

STATE OF  
COLORADO



Colorado Department  
of Public Health  
and Environment

DESIGN CRITERIA  
FOR  
POTABLE WATER SYSTEMS

WATER QUALITY CONTROL DIVISION

Revised March 31, 1997

Price: \$5.00

- a. an arrangement where the water pipe to be injected with chlorine enters and exits the chlorine room. The water pump delivering water through the pipe can either be installed in the pump room or the chlorine room. All chlorine equipment, including the vacuum ejector are located in the chlorine room;
  - b. an arrangement where the water pipe to be injected with chlorine does not enter the chlorine room. Rather, the chlorine vacuum ejector gas tubing leaves the chlorine room, enclosed the full length in schedule 80 PVC conduit, to where it will be injected into the water pipe. Special care must be taken in this design to insure safety. THE CHLORINE EJECTOR-CL TUBING MUST NOT LEAVE THE CHLORINE ROOM UNLESS IT IS ENCLOSED IN SEALED SCHEDULE 80 PVC CONDUIT.
  - c. Pressure type chlorine injector design is strongly discouraged.
- 6.1.42 A heater shall be provided to maintain the chlorine room temperature at 60° F. The room, the feed lines, and the chlorine cylinders/containers should be protected from excessive head to avoid failure of the 158° F fusible plugs located in bottles or ton cylinders. Chlorine tanks shouldn't be exposed to direct sunlight.
- 6.1.43 Individual safety bracket devices shall be provided for all tanks, full or empty, to prevent upset. Chains are not considered adequate.
- 6.1.44 A scale must be provided to measure chlorine usage for each chlorine tank in use or for one tank in each bank.
- 6.1.45 A poster giving chlorine handling instructions and precautions should be posted in a conspicuous place in the chlorination room. Detailed chlorine manuals are available from the various manufacturers and should be available for reference.
- 6.1.46 Additional design considerations are included in Section 7 - Chemical Applications
- 6.2. ULTRAVIOLET
- 6.2.1 The use of ultraviolet disinfection (UV) will be considered for approval on a case by case basis for ground water systems serving less than 100 people. Since there is no residual disinfectant present with UV, the approval will require special conditions to verify the water is safe.
- 6.3. IODINE
- 6.3.1 The use of iodine as a disinfectant in drinking water will not be approved by the Division.
- 6.4. OTHER DISINFECTING AGENTS
- 6.4.1 The use of other disinfectants, such as chlorine dioxide, ozone, or pre-formed chloramines, will be reviewed on a case by case basis.



## PART 7 - CHEMICAL APPLICATION

### 7.0 GENERAL

No chemicals shall be applied to treat drinking waters unless specifically permitted by the reviewing authority. Extreme care must be taken to assure that chemicals are compatible if mixed or stored on site.

### 7.1 PLANS AND SPECIFICATIONS

Plans and specifications shall be submitted for review and approval, as provided for in Part 1, and shall include:

- 7.1.1 descriptions of feed equipment, including maximum and minimum feed ranges;
- 7.1.2 location of feeders, piping layout and points of application;
- 7.1.3 storage and handling facilities including any safety concerns;
- 7.1.4 specifications for chemicals to be used;
- 7.1.5 operating and control procedures including proposed application rates;
- 7.1.6 descriptions of testing equipment and procedures.

### 7.2 CHEMICAL APPLICATION

Chemicals shall be applied to the water at such points and by such means as to:

- 7.2.1 assure maximum efficiency of treatment;
- 7.2.2 assure maximum safety to consumers;
- 7.2.3 provide maximum safety to operators;
- 7.2.4 assure satisfactory mixing of the chemicals with the water;
- 7.2.5 provide maximum flexibility of operation through various points of application, when appropriate;
- 7.2.6 prevent backflow or back-siphonage between multiple points of feed through common manifolds.

### 7.3 EQUIPMENT DESIGN

Chemicals shall be applied to the water at such points and by such means as to assure:

- 7.3.1 feeders will be able to supply, at all times, the necessary amounts of chemicals at an accurate rate, throughout the range of feed;
- 7.3.2 chemical-contact materials and surfaces are resistant to the aggressiveness of the chemical solution;
- 7.3.3 corrosive chemicals are introduced in such a manner as to minimize potential for corrosion;
- 7.3.4 chemicals that are incompatible are not fed, stored or handled together.

#### 7.4 CHEMICAL FEEDERS

Where chemical feed is necessary for the protection of the supply, such as chlorination, coagulation or other essential processes:

- 7.4.1 a minimum of two feeders shall be provided;
- 7.4.2 a standby unit or a combination of units of sufficient capacity should be available to replace the largest unit during shut-downs;
- 7.4.3 where a booster pump is required, duplicate equipment should be provided and, when necessary, standby power;
- 7.4.4 a separate feeder shall be used for each chemical applied;
- 7.4.5 spare parts shall be available for all feeders to replace parts which are subject to wear and damage.

#### 7.5 CONTROLS

- 7.5.1 Feeders may be manually or automatically controlled, with automatic controls being designed so as to allow override by manual controls.
- 7.5.2 Chemical feed rates shall be proportioned to flow.
- 7.5.3 A means to measure water flow must be provided in order to determine chemical feed rates.
- 7.5.4 Provisions shall be made for measuring the quantities of chemicals used.

#### 7.6 WEIGHING SCALES

Scales:

- 7.6.1 shall be provided for weighing cylinders, at all plants utilizing chlorine gas;
- 7.6.2 may be required for fluoride solution feed;

7.6.3 should be provided for volumetric dry chemical feeders;

7.6.4 should be accurate to measure increments of 0.5 per cent of load.

#### 7.7 DRY CHEMICAL FEEDERS

Dry chemical feeders shall:

7.7.1 measure chemical volumetrically and/or gravimetrically;

7.7.2 provide adequate solution water and agitation of the chemical in the solution pot;

7.7.3 provide gravity feed from solution pots;

7.7.4 completely enclose chemicals to prevent emission of dust to the operating room.

#### 7.8 POSITIVE DISPLACEMENT SOLUTION PUMPS

Positive displacement type solution feed pumps should be used to feed liquid chemicals, but shall not be used to feed chemical slurries.

#### 7.9 LIQUID CHEMICAL FEEDERS - SIPHON CONTROL

Liquid chemical feeders shall be protected against cross-connection with chemical solutions into the water supply, by:

7.9.1 assuring discharge at a point of positive pressure, or

7.9.2 providing vacuum relief, or

7.9.3 providing a suitable air gap, or

7.9.4 other suitable means or combinations as necessary.

#### 7.10 CROSS CONNECTION CONTROL

Cross-connection control must be provided to assure that:

7.10.1 the service water lines discharging to solution tanks shall be properly protected from backflow by use of either an air gap of at least six inches or two pipe diameters, whichever is greater, or a reduced pressure principle backflow device;

7.10.2 liquid chemical solutions cannot be siphoned through solution feeders into the water supply (Section 7.9 );

7.10.3 no direct connection exists between any sewer and a drain or overflow from the feeder, solution chamber or tank by providing that all drains terminate at least six inches or two pipe diameters, whichever is greater, above the overflow rim of a receiving sump, conduit or waste receptacle, which must daylight.

## 7.11 CHEMICAL FEED EQUIPMENT LOCATION

Chemical feed equipment shall:

- 7.11.1 be located in a separate room to reduce hazards and dust problems;
- 7.11.2 be conveniently located near points of application to minimize length of feed lines;
- 7.11.3 be readily accessible for servicing, repair, and observation of operation.

## 7.12 SERVICE WATER SUPPLY

Service water supply shall be:

- 7.12.1 ample in supply and adequate in pressure;
- 7.12.2 provided with means for measurement when preparing specific solution concentrations by dilution;
- 7.12.3 properly treated for hardness, when necessary;
- 7.12.4 properly protected against backflow.

## 7.13 STORAGE OF CHEMICALS

Space should be provided for:

- 7.13.1 at least 30 days of chemical supply;
- 7.13.2 convenient and efficient handling of chemicals;
- 7.13.3 dry storage conditions;
- 7.13.4 a minimum storage volume of 1 1/2 truck loads where purchase is by truck load lots.
- 7.13.5 Storage tanks and pipelines for liquid chemicals shall be specific to the chemicals and not for alternates.
- 7.13.6 Chemicals shall be sorted in covered or unopened shipping containers, unless the chemical is transferred into an approved-covered storage unit.

Liquid chemical storage tanks must:

- 7.13.7 have a means of indicating liquid levels;
- 7.13.8 have an overflow and a receiving basin or drain capable of receiving accidental spills or overflows;