PROCEDURE	7102-01
EFFECTIVE	03/16/06
SUPERSEDES	11/01/04

STANDARD OPERATING PROCEDURE NO. 7102-01
Superchlorinated Potable Water Discharges

Purpose

This Standard Operating Procedure (SOP) describes the procedures to be followed when flushing any part or portion of the Santa Cruz Water Department's (SCWD) distribution system and free chlorine residual exceeds 2 parts per million (ppm). (ppm = mg/L) This includes water discharged during flushing activities associated with line disinfections.

Flushing of super-chlorinated water is required prior to laboratory testing to determine bacteriological quality after disinfection.

Disinfection of water mains is addressed in SOP No. 7102-03.

Dechlorination of discharges of low-chlorinated water with a chlorine residual less than 2 ppm is addressed in SOP No. 7102-02.

Discharges Requiring Dechlorination

All discharges from the distribution system must be treated to ensure chlorine residual does not reach waters of the State. Waters of the State include streams, rivers, ponds, lagoons and oceans. Discharges to be super-dechlorinated are those generated in the course of disinfection.

Scope of this Procedure

This procedure addresses manual super-dechlorination of SCWD-generated potable water discharges with free chlorine residual exceeding 2 ppm. Water with free chlorine residual exceeding 2 ppm requires dechlorination such that chlorine does not reach waters of the State and cause damage to plant and animal life. This SOP applies primarily to the dechlorination of water that has been injected with chlorine to disinfect new water mains.

This SOP does not give instructions for making up dechlorinating solution or determining appropriate feed rates. See manufacturer's instructions for dechlorination solution application.

Changes to Procedure

This formal procedure has been revised. Any previously released informal procedures are no longer acceptable and should be replaced with this SOP. Any suggestions or ideas pertaining to this procedure as well as informal or older procedures should be forwarded to the Engineering division to be reviewed.

This procedure may evolve over time as new dechlorination chemicals or methods become available that make dechlorination of potable water discharges quicker and/or easier.

Changes to Procedure, cont.

Note that references to existing interdepartmental SOPs related to this topic are made throughout this SOP.

Impacts of Flushing and Dechlorination

- Environmental: Flushing at high velocities can erode soil and cause instability, uproot vegetation and cause drainage problems.
- Fish and Wildlife / Endangered Species: Chlorine in concentrations exceeding 0.05 ppm kills nitrifying bacteria and other aquatic life. Spikes of ammonia and nitrite, through gill necrosis, result in respiratory failure, suffocation, etc.
- Wastewater Treatment Plant: High doses of chlorine kill nitrifying bacteria and can cause certain unit treatment processes to fail, resulting in potential contamination of effluent discharging to the receiving water.
- Degradation/Capacity Reduction of Storm/Sanitary Sewer: Prolonged contact with high concentrations of chlorine may cause corrosion in cast iron pipe. Further, large discharges may exceed pipe capacity such that normal flows are restricted.

These concerns should be evaluated prior to each discharge and impacts should be minimized as prescribed by regulations.

Priority of Dechlorination Relative to Other Jobsite Tasks

For any job involving flushing or dechlorination, jobsite tasks should be prioritized in order of the following concerns.

1. Worker Health and Safety (e.g., don safety gear, set up traffic control, identify any site contamination concerns).
2. Public Health & Safety (e.g., stop flows from breaks that are impeding traffic or threatening homes or businesses, operate valves as necessary to prevent contamination of mains and minimize number of customers out of water).

Environmental Protection (e.g., set up dechlorination and/or sediment control equipment as necessary, ensure trench spoils are disposed of properly).

Flushing Equipment

The following equipment is needed for flushing:

Hydrant Flushing:

- 2 ½" Hydrant adaptor fitting by 2" male end cam-lock fitting.
- 2" Fire hose with cam-lock fittings.
- 2 ½" Hydrant adaptor fitting with hose bib sampling port.
- Pitot tube.
- Pipe wrench.
- Hydrant wrench.
- Various valve keys.

Blowoff Flushing:

- 2" Blowoff assembly with hose bib sampling port.
- 2" Fire hose with cam-lock fittings.
- Pipe wrench.
- Pitot tube.
- Various valve keys.

Dechlorination Equipment

The following equipment is needed for dechlorination when following this procedure:

- Super dechlorinating unit.
- Super dechlorination solution (ascorbic acid).
- LPD-250 Diffuser
- Diffuser tablets (sodium sulfite)
- Personal Protective Equipment
- Analytical equipment for measuring temperature, free chlorine residual concentration and turbidity. (As described in "Measuring Equipment" below.)
- Lab sampling bottles – 1 general physical (GP) bottle and 2 small sterile Bact bottles for each sampling station, labeled per "Field Chlorination Report".
- Deionized (DI) water.

Note that the LPD-250 diffuser equipment is capable of dechlorinating up to 4 ppm in free chlorine concentration.

Chemical Handling & PPE Requirements

When handling solid or liquid chlorine, use clean rubber or leather gloves and a respirator if in an enclosed area. Do not inhale vapors from closed container (upon opening). Diffusers with tablets (new or used) should be stored in vehicles in secondary containment to prevent particles of sodium sulfite from being deposited directly onto vehicle, tool or other surfaces.

See the Production Division's SOP 7106-IV-4 for handling of dry and liquid chlorine products.

First Aid

See MSDS for specific chemical to determine best course of action:

Eye Contact: Immediately flush eyes with large amounts of water for at least 15 minutes holding lids apart to ensure flushing of entire eye surface. Seek medical attention.

Skin Contact: Wash thoroughly with soap and water.

Inhalation: Remove person from contaminated area to fresh air. If breathing has stopped, resuscitate. Seek medical attention.

Ingestion: Induce vomiting. Seek medical attention.

WARNING!

Some work units that will be using sodium sulfite (LPD-250 Diffuser) for dechlorination also use calcium hypochlorite (HTH) or sodium hypochlorite to disinfect water distribution system mains or appurtenances. These two (2) chemicals can react when mixed in the presence of water. The reaction can produce heat and both hydrogen and chlorine gas, creating both a potentially toxic and explosive/flammable atmosphere. Should the chemicals become mixed, staff should immediately evacuate to a safe area and contact the fire department (911). These chemicals and associated mixing and dispensing equipment must be kept segregated from each other at all times.

PROCEDURE

This procedure includes instruction for dechlorination and flushing for chlorinated water mains through a hydrant or blow off.

- **Notification**

Get permission of City or County Public Works Departments to use sanitary sewer for water disposal. In the City, inform the Wastewater Mains Supervisor in the Water Dept. and Wastewater Mains Field Crew Leader in Public Works, via email. Provide date, location, rough quantity, and main size to be flushed. In the County, inform Santa Cruz County Sanitation Dispatch at 464-5462 with date, location, and estimated quantity of water to be flushed.

- **Preparation**

Direct flushing-water away from traffic, pedestrians, underground utility vaults, watercourses and private lands. Check that travel path of water is clear of hazardous contaminants such as puddles of gas, oil, paint thinners, etc. Take measures necessary to prevent sediment, debris, spilled auto fluids, etc., from entering the sanitary sewer or storm drain. (Reference SOP No. 7105-01.)

- **Backflow Protection**

Where possible isolate new main from the distribution system through a temporary connection between the feed line and the new main utilizing a double check valve assembly with appropriate fittings. If a backflow prevention assembly cannot be incorporated, appropriate timing of supply valve and blow off operation must be coordinated to ensure that a backflow situation does not occur.

- **Dechlorination/ Flushing**

Note that for superchlorinated water, the super-dechlorinating unit with ascorbic acid solution is to be used. In addition, the LPD-250 diffuser with sodium sulfite tablets may be used once free chlorine concentration has dropped to 2 ppm or less.

Refer to equipment manuals for specific instruction on use of the dechlorinating systems.

1. Connect super-dechlorination system to a fire hose attached to hose bib assembly on a fire hydrant or blowoff. Position dechlorinating unit at end of hose such that it discharges into a storm drain or sanitary sewer inlet. Restrain dechlorinator to ensure stability at high flow rate. Connect dechlorinating solution feed assembly with appropriate solution concentration and feed rate per manufacturer's instructions.
2. Open water feed line after partially opening blow off valve or hydrant.
3. Obtain an initial water sample from hose bib in glass quart bottle. Check chlorine concentration using a diluted sample and colorimeter. An appropriate amount of sample is 5 mL of deionized water (DI) (to the fill line on the colorimeter's sample tube) to one (1) drop of sample water from the glass quart bottle (20 drops = 1 mL). Add one (1) DPD Free Chlorine Reagent Pillow. Cover and shake the sample tube. (Ensure that hands remain free of any dechlorinating solution.) If a pink or red color remains, use the colorimeter to determine the approximate free chlorine concentration. (Multiply by 100 to account for the sample's dilution.)

Record initial chlorine residual in the appropriate section on the "*Field Chlorination Report."*

Begin flushing by further opening the hydrant/blow off valve slowly until a flow rate of 2.5ft/s is obtained. (Calculate or use standard tables to determine appropriate flow in gpm and use pitot gauge to substantiate in field.) Sample water being discharged after the dechlorinator to ensure that free chlorine concentration is being reduced to zero using "Method of Measurement" below.

4. Bathe hose bib in superchlorinated water and disinfect nozzle with propane torch for a minimum of 30 seconds.
5. Sample water discharged before dechlorination equipment through hose bib and test using the method described in step no. 3 to ensure that free chlorine concentration is being reduced to system residual (0.5 – 1.0 ppm). When chlorine residual can no longer be detected using a diluted sample, transfer 5mL of sample water taken with the glass quart bottle to the sample tube and add one (1) DPD Free Chlorine Reagent pillow. Cover and shake the sample tube. If a pink or red color remains, use the colorimeter to directly read the approximate concentration of the chlorine. Absence of color indicates that there is no detectable chlorine present.

• Dechlorination/ Flushing, cont.

6. If initial batch of super dechlorination solution (ascorbic acid) is near completion and free chlorine concentration is at 2 ppm or less, super dechlorinator may be replaced with LPD-250 diffuser with sodium sulfite tablets. Otherwise, add more ascorbic acid solution and continue. Opening and closing appropriate valves (slowly to prevent water hammer) to maintain isolation of new main while swapping dechlorinators (or while mixing new batch of ascorbic acid solution) will aid in achieving a thorough scour and flush, while preventing backflow.
7. Periodically sample water discharged through dechlorination equipment and test using "Method of Measurement" below to ensure that free chlorine concentration is being reduced to zero ppm. Adjust feed rate or add tablets as necessary to completely remove chlorine.
8. At this point, begin checking turbidity using the Hach Portable Turbidimeter. Verify calibration of turbidimeter with the standards. Fill glass sample bottles to line at top of bottle and wipe dry outside with KimWipes. Gently tilt bottle to expel air bubbles. Test samples until turbidity is close to a standard set by the Water Quality Control Lab (≤0.5 NTU).
9. Confirm chlorine concentration using a sample with the colorimeter (direct read this value). Chlorine level should be between 0.5 and 1 ppm.
10. At each sample point, take a General Physical sample, filling to neck of the bottle. Carefully fill two (2) small, sterile Bact test sample bottles (two (2) per sample point) to the 100-mL line and cap immediately. Take additional samples if contamination is suspected. Record sample identification on "*Field Chlorination Report."*
11. Close valve to hydrant or blowoff and water feed line. Disassemble dechlorination equipment.
12. Estimate the amount of water flushed. Record on *"Field Chlorination Report."*
13. Submit *"Field Chlorination Report"* as well as samples to SCWD Water Quality Lab within one (1) hour of sampling. Transport samples in an insulated cooler with ice packs.

Method of Measurement

Free chlorine is measured by adding DPD Free Chlorine Reagent pillow to a sample of a given discharge. If a pink or red color develops when reagent is added to the sample, chlorine is present. This is known as colorimetric analysis. Absence of color indicates there is no detectable chlorine present.

Turbidity is measured utilizing the Hach Portable Turbidimeter, which operates on the nephelometric principle of turbidity measurement. This instrument

Method of Measurement, cont.

measures the degree of cloudiness by means of transmitted light. See manufacturer's manual for complete instructions.

Measuring Equipment

DPD Free Chlorine Reagent Pillows, manufactured by HF Scientific, Inc., are used to dispense the reagent into the sample. Utilize the clear, clean sample tubes included in the Hach Colorimeter kit to analyze the water. Transfer 5 mL of sample water taken with the glass quart bottle to the sample tube (fill to line, measure from bottom of meniscus) and add one (1) DPD Free Chlorine Reagent pillow (for 5mL sample).

Cover and shake the sample tube. If a pink or red color remains, use the colorimeter to directly read the approximate concentration. Absence of color indicates that there is no detectable chlorine present. The target chlorine concentration is 0.5 ppm, with an acceptable range of 0.5 to 1.0 ppm.

The Hach Portable Turbidimeter is used to measure turbidity. Verify calibration using the standards. Scratches, fingerprints, or condensation on the bottles will affect the readings. Wipe bottles carefully with Kimwipes, using silicon oil if bottles are scratchy. Line up diamond on bottle with instrument's orientation mark. Close cover. Press READ in AUTO RANGE mode.

Fill sample bottle to white line, cap, and wipe with Kimwipe. Gently rotate bottle to remove air bubbles. If turbidity >0.5 NTU, continue to flush. If turbidity remains over 0.5 NTUs for over an hour, stop flushing and continue procedure with note to lab about high turbidity level.

Attention!

Any activity resulting in a shutdown requires sampling of the water to verify that the turbidity is less than 0.5 NTU and the chlorine residual is between 0.5 and 1 ppm before putting main back in service. (Or to levels comparable to historical system parameters in the area.) If the main is dewatered or the residual pressure drops below 5 psi, the requirements above must be met and samples must be taken to the SCWD Water Quality Lab.

Regulating Agencies

- USEPA
- US Fish and Wildlife
- California Department of Health
- California Department of Fish and Game
- Central Coast RWQCB
- City of Santa Cruz
- NOAA Fisheries

Applicable Regulations

- Clean Water Act Sections 309, etc.
- Endangered Species Act Sections 9 and 11
- California Water Code Sections 13300-13361
- California Fish and Game Code Sections 5650 and 2050
- City of Santa Cruz Municipal Code
- California Code of Regulations, Title 22, Section 64421

Attachments

- MSDS, Sodium Sulfite
- MSDS, Ascorbic Acid
- Field Chlorination Report

References

- ANSI/AWWA C651-99 Standard for Disinfecting Water Mains
- AWWA Research Foundation Guidance Manual for Disposal of Chlorinated Water (2001)
- State of California RWQCB Water Quality Control Plan for the Central Coastal Basin (September, 1994)