NORTH MARIN WATER DISTRICT

STANDARD SPECIFICATIONS

SECTION 15041 DISINFECTION OF PIPING

PART 1 GENERAL

1.01 DESCRIPTION

This section describes requirements for disinfection by chlorination of potable and recycled water mains, services, pipe appurtenances and connections.

1.02 REFERENCED STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA B300	-	Standard for Hypochlorites
AWWA B301	-	Standard for Liquid Chlorine
AWWA C651	-	Disinfecting Water Mains

1.03 RELATED WORK SPECIFIED ELSEWHERE

AWWA Standard Methods for the Examination of Water and Waste Water
NMWD Standard Specifications 15000, 15044, 15056, 15057, 15061, and 15064

1.04 SERVICE APPLICATION

A. All water mains and appurtenances taken out of service for inspection, repairs, or other activity that might lead to contamination shall be disinfected before they are returned to service.

B. All new water mains and temporary pipelines shall be disinfected prior to connection to the District's existing system.

C. All components incorporated into a connection to the District's existing system shall be disinfected prior to installation.

1.05 SUBMITTALS

A written disinfection and dechlorination plan, including all methods and equipment to be used, shall be signed by the person responsible for performing the work and shall be submitted to the District Engineer for approval prior to starting disinfection operations.

1.06 DELIVERY, STORAGE AND HANDLING

Chlorination and dechlorination shall be performed by competent individuals knowledgeable and experienced in the operation of the necessary application and safety equipment in accordance with applicable Federal, State and Local laws and regulations. The transport, storage and handling of these materials shall be performed in accordance with Code of Federal Regulations (CFR) 1910.120 Hazardous Waste Operations and Emergency Response, CFR 49.172 Hazardous Materials Regulations, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5194.

1.07 CONCURRENT DISINFECTION AND HYDROSTATIC TESTING

The specified disinfection of the pipelines may *not* be performed concurrently with the hydrostatic testing in accordance with Section 15044.

1.08 CONNECTION TO EXISTING MAINS

Prior to connection to existing mains, disinfection and bacteriological testing shall be performed in accordance with this specification, and hydrostatic testing shall be performed per Section 15044. District authorization for connection to the existing system shall be given only on the basis of acceptable hydrostatic, disinfection and bacteriological test results. Connection to existing mains shall be performed in accordance with Section 15000.

PART 2 MATERIALS

All materials must be certified to meet NSF/ANSI 60 Standards.

2.01 LIQUID CHLORINE (GAS)

A. Liquid chlorine contains 100-percent available chlorine and is packaged in steel containers in net weights of 68.1kg (150 lb.) or 907.2kg (1 ton).

B. Liquid chlorine shall be used with appropriate gas flow chlorinators, heaters, and injectors to provide a controlled, high-concentration solution feed to the water. The chlorinators and injectors shall be the vacuum-operated type.

2.02 SODIUM HYPOCHLORITE (LIQUID)

Sodium hypochlorite is available in liquid form in glass or plastic containers, ranging in size from 0.95 L (1 Qt.) to 18.93 L (5 Gal). The solution contains approximately 10% to 15% available chlorine.

2.03 TABLET OR GRANULAR HYPOCHLORITE

Tablet or granular hypochlorite shall not be used at any time.

Unless used to create chlorine solution for the purpose of disinfection, tablets or granular hypochlorite must be fully dissolved in water and concentration of chlorine conformed before adding to mains, services pipe appurtenances and connections.

PART 3 EXECUTION

3.01 GENERAL

A. Disinfection of pipelines shall not proceed until all appurtenances and any necessary sample ports have been installed and the Engineer provides authorization.

B. Every effort shall be made to keep the water main and its appurtenances clean and dry during the installation process.

C. All piping, valves, fittings, and appurtenances shall be cleaned, rinsed with potable water, and then sprayed or swabbed with a 5 percent sodium hypochlorite disinfecting solution prior to installation.

D. Water mains under construction that become flooded by storm water, runoff, or ground water shall be cleaned by draining and flushing with metered potable water until clear water is evident. Upon completion, the entire main shall be disinfected using a method approved by the Engineer.

3.02 METHODS

A. Liquid Chorine (Gas)

1. Only vacuum-operated equipment shall be used. Direct-feed chlorinators, which operate solely from gas pressure in the chlorine cylinder, shall not be permitted. The equipment shall incorporate a backflow prevention device at the point of connection to the potable water source used to fill the line being tested.

2. The chlorinating agent shall be applied at the beginning of the system to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected.

3. Only a certified, licensed chlorination and testing contractor shall perform gas chlorination work. The chlorination contractor must also possess a Grade II Treatment Plant Operator Certification from the State of California if required by the Engineer.

B. Sodium Hypochlorite Solution (Liquid)

1. Sodium hypochlorite solution shall be used for cleaning and swabbing piping and appurtenances immediately prior to installation and for disinfecting all components of connections to the District's existing system.

2. Sodium hypochlorite solution may be used for the initial disinfection of newly installed water mains. The solution shall be applied at a terminus of the system to

to be chlorinated using an injector which can adjust the amount of solution being injected into the piping system. The solution shall be injected in the appropriate concentration to achieve the specified concentration range of chlorine throughout the entire piping system. Where pumping equipment is used in conjunction with an injector, an integral backflow prevention device shall be installed and connected to the potable water supply.

3. Water trucks, pumping equipment, piping, appurtenances and all other equipment in contact with potable water shall be disinfected prior to use.

4. Sodium hypochlorite solution may also be used to increase the total chlorine residual if the concentration from the initial chlorination of the system is found to be low. The solution shall be added to the system in sufficient amounts at appropriate locations to insure that the disinfecting solution is present at a concentration within the specified range throughout the piping system.

3.03 PROCEDURE FOR DISINFECTING WATER MAINS AND APPURTENANCES

A. The pipeline shall be filled at a rate not to exceed 1,135 liters per minute (300 GPM) or a velocity of 0.3m per second (1 foot per second), whichever is less.

B. Disinfection shall result in an initial total chlorine concentration of 50-mg/l. This concentration shall be evenly distributed throughout the system to be disinfected.

C. All valves shall be operated with the disinfection solution present in the pipeline. All appurtenances such as air-vacuum relief valves, blowoffs, hydrants, backflow prevention devices, and water service laterals shall be flushed with the treated water a sufficient length of time to insure a chlorine concentration within the specified range in all components of each appurtenance. (Note the limitations for discharge of chlorinated water outlined below.)

D. The Engineer will verify the presence of the disinfection solution throughout the system by sampling and testing for acceptable chlorine concentrations at the various appurtenances and/or at the test ports provided by the Contractor. Areas of the system found to be below the specified chlorine concentration level shall receive additional flushing as noted above and/or additional disinfection solution as necessary. (Note the limitations for discharge of chlorinated water outlined below.) Addition of disinfection solution after the initial charging of the line shall be made by either the liquid chlorine (gas) method, or the sodium hypochlorite method as directed by the Engineer.

E. The chlorinated water shall be retained in the system for a minimum of 24 hours. The District Engineer will test the total chlorine residual. The system shall contain a chlorine residual of not less than 10 mg/L after the twenty-four (24) hour soaking period. If the total residual has decreased below 10 mg/L, the system may be required to be soaked for an additional 24-hour period or rechlorinated at the request of the District Engineer.

F. Following a successful retention period as determined by the District Engineer, the chlorinated water shall be flushed from the system at its extremities and at each appurtenance, using potable water from a source designated by the District Engineer. The minimum water velocity during flushing shall be 3 feet per second or as directed by the Engineer. Flushing shall continue until the replacement water in the new system is equal in chlorine residual to the potable source of supply and the turbidity level is 1.0 NTU's or less as verified by the District. (Note the limitations for discharge of chlorinated water outlined below.)

G. The District will perform bacteriological sampling and testing as specified herein.

Two (2) clean bacterial samples shall be taken within twenty-four (24) hours of each other. Re-flushing will be done between samples.

3.04 DISCHARGE OF CHLORINATED WATER

A. Hydrostatic Test Permit (not required).

B. The environment to which the chlorinated water is to be discharged shall be examined by the Developer and the Engineer. Where necessary, federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of chlorinated water. Any indication that the discharge of chlorinated water may cause damage to the environment shall require the neutralizing of the chlorine residual by means of a reducing agent in accordance with AWWA C651 and the requirements of this specification.

C. In locations where chlorine neutralization is required, the reducing agent shall be applied to the water as it exits the piping system. The Developer shall monitor the chlorine residual during the discharge operations.

The various methods of dechlorination available can remove residual chlorine to concentrations below standard analytical methods of detection, 0.02 mg/l, which will assure compliance with the effluent limit. The Developer will perform all necessary tests to ensure that the total residual chlorine effluent limitations listed above are met.

D. In locations where no hazard to the environment is evident based on the joint examination described above, the chlorinated water may be broadcast for dust control on the surface of the immediate site. Care shall be exercised in broadcasting the water to prevent runoff.

3.05 BACTERIOLOGICAL TESTING

The District will perform bacteriological sampling and testing of all new system installations. The testing methodology employed by the District shall be as set forth in "Standard Methods for the Examination of Water and Waste Water" (current edition). Testing requirements are as set forth in the California Domestic Water Quality and Monitoring Regulations and commensurate with current requirements for surface water testing. The District will analyze the samples for the presence of coliform bacteria and heterotrophic-type bacteria (heterotrophic plate count). The evaluation criteria employed by the District for a passing test sample is as follows:

A. Two consecutive samples taken minimum twenty-four (24) hours apart must pass following tests:

1. Coliform bacteria: no positive sample, and atypical colonies <200 CFU per 100 mls by membrane filter method and negative result by colilert.

2. Heterotrophic plate count (HPC): 500 colony forming units/ml or less.

3.06 REDISINFECTION

If the initial disinfection fails to produce satisfactory bacteriological test results, the pipeline system

shall be re-flushed and after twenty-four (24) hours re-sampled. If the second set of samples does not produce satisfactory results, the pipeline system shall be re-chlorinated, flushed, and re-sampled. The chlorination, flushing, and sampling procedure shall continue until satisfactory results are obtained. Re-disinfection and retesting shall be at the Contractor's expense.

3.07 DISINFECTING TIE-INS AND CONNECTIONS

Pipes, fittings, valves and all other components incorporated into connections with the District's existing system shall be spray disinfected or swabbed with a liquid chlorine solution in accordance with AWWA C651 and as specified herein. Upon connection to the main, the line shall be flushed as directed by the District Engineer. Disinfection by this method is generally limited to assemblies of 6m (20') or less in length. Alternate methods such as "predisinfection" prior to installation in accordance with AWWA C651 may be required at the discretion of the District Engineer.

END OF SECTION