

DISINFECTION OF DOMESTIC WATER LINES**I. PURPOSE**

This procedure is to provide clear guidelines for disinfecting water piping. This procedure covers new domestic water pipe installations and maintenance on existing piping.

II. GENERAL

Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is, therefore, essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination. Also, any connection of a new water main to the active distribution system prior to receipt of satisfactory bacteriological samples may constitute a cross-connection. Therefore, the new main must be isolated until a bacteriological test is satisfactorily completed. The United States Environmental Protection Agency sets national standards for drinking water. To insure our compliance with these standards all work done on domestic water piping will be disinfected according to the following processes. Disinfection activities must be coordinated with and approved by the Utilities Division's Master Water Technician. The six main steps of disinfection are:

1. Preventing contamination materials from entering the water main during storage, construction, or repairs.
2. Removing, by flushing or other means, those materials that may have entered the water main.
3. Chlorinating any residual contamination that may remain, and flushing the chlorinating water from the main.
4. Protecting the existing distribution system from backflow due to hydrostatic pressure test and disinfection procedures.
5. Determining the bacteriological quality by laboratory test after disinfection.
6. Final connection of the approved new water main to the active distribution system.

These steps are provided in greater detail in section III.

III. PROCESS**1.0 Disinfection Procedure When Cutting Into or Repairing Existing Systems**

The following tasks apply primarily when existing mains are wholly or partially dewatered. After the appropriate procedures have been completed, the existing main may be returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains remain full of pressurized water present little danger of contamination and require no disinfection.

1.1 Trench Treatment

When an existing main is open, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of

hypochlorite applied to trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

1.2 Swabbing with Hypochlorite Solution

The interior of all pipe and fittings (particularly couplings and sleeves) used in making the repair shall be swabbed or sprayed with a 1 percent hypochlorite solution before they are installed.

1.3 Flushing

Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

1.4 Slug Chlorination

When practical, in addition to the procedures above, the section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated to a level of at least 100 mg/l for not less than three hours. The dose may be increased to as much as 300 mg/L and the contact time reduced to as little as 15 minutes with the approval of the Master Water Technician. After chlorination, flushing shall be resumed and continued until discolored water is eliminated, and the water is free of noticeable chlorine odor.

1.5 Sampling

Bacteriological samples shall be taken after repairs are completed to provide a record for determining the procedure's effectiveness. If the direction of flow is unknown, then samples shall be taken on each side of the main break. If positive bacteriological samples are recorded, then the situation shall be evaluated by the purchaser (or purchaser's representative) who can determine corrective action, and daily sampling shall be continued until two consecutive negative samples are recorded.

2.0 Disinfection Procedure for New Installations

2.1 Keeping Pipe Clean and Dry

Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize the entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used when it is determined that watertight plugs are not practicable and when thorough cleaning will be performed by flushing or other means.

2.2 Joints

Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

2.3 Packing Materials

Yarning or packing material shall consist of molded or tubular rubber rings, rope of treated paper, or other approved materials. Materials such as jute or hemp shall not be used. Packing material shall be handled in a manner that avoids contamination. If asbestos rope is used, it shall be handled in a manner that prevents asbestos from being introduced into the water-carrying portion of the pipe.

2.4 Sealing Materials

No contaminated material or any material capable of supporting prolific growth of micro-organisms shall be used for sealing joints. Sealing material or gaskets shall be handled in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in closed containers and shall be kept clean.

2.5 Cleaning and Swabbing

If dirt enters the pipe, it shall be removed and the interior pipe surface swabbed with a 1 percent hypochlorite disinfecting solution. If, in the opinion of the purchaser (or the purchaser's representative), the dirt remaining in the pipe will not be removed by the flushing operation, then the interior of the pipe shall be cleaned by mechanical means such as a hydraulically propelled foam pig or other suitable device acceptable to the purchaser) in conjunction with the application of a 1 percent hypochlorite disinfecting solution to the interior pipe surface. The cleaning method used shall not force mud or debris into the interior pipe-joint spaces and shall be acceptable to the purchaser.

2.6 Wet-Trench Construction

If it is not possible to keep the pipe and fittings dry during installation, every effort shall be made to ensure that any of the water that may enter the pipe-joint spaces contains an available-chlorine concentration of approximately 25 mg/L. This may be accomplished by adding calcium hypochlorite granules or tablets to each length of pipe before it is lowered into a wet trench, or by treating the trench water with hypochlorite tablets.

2.7 Flooding by Storm or Accident During Construction

If the main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section exposed to the floodwater shall then be filled with a chlorinated potable water that, at the end of a 24 hour holding period, will have a free chlorine residual of not less than 25 mg/L. The chlorinated water may then be drained or flushed from the main. After construction is completed, the main shall be disinfected using the continuous-feed or slug method.

2.8 Clearing the Main of heavily Chlorinated Water

After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or is acceptable for domestic use.

2.9 Disposing of Heavily Chlorinated Water

The environment into which the chlorinated water is to be discharged shall be inspected and approved by the Master Water Technician. If there is any possibility that the chlorinated discharge will cause damage to the environment and/or the chlorine residual is greater than 100 mg/l, the Master Water Technician will contact SHEA for disposal instructions.

2.10 Standard Conditions

After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart shall be collected from the new main. At least one set of samples shall be collected from every 1200 ft (366 m) of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality and shall show the absence of coliform organisms.

2.11 Special Conditions

If trench water has entered the new main during construction or, if in the opinion of the purchaser (or purchaser's representative), excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 ft (61 m) and shall be identified by location. Samples shall be taken of water that has stood in the new main for at least 16 hours after final flushing has been completed.

2.12 Sampling Procedures

Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate. No hose or fire hydrant shall be used in the collection of samples.

2.13 Redisinfection

If the initial disinfection fails to produce satisfactory bacteriological results, the new main may be re-flushed and shall be sampled. If check samples also fail to produce acceptable results, the main shall be re-chlorinated by the continuous-feed or slug method of chlorination until satisfactory results are obtained.

NOTE: High velocities in the existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is advisable to sample water entering the new main.

2.14 Optional Procedures**2.14.1 Final Connections to Existing Mains.**

As an optional procedure (if specified by the Master Water Tech), water mains and appurtenances must be completely installed, flushed, disinfected, and satisfactory bacteriological sample results received prior to permanent connections begin made to the active distributions system. Sanitary construction practices must be followed during installation of the final connection, so that there is no contamination of the new or existing water main with foreign material or groundwater.

2.14.2 Connections Equal To or Less Than One Pipe Length (≤ 18 ft [5.5 m])

As an optional procedure (if specified by the Master Water Tech), the new pipe, fittings, and valve(s) required for the connection may be spray-disinfected or swabbed with a minimum 1 percent solution of chlorine just prior to being installed, if the total length of connection from the end of a new main to the existing main is equal to or less than 18 ft (5.5 m).

2.14.3 Connections Greater than One Pipe Length (>18 ft [5.5 m])

As an optional procedure (if specified by the Master Water Tech), the pipe required for the connection must be set up aboveground, disinfected and bacteriological samples taken if the total length of connection from the end of a new main to the existing main is greater than 18 ft (5.5 m). After satisfactory bacteriological sample results have been received for this “pre-disinfected” pipe, the pipe can be used in connecting the new main to the active distribution system. Between the time that satisfactory bacteriological sample results are received and the time that the connection piping is installed, the ends of this piping must be sealed with plastic wraps or watertight plugs or caps.

IV. REFERENCES

1. ANSI/AWWA C651-92 “AWWA Standard for Disinfecting Water Mains”

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