Death by Dehydration or Dysentery ... or NOT!

The leading cause of illness and death in both natural and man-made disasters is inadequate sanitation, poor hygiene practice, and contaminated and insufficient water supplies.

Objectives
- Educate
- Motivate

Water
Safe water is absolutely essential for survival!

- Survive less than 3 days without water
- The body and organs can experience severe damage
  - Blood thickens
  - Heart attack and stroke possibilities increase
  - Kidneys begin to fail
  - Brain begins to hallucinate
- Drinking contaminated water can result in water-borne illnesses
  - Dengue fever, gastroenteritis, cholera, typhoid, hepatitis, dysentery and more.

Water Loss
Water is lost through:
- Respiration
- Perspiration
- Elimination

Water Needs
- Drinking – hydration
- Hygiene
- Medical – first aid
- Sanitation
- Food preparation

Dangers in Water

Biological
- Protozoa (the largest of all microorganisms) include such parasites as Giardia, Lamblia, cryptosporidium
  - 1-15 microns
- Bacteria (medium-size microorganisms) include E. coli, Vibrio Cholerae, campylobacter, salmonella
  - 0.2-5 microns
- Viruses (smallest of all the microorganisms <0.1 micron) include hepatitis A and E, Norwalk virus, rotavirus, poliovirus, echovirus.
  - 0.02-0.2 microns

Chemical
- Heavy metals
- Salts
- Chemicals
- Fuels
- Pollutants
- Toxins
**Water Storage**

- **MINIMUM**
  - 1-2 gallons per person per day
  - 2+ week supply

- Containers
  - Clean
  - Food grade only
  - Variety of sizes
  - Cases of commercially packaged water bottles

**Water Sources**

- Beverages
- Bottled water
- Ice
- Liquid from canned fruits and veggies
- Water heater tank
- Water remaining in pipes
- Toilet flush tank (not bowl)
- Rainwater (collect)

- Do not drink water from:
  - Swimming pools
  - Hot tubs
  - Water beds
  - Chemicals do not boil out and may be toxic
  - Okay if distilled
  - Use for hygiene purposes

**Harvesting Rainwater**

**Steps to Water Purification**

Removing organic, inorganic, and particulate matter to make water safe and pleasant to drink

1. Clarify
2. Disinfect
3. Filter

**Step #1 Clarification**

This step removes floating or suspended particulate matter before disinfection

Filter by pouring water through:
- Coffee filters
- Layers of paper towels
- Tightly woven cloth

Allow water to settle
- Skim floating particles off top
- Allow heavy particles to settle to bottom and pour clean water off top

**Filter Bag**

- 1 micron filter bag
- Filters thousands of gallons of water
- Will not remove viruses or some bacteria
- Great for clarifying water
- Do not allow exterior of bag to be contaminated
**Step #2 Disinfection**

Killing or removing pathogens (bugs) that can cause illness and disease
- Boil
- Pasteurize
- Distill
- Solar disinfection (UV)
- Chlorine bleach
- Iodine

**Boiling**

- Boiling is the safest method
- Kills most microorganisms that cause illness
  - Bacteria, viruses and parasites cannot survive a temp of 212°
  - Rolling boil at sea level kills harmful organisms
  - Water boils at lower temp at higher altitudes (boil longer)
- Clarify water before boiling
- Does not remove contaminants such as heavy metals, salts and most chemicals

**Pasteurization**

- Heating water to 150° for 6 minutes
- Kills all microorganisms and dangerous pathogens
- Water Pasteurization Indicator (WAPI) will indicate when pasteurization has occurred when the wax has dropped to the bottom of the tube.

**Water Distillation**

- Removes contaminants that boiling and other methods cannot
- Removes heavy metals, salts, and other chemicals
- Slow process
- Takes lots of energy
- Will not remove substances with lower boiling point than water (oil, petroleum, alcohol, etc.)

**SODIS**

- Destroys pathogenic bacteria, viruses, and protozoa.
- Inactivates these microorganisms:
  - **Bacteria:** Escherichia coli (E.coli), Vibrio cholerae, Streptococcus faecalis, Pseudomonas aeruginosa, Shigella flexneri, Salmonella typhi, Salmonella enteriditis, Salmonella paratyphi
  - **Viruses:** bacteriophage f2, rotavirus, encephalomyocarditis virus
  - **Yeast and Mold:** Aspergillus niger, Aspergillus flavus, Candida, Geotrichum
  - **Protozoa:** Giardia, Cryptosporidium

**SODIS Solar disinfection**

- Uses UV rays to eliminate harmful pathogens
- Fill ¾ full - shake for 20 seconds – finish filling
- Place transparent container of filtered water in direct sun for 5-6 hours
- Increase exposure to two consecutive days if heavy cloud cover
- Will not remove chemicals, tastes, or smells
- Will not treat large volumes of water
**Chlorine Bleach**

- Clarify water before treating
- 16 drops to one gallon water
- Let stand 30 minutes
- Should have slight chlorine smell – if not retreat
- Sodium hypochlorite concentration of 5.25% to 6%
- No added soap or fragrances
- Liquid bleach has a short shelf life – about 6 months
- Does not remove contaminants such as heavy metals, salts and most chemicals

**Choose Carefully!**

“The Splashless variation of our Concentrated Regular Bleach is not registered as a disinfectant and should not be used as one. The ingredient that thickens the formula is Cetyl betaine. The percentage of our Concentrated Regular bleach is 8.25% for our Splashless it is 3.985%”

Cetyl betaine is an amphoteric surfactant that is made by reacting naturally-derived alkyl dimethyl tertiary amine with sodium monochloroacetate. Used as an antistatic agent, hair conditioning agent, skin conditioning agent, cleansing agent, foam booster, etc.

**Clorox Regular Only!**

Not scented, splashless or Clorox Plus bleaches

Concentrated Clorox Directions:

- Remove suspended particles by filtering or settling
- Add 12 drops or 1/8 teaspoon to 2 gallons water
- 2 drops per quart - 3 drops per quart if cloudy
- Let stand 30 minutes. Should have slight bleach odor.
- If not, retreat and wait 15 additional minutes.
- Pour between 2 clean containers to reduce bleach taste

**Salt Cracker Chlorine Solution Device**

- Creates a chlorine solution using salt water and electricity
- Pure, fresh chlorine
- Simple to make

**Calcium Hypochlorite (68-70%)**

- Powdered or granulated chlorine
- 10+ years shelf life
- Dangerous – store carefully! Will corrode metals and react with other chemicals.
- 1/8 teaspoon to 55 gallon barrel of clean water
- 1/4 teaspoon to 55 gallon barrel of cloudy or questionable water
- Slight smell of chlorine should be present after 24 hours, if not repeat process
- Clarify water before treating
- Does not remove contaminants such as heavy metals, salts and most chemicals

**5% Stock Solution Calcium Hypochlorite (68-70%)**

| 5% Chlorine Stock Solution Recipe
| Homemade Liquid Bleach – Do not drink! |
|----------------------------------------|----------------------------------------|
| 1 1/2 cup                               | 1 teaspoon                             |
| 1 quart                                 | 1 Tablespoon (2.7 teaspoons)           |
| 2 quarts                                | 2 Tablespoons (5.3 teaspoons)          |
| 1 gallon                                | 4 Tablespoons (10.7 teaspoons)         |

The US Military standard calculation for a 5% stock solution is based on dissolving 1 teaspoon of 68-70 percent dry calcium hypochlorite in 1 1/2 cups of water.
**Caution!!**

- Chemicals are dangerous!
- Check all items at least annually
- Place chemicals in separate containers
- Practice, practice, practice
- Things break, wear out and expire

**Powdered chlorine and Polar Pure stored in plastic tote with new Aqua Rain in original packaging.**

**Iodine Treatment**

- Chemical halogen available in 5-7% solution, 10% solution, tablets, crystals, and 2% tincture
- Some forms have short shelf life
- Requires a period of time to work
- Varies with water temperature, PH, and strength of solution
- Does not kill cryptosporidium parvum
- NOT recommended for pregnant women, people with thyroid problems, those with known hypersensitivity to iodine, or continuous use for more than a few weeks at a time

**Metal rusted, corroded, and split**

**Polar Pure**

- Indefinite shelf life
- Treats up to 500 gallons
- Small and light weight
- Dosage chart printed on bottle
- Crystalline iodine 4-8 grams used in a stock solution constitutes a human lethal dose if accidentally swallowed in a single dose.
- Keep out of the reach of children.

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**Step #3 Filtration**

- Physically removes protozoa and bacteria
- May remove some chemical contaminants
- Improves taste and smell

**Filter Comparison 101**

<table>
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<th>Water Filter Pore Size Effectiveness Guide</th>
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<td><strong>Filter Size</strong></td>
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<tr>
<td>Microfiltration 0.1 micron</td>
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<tr>
<td>Ultrafiltration 0.01 micron</td>
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<td>Nanofiltration 0.001 micron</td>
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**Filter Life**

Quality of water used will affect the life of the filter. Water with particles will clog the filter quickly. Clear water will make it last much longer.

- Disposable or cleanable?
- Manufacturer recommended filter life?
  - 50 gallons, 100 gallons, 1000 gallons or 1,000,000 gallons
**Homemade Filter**

- Water to be filtered
- Metal frame
- Filter material
- Collection pan or dish

*Photos and Drawing courtesy of Kenneth Moravec*

**Sawyer Filters**

- Technology derived from kidney dialysis
- Two filter choices
  - PointONE Biological Filter
  - Point ZeroTWO Purifier
- 0.1 micron absolute – zero pathogen breakthrough
- 0.02 micron absolute – physically removes viruses
- Filters 1,000,000 gallons
- Inexpensive - $60-$140 for bucket kit and faucet adapter

**Black Berkey Filters**

- Does not publish micron rating
- Pathogenic bacteria, parasites and cysts removed to non-detectible levels >99.9999%
- 99.999% virus reduction
- Removes most volatile organic compounds (VOCs) and inorganic minerals to below lab detectable limits.
- 3000 gallon filter life – may be cleaned up to 100 times
- Retail $107 per filter

**Just Water Ceramic Filters**

- 0.2 micron
- 99.999% bacteria removal
- Virus reduction
- Flow rate – 30 gallons per day
- Rated to last one year
- Stores indefinitely
- Inexpensive at $28

**Seychelle Radiological Filter**

- Ionic Absorption Micron Filtration System
- 2 microns absolute – not for biological contaminants
- Aesthetic (chlorine, taste, odor)
- Chemicals
- Dissolved Solids (heavy metals, lead, mercury, Chromium 6)
- 99.99% of nuclear contaminants found in drinking water
- Bottle filters up to 100 gallons $70
- Straw filters up to 25 gallons $23

**MSR Miniworks Ex Microfilter**

- 0.2 micron
- Ceramic filter plus carbon
- Cleanable
- Removes chemicals such as iodine, pesticides and chlorine
- Cartridge life 528 gallons
- Unit price $90
- Replacement filter $40
Katadyn Pocket Filter

- 0.2 micron
- Silver-impregnated ceramic element
- Cleanable filter
- Cartridge life 13,000 gallons
- Unit price $370
- Replacement filter $180

Aqua Rain Carbon Filters

- Micron rating not published
- Removes protozoan cysts and bacteria
- Self-sterilizing metallic silver
- Granulated Activated Carbon bed absorbs organic chemicals (MTBE, pesticides, chlorine, etc)
- Up to 10,000 gallons
- Improves taste and odor of water
- $58 each filter - $325 for unit

Safe Drinking Water Is A Critical Resource

1. Store as much clean water as you can reasonably store.
2. Where will you get more if you run out?
3. How will you transport it?
4. How will you make the water safe to drink?

Do Something NOW!

- Make your goal right now!
- Be realistic
- Do something in the next few days
- Report –share your success story ibjones0529@gmail.com kyleneanne@gmail.com
- Keep making progress!

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