SECTION 33 13 00 – DISINFECTION OF WATER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Work, material, and procedures for disinfection of installed potable water lines.

B. Related sections:
1. Section 01 33 00 – Submittal Procedures.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:
1. American Water Works Association (AWWA):
   a. AWWA B300, Hypochlorites.
   b. AWWA B301, Liquid Chlorine.
   c. AWWA B303, Sodium Chlorite.
   d. AWWA C651, Disinfecting Water Mains.
   e. AWWA C652, Disinfection of Water-Storage Facilities.
   f. AWWA C653, Disinfection of Water Treatment Plants.
   g. AWWA C654, Disinfection of Wells.

1.3 QUALITY CONTROL SUBMITTALS

A. Procedures and plans for disinfection and testing.

B. Type of disinfecting solution and method of preparation.

1.4 SEQUENCING AND SCHEDULING

A. Commence disinfection after completion of following:
1. Completion and acceptance of internal painting of system(s).
2. Hydrostatic and pneumatic testing, pressure testing, functional and performance testing and acceptance of pipelines, pumping systems, structures, and equipment.

PART 2 - PRODUCTS

2.1 WATER FOR DISINFECTION AND TESTING

A. Clean, uncontaminated, and potable.

B. Owner will supply potable quality water, Contractor shall convey in disinfected pipelines or containers.

2.2 CONTRACTOR'S EQUIPMENT

A. Furnish chemicals and equipment, such as pumps and hoses, to accomplish disinfection.

2.3 MIXING DISINFECTANT.

A. Prepare solution by mixing any of following as described below. The purpose of the stock solution is to facilitate mixing and dilution to ensure a uniform disinfecting solution. The Contractor will not be required to mix a stock solution if a liquid chlorine gas feed system that

can accurately feed a desired amount of chlorine to mix a final (dilute) disinfecting solution is used.

1. Liquid chlorine gas conforming to AWWA B301 and water mixture.
2. Dry chlorine gas conforming to AWWA B301.
3. Calcium hypochlorite conforming to AWWA B300 or sodium hypochlorite conforming to AWWA B303 powder or liquid and water mixture.

B. Feed dry chlorine gas through devices to regulate the rate of flow and ensure uniform diffusion of gas into water within the pipe or vessel being treated. Chlorinating devices for feeding chlorine gas solution or the gas itself shall prevent of water into chlorine cylinder.

C. Use following proportions of hypochlorite or chlorine to water:
   1. Chlorine Gas or Liquid (100 Percent Cl):1 pound per 1 1.75 gallons water.
      a. Apply liquid chlorine gas-water solution by means of a solution feed chlorinating device.
   2. Calcium Hypochlorite (65 to 70 Percent Cl): 1 pound per 7.5 gallons water.
      a. If calcium hypochlorite is used, first mix dry powder with water to make a thick paste, then thin to a 1 percent solution (10,000 ppm chlorine).
   3. Sodium Hypochlorite (5.25 Percent Cl): 1 gallon per 4.25 gallons water.
      a. If sodium hypochlorite procedure is used, dilute the liquid with water to obtain a 1 percent solution.

PART 3 - EXECUTION

3.1 GENERAL

A. Disinfect pumps and pipelines, installed or modified under this Project, intended to hold, transport, or otherwise contact potable water:
   1. Disinfect new pipelines that connect to existing pipelines up to the point of connection.
   2. Disinfect surfaces of materials that will contact finished water, both during and following construction using spray method described below.
   3. Disinfect prior to contact with finished water. Take care to avoid recontamination following disinfection.

B. Prior to application of disinfectants, clean equipment and pipelines of loose and suspended material. Flush pipelines until clear of suspended solids and color. Use water suitable for flushing and disinfecting.

C. Conform to AWWA C651 for pipes and pipelines, C652 for tanks and reservoirs, and AWWA C654 for wells, except as modified in these Specifications.

D. Allow freshwater and stock disinfectant solution to flow into the pipe or vessel at a measured rate so that the chlorine-water solution is at the specified strength. Do not place concentrated commercial disinfectant in the pipeline or vessel before it is filled with water.

3.2 PIPING AND PIPELINES

A. Flushing:
   1. Before disinfecting, flush all foreign matter from pipeline. Provide hoses, temporary pipes, ditches, and other conduits as needed to dispose of flushing water without damage to adjacent properties. Flushing velocities shall be at least 2.5 fps. For large diameter pipe, where it is impractical or impossible to flush the pipe at specified velocity, clean the pipeline in-place from the inside by brushing and sweeping, then flush the line.

2. Flush pipelines through flushing branches and remove branches after flushing is completed. Operate valves during flushing process at least twice during each flush.
3. Flush service connections and hydrants. Flush distribution lines prior to flushing hydrants and service connections.

B. Disinfecting Solution: Chlorine-water solution having a free chlorine concentration of not less than 50 ppm.

C. Disinfecting Procedure: In accordance with AWWA C651, unless herein modified.

D. Point of Application:
1. Inject chlorine mixture into pipeline to be treated at beginning of line through corporation stop or suitable tap in top of pipeline.
2. Control water from existing system to flow slowly into pipeline during application of chlorine.
3. Control rate of chlorine solution flow in proportion to rate of water entering pipe so that combined mixture shall contain not less than 50 ppm of free available chlorine.
4. Prevent of chlorine solution into line supplying water.

E. Retention Period:
1. Retain treated water in pipeline for at least 24 hours to destroy all nonspore-forming bacteria. At end of 24 hour period, disinfecting solution shall contain at least 10 ppm of free chlorine or the pipeline shall be recleaned, disinfecting solution shall be reapplied, and specified procedure repeated.
2. Operate valves, hydrants, and appurtenances during disinfection to ensure that disinfecting solution is dispersed into all parts of pipeline, including dead-ends and areas that otherwise may not be treated.
3. After disinfection, flush water from the permanent source until water through the pipeline is equal chemically and bacteriologically to permanent source of supply.

3.3 PUMPS

A. Disinfecting Solutions: Minimum free chlorine concentration of 200 ppm.

B. Disinfecting Procedure: In accordance with AWWA unless herein modified.

C. Application:
1. Inject the disinfecting solution into the pump and associated piping and circulate for a minimum 2 hour period of time. At the end of the 2 hour period, the solution shall have a strength of at least 100 ppm free chlorine.
2. Operate valves and/or pump appurtenances during disinfection to ensure that the disinfecting solution is dispersed into all parts of the pumps and lines.
3. If the disinfecting solution contained in the pumps has a residual free chlorine concentration less than 100 ppm after the 2 hour retention period, reclean the pump, reapply disinfecting solution, and retest until a satisfactory test result is obtained.
4. After chlorination, flush the water from the pumps until the water through the units is chemically and bacteriologically equal to the permanent source of supply.

3.4 DISPOSAL OF DISINFECTING WASTEWATER

A. Do not allow flow into a waterway without neutralizing disinfectant residual.
1. See AWWA C652 for acceptable neutralization methods.

3.5 TESTING

A. Test Equipment:
   1. Clean containers and equipment used in sampling and assure they are free of contamination.
   2. Obtain sampling bottles with instructions for handling from laboratory.

B. Chlorine Concentration Sampling and Analysis:
   1. Sampling Frequency for Disinfecting Solution: Two samples per disinfecting procedure.
   2. Residual Free Chlorine Samples: Two samples per disinfecting procedure.
   3. Dechlorinated Disinfecting Wastewater Residual Samples: Two samples per disinfecting procedure.
   4. Sampling Locations: Each 1,000 feet of pipeline or each building.
   5. Analysis to be performed by the Owner's laboratory.

C. After pipelines have been cleaned, disinfected, and refilled with potable water, Owner will take water Samples and have them analyzed for conformance to bacterial limitations for public drinking water supplies. Samples shall be analyzed for coliform concentrations in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater.
   1. A minimum of two Samples on each of 2 consecutive days from each separable structure every 1,000 feet of pipeline will be obtained and analyzed by standard procedures outlined by state and local regulatory agencies.

D. If the minimum Samples required above are not bacterially negative, the disinfecting procedures and bacteriological testing shall be repeated on the respective facilities until bacterial limits are met.

- END OF SECTION -