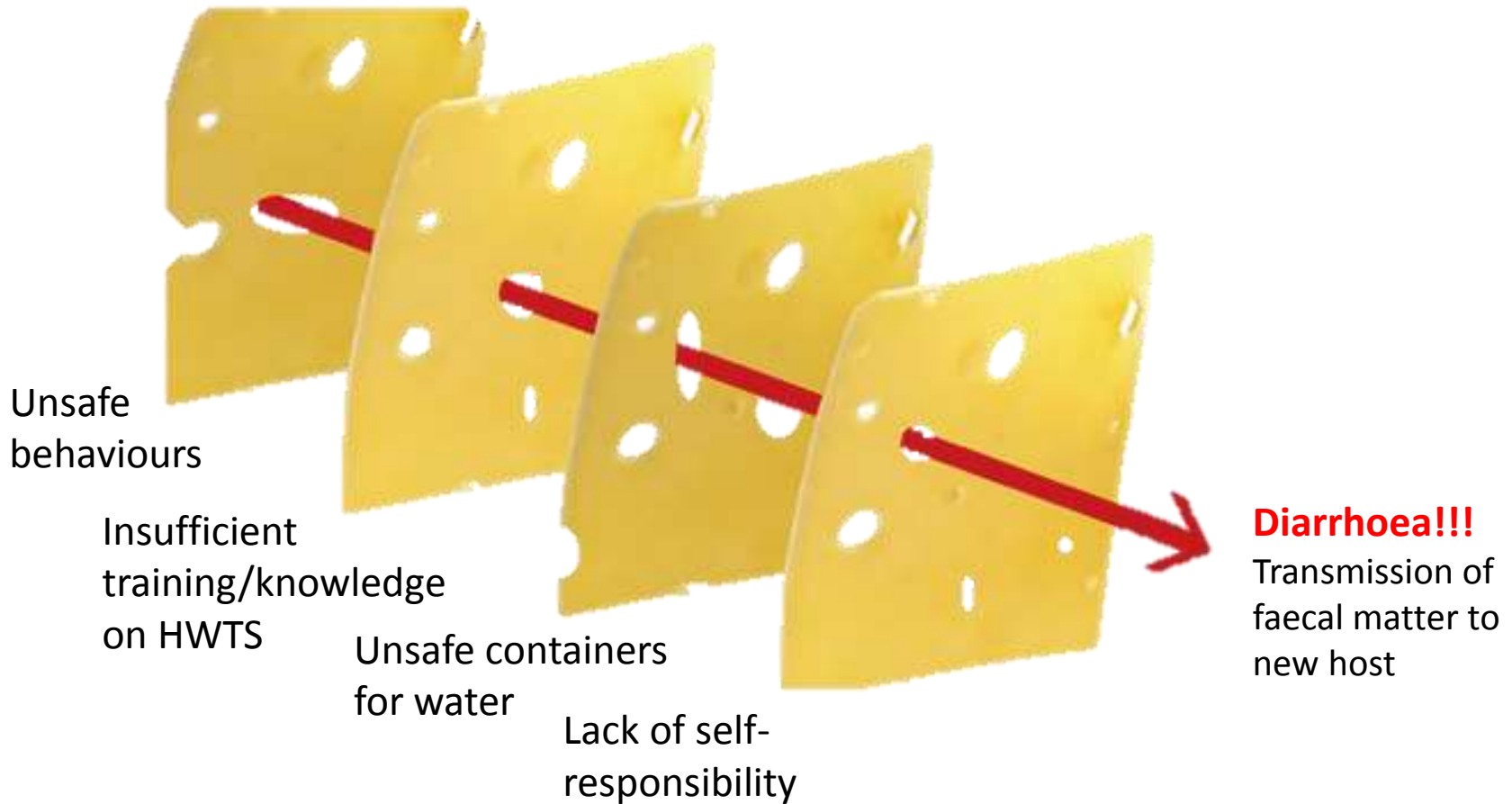
# 'f' diagram



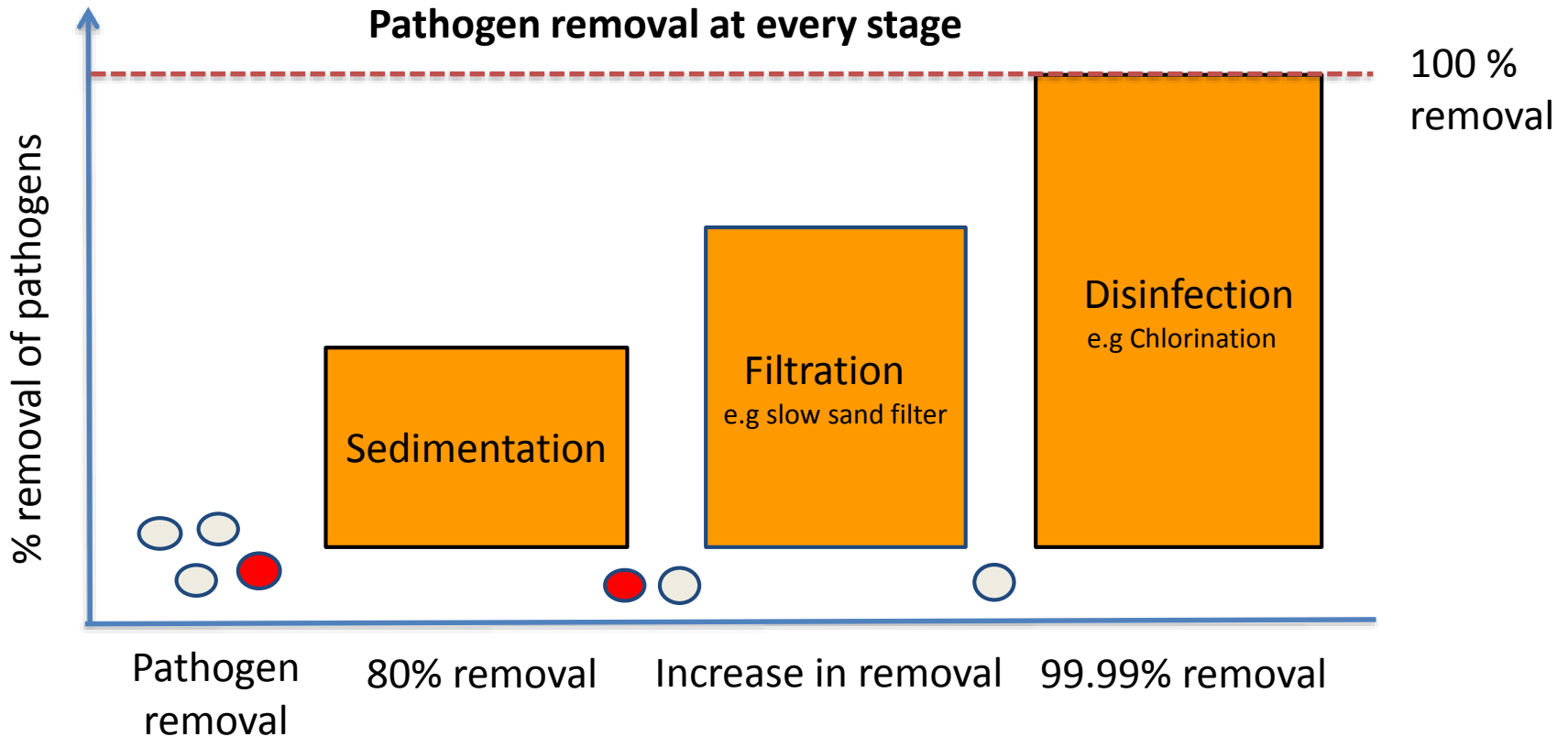
- Movement of pathogens from faeces of a sick person to where they are ingested by somebody else can take many pathways.
- Main pathways:
  - fluids (drinking water)
  - fingers
  - flies
  - fields (crops and soil)
  - floods (and surface water generally)
- Barriers can stop transmission of disease:
  - primary
  - secondary



## *Why more than one barrier for the transmission of faeces to new host?*



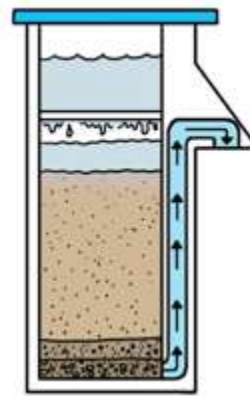
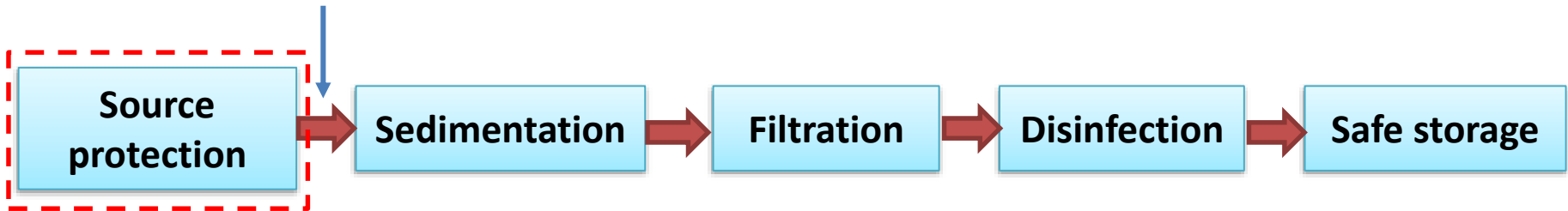
# Multi-barrier approach



Source: RedR

# Multi-barrier approach

Straining



Source: CAWST (2009)



# HWTS decision tree

Is the source contaminated?

**YES**

Are products from outside the community available in the market or through humanitarian response?

**NO**

Is water muddy?

**NO**

Is wood or another heat source readily available?

**NO**

Promote straining, SODIS, three pot method or basic filtration

**YES**

Promote straining, three pot method or SODIS

**YES**

Promote straining, boiling and safe water storage and handling

**YES**

Is water muddy?

**YES**

Promote straining, three pot method, chemical sedimentation or filtration

**NO**

Is water cloudy?

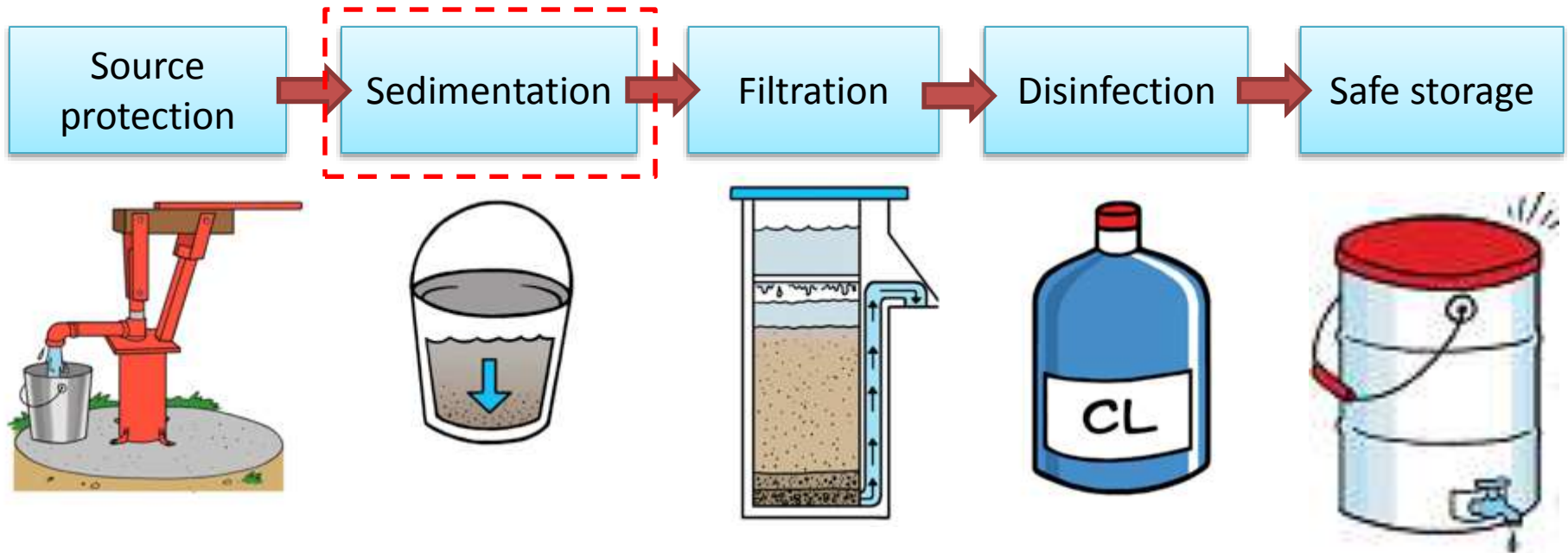
**NO**

Use normal does of chemical disinfection

**YES**

Strain water and use double dose of chemical disinfection

# Multi-barrier approach



Source: CAWST(2009)



# Sedimentation

Sedimentation is a physical treatment process allowing dirt (impurity) to fall to the bottom of the water container over time or can also be achieved through the addition of chemicals

## Option 1: Settling



Three pot method

### TIP

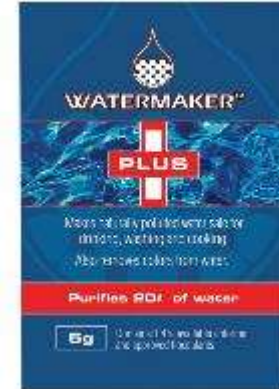


- Strain water before carrying out other treatment options
- Use clean, fine cotton cloth
- Wash the cloth in between uses

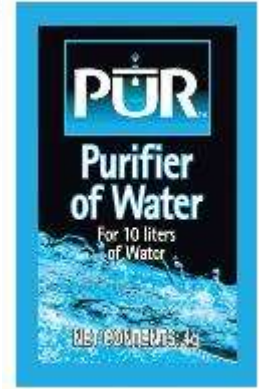
# Sedimentation

## Option 2: Chemical sedimentation

- **Chemical coagulants**
  - Watermaker/PuR sachets: coagulation + chlorination
  - Alum (aluminium sulphate)
  - Poly aluminium chloride – liquid alum)
  - Aluminium/iron salts i.e. ferric sulphate
- **Natural/plant coagulants**
  - Moringa seeds (*Moringa oleifera*)
  - Prickly pear cactus (*Cactus opuntia*)




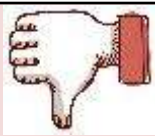
5g for 20 litres



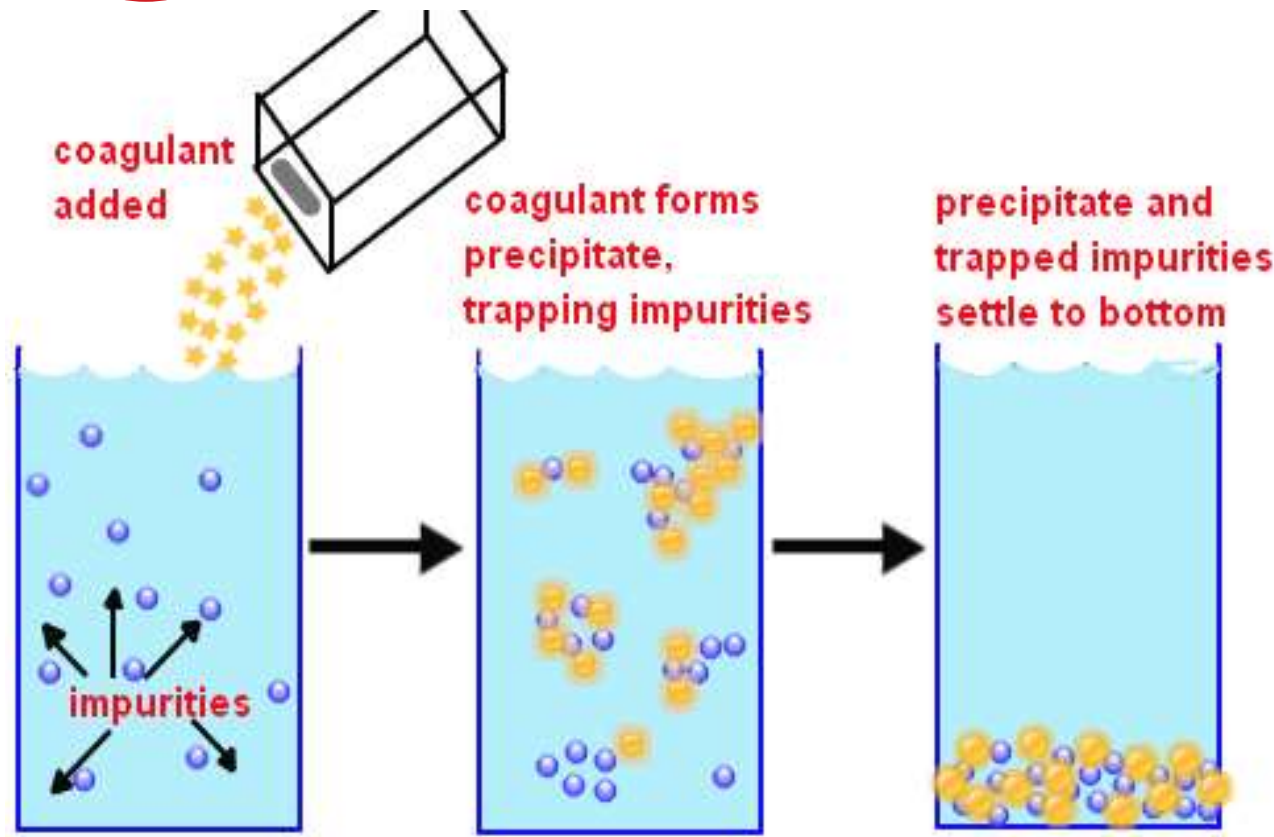
4g for 10 litres



## *Comparison between three pot method and combined chemical sedimentation & disinfection*

Method		
<b>Three pot method</b>	<ul style="list-style-type: none"> <li>• Greatly reduces dirt and disease-causing germs in water.</li> </ul>	<ul style="list-style-type: none"> <li>• Does not totally remove disease-causing germs.</li> <li>• Boiling, chemical or solar disinfection is still needed to completely remove disease risk.</li> </ul>
<b>Chemical sedimentation plus disinfection</b>	<ul style="list-style-type: none"> <li>• Can make muddy water safe to drink.</li> <li>• The disinfection aspect of chemical sedimentation has a residual effect, which gives some protection against contamination post treatment.</li> </ul>	<ul style="list-style-type: none"> <li>• More complicated to use and requires more training and follow-up.</li> <li>• Some chemicals may not be available everywhere</li> </ul>

## Coagulants: how does it work?



### TIP

- Use clear buckets for demonstrations
- Use straining cloth when pouring into containers

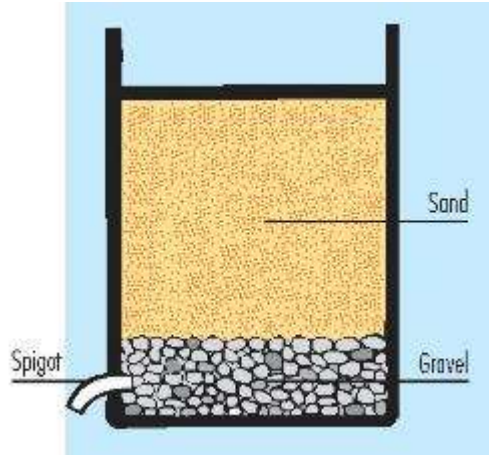
Source:chemistry.tutorvista.com

# Filtration

Cloth filter



Sand filter



Biosand filter



Ceramic pot filter



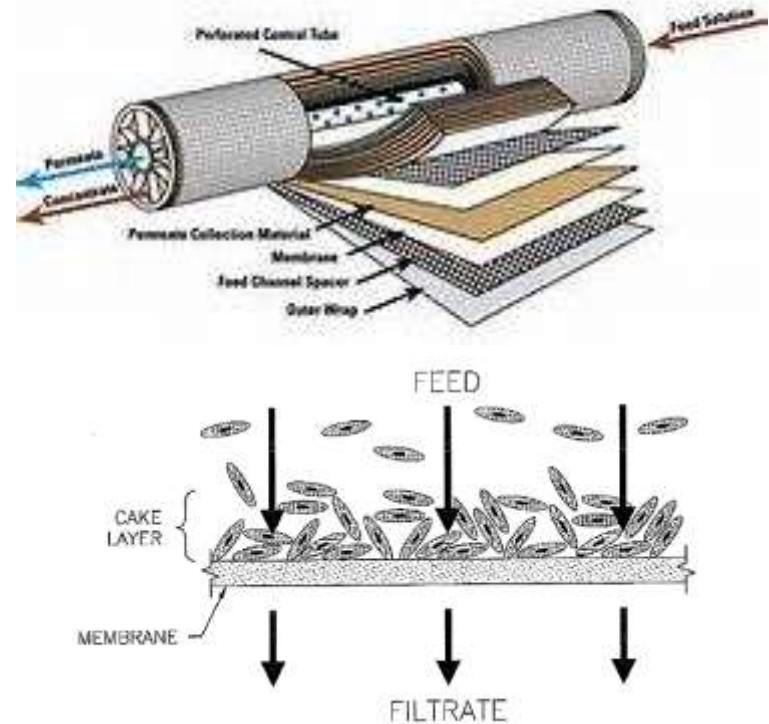


# Filtration



## Ceramic candle filter




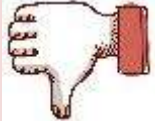
## Membrane filter



# Comparison between filtration types

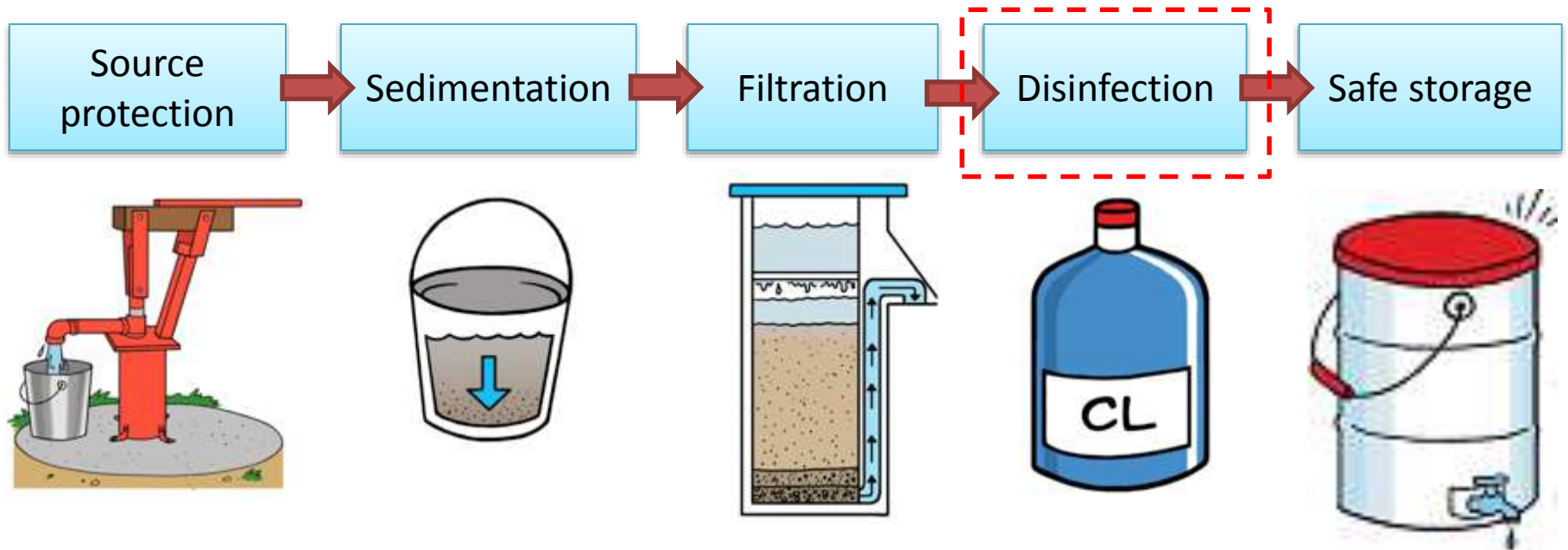
		
<b>Cloth filter</b>	<ul style="list-style-type: none"> <li>• Low cost</li> <li>• Minimal time required</li> <li>• Simple and easy to reduce turbidity</li> <li>• Known to reduce risk of cholera</li> </ul>	<ul style="list-style-type: none"> <li>• Require diligent washing of cloth after use</li> <li>• Fibres may loosen significantly over time</li> <li>• Cannot remove all bacteria and viruses</li> </ul>
<b>Sand filter</b>	<ul style="list-style-type: none"> <li>• Simple and fast to use</li> <li>• Effective at removing dirt and some disease-causing germs</li> <li>• Inexpensive if sand and containers are available locally</li> </ul>	<ul style="list-style-type: none"> <li>• Requires 3 containers (1 of which must have a spigot)</li> </ul>
<b>Biosand filter</b>	<ul style="list-style-type: none"> <li>• High removal of pathogens</li> <li>• Removal of turbidity, colour, odour and iron</li> <li>• Relatively high flow-rates (&gt;30 L/hour)</li> <li>• One-time installation with few maintenance requirements and negligible operation costs</li> <li>• Long life</li> <li>• Can be fabricated from locally available materials</li> <li>• Easy to operate and maintain</li> </ul>	<ul style="list-style-type: none"> <li>• Biological layer takes 20-30 days to develop to maturity</li> <li>• Low rate of virus inactivation</li> <li>• High turbidity (&gt; 50 NTU) will cause filter to clog and requires more maintenance</li> <li>• Requires that the filter be used on a regular basis</li> <li>• Cannot remove dissolved compounds</li> <li>• Can be difficult to move or transport (due to weight)</li> <li>• Lack of residual protection (risk of re-contamination)</li> <li>• Requires that the filter be used on a regular basis</li> </ul>

# Comparison between filtration types

		
<b>Ceramic pot filter</b>	<ul style="list-style-type: none"> <li>• Proven reduction of bacteria and protozoa in water</li> <li>• Simple to use</li> <li>• Proven reduction of incidence diarrhea among users</li> <li>• Long life as filter remains unbroken</li> </ul>	<ul style="list-style-type: none"> <li>• Not as effective against viruses</li> <li>• Lack of residual protection (risk of re-contamination)</li> <li>• Variable QC for locally produced filters</li> <li>• Filters can break over time – need spare parts</li> <li>• Low flow rate of 1-3 L/hr for non-turbid water</li> <li>• Need to be cleaned regularly esp if water is turbid</li> </ul>
<b>Ceramic candle filter</b>	<ul style="list-style-type: none"> <li>• Cheap, simple and easy to use and clean</li> <li>• Removes pathogens, turbidity and suspended solids</li> <li>• Somewhat effective for removal of viruses and iron</li> <li>• Improves taste, smell and colour of water</li> <li>• Generally durable, easy to move and transport (except clay pot)</li> </ul>	<ul style="list-style-type: none"> <li>• Does not remove all pathogens</li> <li>• Does not remove chemical contaminants</li> <li>• Highly turbid/iron-containing water plugs candle pores</li> <li>• Low flow rate</li> <li>• Clay pot can be fragile and heavy</li> <li>• QC is difficult in local productions</li> </ul>
<b>Membrane filter</b>	<ul style="list-style-type: none"> <li>• High performance</li> <li>• Simple operation</li> <li>• Able to separate different contaminants i.e. high selectivity</li> <li>• Disinfection can be performed without chemicals depending on pore size</li> </ul>	<ul style="list-style-type: none"> <li>• Equipment cost can be quite high</li> <li>• Membrane fouling which could lead to decrease of permeate flux</li> <li>• Production of polluted water from backwashing</li> <li>• Membranes have to be replaced on a regular basis</li> </ul>

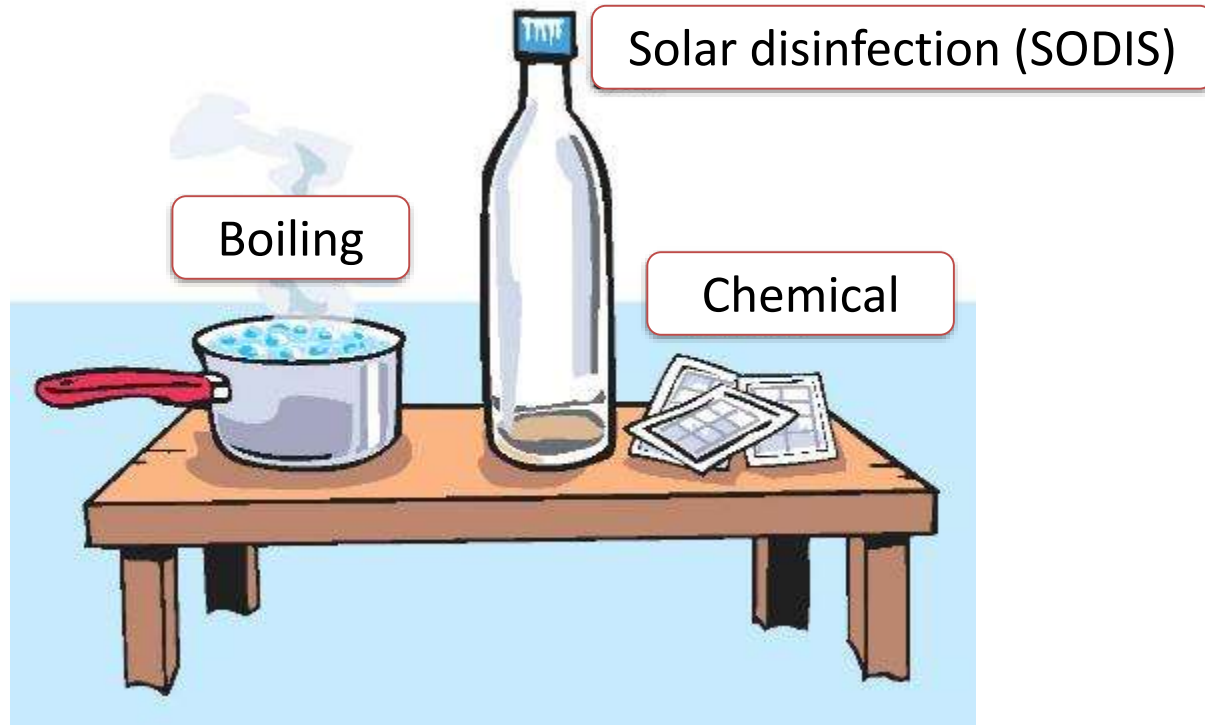


# Multi-barrier approach



Source: CAWST(2009)

## *Types of disinfection*



## *Boiling*

- For boiling water to work, water must be brought to a rolling, bubbling boil



### TIP

Boiling will make water taste flat – this can be fixed with salt or shaking!

## Solar disinfection (SODIS)

- Sunny - 6 hours
- Cloudy - 2 days



### TIP

- Fill the bottle abt  $\frac{3}{4}$  full – shake it vigorously – then fill the bottle and expose to the sun
- Sporadic shaking during exposure

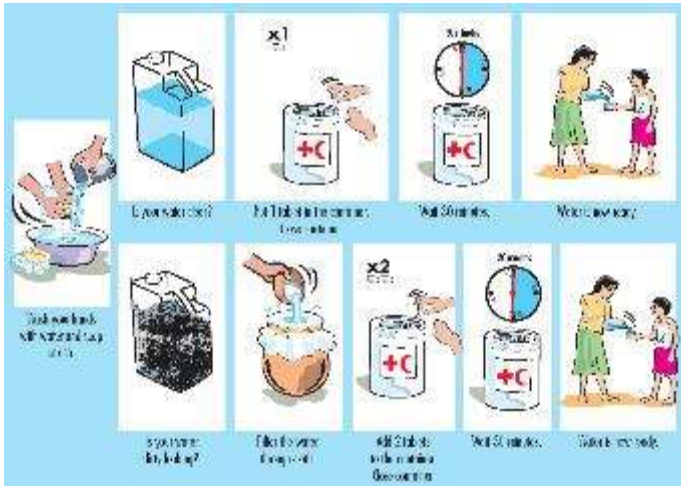
Source: <http://www.thescienceofcreativity.com/>

# Chemical disinfection

- Chlorine tablets

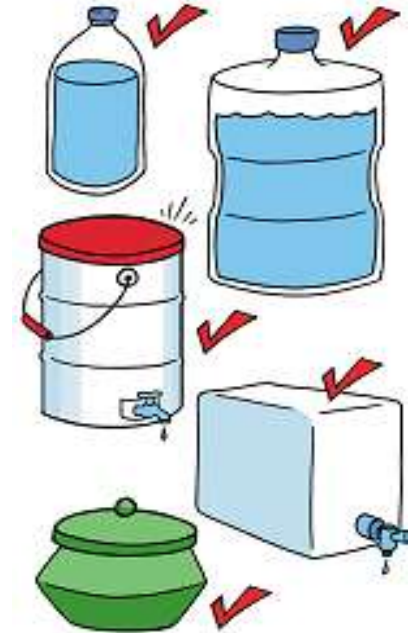
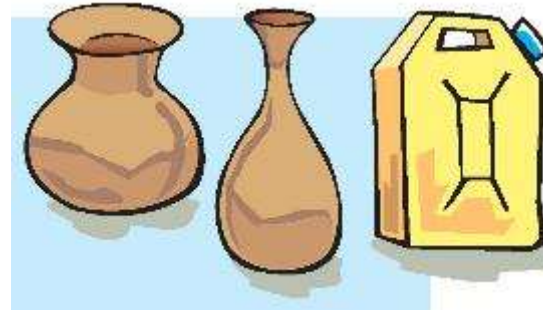
**TIP**

- Use double dose of chemical if water looks dirty or cloudy
- Talk to people about the product – ask for feedback



## *Safe water storage*

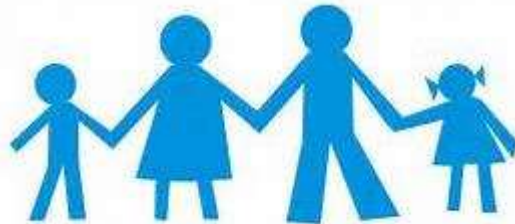
- **Water storage container**
  - Tight fitting lid or cover
  - Tap or narrow opening
  - Stable base
  - Durable
  - Easy to clean
  - Locally available





# *Considerations for successful implementation of a HWTS in emergencies*

HWTS should be targeted to the most vulnerable populations



# *Considerations for successful implementation of a HWTS in emergencies*



Long term maintenance plan which supports effective exit strategy



Plan the source of financial support



User appropriateness & acceptability through community engagement



Creates ownership



# What should be monitored



No. of products distributed



No. of people trained



No. of education materials distributed



No. of HHs visits conducted

**These kinds of numbers are not enough!!**

**Household visits should also include checks of *proper use* of products distributed**

## *Further resources*

- **Household water treatment and safe storage in emergencies**

A field manual for Red Cross/Red Crescent personnel and volunteers

Download it at [www.watsanmissionassistant.org/water](http://www.watsanmissionassistant.org/water)

- **Public Health – Module 4: Household Water Treatment and Safe Storage**

Available on IFRC Learning Platform <https://ifrc.csod.com>

- **Sphere handbook**

Download it at <http://www.sphereproject.org/handbook/>

