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Disinfection of Seasonal Noncommunity Water Supplies

Issue

There are a number of noncommunity water supplies that operate only on a seasonal basis. These facilities are normally open only during the warm weather seasons. Representative examples of these systems would include campgrounds, boat launches, scout camps, fairgrounds, and seasonal food service facilities.

The systems are winterized by draining all or a portion of the distribution system including hot water heaters, pressure tanks, water treatment and distribution systems. The Michigan Safe Drinking Water Act (MSDWA), 1976 PA 399, as amended, requires that prior to opening each year the systems are properly flushed, disinfected, re-flushed and sampled to ensure the microbiological integrity of the water supplied to the consumer. Prior to putting depressurized systems into service, a minimum of 2 consecutive coliform free sample results collected a minimum of 24 hours apart are required.

This document provides guidance for the water supply operator/owner and sanitarian on installing a positive displacement chlorinator as a means to disinfect these types of facilities prior to opening.

Authority

The MSDWA covers distribution system disinfection and sampling under R325.11110 (4):

The owner of a public water supply in which all or part of a distribution system is not in year-round service shall disinfect the distribution system before resuming use. Bacteriologic sampling and analysis shall be performed and shall show results that meet the state drinking water standards before resuming use.

Disinfecting with chlorine

The disinfectant of choice for water system disinfection has been chlorine. The chlorine used for disinfecting wells can be purchased in two formulations: calcium hypochlorite, which is a dry powder or tablet, and sodium hypochlorite, which is a liquid (chlorine bleach is a common form of sodium hypochlorite).

Commonly either calcium hypochlorite that has been dissolved in water or sodium hypochlorite is put into the system by adding the disinfectant solution directly into the well. The well pump is then used to distribute the disinfectant throughout the distribution piping and accoutrements. The disinfectant is typically added through the well due to the inability of the owner/operator or well drilling contractor to easily put the disinfectant solution directly into the distribution system.

Problems associated with through the well disinfection

There are several disadvantages with the placement of the chlorine solution into the top of the well. The major disadvantages include:

- There is little control over the concentration of disinfectant pumped into the distribution system, or the overall contact time.
- Frequently the well cap, after being removed to allow pouring of the disinfection solution into the well, is not properly re-secured to the well casing. The nuts and bolts used for securing the well cap are frequently lost or not replaced.
- The vent screen of the well cap is damaged or missing.
- The pouring of a concentrated solution of chlorine onto the electrical cable, pitless unit and the resultant contact with the stainless steel screen and the submersible pump can be very corrosive and damaging to these well components.

Also, if the subsequent sampling results do not produce coliform free water the disinfection process will have to be repeated, and frequently with a significant time delay to bring together the needed equipment (appropriate bulk water tank for mixing the chlorine) and a well drilling contractor to reintroduce the chlorine.

Chlorination with positive displacement feed pump

A preferred method to disinfect these systems is to add the chlorine disinfectant directly into the water system with an injection pump. This is done by injecting a chlorine solution into the water supply system with a positive displacement solution feed pump. A positive displacement chlorinator is a type of piston, diaphragm, gear or screw pump that delivers a constant volume with each stroke. The pump is wired to come on every time the well pump starts. The amount of chlorine introduced is controlled by the solution pump stroke and or frequency of stroke.

These pumps are equipped with: an electric motor, piston, diaphragm, suction and injection valve, chemical holding tank, and foot valve. Advantages of this type of injection pump are its ability to deliver the disinfectant over a wide range of injection rates, time, and ease of adjustment.

The concentration of free chlorine introduced into the system to disinfect a seasonal system should be between 25 – 100 mg/l. The concentration of the chlorine is to be measured at various places in the distribution system to make sure there is an adequate level of free chlorine remains after the chlorine demand of the system is satisfied. Only free chlorine needs to be measured. The chlorine can be easily tested with chlorine test strips like those used for food service. The water is not to be consumed prior to demonstrating compliance with coliform standards. In addition, any persons in the facility should be advised to avoid contact with the water during seasonal disinfection to prevent possible exposure to high chlorine levels.

The chlorinated water should remain in the pressure tank, distribution system and lines for a minimum of 10 hours. Coliform samples are not to be collected from the system until the distribution system has been properly flushed and checked to confirm there is no residual chlorine. A minimum of two coliform samples must be collected, and the samples must be collected 24 hours apart. If test results are coliform positive, the entire process should be repeated with the one additional step of collecting a raw water sample at the sampling tap prior to chlorine injection. This sample is done to confirm the well is delivering coliform free water.

After good samples are collected, the chlorinator is to be disconnected from the system. For most noncommunity systems, the chlorinator would only be used during the start up phase of the seasonal supplies operation. It is not intended to be a permanent installation. However, there are a few facilities that may continuously inject low levels of chlorine due to concerns of very large storage/distribution systems. If chlorine is being injected into the system during routine operation the facility is required to have a D-level certified operator and submit monthly operation reports.

Maintenance

When the positive feed displacement chlorinator is only used for disinfection to start the season it is important that after use the solution tank and chlorinator be thoroughly flushed with clean water. Maintenance of the injection pump is crucial to its reliable operation. The motor and piston must be lubricated. Because of the corrosive nature of the concentrated chlorine solutions, the valves wear out and have to be replaced. Chlorine storage containers must also be corrosion resistant and kept out of the light.

Plan review and schematic of positive displacement chlorinator

Illustrated in the provided diagram is a properly configured chlorine injection system for a seasonal facility. The local water treatment equipment and service dealer will carry the needed chlorine injector pump and accessories. The treatment specialist can install the system. Prior to the installation the following information must be provided to the local health department for plan review:

- a diagram showing the layout of the system, valving, sample taps, materials,
- a description of the feed equipment (make, model, and specifications), including maximum and minimum chlorine feed ranges, and
- for large systems that desire to use continuous chlorination the name and certification number of the certified operator.