Guidance on Selection and Use of Portable Water Treatment Units for Providing Potable Water as a Last Resort under Emergency Conditions

STATEMENT ON EMERGENCY WATER TREATMENT UNITS

The Missouri Department of Health and Senior Services and the Missouri Department of Natural Resources recommend using emergency water treatment units as a last resort during catastrophic events. During other emergencies, plans should be in place for providing potable water through other means, such as emergency interconnections between public water systems, bottled water, hauled potable water, and disinfection by boiling water or other suitable methods. These have proven effective in supplying communities with sufficient safe drinking water during past emergencies. If the decision is made to purchase and use portable water treatment units, the departments of Health and Senior Services and Natural Resources recommend the following guidelines.

CONCERNS WITH EMERGENCY WATER TREATMENT UNITS

Despite marketing claims, many emergency water treatment units do not produce water that meets safe drinking water standards. Treatment methods and devices that do not produce water meeting these standards are unsafe for use.

Viruses and other microbial contaminants are of particular concern. At a minimum, a portable water treatment unit should be able to provide reliable protection from microbial contamination. If the source water is suspected or determined to be contaminated with chemicals, the water treatment unit should also be approved for treating chemical contamination. Further, the treatment unit should be certified by a third-party certification organization. Units that have not been properly certified cannot be assessed for their capability of treating nonpotable water to meet safe drinking water standards.

KEY CONSIDERATIONS IN SELECTING A TREATMENT UNIT

This guidance does not provide a listing of approved emergency water treatment units. Instead, it provides parameters and key considerations outlining recommended functions and certifications to assist in the selection and purchase of these systems.

Source Water Quality

The intended source of water to be processed through the emergency water treatment system is a key consideration to be made early in the planning stages. Because much of the risk to public health depends on raw source water quality, source water selection is of great importance.

Groundwater from a public water system well is the best source if it is available. If a public water source is not available, a private well source may be used. The next choice would be a spring. Other surface water sources should only be used as a last resort due to the greater likelihood of biological and chemical contamination and increased turbidity, which will require more frequent maintenance of the emergency water treatment unit.

If surface water from a compromised public water system treatment plant is available, it may be advisable to run the raw water through the plant's settling basins, filtration or other treatment processes to reduce the turbidity and solids that could reduce the emergency water treatment unit's efficiency. This would be recommended as a source over other surface water of poor quality or unknown quality, such as surface water directly from a river, lake, or pond that has not previously been a raw water source for a public drinking water supply. If water is obtained from one of these sources, any available settling basin (such as a large stock tank) that would reduce sediment before passage through the emergency water treatment device should be used.

National Sanitation Foundation

For more than 65 years, the National Sanitation Foundation (NFS) has been the trusted third-party testing organization for products that deliver and treat drinking water. NSF provides testing and certification for drinking water treatment systems and components. It is recommended that an emergency water treatment unit, at a minimum, has gone through the NFS approval process for treatment of microbial contamination. If using a device for treatment of both chemical and microbiological contamination, the device must also be certified by NSF. A list of approved devices and supporting information is available at info.nsf.org/Certified/DWTU/ and www.epa.gov/nrmrl/std/etv/vt-dws.html.

It is recommended that an emergency water treatment unit, at a minimum, has gone through the Environmental Technology Verification approval process for treatment of microbial contamination. If using a device for treatment of both chemical and microbiological contamination, the device must also be certified by the Environmental Technology Verification Program.

A list of approved devices can be found at: www.nsf.org/business/drinking_water_systems_center/dws_homeland_list.asp?program=DrinkingWatSysCen.

Ultraviolet Light Disinfection

Point-of-use or point-of-entry emergency water treatment units that use an ultraviolet (UV) disinfection process should be certified to National Sanitation Foundation/American National Standards Institute (NSF/ANSI) Standard 55, Class A. This certification defines the NSF/ANSI requirements for treating microbiologically unsafe water. NSF/ANSI Standard 55 for Ultraviolet Microbiological Water Treatment Systems states that a Class A device must be capable of producing at least 40 milliJoules/cm2. Some point-of-use and point-of-entry emergency water treatment units have been shown to produce only 16 milliJoules/cm2. Treatment units that do not meet NSF/ANSI Standard 55 Class A requirements will require additional disinfection and longer disinfection contact time to achieve effective viral inactivation.

The ANSI/NSF Standard 55 Class A basic requirements for microbiological UV treatment are:

- Class A systems shall be equipped with a UV sensor to indicate when the UV irradiance at the sensor is below the minimum required by this standard. One or more of the following means shall be used to indicate ineffective operation:
    - a visual alarm
    - an audible alarm
    - a system that terminates discharge of water

This standard requires 40 mJ/cm2, which is the same as 40,000 microwatts-sec/cm2, at the alarm set point. (mJ = milliJoules)

EPA's Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule, November 2006 (EPA 815-R-06-007) provides technical information and guidelines on the use of ultraviolet light for disinfecting drinking water.

Ultraviolet disinfection should be considered only one part of a comprehensive multiple-barrier disinfection approach essential for safely reducing microbial risks in drinking water. Even approved devices must be closely monitored for flow rate, ultraviolet intensity, and lamp status in accordance with these guidelines to ensure their effectiveness in this step of the treatment process. To ensure safe drinking water during emergencies, close monitoring of these parameters must also be conducted for the emergency water treatment units in accordance with the guidelines.

Treatment for Viruses

Some point-of-use and point-of-entry emergency water treatment units do not provide the required removal or inactivation of viruses. Viruses are particularly challenging because some have the ability to repair themselves within a host after inadequate UV exposure. Disinfection processes for microbiologically unsafe water must provide a 4-log (99.99 percent) removal and/or inactivation of viruses. Missouri's Ground Water Rule (10 CSR 60-4.025) does not allow ultraviolet as a stand-alone treatment for virus inactivation, as there are currently no means to validate reactors for adenovirus inactivation. Therefore, additional treatment may be required (e.g., sedimentation, filtration, chlorination with contact time, etc.).

Point of use or point of entry emergency water treatment units using an ultraviolet disinfection process should be certified to NSF/ANSI Standard 55, Class A. This certification defines the NSF/ANSI requirements for treating microbiologically unsafe water.

If an emergency water treatment unit is selected that does not meet these standards, additional disinfection and detention time will be necessary to achieve 4-log (99.99 percent) removal and/or inactivation of viruses. This will require the addition of 5.25 – 6 percent unscented chlorine bleach at a dose of 1/8 teaspoon per gallon clear water or eight drops per gallon clear water (two drops per quart or two drops per liter) or (2.5 cups per 1,000 gallons or 20 ounce per 1,000 gallons). All water treated with unscented chlorine bleach must have a retention time of at least 30 minutes to effectively inactivate viruses. Jurisdictions should plan for holding basins following the treatment unit to allow for the correct chlorine contact time.

Operation and Maintenance

To ensure pathogenic microorganisms, including virus, bacteria and protozoans are effectively and consistently being removed or inactivated throughout the duration of use, the departments of Health and Senior Services and Natural Resources recommend the jurisdiction or organization responsible for operating an emergency water treatment unit follow the manufacturer's specifications for storage, operation, monitoring, and maintenance of that system. Standard operating guidelines should be developed that detail the treatment unit's storage, operation, maintenance, and operator training. All operations should be done in accordance with all applicable local, state, and federal safety regulations.

Operators

It is further recommended there be a designated certified water treatment operator and two alternate backup operators trained by the vender for the proper operation and maintenance of the specific units purchased in accordance with

manufacturers specifications. At least once a year the treatment unit should be field-tested and the operators should be trained by the manufacturer under field conditions to ensure continued familiarity with the operation of the equipment. This routine testing of the unit will ensure it is maintained in proper operating condition. Studies have shown that even the best water treatment units produce marginally when run by inexperienced operators.

Storing and Transporting the Treated Water

Another consideration that must be made in advance is the type of container that will be used to store and transport the treated water. Not all containers are approved for safe long-term storage of potable water, while others may not be adequate for efficiently holding or transporting large volumes of water. More information on water container preparation and water storage may be found at extension.missouri.edu/publications/DisplayPrinterFriendlyPub.aspx?P=EMW1026 and www.cdc.gov/healthywater/emergency/safe_water/personal.html.

Dispensing

How the treated water will ultimately be dispensed is another important factor that must be carefully considered and planned. The best efforts of local planners in supplying their community with potable water can be defeated by contamination while dispensing or by dispensing into unsafe containers that may hold chemical or microbiological residues.

There are multiple methods of dispensing treated water. The method ultimately chosen must coordinate with the type of treatment system selected and either be well-matched to the circumstances or be flexible to adjust to a wide variety of possible situation. The manufacturer or vendor of the portable treatment unit should provide information or instructions on safely dispensing water from the treatment system. Careful consideration should go into planning for dispensing treated water to ensure it can be safely delivered to the end user without further contamination. Care must be taken to prevent cross-contaminating or re-contaminating the treated water.

In Summary

Portable potable water units can be effective in providing water during catastrophic events. They should be considered a last resort. Units should produce water meeting safe drinking water standards, be approved by the EPA/NSF ETV, and if using ultraviolet disinfection, be certified to NSF/ANSI Standard 55. When treating for viruses, the unit must include disinfection that will treat to 4-log removal or inactivation of viruses. Other considerations include operation, maintenance, training, and water storage, transport, and dispensing.

Local expertise, such as public drinking water operators, environmental public health specialists, county extension agents, engineers and others with knowledge of water borne disease and water distribution should be utilized in conjunction with state specialists to make the best possible decisions in providing safe water to the public.

For additional information on developing contingency plans to ensure availability of potable water, planners are encouraged to use the U.S. Environmental Protection Agency's Guide: Planning for an Emergency Drinking Water Supply available at: www.awwa.org/portals/0/files/resources/water%20knowledge/rc%20emergency%20prep/emergencywater.pdf