# EMERGENCY WATER ACQUISITION AND PURIFICATION FOR COASTAL OREGON

# Disclaimer

I’m not an expert and have no formal training in water treatment, chemistry or any related field.

Please do your own research.

# Overview

-Purpose Statement
-Water Needs
-Part I - Acquisition
-Part II - Storage
-Part III - Purification
-Part IV - Emergency Water Plan

# Assumptions

- Focusing on the Cascadia EQ/Tsunami Scenario.
- Audience prefers not to evacuate.
- Operating in the local climate, without extreme heat and with local rainfall amounts.
- Audience retains access to property, even if home is uninhabitable.
- Recommendations are for the average person without special needs – make adjustments if necessary.

# Purpose Statement

The goal of this presentation is to provide a base of information on water acquisition, storage and purification in order to facilitate the development of a family emergency water plan.

Water is needed for many purposes, but this presentation will focus on drinking water only. Amounts and techniques can be extrapolated and adjusted to provide water for other uses.

This information is incomplete and designed to stimulate thought and spur activity toward the development of an individualized plan.

# Why Water Is Important

Survival Rule of Three's

You can survive-

-3 minutes without oxygen

-3 hours without shelter

**-3 days without water**

-3 weeks without food

# CSZ EQ Scenario

Estimates by State Agencies for the Coast:

- 1-3 years without operational water and sewer systems
- 3-6 months without electricity
- Airport runways will likely be too damaged for fixed wing aircraft
- Approximately half the bridges will collapse and the other half will be severely damaged
- Hwy 101 and routes to the valley will be initially impassible and could take months or years to repair

# Emergency Water Plan

Your plan:

- must be sustainable (able to function for years)
- will allow you to avoid evacuation, if so desired
- will allow you to avoid hauling water from central locations (and save your energy and fuel)
- will leave emergency water to those less prepared
- will ensure you have adequate water for all uses, if planned for in advance

# Water Needs

FEMA, The CDC and the Red Cross call for ½ gallon a day for drinking (64 oz.) and ½ gallon for cooking and hygiene.

Some estimates for daily water needs for all purposes go as high as 13 gallons a day. You must determine what your own needs are. And don't forget pets.

**This talk focuses on ½ gallon (64oz) a day for drinking.**

One half gallon equals the 8 glasses of water that health experts recommend, and that many people don't achieve. Understand the symptoms of dehydration so you can monitor your individual needs.

A note about rationing.

# PART I

# AQUISITION

# Acquisition

Considerations:

Transport – water is HEAVY! (8.35 lbs. + container)

Contamination levels -will determine treatment method

Turbidity – must be filtered/decanted prior to treatment

Purification – available methods may suggest appropriate water sources

# Acquisition

Household Sources (use first):

- Stored water
- Ice
- Water heater
- Plumbing pipes
- Toilet tank
- Bad sources: toilet bowls (okay for pets), radiators, boilers, waterbeds, hot tubs (okay for hygiene)

# Acquisition

Outdoor Sources:

-Rainwater

-Flowing streams

-Clear ponds and lakes

-Stagnant murky, cloudy or colored water with organic debris

-Seawater

-Dew, Plant transpiration, Access water table, Condensation

# Acquisition

Rainfall (most feasible source)

- Minimal transport
- Minimal contamination
- Low turbidity
- Abundant nine months a year
- Must be augmented with other sources during summer if stored amounts are insufficient

Other Sources

- Determined by proximity

# Rainwater Harvesting

Surface area (not depth) is key

Collection methods limited only by your imagination:

-buckets
-pots, pans, cookware
-kiddie pools
-plastic storage tubs
-laundry baskets lined with trash bags
-tarps

# Rainwater Harvesting

We average almost 70 inches of rain per year.

Five 1 square foot collection vessels used year round will harvest one person’s annual drinking water needs.

# PART II

# STORAGE

# Storage

Containers:

- Commercial containers designed for this purpose
- Reused plastic containers (water, soda and rinsed chlorine bleach containers-not milk or juice containers)
- Plan for treated and untreated water storage
- Purified water is best stored in a pourable, covered vessel (anything dipped into water must be sanitized)
- Small openings minimize contamination when lid is removed
- These factors less critical with untreated water

# Storage

Container Preparation:

- Wash and rinse all containers thoroughly, and sanitize using a solution of 1 tsp. bleach to 1 quart water
- Ensure sanitizing solution touches all interior surfaces, threads and cap

Tap Water:

- Can be stored for 6 months, then must be purified before use
- Many contaminants unlikely

# PART III

# PURIFICATION

# Purification

Why purify:

- Water can contain protozoa, bacteria, viruses and chemical contaminants, all of which can make you sick
- Two million people a year die from diarrheal disease
- Diarrhea can quickly lead to extreme dehydration
- Disease prevention is much easier than treatment, particularly in an emergency setting

# Purification

Contaminants:

Pathogens

-Parasites (including Protozoa)

-Bacteria

-Viruses

Chemicals

- difficult to remove, so best avoided

# Purification

Disease susceptibility is dependent upon on three broad factors:

-Virulence of the pathogen
-Volume of the pathogen
-Health of the host (you)

No purification method is perfect, but they reduce pathogen virulence and volume, mitigating risk.

The method(s) chosen should reflect the last variable - your health.

# Purification

Protozoa:

- Single celled organisms that form a protective shell when outside the host
- Largest and most common of the pathogens (4-15 microns)
- Spread by animal and human fecal contamination (or transmission of contamination by flies)
- *Giardia* and *Cryptosporidium* most common types
- *Cryptosporidium* resists chloride treatment
- Cause gastrointestinal illness; dangerous to immune compromised people

# Purification

Other Parasites:

-Many types (worms, flukes, etc.)

-Transmitted by animal and human fecal contamination

- Infections can include gastrointestinal, neurological and internal organ ailments

-Treatment methods for protozoa will be effective against other parasites

# Purification

Bacteria:

-Many types and contamination sources

-.2 to 10 microns

-Symptoms range from mild forms of dysentery

(E. coli, Salmonella) to death (typhoid, cholera)

# Purification

Viruses:

-Least common and smallest pathogen

-.004 to .1 microns

-Spread by fecal contamination or can manifest in water

-Polio, Hepatitis A, SARs (Coronavirus)

# Purification

Methods:

-Heat (boiling or pasteurization)

-Chemicals

-Filtration

-UV Light

-Distillation

-Solar Disinfection (SODIS)- combination of UV and heat

Plan to have at least two methods available!

# Purification

Boiling:

- One minute rolling boiling (at elevations < 1 mi.), or reach boiling and remove from heat but leave covered, then allowed to cool
- Effective against virtually all pathogens, but not chemical contaminants
- Pathogens inactivated at lower temps (pasteurization) but boiling is visually recognizable
- Best method, if feasible
- Requires a vessel, heat source and fuel

# Purification

Common Chemicals for Purification:

-Chlorine bleach and bleach based tablets
-Chlorine dioxide tablets and liquid
-Iodine and iodine based tablets

# Purification

Chlorine Bleach:

- 8 drops (1/8 tsp.) per gallon for clear water (x2 for cloudy)
- Effective against *Giardia*, bacteria and viruses, but not *Cryptosporidium*
- Available as liquid or tablets (liquid degrades with age)
- Chlorine based commercial purification tablets-follow manufacturers instructions
- When used with .2 micron filter, is as effective as UV light

# Purification

Chlorine Dioxide:

-Available as commercial purification tablets or liquid
-Effective against virtually all pathogens, including *Cryptosporidium*
-No unpleasant taste
-Somewhat expensive but very portable

# Purification

Iodine:

-Effective against bacteria and viruses, partially effective against *Giardia* and not effective against *Cryptosporidium*
-Should only be used for 1-2 weeks and should not be used by pregnant women or people with thyroid disease or an iodine allergy
-Requires lengthy exposure time with cold or cloudy water
-Is truly unpleasant tasting and a challenge to drink

# Purification

Filtration:
-Absolute pore size determines effectiveness (nominal pore size can let up to 30% of smallest size through)
-1 micron is effective against protozoa only
-.2 or smaller is effective against protozoa and bacteria, but not viruses
-. 01 ultrafiltration necessary to filter viruses

# Purification

UV Light:

-Effective against protozoa, bacteria and viruses
-Avoid prolonged exposure to light after treatment
-Small, portable unit (SteriPen) delivers a measured dose
-Very quick
-Relies on batteries
-Somewhat expensive

# Purification

Distillation:

-Method to render seawater potable, no additional treatment needed
-If using solar method, uses no fuel, otherwise it is fuel intensive
-Requires sunny weather, use this method in summer if collected rainwater is insufficient
- Low volume method

# Purification

Solar Disinfection (SODIS):

-Method developed by relief agencies for equatorial areas without safe drinking water
-Involves exposing water in clear plastic bottles to sunlight for 6 hours (sunny weather) or two days (cloudy weather)
-Unsure of effectiveness at our latitude, so can’t recommend

# Purification

-Plan for at least two purification methods for each scenario (assembly area and home)
-Understand that most purification methods require clear water so pre-filtering and/or decanting may be necessary (store coffee filters or cloth with a fine weave)
-Best long term solutions are boiling and bleach
-A solar oven can be used to pasteurize water in sunny weather to conserve fuel

# PART IV

# EMERGENCY WATER PLANNING

# Planning Considerations

Your plan:

- must address acquisition, storage and purification
- must be tailored to your situation (size of household, health of members, etc.)
- must be sustainable for 1-3 years
- must take fuel needs into account (until electricity returns)
- should be expandable to include water for other uses

# Recommendations

- Store at least 45 gallons per person (plus pets); this will get you through low rainfall months in case the disaster strikes at the start of summer
- Immediately after the disaster, start harvesting and storing as much rainwater as possible
- Plan usage so you'll have enough to last through the dry season
- Only if rainwater is inadequate, pursue other water sources

# Recommendations

- Make a detailed plan that outlines each phase and has alternate strategies in case the first doesn’t work
- Put your plan on paper and store in plastic in your go kit so you can immediately get started after the disaster – don’t trust yourself to remember anything when under that much stress
- Make sure all members of the household understand the plan, know where to find it and know how to implement it

# Anne’s Example Plan

Acquisition

-I have practiced rainwater collection for years (for garden use) and feel confident I can collect plentiful amounts if conventional water service fails
-I have one 55 gallon drum of stored rainwater
-I have many vessels I can use to collect rainwater
-I have a plan for distilling water, if necessary

# Anne's Example Plan

Storage

- I have a 55 gallon rain barrel to store untreated rainwater
- I have many 1 gallon PET containers to store purified water and to easily transport water to others in need
- I also have food-safe 5 gallon buckets, in case I need additional storage

# Anne's Example Plan

Purification

- I have two portable purification tools (SteriPen and .2 micron filter) and water bottles in my go-kit for assembly area use
- For home use, I have bleach and a tripod to hang over a fire with lots of firewood to boil water
- Once electricity returns, I'll boil water on the stove
- By using rainwater, I'll reduce the pathogen load and increase the effectiveness of purification

# Anne's Example Plan

Future Improvements

- Install a rainwater collection system with a cistern to collect large volumes of water for garden use and emergency preparedness
- Store more firewood
- Research bleach tablets (Evolve/Clearon) as a substitute for liquid bleach
- Test distillation method

# Conclusion

-Please – use this presentation only as a guide and do your own research

-Once you have a plan, continually work to improve it

-Never stop learning

Handouts

# Conclusion

Questions?