



**MANUAL**  
**for**  
**WASTEWATER CHLORINATION**  
**and**  
**DECHLORINATION PRACTICES**

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**CALIFORNIA STATE WATER RESOURCES CONTROL BOARD**

**MANUAL FOR  
WASTEWATER CHLORINATION AND DECHLORINATION PRACTICES**

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STATE OF CALIFORNIA  
HEALTH AND WELFARE AGENCY  
MARIO G. OBLEDO, Secretary  
DEPARTMENT OF HEALTH SERVICES  
BEVERLEE A. MYERS, Director

Prepared by: Endel Sepp, Senior Sanitary Engineer  
George C. White, Consulting Engineer

**SANITARY ENGINEERING SECTION  
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## FOREWORD

This report has been reviewed by the California State Water Resources Control Board and approved for publication. Approval does not signify that the mention of trade names or commercial products constitute endorsement or recommendation for use.

## ABSTRACT

This manual was prepared to provide regulatory agencies, consulting engineers, and treatment plant operators with the urgently needed information on recommended chlorination and dechlorination practices. The principal aim of the manual is to improve wastewater disinfection and reduce residual toxicity associated with chlorination. It is expected that significant savings in chlorine will be realized by following the design and operating practices outlined herein.

The manual has been directed at chlorination systems that meter and control compressed liquid molecular chlorine. The text does not include aspects of hypochlorite or *in situ* chlorination systems. The sections on dechlorination deal primarily with compressed liquid sulfur dioxide as the dechlorinating agent.

Chlorination-dechlorination practices are subject to change and some aspects have received little study. This manual is a revision of an interim manual which was published in 1974 (6). It contains the best information available to date.

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**Alarms**—Every chlorination facility should have an alarm system that adequately alerts the operators in the event of deficiencies, malfunction, or hazardous situations related to chlorine supply, chlorine metering equipment, chlorine leaks, and chlorine residual.

The chlorine supply system should be monitored for chlorine leaks and low pressure which indicates loss of supply. High pressure alarms are only appropriate for liquid withdrawal systems. Pressure alarms are triggered by high and low pressure switches. Chlorine leaks in the supply and control area should be monitored by a permanent chlorine leak detector and alarm that meets OSHA requirements. The detector should be capable of sensing atmospheric chlorine concentrations as low as one ppm (by volume).

The chlorinators should be equipped with high and low vacuum sensing devices. Low vacuum signifies failure of the injector system and high vacuum signifies loss of chlorine supply. Either of these is indicated by a vacuum switch.

Installations using evaporators require alarms for warning of high and low water bath temperature and low water bath level.

Chlorine residual control analyzers should be equipped with adjustable high and low residual alarms.

Systems using tank cars, storage tanks, or tank trucks that involve air padding system should have a high humidity alarm on the dried compressed air supply.

**Monitoring Equipment**—In addition to the chlorine leak detector previously described, two categories of monitoring equipment may be utilized. One is for monitoring chlorine residual at the end of the contact chamber, and the other is for recording of chlorine flow through the chlorinator.

It is desirable to install an amperometric chlorine residual analyzer/recorder to record the chlorine residual in the effluent from the contact chamber. This unit will be in addition to the analyzer used in the chlorine control system. (See Figure 5.) The effluent monitor will insure against the loss of residual in the chlorine contact tank and thus help to prevent improper disinfection and the proliferation of slime growths in the contact tank. Where dechlorination is required the analyzer at the end of the contact tank is necessary for automatic control of the sulfonator.

The effluent monitor residual recorder and the control residual recorder should both be furnished with identical capabilities so that one can be a standby for the other.

Continuous recording of the amount of chlorine applied by each chlorinator provides valuable information, particularly for trouble-shooting the residual control process. Malfunctions in the system are readily identified when the chlorine feed rate can be compared with the chlorine residual chart at any given moment. Facilities utilizing chlorine residual control should have each chlorinator equipped with individual chlorine flow recorders.

Recorders should also be provided for the plant effluent flow meters so that the flow for any given moment can be compared with chlorine residual and chlorine dosage.



**Safety Equipment**—Certain items of safety equipment should be provided for the operators. This equipment consists of, but is not limited to, the following:

1. Breathing apparatus.
2. Chlorine absorption tank.
3. Emergency chlorine container repair kits.
4. Chlorine leak detector.
5. Expansion tanks.

There are two types of breathing apparatus—the canister-type gas mask and the oxygen or air-type breathing unit. The canister-type gas mask is limited in effectiveness to changing chlorine cylinders or normal maintenance work. It is not satisfactory for use in repairing a leak. Therefore, either of the following type equipment, or equivalent, should be furnished: the air-tank type breathing unit with thirty minutes air supply as manufactured by MSA or Scott Aviation Company; or the oxygen-breathing apparatus as manufactured by MSA (Mine Safety Appliance Company). The latter is similar to a canister type. When the seal on the unit is broken, the unit manufactures its own oxygen which lasts for forty-five minutes. These canisters must be discarded after the seal is once broken.

Emergency chlorine container repair kits are available for 100- and 150-pound cylinders, ton containers, tank cars, and storage tanks. These are identified as Chlorine Institute Emergency Container Kits. It is imperative that the appropriate kit be provided for installations using ton containers, tank cars, or storage tanks. Should an operation involve the storage of four or more 150-pound cylinders, it would also be advisable to have an emergency container kit available.

A suitable continuous chlorine leak detector should be furnished for every chlorination station, regardless of the size of containers. This is not only desirable from a safety viewpoint but is necessary to meet the OSHA personnel safety requirements. Leak detectors are equipped with circuitry to actuate external alarms. Leak detectors have been described under "Alarms."

The use of expansion tanks with frangible discs is described in the section on chlorine supply. These devices are used only on liquid supply systems when it might be possible to trap liquid chlorine in a section of pipe or in the evaporator. (See Figure 17.)

### 2.35 Injector System

**Description**—The injector system is the heart of the entire chlorination facility. If this system is inoperable, no other part of the system can function. The injector puts the chlorine gas into solution and carries it to the point of application. The various parts of this system include: the operating water supply to the injector; the injector; the injector vacuum line from the chlorinator; the injector discharge system described as the chlorine solution line; and the diffuser at the point of application.