EMERGENCY WATER SUPPLY GUIDEBOOK

For Commercial, Industrial and Institutional Facilities

ACKNOWLEDGMENTS

SUBJECT MATTER EXPERTS

This guidebook was written and reviewed by Lane Preparedness Coalition (LPC) Members who are experts in the fields of water supply and distribution, plumbing code, water quality and facility operations.

This guide touches on water supply considerations during a disaster and recovery. The intent is to provide general information as a starting point for this important aspect of business continuity planning. This guide is not meant to replace staff expertise or consultation with a professional regarding the unique attributes of your agency or facility.

EUGENE-SPRINGFIELD NATURAL HAZARD MITIGATION PLAN

This guide has been produced under the care of the LPC Natural Hazard Mitigation Plan Sub-Committee. In the 2015 plan, emergency water supply was called out as a critical need that had not yet been adequately addressed by our community. This guide was written to answer to the need for guidance about how businesses can include emergency water supply into their business continuity plans. By providing this resource we aim to help our community become more resilient in the face of minor or major disasters.

Many thanks to these volunteers and their agencies for their work writing and reviewing this guide.

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INTRODUCTION

PREPARE FOR A WATER EMERGENCY

Citizens of Lane County have enjoyed extraordinarily reliable municipal water systems for decades. Large and small water utilities have built reliable infrastructure and prepared to respond to water emergencies. Only recently has our community come to realize that we all must prepare for water emergencies that may last hours, days or months.

The purpose of this guide is to provide a practical checklist to help commercial, industrial and institutional facility managers prepare for water emergencies ranging from frozen pipes at your facility, to a neighborhood water utility outage, to a catastrophic regional disruption.

PREPARE FOR THE BIG ONE, BE READY FOR MORE COMMON EMERGENCIES

December 2013: Unusually low temperatures caused water mains and service lines to burst throughout Lane County. In Eugene 19 water mains burst. Over 2,000 EWEB customers were affected by water outages for 1 to 5 days. Some businesses had to work with Lane County Environmental Services to maintain sanitation standards or temporarily close.

Earthquakes are high on the list of natural disasters that can interrupt our drinking water. Research published in the *Oregon Resilience Plan* indicates there is high probability the Willamette Valley will experience a very large earthquake within 50 years; *it's not a matter of if, but when*. The Governor's Task Force concluded that few communities in Oregon are prepared for a major event similar to the magnitude 9 earthquake that struck Japan in 2011 and issued a call to action.

Water utilities answered the call to action and have come to realize that preparing for the big one has helped crews respond more effectively to more common Lane County emergencies: winter storms, flooding and wildfires.

EMERGENCY PREPAREDNESS IS A SHARED RESPONSIBILITY: WHAT YOU CAN DO

The economic health of our community after a disaster depends upon each business owner and facility manager putting together a business continuity plan. Some investment may be needed to assure business continuity. Preparing for a water emergency is only one consideration.

EMERGENCY PREPAREDNESS IS A SHARED RESPONSIBILITY: UTILITIES PREPARE

Many water utilities in Lane County have established mutual aid agreements. Some have built water system inter-ties and coordinated emergency response planning. In addition to funding capital projects aimed at increasing water system resilience, the Lane County utilities have committed to an ongoing investment in emergency response training and equipment. Local utilities have also signed a state-wide mutual aid agreement to open the way for help from out-of-area utilities.

EWEB's Water Incident Response trailers can be deployed in a water emergency.

ESTIMATED WATER UTILITY RECOVERY TIME AFTER A DISASTER

- First priority: isolate water system damage, then restore basic services
- Emergency water distribution is currently planned only if an outage is expected to last more than 3 – 7 days
- The Oregon Resilience Plan Target – By 2050 build resilient water systems so that customers can expect a recovery time between one month (basic services) to one year (full services)
- Significant community investment is needed to meet the 2050 target.

Basic Services include provision of water for fire protection, hospitals and other emergency response facilities. A minimum amount of water may be available at emergency water distribution sites during an extended outage.

Full services include provision of water to all businesses and households at the meter.

In the most extreme water emergency, municipal water use will be limited to fire protection, hospitals and emergency water distribution. Other uses will be banned.

EMERGENCY MANAGEMENT RESOURCES

Deployment Priority in a Disaster	
Level	**Timing: Response**
City	Immediate: Police, Fire, Public Works
Non-Profit Agencies	Immediate: Hospital, American Red Cross, Social agencies
County	Varies: Sheriff, Public Health Department, Public Works
State	Varies: Requires Governor declaration
Federal	Delayed: Requires Governor request; Presidential signature

County, State and Federal emergency management services will only be available during a major event that affects the majority of the population in a wide area. Resources must be exhausted at each level before deployment at the next level can be requested. It may take days or weeks for County, State or Federal resources to become available. Prepare accordingly!

EMERGENCY WATER DEMAND

ABOUT EMERGENCY WATER DEMAND

Commercial, industrial and institutional water users, are advised to estimate emergency water supply needs based upon either winter average water use or minimum essential water use for your facility. Tools are provided in this guide to help you determine which method of estimating water demand is best for your facility.

The purpose of this section is to provide a resource for determining water demand at your facility. Use calculations from this section to estimate how much water you need to store or obtain by other means for use during an emergency.

WATER DEMAND CONSIDERATIONS

The first step to being prepared is to determine your facility's water needs not only for business processes but also for employee or guest use. The following list can help you start thinking about your water use and needs during an emergency.

- ☐ What water uses does your facility have and which of those are essential?
- ☐ How many days should your facility prepare to operate in an emergency?
- ☐ How much water will be needed to keep employees and guests safe, prevent equipment damage and implement your facility's business continuity plan?
- ☐ Is your facility expected to remain operational during an emergency?
    - If yes, for the entire emergency?
    - If no, how long would it take to shut down your facility?
- ☐ Is it important for security staff to stay on site?
    - If yes, for the entire emergency?
    - If no, is there a water use need for security checks on your facility?
- ☐ Should my facility plan include sheltering employee families so that they can remain at work?
    - If yes, for the entire emergency?
    - If no, how will your emergency operations be affected by employee absence to care for family concerns?
- ☐ What is the hygiene water use estimate for staff and equipment if you have to shelter in place?
- ☐ Do you have multiple facilities within the municipal water service area?
    - If yes, what opportunities exist for sharing resources?
    - If no, can you share resources between neighboring businesses?
- ☐ Is there an opportunity for installation of water conserving fixtures to reduce water demand in the event of an emergency?

DETERMINE WINTER AVERAGE WATER USE AND MINIMUM ESSENTIAL WATER USE

The following two sections provide two ways to calculate water demand for your facility: winter average water use and minimum essential water use.

Calculate Winter Average Water Use

- ☐ Gather water bills for a minimum period of November of the previous year through April of the next year.
- ☐ Use the table in Appendix A to enter the date, water use per bill, units on the bill, and the days of service.
- ☐ Calculate using Appendix A the gallons per day that your facility used.
- ☐ Calculate the average gallons per day for November through April.
- ☐ Multiply the winter average gallons per day by the number of days your facility needs to be prepared to operate in an emergency, this is the amount of water you need to store or obtain by other means.

Some utility bills provide a quick way to determine indoor water use called the "winter average". Your wastewater billing in the summer could be based on average water use billed during the preceding November through April.

Calculate Minimum Essential Water Use

- ☐ Make an inventory of how water is used in your facility. An example Inspection Form is included (Appendix B).
- ☐ Use the Inspection Form to determine the gallons of water needed and estimated duration of need for each of your critical water uses.
- ☐ Add up all of your critical uses to determine the amount of water you need to store or obtain through other means.

The Mayo Clinic recommends about 11 cups (0.75 gallons) of beverage intake per person per day.

American Red Cross basic shelter guidance specifies 1 toilet, 1 shower and 1 hand washing sink per 20 people. Facilities should be supplied with toilet paper, soap and paper towels.

A 30 gallon trash container per 10 people is also recommended. Facilities should be supplied with appropriately sized trash bags.

NEXT STEP: EMERGENCY WATER SUPPLY STORAGE

Emergency water demand calculations help determine how much water to store or obtain through other means. In most cases the amount of water that you can store is dependent on available space. The following section will provide guidance on how to provide a variety of methods to help you meet the water demand of your facility.

WATER STORAGE AND SUPPLY

ABOUT EMERGENCY WATER STORAGE AND SUPPLY

Commercial, Industrial, and Institutional water customers are advised be prepared to be without municipal water for their critical uses for an extended period of time. Access to water could impact your ability to recover and the speed of your recovery from disaster.

The purpose of this water storage chapter is to provide resources to aid in researching water storage and other supply options for your facility.

WHERE DOES THE WATER COME FROM?

Area water utilities take water from rivers (surface water) or wells (groundwater), treat it, and pump it into the piping network to deliver it to your home or business under pressure. Large storage tanks absorb daily fluctuations in supply vs. demand, but they are not designed to provide an extended source of supply. In a disaster that disables power to pumps or breaks the delivery pipes, your facility will not receive water through your plumbing fixtures and you will need an on-site emergency water supply.

ON-SITE WATER SOURCES

Some facilities may have access to on-site surface water or groundwater. Be aware that water rights or permits may be required to access an on-site alternate water supply. Sources may include:

- ☐ Private wells
- ☐ Access to a river or stream, lake or pond
- ☐ Hot water heater or other water storage tanks

Please note that water from hot water tanks may contain pathogens and heavy metals such as lead. Water from this source should not be used as drinking water unless properly disinfected and filtered.

STORAGE & SUPPLY CONSIDERATIONS

The following concerns should be considered when deciding what type of water storage or supply is appropriate for your facility:

- ☐ Are there land use code restrictions pertaining to water storage at your site?
- ☐ Will people need to drink the stored water or can the stored water be of lesser quality used for processes only?
- ☐ How long can water be stored before it needs to be treated?
- ☐ What are the space requirements for different types of water storage?
- ☐ What are the different ways water can be stored and what way best fits your needs? Appendix C shows details regarding each type of storage and supply.

- Bottled water may be purchased from a vendor for drinking water.
- Food grade containers may be filled with tap water for drinking water.
- Large food grade tanks may be filled with tap water for emergency drinking and process water needs.
- A very large custom built tank may be filled with tap water, rainwater or on-site reuse water suitable for production processes, not for drinking.
- Your site may have access to an on-site water supply such as a stream, pond or well

☐ Considerations when building a water tank:
- Do you need a plumbing or building permit for tank construction?
- How will water enter the tank?
- How will water be piped or delivered from the tank?
- Is there a need for an overflow pipe from the tank?
- Will insects and dirt be prevented from entering the tank?
- Will structural reinforcement be needed?
- Is water pressure needed for the intended use?

☐ Considerations for on-site water supplies:
- Emergency power supply may be needed to pump water from the source to distribution.
- Test water quality of the on-site source periodically.
- Store supplies for filtration and disinfection if you plan to use the source for drinking water.

If you plan to connect water storage or an on-site water source to the public water system contact the plumbing official and your water utility about backflow prevention methods. Unexpected changes in pressure can cause water to flow backward, causing contamination to accidentally enter your facility piping or the public water supply.

STORAGE & SUPPLY RESOURCES

Building Departments of Lane County	
City of Oakridge	ci.oakridge.or.us/forms
City of Cottage Grove	cottagegrove.org/commdev/building.html
City of Springfield (Development and Public Works)	springfield-or.gov/dpw/dept_dpw.htm
City of Eugene (Planning and Development)	eugene-or.gov/146/Planning-and-Development
City of Veneta	venetaoregon.gov/building
City of Florence	florenceal.org/City_Departments/Building_Department/index.html
Lane County (Land Management Division)	lanecounty.org/Departments/PW/LMD/Pages/default.aspx

Water Hauling Vendors*		
Vendor	**Service**	**Phone**
No Drought Potable Water Service nodroughtservices.com	Up to 3,300 gallon capacity	541-409-3556
Emerald Water Supply facebook.com/EmeraldWaterSupply	1,600 – 2,000 gallon capacity	541-747-5068
South Fork Coffee & Water Company southforkcoffee.com	5 gallon container; single serve bottles	541-284-2002 800-327-3820
Sierra Springs www.sierrasprings.com	5 gallon containers	800-201-6218

*During an emergency water haulers may be in high demand or have limited supply.

NEXT STEP: EMERGENCY WATER DISINFECTION

Once you have determined how much water will be stored or available on-site during an emergency, you will need to determine how to make stored water safe to drink. The following section will provide guidance on how to help you disinfect your emergency water supply.

EMERGENCY WATER DISINFECTION

DISINFECTION MAKES WATER SAFE TO DRINK

Waterborne disease was once the leading cause of death in the United States. According to the World Health Organization waterborne disease is still the leading cause of death around the world. During a community-wide disaster the lifesaving water and sanitation systems may not be operational. Commercial, Industrial, and Institutional water customers are advised be prepared to disinfect or filter water before distribution to prevent illness that can impact your business for years to come.

The purpose of this water disinfection chapter is to provide resources to protect the health of employees and other who are served water distributed by your facility during a water emergency.

HOW TO MAKE WATER SAFE TO DRINK

During a disaster there is a high likelihood that drinking water quality will be affected even if water still flows from the tap. If tap water is flowing check the utility website to learn if a boil water (biological contamination) or do not consume (chemical contamination) notice has been issued. Follow utility directions for disinfection or filtration of tap water until you receive notice that untreated or unfiltered tap water is safe to drink.

There are four ways to make water safe to drink if there is biological contamination:

- ☐ Boil: If an energy source is available, boiling is the simplest way to make water safe to drink. Water must be brought to a rolling boil for at least one minute.
- ☐ Chlorination: The chlorine dosage in the chart provided is for unscented household bleach that contains 8.25% sodium hypochlorite. Chlorine dosage will not be effective if water is cloudy. Filter cloudy water through a clean cloth or coffee filter until it is clear. Bleach should smell of <u>strongly</u> of chlorine. If it does not, discard it and get a fresh source of bleach. Add proper dosage to clear water, then mix well and let stand for 30 minutes. The water should smell <u>slightly</u> of chlorine after 30 minutes. Repeat the dosage if bleach odor is gone, let stand another 15

Volume of Water	Amount of Liquid Bleach to Add*
1 gallon	1/8 teaspoon
3 gallons	3/8 teaspoon
10 gallons	1 1/4 teaspoon
55 gallons	3 ½ teaspoons

*Bleach stored at room temperature has a shelf life of one year.

Source for chlorine effective date: clorox.com/dr-laundry/shelf-life/

minutes. If the water still does not smell of chlorine after the second treatment, discard it and find another source.

- ☐ Filtration: Filtration will be necessary if your emergency water supply might include chemical contaminants such as gasoline or oil from roadside runoff or fertilizer from landscapes. Read filter specifications to assure removal of suspected contaminants. See Appendix D for more information about filtration considerations.
- ☐ Ultraviolet Light (UV): Water can also be disinfected with a UV but will not be effective if water is cloudy. Filter cloudy water through a clean cloth or coffee filter until it is clear. UV disinfection requires a reliable and sustained power supply to maintain the specified light intensity that will kill or inactivate biological contaminants. Commercially available UV systems will include directions for intensity and duration of exposure to UV treatment that must be followed make water safe to drink. See Appendix D for more information about UV disinfection considerations.

Disinfection and filtration require resources that may be limited during a disaster. Use the chart below to determine which tasks require use of disinfected water.

Activities that DO require disinfection	Activities that DO NOT require disinfection
Drink (people and pets)	Showering
Hand washing	Tub bathing
Cleaning food contact surfaces	Dishwashing or rinsing*
Washing food served without cooking/baking	Laundering
Adding water to food without cooking/baking	General cleaning, mopping
Ice making	Pet bathing
Taking water with medications	Watering plants
Gargling	
Tooth brushing	
Eye washing	
*Cleaned dishes and utensils should be rinsed in water that contains one tablespoon of household bleach per gallon of water and allowed to air dry before use. Source: Oregon Health Authority	

NEXT STEP: EMERGENCY WATER DISTRIBUTION

Once you have determined the method(s) you will use to make your emergency water supply safe to drink, you will need to determine how to distribute the water efficiently. The following section will provide guidance on how to distribute your emergency water supply.

EMERGENCY WATER DISTRIBUTION

ABOUT EMERGENCY WATER DISTRIBUTION

Immediately after a major disaster water supplies are likely to be limited to water stored on-site. Commercial, Industrial, and Institutional water customers are advised to be prepared to distribute shelter-in-place water rations to employees and others served by your facility

The purpose of this guide is to help commercial, industrial and institutional water customers determine the most efficient method to distribute water that they have stored or otherwise obtained during an emergency.

MOVING WATER FROM THE SOURCE

Water will need to be moved from the source to points of distribution. Water can be moved using equipment commonly found on-site or special equipment may need to be purchased.

- ☐ Bucket or other container
- ☐ Gravity or suction device
- ☐ Human-powered pedal or hand pump
- ☐ Electric pump with a generator (until your fuel runs out)
- ☐ Alternative energy pump (wind, waterwheel, solar)

NOTIFICATION OF WATER QUALITY

Disinfection or filtration may occur between the source and point of distribution or after water is distributed. Place signage at each point of distribution indicating whether the distributed water is safe to drink or must be treated before drinking. Printers may not be operational after a disaster. Print water notices and store them in your emergency water supply area. Sample signage and handouts suitable for printing are provided in Appendix E.

ON-SITE WATER DISTRIBUTION STATION CONSIDERATIONS

Facility demand calculations will help you determine how many points of distribution will be needed. For public health reasons it is recommended that drinking water points of distribution be separate from hand washing stations. Shower and laundry stations (if needed) may use the same point of distribution as the hand washing stations.

Recall: The Mayo Clinic recommends about 11 cups (0.70 gallons) of beverage intake per person per day.

American Red Cross basic shelter guidance specifies 1 toilet, 1 shower and 1 hand washing sink per 20 people.

The drinking water point of distribution should include supplies to sanitize the tap between users. The preferred disinfection product for emergency drinking water taps is a canister of single-use 70-percent isopropyl alcohol wipes.

MUNICIPAL WATER DISTRIBUTION STATIONS

Recall, the first priority of water utilities will be to restore water for the Basic Services of fire protection, hospitals, and other emergency response facilities. Utilities will work with local partners to provide emergency water distribution at designated sites within 72 hours if possible.

Transportation infrastructure is likely to be damaged in the event of a disaster. When shelter-in-place water supplies are exhausted, employees or others served may need to walk to a designated municipal distribution location and receive an emergency water ration. Individuals need to bring their own container for self-serve filling. If you manage a large facility, part of your emergency water supply plan might include serving as a designated distribution site for your neighborhood. Contact your water utility for more information.

NEXT STEP: SANITATION

Once you have determined the method you will use to distribute water that is safe to drink, you will need to make arrangements for waste water collection and disposal. The following section will provide guidance on sanitation methods.

SANITATION

SANITITATION AND HYGEINE: ESSENTIALS OF DISEASE PREVENTION

In the event of a major disaster there is a high likelihood that the public sanitary sewer infrastructure will not function. Expected time for restoration of sanitation services are much longer than for drinking water services.

The purpose of this guide is to provide practical solutions for sanitation and hygiene needs during a disaster.

Commercial, industrial, and institutional water customers are advised to be prepared to provide temporary sanitation services to employees and other served to prevent unsanitary conditions that would lead to disease by direct contact or contamination to drinking water supplies.

ESTIMATED WASTEWATER UTILITY RECOVERY TIME AFTER A DISASTER

- First priority: control direct threats to health and safety (2 weeks to 1 month)
- Raw sewage contained and routed away from population and drinking water supply (up to 3 months)
- The Oregon Resilience Plan Target – By 2050 build resilient waste water systems so that customers can expect a recovery time between 3 months (basic services) to 3 years (full services)
- Significant community investment is needed to meet the 2050 target.

PORTABLE TOILET RENTAL AND SERVICES

Portable toilets are a good alternative to indoor plumbing and are readily available in Lane County. During an emergency these services may be limited due to high demand and/or compromised transportation systems.

Lane County Sanitation Resources	
Buck's Sanitary Service (541) 342-3905 http://www.bucks-sanitary.com/	Above All Sanitation (541) 935-4248 http://aboveallsanitation.com/
Honey Bucket (800) 966-2371 http://www.honeybucket.com/service-areas/oregon.asp	Best Pots (541) 343-3554 http://www.bestpots.com/

PERSONAL SANITATION RESOURCES

Contract portable toilet services may be impractical for some facilities. Some low cost, simple solutions for personal sanitation include trash bags to line toilets or a five gallon bucket portable toilet. A somewhat more expensive alternative is a portable chemical toilet.

Recall: American Red Cross basic shelter guidance specifies 1 toilet, 1 shower and 1 hand sink per 20 people. Facilities shall be supplied with toilet paper, soap and paper towels.

A 30 gallon trash container per 10 people is also recommended.

Proper disposal of collected waste is equally important for disease prevention. Promptly remove waste from living areas. Place waste in a sealed plastic bag and put the bag in a trash container or dumpster that will be picked up and taken to the nearest landfill. This is the same protocol used for disposal of adult or baby diapers. Disinfect sanitation station using a bleach solution.

Trash bag liner in a toilet; kitty litter optional

5-gallon portable toilet kit

Portable chemical toilet

Handwashing is a critical disease prevention measure. Handwashing stations are an important component of emergency sanitation planning. Most facilities have the basic elements in stock for assembling a handwashing station as shown in Appendix F.

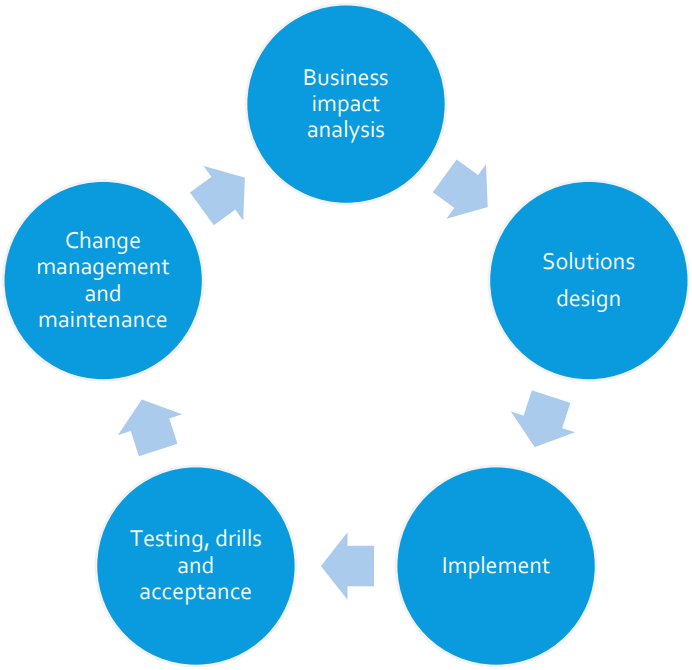
NEXT STEP: MAINTAIN WATER AND SANITATION EMERGENCY READINESS

Once you have purchased and installed emergency water supply equipment and established deployment procedures, you will need a strategy to maintain your state of readiness. The following section will provide guidance on how to educate employees and ensure that equipment is operational if (when) disaster occurs.

MAINTAIN READINESS

MAINTAIN WATER AND SANITATION EMERGENCY READINESS

Business continuity planning and implementation cycle includes five stages of readiness as shown in the cycle diagram. The demand analysis section of this publication provided guidance regarding how to determine the business impact of a water emergency. The following sections offer considerations for solutions design at your facility. The purpose of this section is to provide guidance to sustain your state of readiness after implementation.



TESTING, DRILLS AND ACCEPTANCE

Once you have implemented the solutions appropriate to the unique attributes of your facility, commercial, industrial, and institutional water customers are advised test the new equipment and procedures to assure that they work as planned. When testing and adjustments are complete, educate your employees and others served by conducting drills. Over time employees and those served by your facility will come to appreciate and accept your commitment to preparedness.

Test equipment and procedures

- ☐ Closely monitor storage and supply solutions for leaks or other problems immediately after initial installation.
- ☐ Practice disinfection procedures using newly purchased or repurposed existing equipment and supplies.
- ☐ Test distribution methods on a small scale soon after initial installation.
- ☐ Set up a small scale sanitation station in one selected area to test disease prevention assumptions.
- ☐ Document equipment operation and procedures after initial testing. Print paper copies of the documentation near equipment and supplies.

Conduct a drill

- ☐ The first drill conducted at your facility should be a planned educational event that includes as many employees as possible.
- ☐ Once your employees are familiar with water emergency response equipment and procedures you could include those served by your facility in drills.
- ☐ An occasional surprise drill, perhaps every two or three years, is recommended to simulate the conditions of an actual disaster.
- ☐ Drills could be an opportunity to provide employees with home emergency preparedness information.

Acceptance

Many organizations have active safety programs that protect employee health and prevent time loss injuries. It is widely recognized that workplace safety is a shared responsibility.

Emergency preparedness is also shared responsibility. Just as water utilities and facility managers must prepare for emergencies, it is in your organization's best interest to inspire the employee's sense of responsibility to be prepared.

CHANGE MANAGEMENT CONSIDERATIONS

Commercial, industrial, and institutional water customers are advised to revisit the first three stages of readiness whenever significant changes in facilities or business practices occur. A few examples of changes that might prompt readiness revisions:

- ☐ New management
- ☐ Remodel or expansion of the existing facility
- ☐ Increases in the work force or those served by your facility
- ☐ Addition of a new site
- ☐ New production processes adopted or discontinued

MAINTENANCE CONSIDERATIONS

The maximum state of readiness will be reached immediately after implementation or after the first drill conducted at your facility. After the excitement of the initial stages has passed it is important to establish a schedule to maintain a state of readiness that makes the most of your business continuity investment.

Maintain water storage and supply

- ☐ At least once a year:
  - Private well pumps should be tested.
  - Private well water should be tested to assure that method(s) for disinfection or filtration measures are adequate for the quality of water.
  - Pumps for river or stream, lake or pond should be tested.

- ☐ Note that water from hot water heater or other water storage tank does not need to be drained and refilled or tested but should be disinfected upon use.
- ☐ Regulations for rainwater harvesting or on-site water reuse may include additional requirements to maintain storage and supply.

Maintain effective disinfection methods

- ☐ Every six months or so:
  - Test the operation of ultraviolet light (UV) disinfection systems. Make sure that you have a reliable and sustained power supply to ensure the light intensity necessary for effective disinfection:
    - Replace the supply of batteries or
    - Test the back-up generator and replace the supply of fuel.
- ☐ At least once a year:
  - Supplies for boiling water during an extended power outage, such as propane for barbecue or camp stove, should be checked.
  - Unscented chlorine bleach has a shelf life of one year. When you purchase replacement supplies, write the date on the bottle with permanent marker to ensure that you maintain effective disinfection.
  - Test the operation of your filtration system. Check the supply of replacement cartridges or other filtration supplies.

Maintain distribution supplies

- ☐ Every six months or so:
  - Test your electric pump with a generator. Replace the supply of fuel.
- ☐ At least once a year:
  - Check the supply of designated buckets or other water distribution containers.
  - Check the supply of gravity or suction devices and assure that they remain effective.
  - Test the operation of human-powered pedal or hand pumps. This equipment also may require lubrication or other maintenance on a periodic basis.
- ☐ Follow manufacturer's maintenance guidelines for alternative energy pumps.

Maintain sanitation supplies

Most emergency sanitation supplies are readily available janitorial supplies. The best way to maintain an emergency supply is to increase janitorial stock on hand. Plastic bags, toilet paper and paper towels lose integrity when stored over long periods of time. Proper rotation practices will assure that older supplies are used up and new supplies are refreshed on a regular basis.

Commercial, industrial, and institutional facility managers are advised to check on stored sanitation supplies annually if your facility does not have on-site janitorial supplies on hand. Replace supplies on an as needed basis.

APPENDIX A: FACILITY WATER USE ANALYSIS TABLE

The most common way to learn about water use is from your utility bill. Regardless of the interval of your water bill you can calculate your winter average water use per day by dividing the billed amount by the days of service.

Facility:				Date:	
Date of Bill	Water Use per Bill	Unit of Measure Conversion	Days of Service	Gallons	Gallons Per Day
Winter Average Use, gallons					
Critical Water Use, gallons					

Water Use per Bill = The amount of water used during the billing period.

Unit of Measure = The water bill should note the unit of measure. Typical notations would include KGAL (kilogallons), Unit or CCF (cent [100] cubic feet), Unit.

Days of Service = The number of days during each billing period, usually noted on the bill.

Unit Conversion Multiplier = Municipal water is typically sold in bulk rather than by the gallon. See the table below for common multipliers.

Unit of Measure Conversions		
KGAL = 1,000 gal	UNIT = 748 gal	CCF = 748 gal

Gallons = Multiply the water use per bill times the multiplier to get the gallons used for the entire billing cycle.

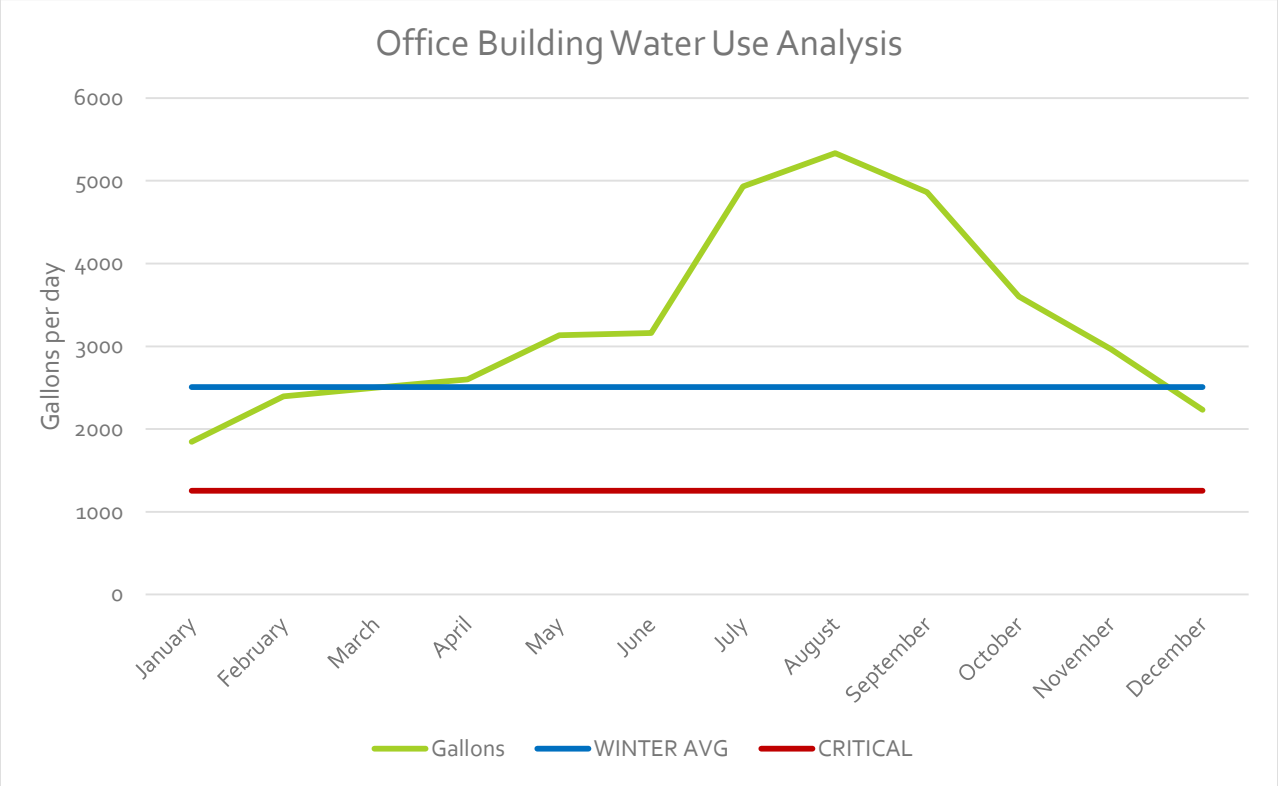
Gallons per day = The gallons of water used per day at your facility. Divide the gallons by the number of days from your bill.

Winter Average = Add water use from November of the preceding year to April of the current year then divide by 6.

Critical Demand = Obtained from the inspection form (Appendix B)

Facility: Office Building				Date: 2015	
Date of Bill	Water Use per Bill	Unit of Measure Conversion	Days of Service	Gallons	Gallons Per Day
Jan	59	1000	32	59,000	1844
Feb	67	1000	28	67,000	2393
Mar	70	1000	28	70,000	2500
Apr	78	1000	30	78,000	2600
May	94	1000	30	94,000	3133
Jun	98	1000	31	98,000	3161
Jul	148	1000	30	148,000	4933
Aug	176	1000	33	176,000	5333
Sep	141	1000	29	141,000	4862
Oct	108	1000	30	108,000	3600
Nov	95	1000	32	95,000	2969
Dec	67	1000	30	67,000	2233
Winter Average Use, gallons					2508
Critical Water Use, gallons					1254

The table on the previous page shows an example of using the water use analysis template provided. The data have also been graphed to provide an example of how you can use the information.



APPENDIX B: CRITICAL WATER USE INSPECTION FORM

Facility:	Date:
Inspector:	Phone:
Address:	Cell:
# Employees:	# Guests Served:

List the number of employees and guests expected to be served during a water emergency.

CRITICAL Domestic Water Using Equipment

	Count	Gallons per Use	Uses per Day[1]	Duration of Outage (Days)	Total Gallons = Uses per day x duration
Toilets					
Tank-type Toilet, gallons per flush (gpf)[2]					
Flush Valve Toilet, gpf[3]					
Flush Valve Urinal, gpf[3]					
Bucket-style Shower[4], gpm					
Sink to be converted to hand washing station[5]					
Water Fountain to be converted to drinking water distribution station[5]					
Bucket-style Clothes Washing Station[6]					

CRITICAL Water Cooled Equipment

	Count	Gallons needed to prevent damage	Uses per Day[1]	Duration of Outage (Days)	Total Gallons = Uses per day x duration
Chiller					
Cooling Tower					
Refrigerant Compressor					
Air Compressor					

Other Critical Water Uses					
	Count	Gallons needed to prevent damage	Uses per Day[1]	Duration of Outage (Days)	Total Gallons = Uses per day x duration
Process Water					
Irrigation					
Outdoor hose bibs, faucets, spigots					
Other:					
Other:					
Other:					
Critical Water Use Total (gallons):					

Non-Municipal Water Sources (that will be available in an emergency)					
	Count	Gallons available	Ration per Day[1]	Duration of Outage (Days)	Total Gallons = Uses per day x duration
Hot Water Heater NOT DRINKABLE					
On-site Water Source (well, water quality tested)					
Other:					
Other:					
Other:					
Non-Municipal Water Source Available Total (gallons):					
TOTAL GALLONS OF WATER STORAGE REQUIRED (Critical water use minus other water sources)					

Comments/Notes:

1. Enter the number of flushes per day, minutes of operation per day, number of uses per day, number of gallons needed to avoid equipment damage etc.
2. If the wastewater system is functional, toilets can be flushed by pouring the specified gallons per flush into the bowl of the toilet. If actual information is not available for gallons per flush the following can be used as an estimate based on the age of the tank type toilet: Pre-1970~6-7 gpf, 1970-1982~5 gpf, 1983-88~3.5 gpf and 1989-2016 ~1.6 gpf.
3. If the wastewater system is functional, toilets can be flushed by pouring the specified gallons per flush into the bowl of the toilet. Flush valves are often imprinted with gallon use.
4. A 5-gallon bucket can be fitted with valve and a water efficient showerhead to maintain hygiene during an extended water emergency. To use the bucket shower, fill with desired temperature of water then place on a shelf above head height with showerhead extended over the lip of the shelf. Assume 5 gallons per shower per person per desired interval between showers.
5. Assume 1 gal per person per day for drinking water and hand washing. Also consider length of time employees and guests served may need to shelter in place.
6. A 5-gallon bucket and toilet plunger can serve as a clothes or linens washing station. Rope can be used as a clothes line for drying washed clothing or linens. Assume up to 10 gallons per person per interval desired between washing of clothes: 5 gallons for wash cycle; 5 gallons for rinse cycle.

Bucket clothes washer

Source: http://www.survivopedia.com/diy-bucket-washer/

Bucket shower

Source: https://www.youtube.com/watch?v=ROJASOgLeIE

APPENDIX C: TYPES OF WATER STORAGE & SUPPLY

This appendix shows some of the options regarding each type of on-site water storage and supply. The information provided in this appendix is not intended to replace staff expertise or consultation with professionals regarding the unique attributes of your agency or facility.

Bottled water is readily available. Be aware that the expiration date pertains to water quality and to integrity of the container itself.

Note that inclusion of these images are for example only and does not imply endorsement for the use of bottled water nor any specific brand of bottled water.

Food grade containers, such as the 55-gallon barrel pictured, may be filled with tap water to be used for drinking water. Note that the barrel pictured is also sold with a filtration kit to aid disinfection and distribution of stored water.

Directions and dosage for "shock chlorination" of water storage tank are available from the Oregon Health Authority Drinking Water Program http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Operations/Pages/shockchlorination.aspx

Picture credit: www.costco.com/Nutristore%E2%84%A2-Deluxe-BPA-Free-55-gallon-Barrel-Water-Storage-System-with-Aquamira%C2%AE-Filtration-Kit.product.11766218.html

Note that inclusion of this image is for example only and does not imply endorsement for the use of food grade water barrels nor any specific brand of barrel.

Large food grade tanks, such as the 275 gallon tanks pictured, may be filled with tap water for emergency drinking and process water needs. Note that the barrel pictured is also sold with filtration kits to aid disinfection and distribution of stored water.

Note that inclusion of this image is for example only and does not imply endorsement for the use of large food grade water tanks nor any specific brand of tank.

Picture credit: costco.com/Nutristore%E2%84%A2-275-Gallon-Super-Tanker-with-Aquamira%C2%AE-Filtration-Kit-2-pack.product.100106932.html

Directions and dosage for the size of water tanks shown. Two day disinfection:

- 55 gallons @ 50ppm, add 2.82oz of chlorine and let stand for 24 hours then rinse container before use.
- 275 gallons @ 50ppm, add 14.08oz of chlorine and let stand for 24 hours, then rinse container before use.

Same day disinfection:

- 55 gallons @ 300ppm, add 16.90oz of chlorine and let stand for 15 minutes, then rinse container several times before use.
- 275 gallons @ 300ppm, add 84.48oz of chlorine and let stand for 15 minutes, then rinse several times before use.

When using the 300ppm process it can take several rinses to get the chlorine residual out of the containers.

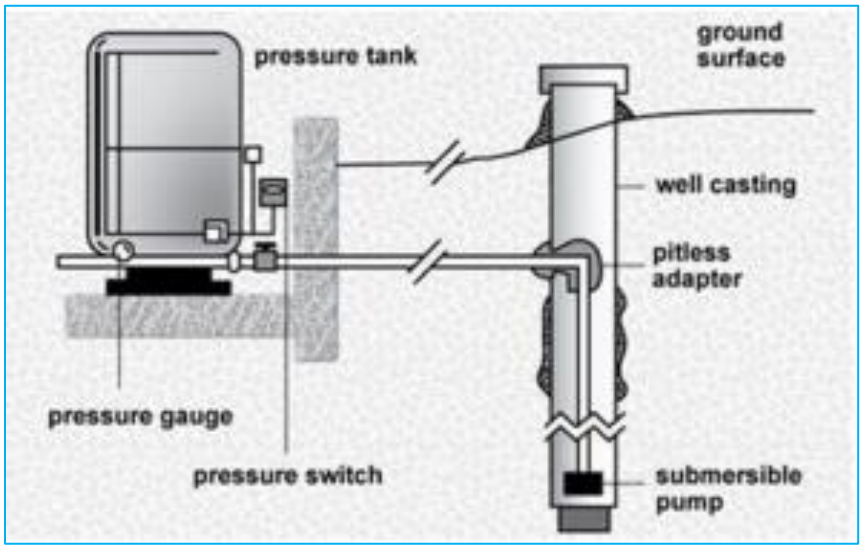
Directions and dosage for "shock chlorination" of water storage tanks of various sizes are available from the Oregon Health Authority Drinking Water Program http://public.health.oregon.gov/ HealthyEnvironments/DrinkingWater/ Operations/Pages/shockchlorination.aspx

A very large custom built tank may be filled with tap water, rainwater or on-site reuse water that is suitable for production processes, but perhaps not for drinking water.

Photo: "IWS - watercache.com"; 5600 gallon commercial rainwater collection system for LEED Gold rated fire station in Denton, Texas. Rainwater is used to irrigate native plant landscaping around the station.

Your site may have access to an on-site water supply such as a stream, pond or well

Photo Credit:
djc.com/news/en/11135644.html



Picture Credit:
merrilldrilling.com/well-service/well-pump-repair-salem-oregon/

EMERGENCY WATER STORAGE WATER QUALITY STUDY

An Oregon water utility conducted testing to determine to what degree filling procedures affected the length of time that water could safely be stored. Six 55-gallon food grade high density polyethylene (HDPE) barrels were disinfected according to the guidance provided in this appendix. Water quality analysis and data collection was performed at specific intervals for nine consecutive years.

Key findings:

- Potable tap water stored without adding chlorine over the storage period was kept in satisfactory microbiological condition so long as proper disinfection of all equipment was maintained during filling process.
- Microbiological quality was greatly and negatively impacted when equipment used for filling (faucets and hoses) were not properly disinfected prior to the filling process even though the container was properly disinfected.

Conclusion:

The long-term storage of tap drinking water without added disinfection appears adequate, assuming the containers and fill equipment used are properly disinfected. The properly disinfected barrels that were filled with properly disinfected fill equipment in the pilot study were tested for a nine year period with no additional microbiological activity evident.

Taste and odor is an issue with regards to the use of HDPE. No testing was conducted to determine the chemical safety of water. However, HDPE is classified as a "good" plastic and is used for milk, water and juice bottles as well as yogurt and margarine tubs. According to the Pacific Northwest Pollution Prevention Resource Center, HDPE is not known to leach any chemicals that are suspected of causing cancer or disrupting hormones.

Source: Pacific Northwest Pollution Prevention Resource Center pprc.org/index.php/2015/p2-rapid/is-high-density-polyethylene-hdpe-a-good-choice-for-potable-water/

This appendix shows some of the options regarding some ultraviolet disinfection and filtration options. Options range from portable emergency water filtration systems to permanent installations.

The information provided in this appendix is not intended to replace staff expertise or consultation with professionals regarding the unique attributes of your agency or facility.

Filtration disinfection system effectiveness is expressed in strainer size measured in micrometers (one millionth of a meter). Cloudy water is contaminated with suspended sand, dirt and debris particles are typically 20 micrometers or larger and can be seen with the naked eye. Waterborne pathogens are not visible without using a microscope and range in size from 15 to 0.5 micrometers. Filters can provide disinfection as well as removal of many chemical contaminants depending upon the model selected. Microfiltration provides at least 4-log removal of bacteria and two indicator waterborne pathogens, Giardia and Cryptosporidium. Ultrafiltration provides at least 4-log removal of viruses.

What is log reduction?

Log reduction is how engineers express the percentage of organisms removed or inactivated by a given water treatment process. The percentage of removal is calculated using the base 10 logarithmic system, hence the term "log reduction".

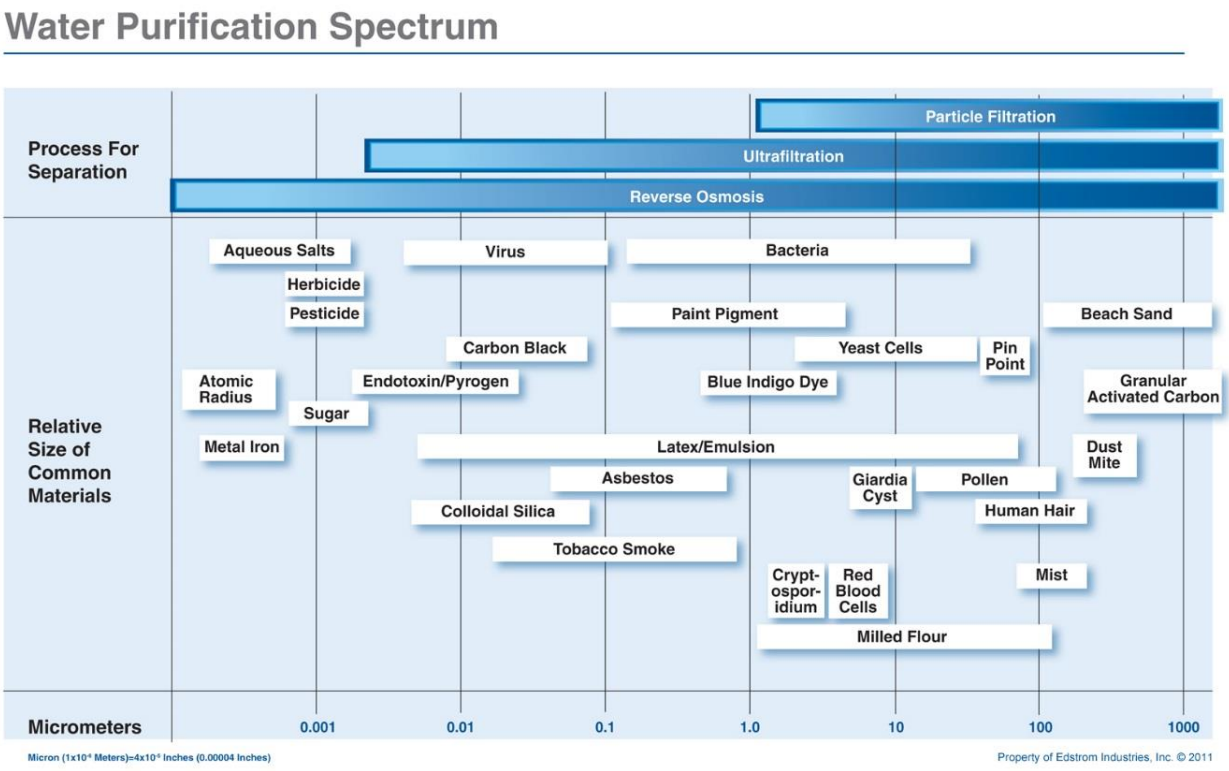
1-log reduction = 90%

2-log reduction = 99%

3-log reduction = 99.9%

4-log reduction = 99.99%

Portable filtration systems may be sized for personal use, facility use or community use. Products such as these provide disinfection as well as filtration of many chemical contaminants as shown in the chart on the following page.



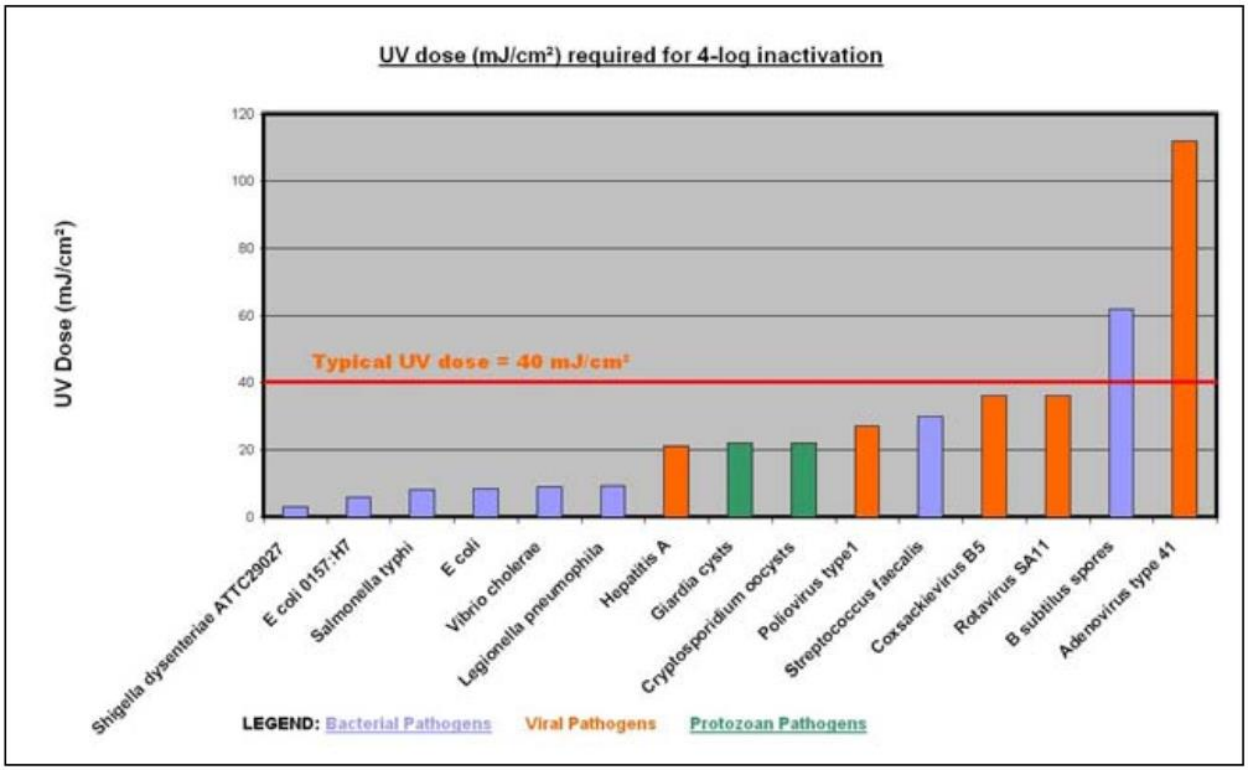
Pricing for personal use filters ranges from $20 to $150.

Note that inclusion of these images and product details are for example only and do not imply endorsement for the use of any specific brand of filtration system.

Pricing for facility and community use ranges from $300 to over $2,000. Inline permanent filtration systems can be installed where the water service enters the building or at points of use, such as under a sink.

Note that inclusion of these images and product details are for example only and do not imply endorsement for the use of any specific brand of filtration system.

Ultraviolet light (UV) disinfection systems require a reliable and sustained power supply to maintain specified light intensity that will achieve 4-log removal of biological contaminants. Battery operated systems may require a supply of spare batteries to sustain water supply over an extended period of time. A generator may be needed for larger systems during a disaster.



UV light intensity required for 4-log inactivation of common waterborne pathogens

APPENDIX D: WATER FILTRATION & ULTRAVIOLET DISINFECTION

Pricing ranges for UV disinfection systems shown below range from $90 to $650. Products such as these will not make water safe if chemical contaminants are present.

SteriPen Adventurer Opti


CamelBal All Clear Bottle

Note that inclusion of these images and product details are for example only and do not imply endorsement for the use of any specific brand of ultraviolet light disinfection system.

DISINFECTION AND FILTRATION INFORMATION RESOURCES

Public Health Protection Agencies	
Centers for Disease Control and Prevention	cdc.gov/healthywater/drinking/home-water-treatment/household_water_treatment.html
Lane County Public Health	lanecounty.org/Departments/HHS/PubHlth/EnvHlth/Pages/default.aspx
Oregon Health Authority	public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/consumers.aspx

THIS WATER HAS BEEN PROPERLY DISINFECTED FOR DRINKING, COOKING, MAKING PREPARED DRINKS AND/OR BRUSHING TEETH.

Please only fill clean containers.

Please use the wipes provided to disinfect the tap before and after you fill your container. Notify site maintenance staff if disinfection supplies are not available.

Thank you for preventing the spread of waterborne disease.

THIS WATER

IS NOT SAFE FOR DRINKING

COOKING, MAKING PREPARED DRINKS AND/OR BRUSHING TEETH.

Please take the handout and follow directions to disinfect this water before use.

Thank you for preventing the spread of waterborne disease.

APPENDIX E: PRINT READY WATER QUALITY NOTIFICATION

This print ready handout is provided in case you are unable to make water safe to drink before distribution.

DIRECTIONS TO MAKE WATER SAFE TO DRINK

If water is not safe to drink or has been stored for more than five days, follow these steps to properly disinfect water for drinking, cooking, making prepared drinks and/or brushing teeth:

1. **Boil** – Bring water to a rolling boil for at least one minute.

2. **Bleach** – If you can't boil the water, add 1/8 teaspoon of unscented liquid chlorine bleach for 2 gallons of water. Stir well and let stand for 30 minutes before use. The water should smell slightly of chlorine after 30 minutes. Repeat the dosage if bleach odor is gone, let stand another 15 minutes. If the water still does not smell of chlorine after the second treatment, discard it and find another source.

3. **Reserve** – Store disinfected water in disinfected containers with covers.

If the water is cloudy, filter it through a clean cloth or coffee filter, or allow it to settle before following the three previously listed steps.

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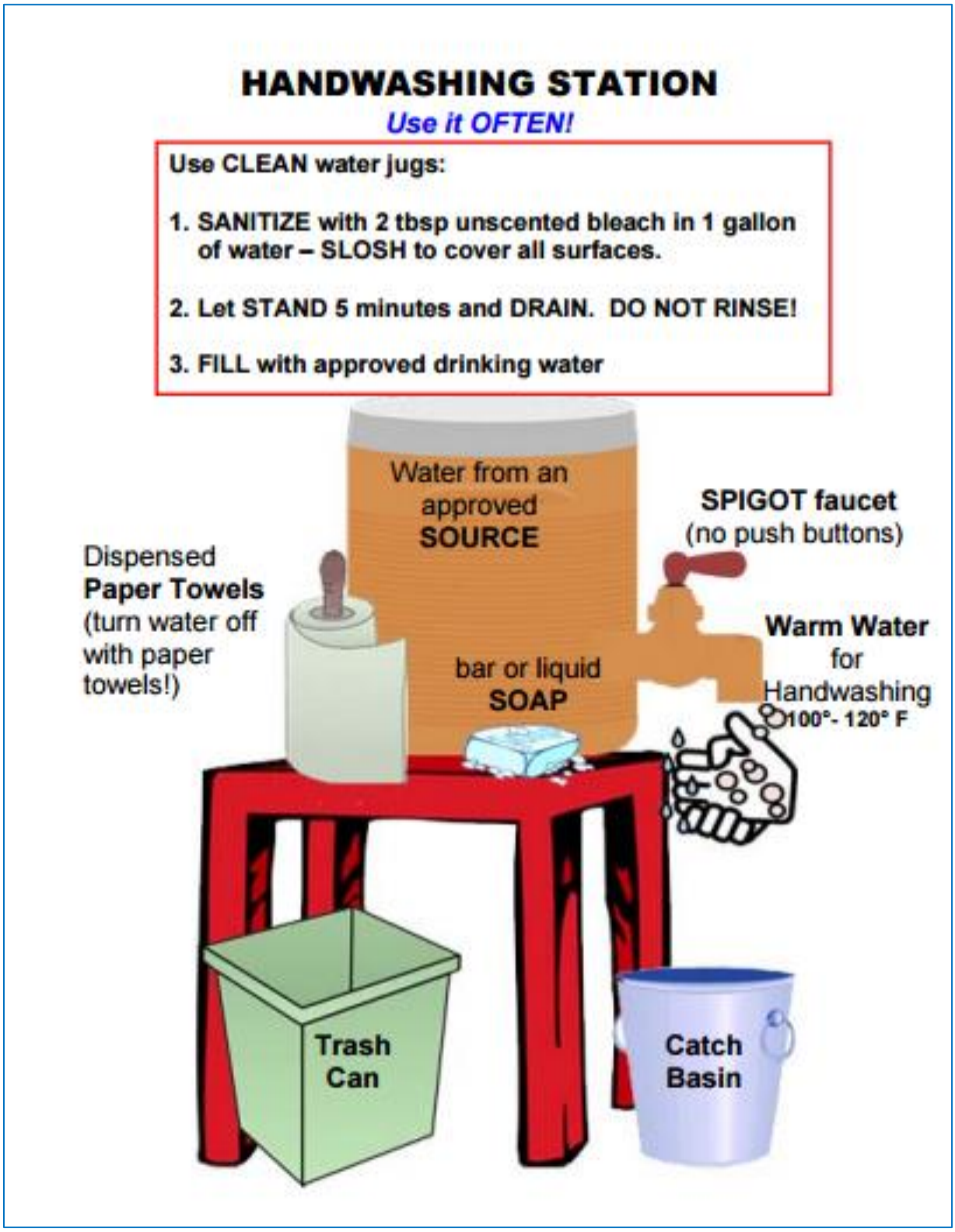

Source: dec.alaska.gov/eh/fss/Food/Docs/HANDWASHING_STATION.pdf