

Recreation Management Tech Tips

United States Department of Agriculture
Forest Service



Technology &
Development Program

March 2005

2300

0523 1302—SDTDC

HANDPUMP DISINFECTION TREATMENT SYSTEM

Brenda Land, Sanitary Engineer

Handpumps are located in remote locations without electricity. Treating the water delivered by handpumps is challenging without electricity. The Saxon Remote Site Chlorinator can provide treated potable water from a handpump delivery system. The purpose of this report is to inform sanitary engineers and handpump operators of its availability.

SAXON REMOTE SITE CHLORINATOR

San Dimas Technology and Development Center's search of disinfection systems for handpumps located the Saxon Remote Site Chlorinator. Saxon's proprietary design is based upon a controlled ratio of concentrated chlorinated water mixed with untreated well water. The chlorinated mixture flows from a 6.25-gallon (gal) concentrate tank into a 21-gal detention tank and then to a pump fountain. The detention tank provides chlorine-concentration leveling to compensate for varying pumping rates.

Chlorine Contact Time

The detention tank also provides the chlorine contact time (CTT). The U.S. Environmental Protection Agency draft Groundwater Disinfection Rule requires a CTT adequate for viral inactivation. CTT is one of the most important methods of ensuring reliable and complete disinfection of the source water. A CTT of 6-milligram minutes per liter (mg min/L) is needed for viral inactivation at 50 °F. A chlorine residual of 1 milligram per liter (mg/L) for 6 minutes (min) provides a CTT value of 6 mg min/L. This CTT value is sufficient to kill coliform bacteria. **NOTE: These numbers are not sufficient to inactivate *Cryptosporidium* or**

***giardia* cysts that may be found in surface-water sources. Consult the forest engineer if the handpump is under the direct influence of surface water.**



Figure 1—Saxon Remote Site Chlorinator handpump treatment system.

Contact time depends on flow rate and length of time between uses. Flow rate at handpumps varies depending on handle length, depth to water, and pumping speed. A constant flow rate of 3.5 gallons per minute (gal/min) results in a 6-minute (min) contact time (21-gal tank/3.5 gal/min = 6 min). A constant flow rate of 1 gal/min results in a 21-min contact time (21-gal tank/1 gal/min = 21 min). A



larger detention tank, which increases the contact time, may be specified when placing an order.

Chlorine is derived from PPG Industries' 0.75-inch (in) calcium hypochlorite tablets that dissolve in the concentrate tank. The calcium settles to the tank bottom and is flushed out periodically. The mixture from the 6.25-gal concentrate tank is drawn into the main waterflow in a ratio of 1 part concentrate to 50 parts well water. This ratio yields a 1.5-mg/L free chlorine concentration in the 21-gal tank.

The mixing ratio is initially set to deliver 1.5-parts per million total chlorine at the water faucet. All chlorine residual samples taken at the sample valve on the mixing platform must settle for 1 min prior to testing. This allows for a proper reaction time between the chlorinated water and the raw well water. The amount of chlorine in the concentrate tank must be checked periodically because the chlorine level is continually being reduced as the chlorine is removed from the concentrate tank and is added to the system. The operating manual discusses the procedure for checking and recharging the chlorine concentrate. An optional 1-micron polishing filter is available with the system. All components are NSF International certified.

Discussion

The Saxon Remote Site Chlorinator (chlorinator) is a stand-alone system that is 36 in long, 17 in wide, and 40 in high. It weighs 145 pounds, dry. It can be installed in a pit or vault near the handpump. Ten pounds per square inch (psi) operating water pressure is required. Vault access is required for sampling, maintenance, and repair. The chlorinator also may be installed above ground in a secure box or small building near the well. The distance between the well and the chlorinator should be as short as possible to avoid excessive headloss through the plumbing.

The water delivery line from the pump and the delivery line to the fountain are the only external plumbing connections required. A diverter chamber (installed by the customer) is supplied with each system. The standard diverter chamber is designed for direct installation onto a Baker Monitor handpump that directs the pump flow from the wellhead to the chlorinator system and return to the fountain. For other handpumps, a custom-designed diverter chamber is available.



Figure 2—Connection to handpump.

Flow-control ratios, set at the Saxon factory, should not be changed. The chlorine level in the concentrate tank will control the amount of free chlorine in the delivery water. To track the operating parameters for safe and effective operation, a system operating and maintenance log is provided with each unit.

FIELD TEST

A Saxon Remote Site Chlorinator, with filter, was installed on a handpump in the Boulder Creek Campground at the Umpqua National Forest in July 2003. This handpump had been out of service since June 2002 because of a positive total coliform test. The system was installed in an aboveground welded-steel box to avoid ground disturbance in an archeological-sensitive area. The unit was operational in August 2003.



Figure 3—Aboveground installation at Boulder Creek Campground, Umpqua National Forest.

The district employees found the Saxon Remote Site Chlorinator easy to install and maintain. Visitors commented about reduced waterflow, but did not complain about chlorine taste. Visitors commented positively on water clarity. No vandalism occurred. This handpump had no positive coliform tests after the Saxon system was installed.

Consult the forest engineer prior to installing any treatment device on a potable water system. The system must be maintained according to the operation and maintenance manual to provide safe water. Chlorine residual measurements must be taken routinely and chlorine tablets added as needed. This system is not designed to treat highly turbid water.

Pricing and Additional Information

The price of the Saxon Remote Site Chlorinator unit tested was \$3,230. For further information, contact the SDTDC project engineer, Brenda Land, by phone at 909-599-1267, ext 219, or by e-mail at bland@fs.fed.us, or the company listed below.

Saxon Research Systems, Inc.

965 Saxonburg Boulevard
Saxonburg, PA 16056
Phone: 724-265-3250
Fax: 724-265-2366

Acknowledgement

The author thanks Recreation Technician Lori Depew (Tiller Ranger District) and Facilities Engineer John Ulicny (Umpqua National Forest) from Region 6, and Region 8 Facilities Engineer Peter LaShoto (Chattahoochee/Oconee National Forests) for information on the operation and maintenance of the handpump treatment unit.

Information contained in this document has been developed for the guidance of employees of the Forest Service, United States Department of Agriculture (USDA), its contractors, and cooperating Federal and State agencies. The USDA Forest Service assumes no responsibility for the interpretation or use of this information by other than its own employees. The use of trade, firm, or corporation names is for the information and convenience of the reader. Such use does not constitute an official evaluation, conclusion, recommendation, endorsement, or approval of any product or service to the exclusion of others that may be suitable.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities



on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.