

Rural Training Center – Thailand (RTC-TH)



**Community-based Environmental Education
for the Self-sufficiency and Sustainability of
Small Rural Family Farms**

Preparing for Emergencies: **WATER**



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Created by G.K. Lee for the RTC-TH EmComm

EP-3



An Emergency Preparedness Training Series presentation



Rural Training Center-Thailand
Emergency Preparedness Community Service Program

Ready to serve and sustain our community

For other lessons in the series e-mail rtc2k5@gmail.com

www.neighborhoodlink.com/org/rtcth

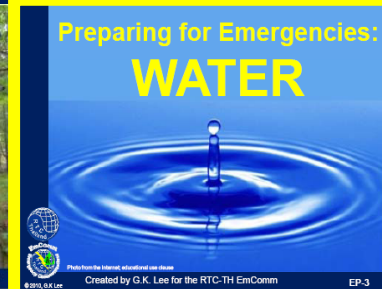
The EP Lesson Series



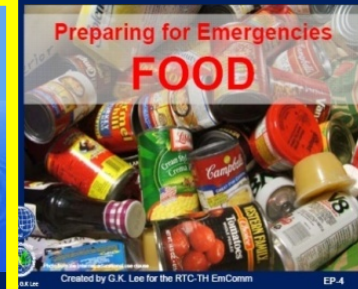
EP-1



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EP-3



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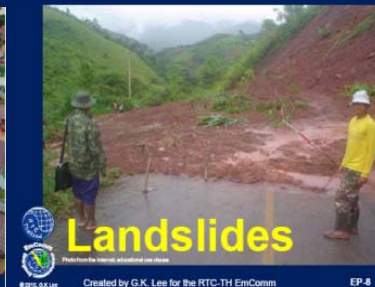
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A part of the RTC-TH EmComm Program

The Rural Training Center-
Thailand Emergency
Preparedness program is a
community service effort to
provide emergency



Preparedness training for local
community self-sufficiency and
sustainability in times of need.



The Rural Training Center-Thailand (RTC-TH)

is an all volunteer
organization providing
community-based
environmental education
for self-sufficiency and
sustainability of small
rural family farms

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The lessons were adapted from existing RTC-TH REEEPP program lessons

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REEEPP

Rural Environmental Education Enhancement Pilot Program



An innovative, non-traditional community-based environmental education program integrating math, science, geography, English language, and technology lessons for environmental stewardship using interactive experiential learning in outdoor settings at Ban Na Fa Elementary School, Nan Province, Thailand.



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The Rural Training Center-Thailand was created to honor the life and memory of Mr. Tang Suttisan, a father, farmer and former custodian of Ban Na Fa Elementary School who appreciated and valued education.



When will help arrive?

It can come as fast as 1-2 hours or 1-2 days.
In major disasters, it may take 1-2 weeks.



Photos from the Internet; educational fair use clause

If you have enough supplies for 1-2 weeks, you will be better prepared for the “worst case” situation.



Basic Survival Guidelines

Depending on your situation, in general, you can expect to live for:

- 1-3 minutes without air
- 15 minutes to a few hours if you cannot maintain your core body temperature
- 1-7 days without water
- 1-2 weeks without food
- 1-2 months without shelter.



Until help comes, this may be the water you can get



Photos from the Internet; educational fair use clause



Even if you have stored clean water, it won't last forever.
It takes time to get more and to make it safe to drink, so start soon.





Water

Clean, safe drinking water is needed to survive a disaster.



Photos from the Internet; educational fair use clause



Each person needs 4 L of water per day or 56 L for 2 weeks.

The actual amount of water needed depends on a person's age, health, activity level, weather conditions and other factors.
Adjust the 4 L/day estimate according to you situation.



Hot weather can double your need for water.





Water Use

Water use depends on physical activity, the weather and your physical condition (among other factors).

- Walking 32 km / 20 miles at night takes 4L of water; 8 L in the day.
- Without water you may be able to walk 32-40 km / 20-25 miles
- Conserve water by staying in shade, wearing loose clothing to reduce evaporation from your skin, minimizing eating (you need water to digest food)
- Minimizing physical activity or do it in early morning or early evening when it is cooler





Water is heavy



Photo from the Internet; educational fair use clause

1 Liter of water =
1 kg

If you have to
carry water, a 1
day supply will
weight 4 kg.

A 2 week supply
will weight 56 kg.



If you are trying to walk to safety, you may not be able to carrying the water you need.
If you cannot find water on the way, it may be better to stay where you are.



Water and Weather

Temperature, Relative Humidity, & Heat Stress affect water needs.

Getting weather data from the disaster area is important for planning the relief effort and supplies needed.

Heat Stress Index (Sensible Temperature)									
Air Temp	Relative Humidity								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
46°C	44°C	49°C	57°C	66°C					
43°C	41°C	44°C	51°C	58°C	56°C				
41°C	38°C	41°C	45°C	51°C	57°C	65°C			
38°C	35°C	37°C	40°C	43°C	49°C	56°C	62°C		
35°C	32°C	34°C	36°C	38°C	42°C	46°C	51°C	58°C	
32°C	29°C	31°C	32°C	34°C	36°C	38°C	41°C	45°C	50°C
29°C	27°C	28°C	29°C	30°C	31°C	32°C	34°C	36°C	36°C
27°C	24°C	25°C	26°C	26°C	27°C	28°C	29°C	30°C	31°C
Danger Level	I Caution		II Extreme Caution		III Danger		IV Extreme Danger		---
Heat Index	27-32°C		32-40°C		40-54°C		Above 54°C		Relative humidity rarely observed
Heat Syndrome	Fatigue possible with prolonged exposure and/or physical activity		Sunstroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity		Sunstroke, heat cramps, or heat exhaustion likely; heat stroke possible with prolonged exposure and/or physical activity		Heat / sunstroke highly likely with continued exposure		Generally not applicable but conditions would be extremely dangerous
<ul style="list-style-type: none">• Use a hygrometer placed in a shaded position about 1.2 m / 5 ft above the ground.• Air Temperature is read from the Dry Bulb Thermometer.• Relative Humidity is calculated using the Relative Humidity Table. This requires the following data: Air Temperature and the Temperature Difference between the Dry and Wet Bulb readings.									



You can learn more about temperature, relative humidity and the heat stress index in MEWS Lesson B1 & A1; see www.neighborhoodlink.com/org/rtcth/

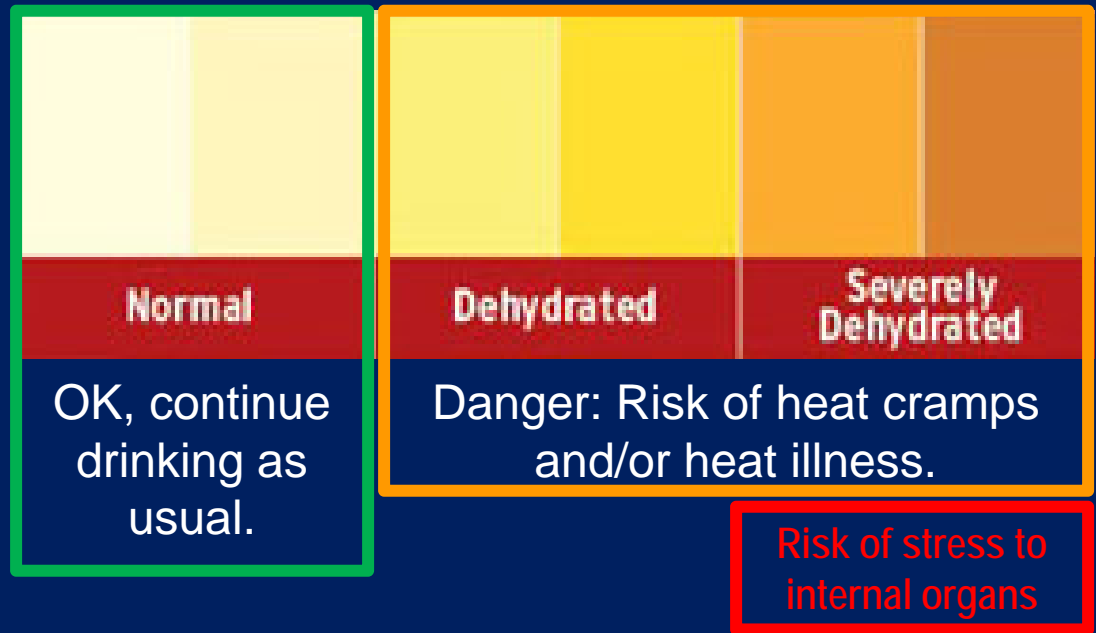


Proper Hydration Biofeedback

Each time you urinate, check the color of your urine.

Water is ~60% of a male's body weight;
~50% of a female's.

Degrees of Dehydration	Body Water Lost
Severe	10-15%
Moderate	5-10%
Mild	5%



People over 60 yrs old who drink only when they are thirsty get only about 90% of the water they need.



Heat Illnesses

Get out of direct sunlight. Increase air circulation.
Use water and fans to cool the person quickly.

	HEAT EXHAUSTION	HEAT CRAMPS	HEATSTROKE
Cause	Failing to replace fluids and electrolytes when dehydration starts	Apply a cold pack on the head and neck. Restore fluid and salt balance with foods and drinks that contain sodium	Extreme exertion, coupled with very hot, humid conditions and dehydration, impair body's ability to maintain an optimal temperature.
Symptoms	A core body temperature of 102°F to 104°F, headache, fatigue, profuse sweating, nausea, clammy skin	Severe abdominal cramps or large-muscle cramps (such as quads and glutes)	A core body temperature of 104°F or above, headache, nausea, vomiting, diarrhea, rapid pulse, disorientation.
Action plan	Apply a cold pack on the head and neck. Restore fluid and salt balance with foods and drinks that contain sodium	Restore fluid and salt balance with foods and drinks that contain sodium (salted snack foods, sports drinks)	Emergency medical attention necessary
Danger Level			





Dehydration Symptoms

Watch yourself and each other for these signs:

Other than thirst,
people can get
headaches, fatigue,
restlessness, have
difficulty sleeping,
shortness of breath
when they are
dehydrated

STATUS	No Dehydration	Some Dehydration	Severe Dehydration
CONDITION	Well, alert	Restless, Irritable*	Lethargic or unconscious; floppy*
EYES (Tears)	Normal (present)	Sunken (not present)	Very sunken and dry (not present)
MOUTH & TONGUE	Moist	Dry	Very dry
THIRST	Drinks normally, not thirsty	Thirsty, drinks eagerly*	Drinks poorly or not able to drink*
SKIN PINCH	Goes back quickly	Goes back slowly*	Goes back very slowly*
DECIDE	The child has no signs of dehydration	If the child has 2 or more signs, including at least 1 major sign, there is some dehydration	If the child has 2 or more signs, including at least 1 major sign, there is severe dehydration





Other Causes of Dehydration

Other than a shortage of water due to a disaster, there are medical conditions that cause dehydration. Medical attention is required for those people in addition to replacing lost body fluid.

- Fever
- Vomiting, Diarrhea
- Diabetes, Kidney disease
- Adrenal gland disorders
- Sunstroke



Keep medical records of all family members. Have copies of prescriptions and extra medications in your preparedness kit adequate for the duration of your emergency plan.



Water



If you cannot store all the water you need, be prepared to treat contaminated water to meet your needs.



Keep all materials for water treatment in one place ready for use.





Water

If you cannot store enough water, you need to prepare to get more water.

Some possible sources of water are:

- Catch rainwater
- Collect dew or fog
- Collect it from soil and plants



Photo from the Internet; educational fair use clause



You may need to treat the water to make it safe to drink.



Water: Catching the Rain

Each family should be able to store rain water.

Rain collecting materials:

- Metal roof sheets or plastic sheets
- Concrete ring or plastic barrel or bottles to hold 10-20 L of water



Photo from the Internet; educational fair use clause



You may need to treat the water to make it safe to drink.



Water: From Coconuts

Coconuts are an additional water source.

- A green coconut can have ~0.3-1.0 L of water
- About 4-13 coconuts per day could provide the 4 L of daily water for 1 person
- Coconut water has about 45 calories per 0.25 L



- Carbohydrates: 28 g
- Sugar: 15 g
- Fat: 3 g, saturated
- Fiber: 2 g
- Protein: 2
- Sodium: 50 mg
- Cholesterol: 0

Coconut water/juice (the liquid from young green coconuts) is not the same as coconut milk (which is made from the pulp/meat of mature coconuts).





Water: Storing Rain Water

Water collection and storage containers need to be clean and covered.

Any water collected must be kept clean before and **AFTER** treating it to make it safe for drinking.



Photo from the Internet; educational fair use clause

Cover all water containers to prevent mosquitoes from breeding in the stored water.



You may need to treat the water to make it safe to drink.



Water: Catching Dew or Fog

You can use the same materials used for catching rain water.

But the weather conditions need to be “just right”. Early morning is the best time to try this.



Photo from the Internet; educational fair use clause



You may need to treat the water to make it safe to drink.



Water: Catching Dew or Fog

You can spread clean cloth or clothing over bushes at night to absorb the dew forming on plant leaves.

Collect the dew by wringing out the clothes in the early morning.



Photo from the Internet; educational fair use clause

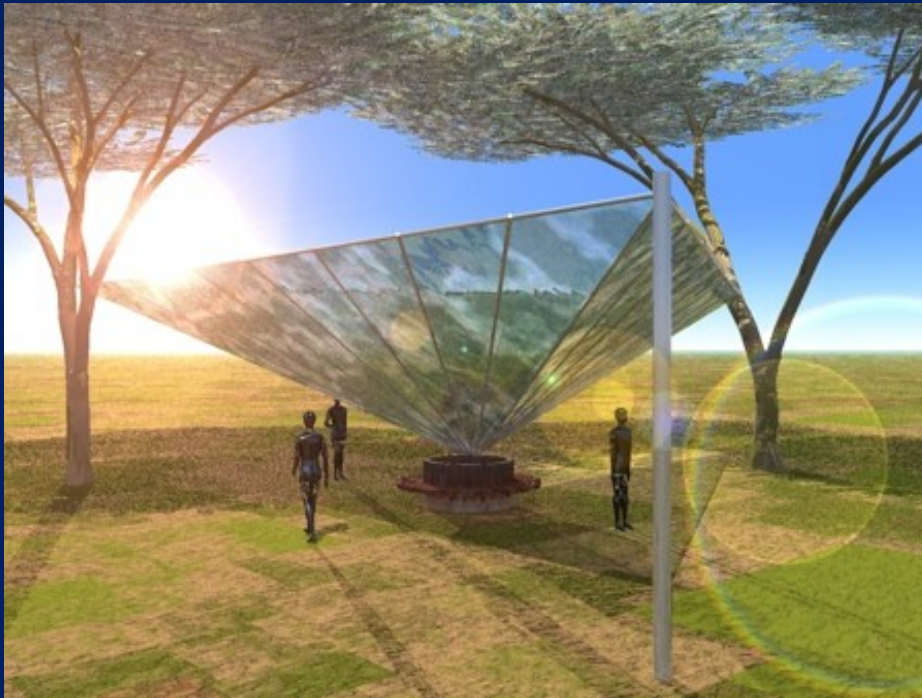


You may need to treat the water to make it safe to drink.



Water: Catching Dew or Fog

You can make fog / dew catchers



Photos from the Internet; educational fair use clause

Use window screen or garden shade cloth to make a “trap” to collect the water.



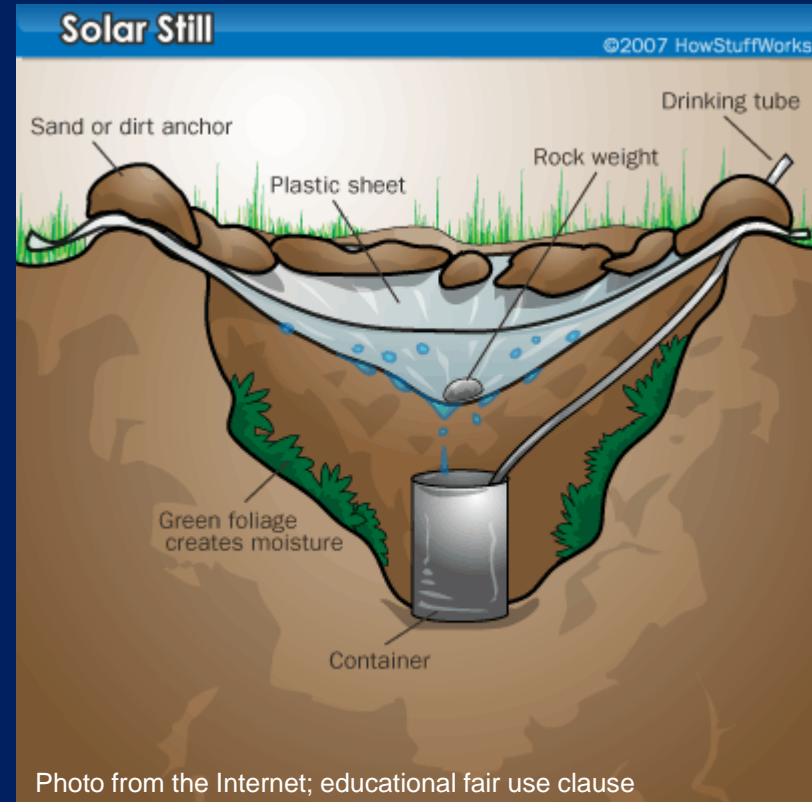
You may need to treat the water to make it safe to drink.





Water: From Soil and Plants

Use a shovel, a plastic sheet, a clean plastic tube (~ 1 m long), a clean container, and some small stones to dig a solar still

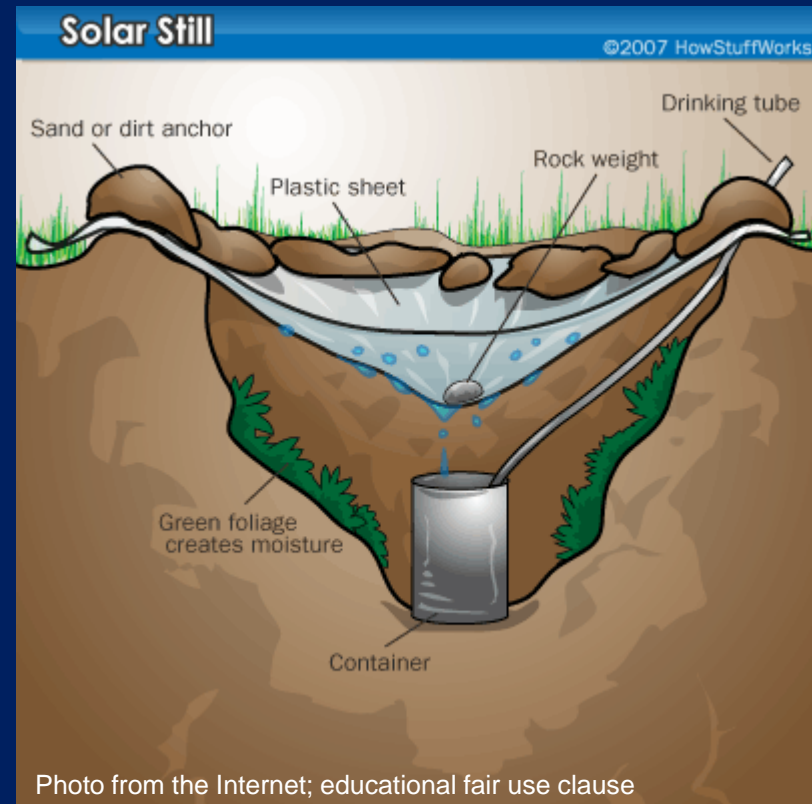


You may need to treat the water to make it safe to drink.



Water: From Soil and Plants

- Dig a hole
- cut some leafy plants; put them in the hole
- put the container in the bottom center of the hole
- put the drinking tube in the container
- cover the hole with the plastic sheet

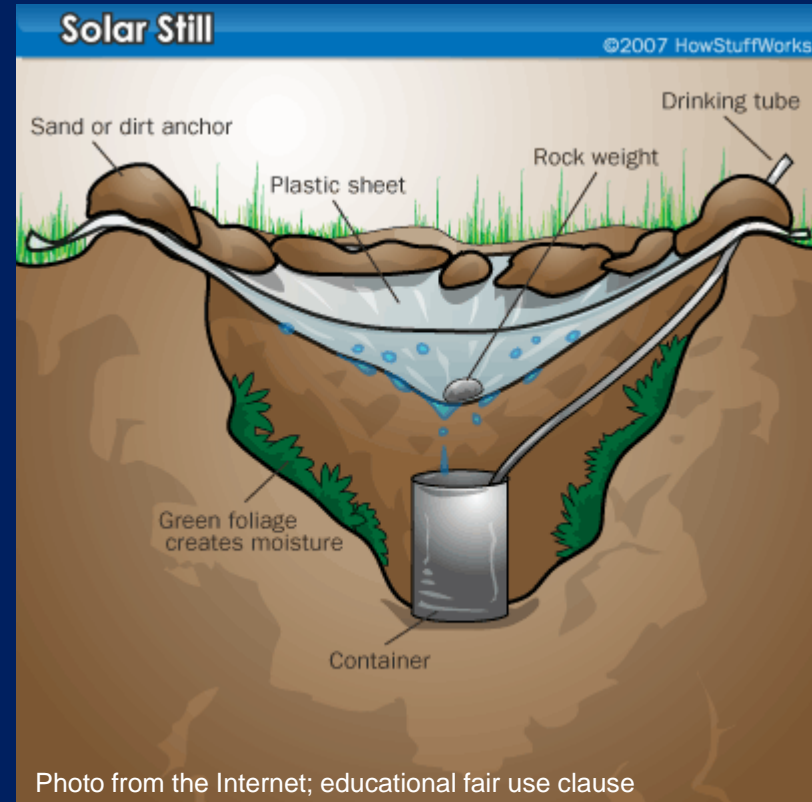


You may need to treat the water to make it safe to drink.



Water: From Soil and Plants

- use small stones or soil to hold the plastic sheet in place
- place a small stone in the center of the plastic sheet directly over the collecting container
- wait several hours for the water to evaporate and condense



If the plastic sheet and tube are clean, the water to will be safe to drink.



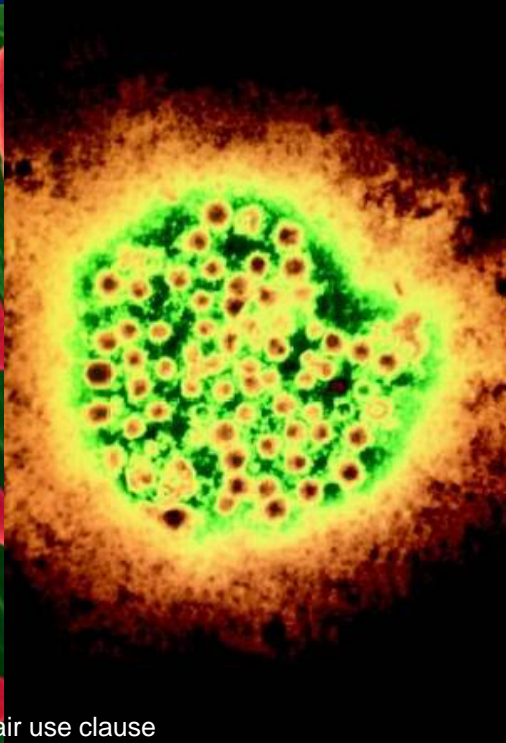


Water Treatment



During a disaster, water may be contaminated and unsafe to drink.

Bacteria, viruses, and chemicals are the main water contaminants.



Photos from the Internet; educational fair use clause





Water Treatment



Most flood water will be muddy.
Leave the water in the collecting bucket until the mud settles and the water appears clear.

Depending on how small (fine) the mud particles are, it could take up to 2 days for the mud to settle out of the water. In that case, straining the water through fine cotton cloth or fine sand may help to get clear water faster.



Even when the water is clear, it can still contain harmful bacteria, viruses, and chemicals.



You may need to treat the water to make it safe to drink.



Water Treatment



Boil the water in a clean pot or container for at least 5 minutes.

If you are over 1500 m amsl, add 1 minute for each 300 m of added height.



Do you know the altitude of your safe area? Use topographic maps or check with your local sub-district officials.





Water Treatment



Boiling will kill bacteria and viruses. Volatile Organic Chemicals (VOCs) will vent if the pot is not covered.

You must have a clean pot and fire making materials or a stove and fuel. These may all be in short supply during a disaster.





Water Treatment



At sea level, a 1 minute boil inactivates:

- *Vibrio cholerae*
- *E. coli*
- *Salmonella*
- Waterborne protozoa, such as *Giardia*, *Cryptosporidium*

3 minutes is needed to inactivate the pathogenic viruses

If your emergency plan calls for boiling to treat water, be sure you have adequate fuel for the fire and the ability to start fires. To be well prepared, have a back-up plan in case fuel is not available.





Water Filtration



If possible, let muddy water settle in a bucket before filtering. Depending on how fine the mud particles are, this could take 24-48 hours or longer.



Less sediments in the water won't clog the filters so quickly.



Flood waters are muddy. This can clog filters very quickly. You may need to change filters or clean them often.





Water Filtration



Commercial water filters are available. These may be too expensive for most rural farmers. There are many types of filters being sold making it hard to choose. Finding replacements after a disaster is also a problem.





Water Filtration



Considerations:

- Filter capacity: for smallest particle filtered and how long it will last
- Replacement filters: how often to replace, cost, and availability



Flood waters are muddy. This can clog filters very quickly.
You may need to change filters or clean them often.



Low-Cost Water Filtration



Studies in Bangladesh show filtering water through 4-8 layers of old sari cloth reduces cholera infections by 48%.



Any "finely woven" cloth will do (~180 thread count). Older fabric is better than new as the fibers have loosened thus closing the space between the weave. Multiple folds result in a mesh capable of filtering particles ~20 microns which removes about 99% of particles to which *V. cholera* attach themselves to in water.

Additional treatment is needed to make the water safer for drinking.

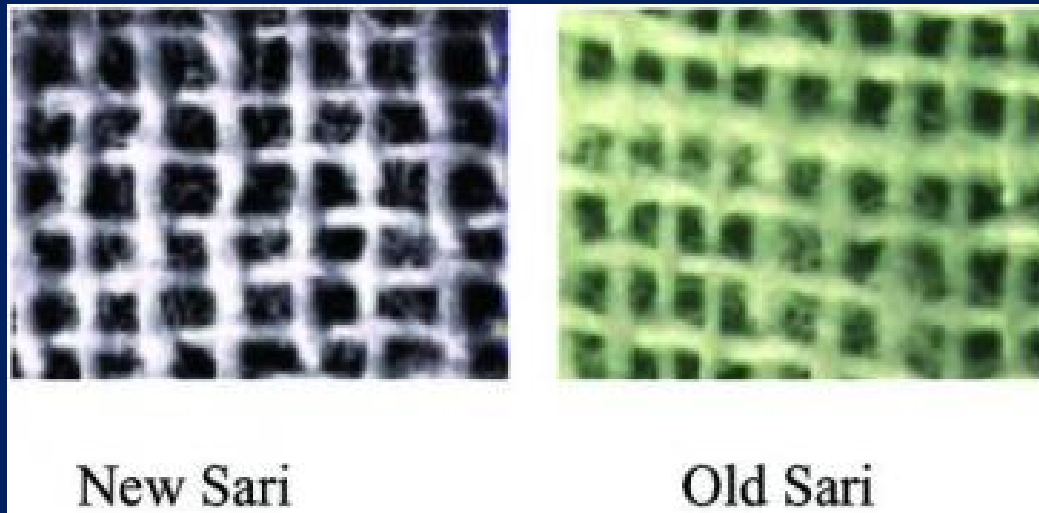




Low-Cost Water Filtration



Microscopic contrast of new vs. old sari cloth
The weave is about 100-120 microns, but 4-8 folds of cloth reduces the openings to ~20 microns



This shows the weave of a single layer of cloth.
Folding the sari to get 8 layers makes an effective filter.

The ~20 micron openings effectively filtered out all zooplankton, most phytoplankton, and all particulates > 20 microns.
Additional treatment is needed to make the filtered water safer for drinking.





Low-Cost Water Filtration



The cloth filter is “cleaned” by rinsing then sun drying for 1 day. If plain chlorine bleach is available, the cloth can be treated and put in the sun to dry. Then it is ready for re-use.



Depending on the anticipated need for water, having more than 1 old cloth filter available can be very useful.



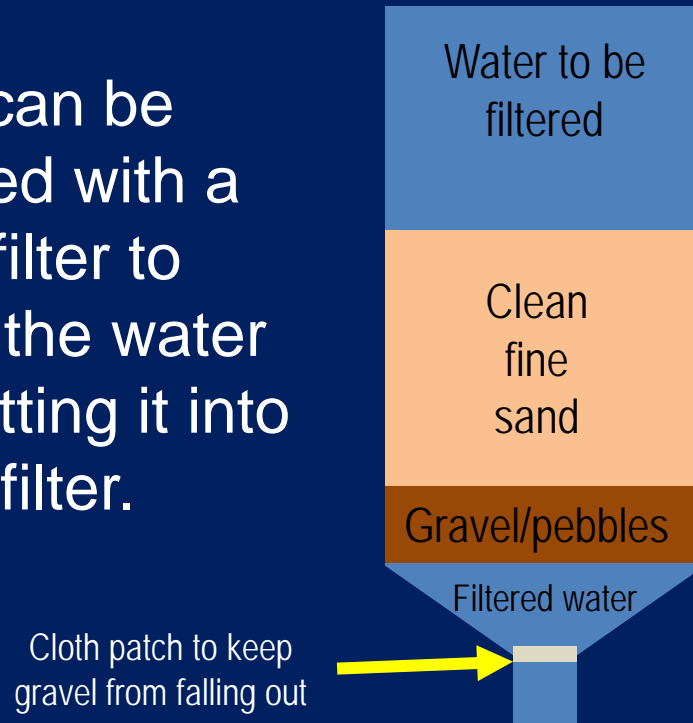


Water Filtration



You can make your own water filter with sand and gravel.

This can be combined with a cloth filter to “screen” the water before putting it into this filter.



This system will not be practical for large groups of people. But individuals may be able to find materials to make a system for themselves.



You need to treat the water to make it safe to drink.

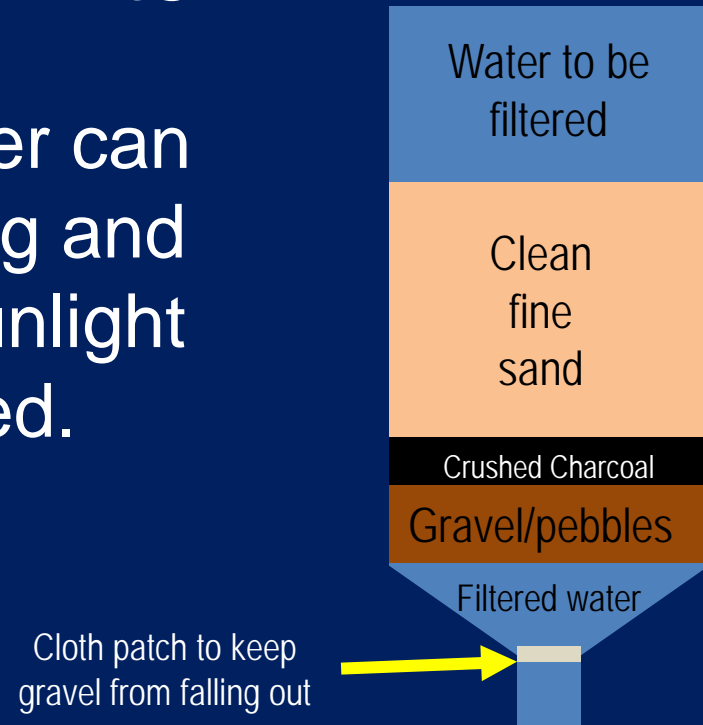


Water Filtration



Adding crushed charcoal can improve the basic sand and gravel filter.

All the parts of this filter can be cleaned by washing and drying in full strong sunlight before being reused.



Flood waters are muddy. This can clog filters very quickly. You may need to change filters or clean them often.



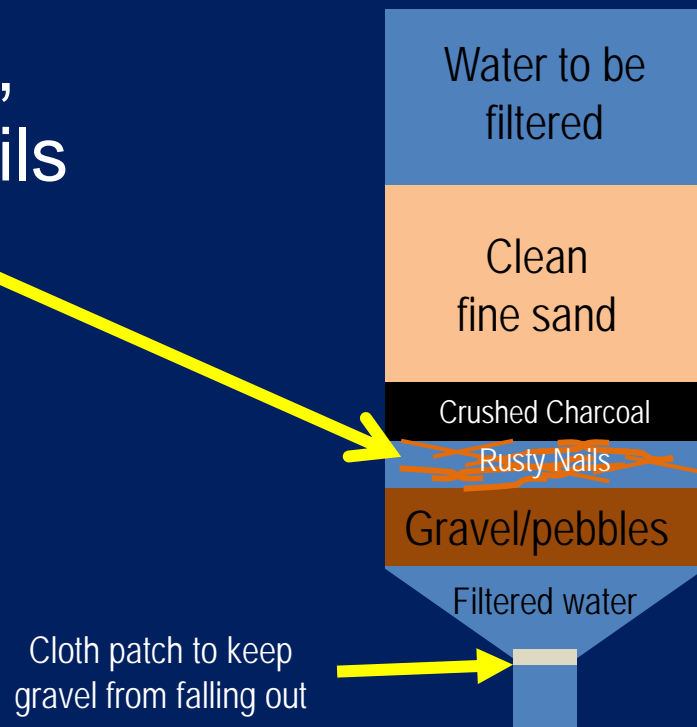


Removing Arsenic



If water in your area has high arsenic content:

Make a sand/gravel filter,
but add a layer of rusty nails
at the bottom layer.



Flood waters are muddy. This can clog filters very quickly.
You may need to change filters or clean them often.





Solar Pasteurization of Water



“Sodis” (Solar Water Disinfection Process)

- Solar pasteurization can make water safe to drink.
- You need clean water bottles.
- It will take 6 hours of strong sunlight.

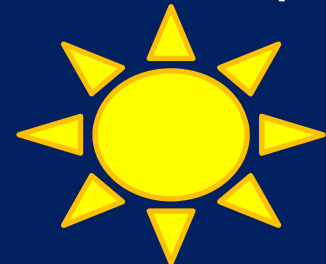


Photo from the Internet; educational fair use clause

If you cannot get 6 hours of full strong sunlight, leave the bottles out for another day before drinking the water.

In Pasteurization, the water is heated to 82.78°C / 149°F for about 15-20 minutes. The Sodis method has no way to monitor the water temperature / time to fully meet the definition of Pasteurization. In emergency situations, this may be as good as it gets.

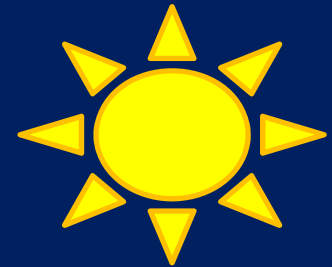




Solar Pasteurization of Water



- Start with filtered water in clean water bottles with caps.
- Fill the bottles 2/3 with water; seal them.
- Vigorously shake the bottles to aerate them.
- Fill the bottle to the top; seal
- Place on its side in direct sun.
- Water is safe to drink after 6 hrs.



This may not be as safe a solar water distillation (shown later in this lesson). But it is better than nothing.



Photo from the Internet; educational fair use clause



Water Chlorination



You will need:

- unscented liquid chlorine bleach
- a medicine dropper
- a standard measuring teaspoon
- clean storage containers
- dark cool place to store the treated water





Water Chlorination



If the water is muddy, try to let it settle for 24-48 hours. Clear water will use less chlorine to treat than muddy water.

Amount of Water	Amount of Chlorine	
	Clear water	Cloudy water
1 L	2 drops	4 drops
3.75 L	8 drops	16 drops
18.9 L	$\frac{1}{2}$ teaspoon	1 teaspoon
56.7 L	1 $\frac{1}{4}$ teaspoons	2 $\frac{1}{2}$ teaspoons
208 L	4 $\frac{1}{2}$ teaspoons	9 teaspoons

1 teaspoon is about equal to 100 drops

Add unscented liquid chlorine bleach to the water, stir and let stand for 30 minutes. If the water does not taste and smell of chlorine at that point, add another dose and let stand another 15 minutes



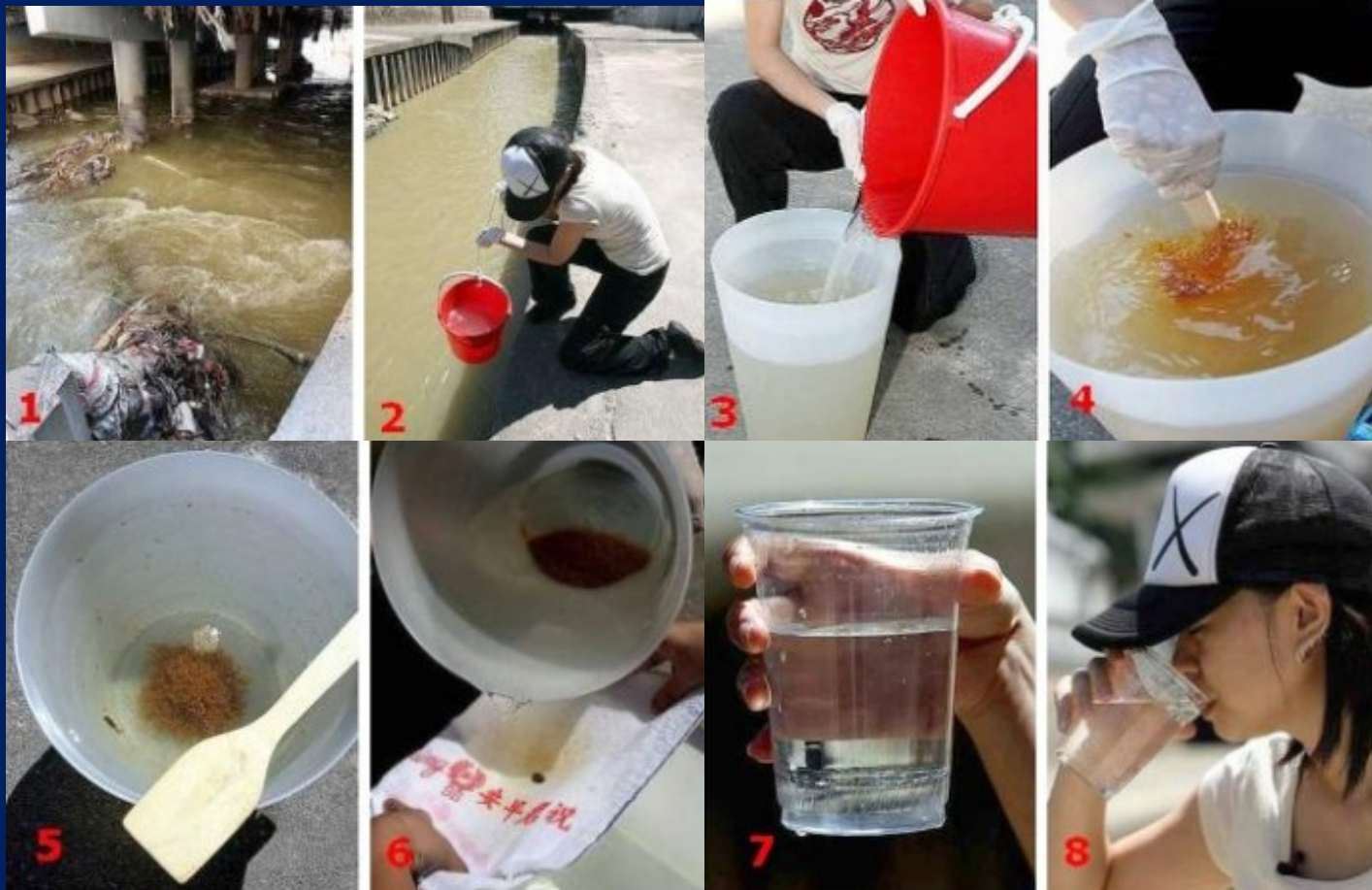


Water Chlorination



Collected muddy water can be treated with plain chlorine bleach. In this example, about 10 L of water is treated in about 30 minutes. You can also use a multi-layered cloth filter in Step 3.

This process will make more safe water faster than a sand / gravel filtering system. But you must have plain chlorine bleach.





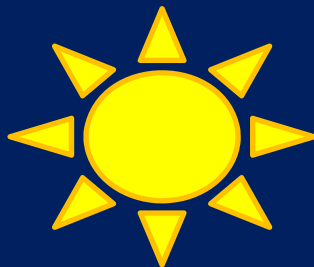
Water Purification by Solar Distillation



You will need: a clear sunny day and

- a large pan or tub
- a smaller pan or tub
- a clear plastic sheet
- some clips or sticks
- clean storage containers
- dark cool place to store the treated

water

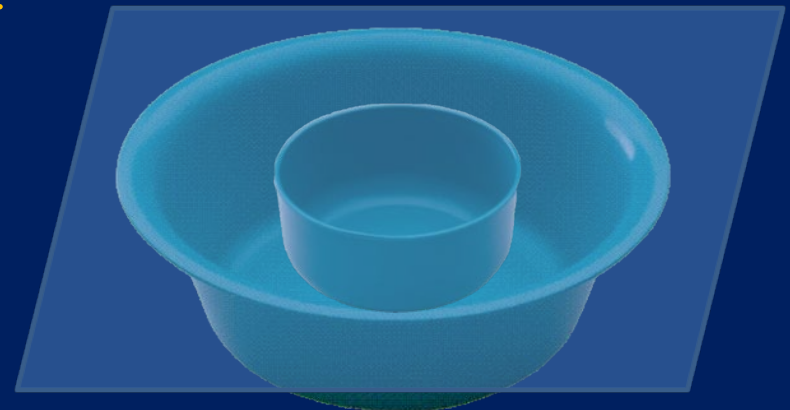
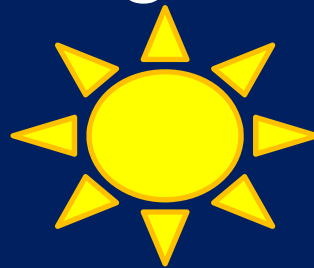




Solar Distillation of Water



- Place the large tub in direct sunlight; fill it about $\frac{1}{2}$ with water to be treated.
- Put the small tub in the center of the large tub.
- cover the large tub with clear plastic



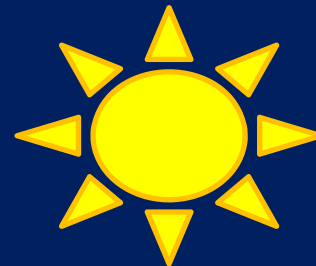


Solar Distillation of Water

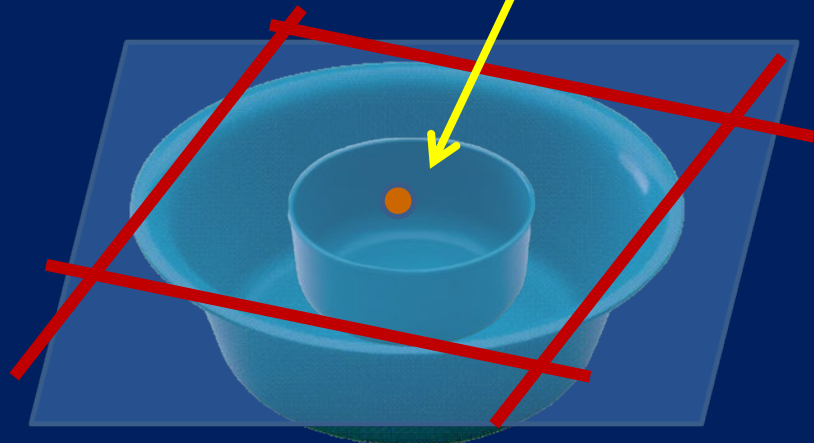


- Use clips or sticks to keep the plastic sheet in place
- Put a small pebble in the center of the plastic sheet over the small tub

Evaporated water
will condense on
the plastic and
drip into the small
tub for collection

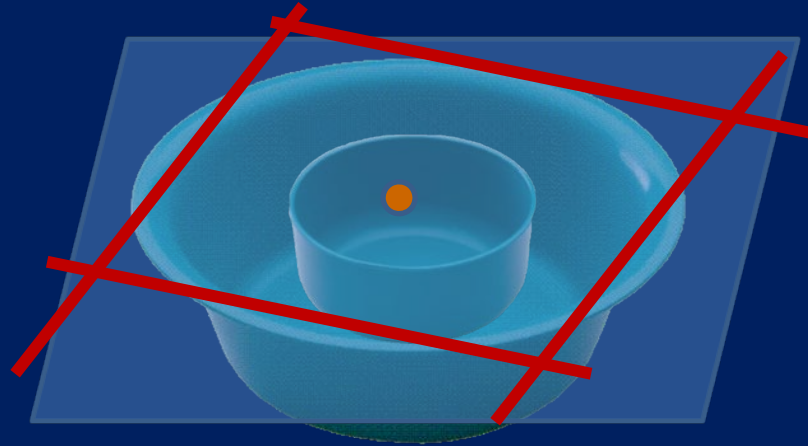
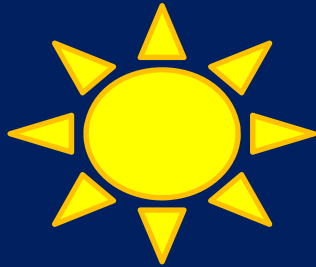


The pebble makes
a small dip in the
plastic sheet.





Solar Distillation of Water

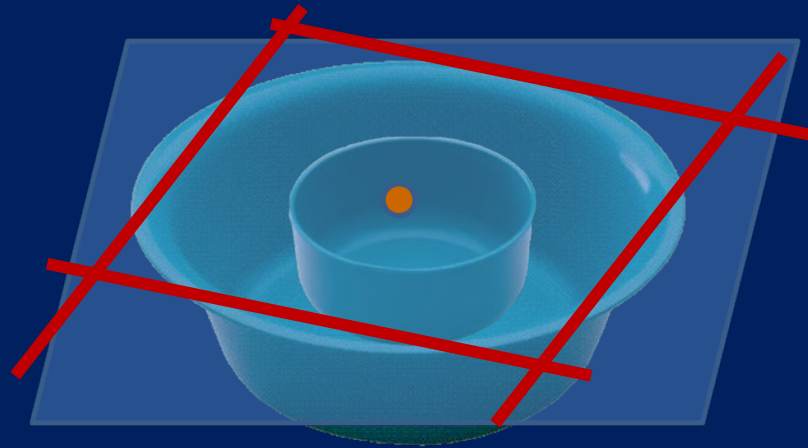
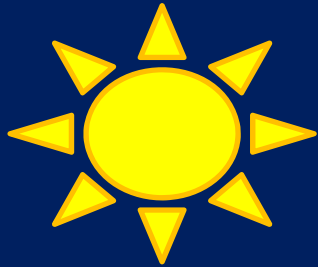


- Solar distillation is safe to drink.
- Store the distilled water in clean, tightly sealed containers.
- Store the containers in a cool, dark place.





Solar Distillation of Water



Practice this at home BEFORE a real emergency. Then you will know how much water you can purify to meet your daily needs.





Water

You can have clean safe water for drinking, cooking, and washing IF you prepare.



Photo from the Internet; educational use clause

Store water in sealed containers in a safe place that will NOT get flooded.





Water Storage

Use commonly available 2 Liter plastic soda bottles. Properly sanitize them. Rotate water stored in these bottles every 6 months.



Use 1 cup of plain chlorine bleach to 4 L of clean water; fill bottle 2/3 full, cap it, shake vigorously, thoroughly rinse out bleach solution. Clean caps thoroughly.



Avoid using glass bottles to store water because they may be broken during the disaster. You lose the water and create an added hazard.



Water Storage

Do not use plastic milk bottles or laminated cardboard beverage containers for water storage.



The plastic used for milk bottles tends to get brittle over time.
Cardboard containers are difficult to sanitize for re-use.



Water

Plan on 4 liters per day for each person in your family.



Photos from the Internet; educational use clause



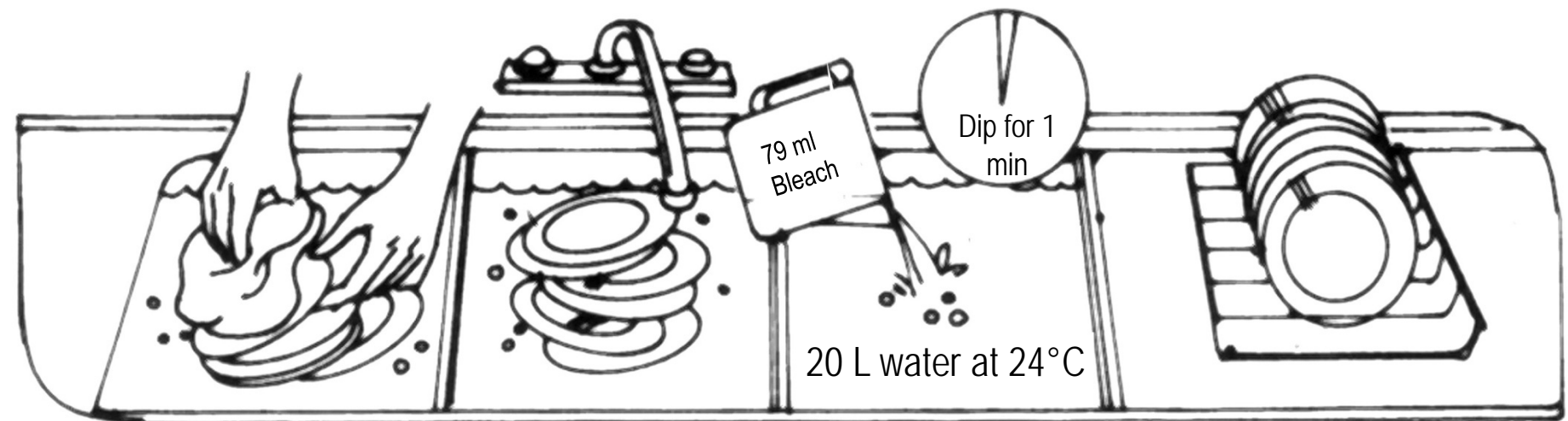
Have enough water for 2 weeks for everyone.





Wash Water

Proper cleaning of cooking equipment and eating utensils is essential for good sanitation



Wash

Rinse

Sanitizing Dip

Drain Air Dry

Make a sanitizing solution by mixing 79 ml / 1/3 cup chlorine bleach to 20 L / 5 gallon of water at 24°C / 75°F.
Dip utensils in for 1 minute before air drying.

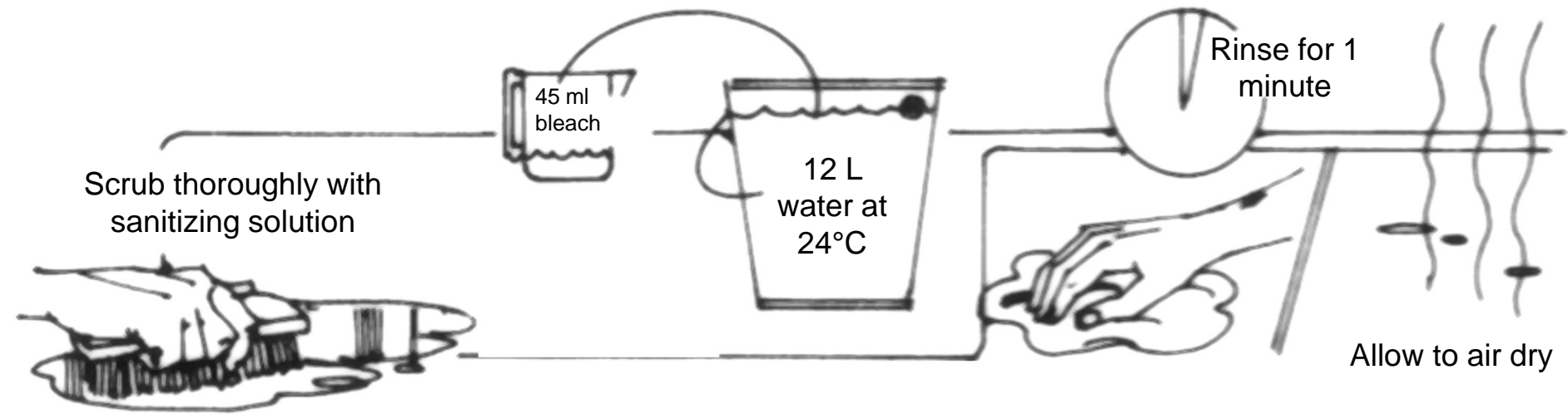


Learn more about this in Lesson EP-3 Water.



Sanitizing Solution

Sanitize food preparation surfaces by scrubbing and rinsing them with a sanitizing solution



Make a sanitizing solution by mixing 45 ml / 1.5 oz chlorine bleach to 12 L / 3 gallon of water at 24°C / 75°F.

Rinse food preparation surfaces for 1 minute. Let thoroughly air dry.



Learn more about this in Lesson EP-11 Disease.



Wastewater Disposal



Main purposes:

- Prevent insect infestation and disease
- Prevent water supply contamination

Main wastewater sources:

- Food preparation/clean up area
- Bathing/washing area
- Latrines (toilets)



Proper wastewater disposal prevents disease.
To learn more, see Lesson EP-11.

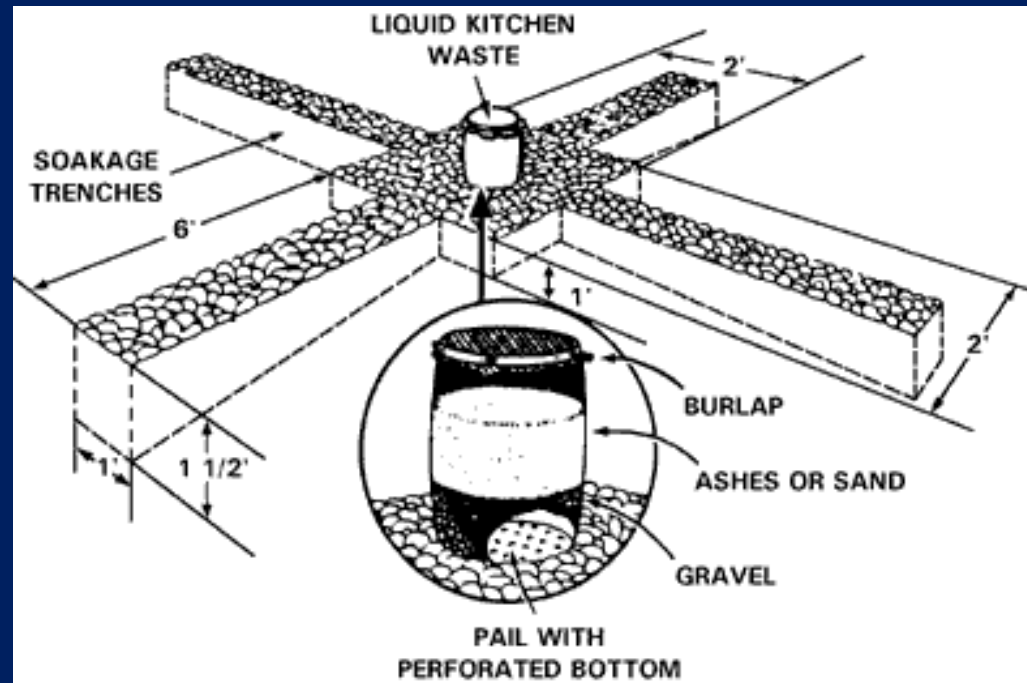


Wastewater Handling



Kitchen wash water:

- Screen food particles from water
- Trap grease



Proper wastewater disposal prevents disease.
To learn more, see Lesson EP-4 and EP-11.





Safe Drinking Water is Vital

Be sure to study Lesson EP-11 **BEFORE** setting up a camp, toilets, and cooking areas.



Photo from the Internet; educational use clause

Remember: You are responsible for your safety and survival in a disaster.



Take action today:

- Make an Emergency Plan
- Prepare your Emergency Kits
- Encourage others to prepare



Once a disaster strikes, it is too late to try to prepare!



The next lesson in the Emergency Preparedness Series is EP-4 Food



Photo from the Internet educational use clause

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Free Self-Study Materials by Internet

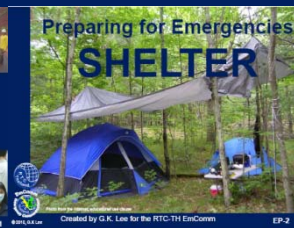
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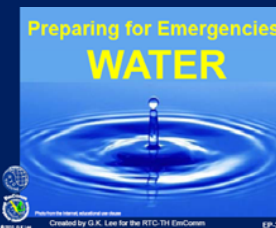
These materials are in English. Volunteer assistance for translation to Thai is welcomed and will be acknowledged and cited.



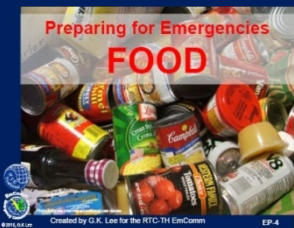
EP-1



EP-2



EP-3



EP-4



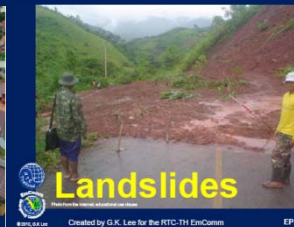
EP-5



EP-6



EP-7



EP-8



EP-9



EP-10



EP-11



EP-12



Questions or Comments

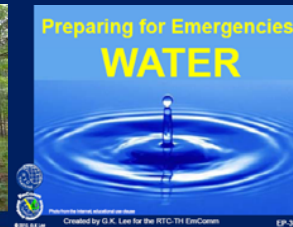
We are
always trying
to improve
our lessons.
Your
comments
and
suggestions
are
welcomed.



EP-1



EP-2



EP-3



EP-4



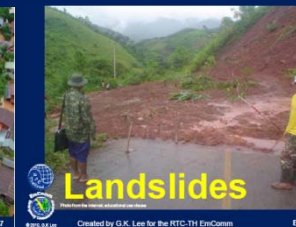
EP-5



EP-6



EP-7



EP-8



EP-9



EP-10



EP-11



EP-12



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For Emergency Preparedness Training



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Via Skype video
conference call: [rtc_th](https://www.skype.com/join/rtc_th)



Future RTC-TH Emergency Preparedness Lessons

- Identifying local Geo-Hazards
- Finding safe evacuation / shelter sites
- Identifying main supply routes and alternate routes
- Finding Helicopter Landing Zones
- Helicopter landing zone hand signals
- Ground to air communication without radios



Community-based Environmental Education for



The End

www.neighborhoodlink.com/org/rtcth

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