

## **8. CHEMICAL APPLICATION**

8.0 GENERAL No chemicals shall be applied to treat drinking waters unless specifically permitted by the Division. Extreme care must be taken to assure that chemicals are compatible if mixed or stored on site. Disinfection chemical application is covered in Chapter 7 and specific chemical addition related to contaminant removal is covered in Chapter 9.

### **8.1 PLANS AND SPECIFICATIONS**

Plans and specifications shall be submitted for review and approval, as provided for in Part 2, and the following must be addressed in the engineering report:

- a. descriptions of feed equipment, including maximum and minimum feed ranges;
- b. location of feeders, piping layout and points of application;
- c. storage and handling facilities including any safety concerns;
- d. specifications for chemicals to be used showing they meet requirements of NSF 60
- e. operating and control procedures including proposed application rates;
- f. descriptions of testing equipment and procedures.

### **8.2 CHEMICAL APPLICATION**

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

- a. assure maximum efficiency of treatment;
- b. assure maximum safety to consumers;
- c. provide maximum safety to operators;
- d. assure satisfactory mixing of the chemicals with the water;
- e. provide maximum flexibility of operation through various points of application, when appropriate;
- f. prevent backflow or back-siphonage between multiple points of feed through common manifolds.

### **8.3 EQUIPMENT DESIGN**

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

- a. feeders will be able to supply, at all times, the necessary amounts of chemicals at an accurate rate, throughout the range of feed;

- b. chemical-contact materials and surfaces are resistant to the aggressiveness of the chemical solution;
- c. corrosive chemicals are introduced in such a manner as to minimize potential for corrosion;
- d. chemicals that are incompatible are not fed, stored or handled together.
- e. all chemicals are conducted from the feeder to the point of application in separate conduits,
- f. chemical feeders and pumps shall be sized and specified to operate between the upper and lower 20 per cent of the feed range.
- g. Pumps should have fully independent adjustment mechanisms such as pump pulse rate and stroke length.
- h. Chemicals may not be gravity fed.

#### 8.4 CHEMICAL FEEDERS

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

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

#### 8.5 CONTROLS

- a. Feeders may be manually or automatically controlled, with automatic controls being designed so as to allow override by manual controls.
- b. At automatically operated facilities, chemical feeders shall be electrically interconnected with the well or service pump.
- c. Chemical feed rates shall be proportioned to flow.
- d. A means to measure water flow must be provided in order to determine chemical feed rates.
- e. Provisions shall be made for measuring the quantities of chemicals used.



## 8.6 WEIGHING SCALES

Scales:

- a. shall be provided for weighing cylinders, at all plants utilizing chlorine gas. A scale must be provided to measure chlorine usage for each chlorine tank in use or for one tank in each bank.
- b. may be required for fluoride solution feed;
- c. should be provided for volumetric dry chemical feeders;
- d. should be accurate to measure increments of 0.5 per cent of load.

## 8.7 DRY CHEMICAL FEEDERS

Dry chemical feeders shall:

- a. measure chemical volumetrically and/or gravimetrically;
- b. provide adequate solution water and agitation of the chemical in the solution pot;
- c. provide gravity feed from solution pots;
- d. completely enclose chemicals to prevent emission of dust to the operating room.

## 8.8 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. Pumps must be capable of operating at the required maximum rate against the maximum head conditions found at the point of injection.

## 8.9 LIQUID CHEMICAL FEEDERS - SIPHON CONTROL

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

- a. assuring discharge at a point of positive pressure, or
- b. providing vacuum relief, or
- c. providing a suitable air gap, or
- d. other suitable means or combinations as necessary.

## 8.10 CROSS CONNECTION CONTROL

Cross-connection control must be provided to assure that:

- a. 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 1½ pipe diameters, whichever is greater, or a reduced pressure principle backflow device;

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- b. liquid chemical solutions cannot be siphoned through solution feeders into the water supply (Section 7.9 );
- c. 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.

#### 8.11 CHEMICAL FEED EQUIPMENT LOCATION

Chemical feed equipment shall:

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

#### 8.12 SERVICE WATER SUPPLY

Service water supply shall be Finished Water and:

- a. ample in supply and adequate in pressure;
- b. provided with means for measurement when preparing specific solution concentrations by dilution;
- c. properly treated for hardness, when necessary;
- d. properly protected against backflow.
- e. obtained from a location sufficiently downstream of any chemical feed point to assure adequate mixing and contact time.

#### 8.13 STORAGE OF CHEMICALS

##### 8.13.1 Storage

Space should be provided for, at least 30 days of chemical supply or a minimum storage volume of 1 1/2 truck loads where purchase is by truck load lots

##### 8.13.2 Space must be provided for:

- a. safe, convenient and efficient handling of chemicals
- b. dry storage conditions;
- c. Storage tanks and pipelines for liquid chemicals shall be specific to the chemicals and not for alternates. Offloading areas must be clearly labeled to prevent accidental cross-contamination.

- d. Chemicals shall be sorted in covered or unopened shipping containers, unless the chemical is transferred into an approved-covered storage unit.

8.13.3 Liquid chemical storage tanks must:

- a. have a means of indicating liquid levels;
- b. have an overflow and a receiving basin or drain capable of receiving accidental spills or overflows without uncontrolled discharge; a common receiving basin may be provided for each group of compatible chemicals, that provides sufficient containment volume to prevent accidental discharge in the event of failure of the largest tank;
- c. be properly protected against backflow.

8.14 SOLUTION TANKS

8.14.1 Mixing

A means which is consistent with the nature of the chemical solution shall be provided in a solution tank to maintain a uniform strength of solution. Continuous agitation shall be provided to maintain slurries in suspension.

8.14.2 Number of Tanks

Two solution tanks of adequate volume may be required for a chemical to assure continuity of supply in servicing a solution tank.

8.14.3 Measurement

Means shall be provided to measure the solution level in the tank.

8.14.4 Covers

Chemical solutions shall be kept covered. Large tanks with access openings shall have such openings curbed and fitted with tight overhanging covers.

8.14.5 Subsurface Locations

Subsurface locations for solution tanks are not allowed:

8.14.6 Overflow pipes, when provided, should:

- a. be turned downward, with the end screened;
- b. have a freefall discharge;
- c. be located where noticeable.

#### 8.14.7 Venting

Acid storage tanks must be vented to the outside atmosphere, but not through vents in common with day tanks.

#### 8.14.8 Backflow Protection

Each tank shall be provided with a valved drain, protected against backflow in accordance with Section 8.9 and 8.10.

#### 8.14.9 Spill Containment

Solution tanks shall be located and protective curbing provided so that chemicals from equipment failure, spillage or accidental drainage shall not enter the water in conduits, treatment or storage basins.

### 8.15 DAY TANKS

Day tanks shall be provided where bulk storage of liquid chemical is provided, to prevent contamination of bulk storage vessel.

- a. Day tanks shall meet all the requirements of Section 8.14; and
- b. Day tanks should hold no more than a 30 hour supply.

#### 8.15.1 Measurement

Day tanks shall be scale-mounted, or have a calibrated gauge painted or mounted on the side if liquid level can be observed in a gauge tube or through translucent sidewalls of the tank. In opaque tanks, a gauge rod extending above a reference point at the top of the tank, attached to a float may be used. The ratio of the area of the tank to its height must be such that unit readings are meaningful in relation to the total amount of chemical fed during a day.

#### 8.15.2 Liquid Transfer

Hand pumps may be provided for transfer from a carboy or drum. A tip rack may be used to permit withdrawal into a bucket from a spigot. Where motor-driven transfer pumps are provided, a liquid level limit switch and an over-flow from the day tank, which will drain by gravity back into the bulk storage tank, must be provided.

#### 8.15.3 Mixing

A means which is consistent with the nature of the chemical solution shall be provided to maintain uniform strength of solution in a day tank. Continuous agitation shall be provided to maintain chemical slurries in suspension.

#### 8.15.4 Labels

Tanks shall be properly labeled to designate the chemical contained.



## 8.16 FEED LINES

All feed lines:

- a. should be as short as possible in length of run;
- b. must be of durable, corrosion resistant material;
- c. should be easily accessible throughout the entire length;
- d. must be protected against freezing;
- e. must be readily cleanable;
- f. must slope upward from the chemical source to the feeder when conveying gases;
- g. should be color coded;
- h. shall be designed to minimize negative impacts of scale-forming or solids depositing properties of the water, chemical, solution or mixtures conveyed.

## 8.17 CHEMICAL HANDLING

### 8.17.1 Lifting

Carts, elevators and other appropriate means shall be provided for lifting chemical containers to minimize excessive lifting by operators.

### 8.17.2 Dust Exposure

Provisions shall be made for disposing of empty bags, drums or barrels by an approved procedure which will minimize exposure to dust.

### 8.17.3 Dust Control

Provision must be made for the proper transfer of dry chemicals from shipping containers to storage bins or hoppers, in such a way as to minimize the quantity of dust that may enter the room in which the equipment is installed. Control should be provided by use of:

- a. vacuum pneumatic equipment or closed conveyor systems,
- b. facilities for emptying shipping containers in special enclosures, and/or
- c. exhaust fans and dust filters which put the hoppers or bins under negative pressure.

### 8.17.4 Measurement

Provision shall be made for measuring quantities of chemicals used to prepare feed solutions.

## 8.18 HOUSING

### 8.18.1 Floor Surfaces

Floor surfaces shall be smooth and impervious, slip-proof and well drained with a minimum slope of 3" in 10'.

### 8.18.2 Floor Drains

Floor drains will not be allowed in chlorine rooms unless properly trapped.

### 8.18.3 Venting

Vents from feeders, storage facilities and equipment exhaust shall discharge to the outside atmosphere above grade and remote from air intakes.

## 8.19 SHIPPING CONTAINERS – O&M CONSIDERATION

Chemical shipping containers shall be fully labeled to include:

- a. chemical name, purity and concentration; and
- b. supplier name and address.

## 8.20 SPECIFICATIONS

Chemicals shall be approved by the Division or meet the appropriate ANSI/AWWA standards and/or ANSI/NSF Standard 60/61.

## 8.21 OPERATOR SAFETY

### 8.21.1 Protective equipment

- a. At least one pair of rubber gloves, a dust respirator of a type certified by NIOSH for toxic dusts, an apron or other protective clothing and goggles or face mask shall be provided for each operator as required by the Division.
- b. A deluge shower and eyewashing device must be installed where strong acids and alkalis are used or stored.
- c. A water holding tank that will allow water to come to room temperature must be installed in the water line feeding the deluge shower and eyewashing device. Other methods of water tempering will be considered on an individual basis.
- d. Other protective equipment should be provided as necessary.

8.21.2 The fire department shall be notified of the chemicals used or stored on site.

## 8.22 SPECIFIC CHEMICALS

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### 8.22.1 Acids and caustics

- a. Acids and caustics shall be kept in closed corrosion-resistant shipping containers or storage units.
- b. Acids and caustics shall not be handled in open vessels, but should be pumped in undiluted form from original containers through suitable hose, to the point of treatment or to a covered day tank.

### 8.23 FLUORIDE

Sodium fluoride, sodium silicofluoride and fluorosilicic acid shall conform to the applicable AWWA standards and ANSI/NSF Standard 60. Other fluoride compounds which may be available must be approved by the reviewing authority.

#### 8.23.1 Fluoride compound storage

Fluoride chemicals should be isolated from other chemicals to prevent contamination. Compounds shall be stored in covered or unopened shipping containers and should be stored inside a building. Unsealed storage units for fluorosilicic acid should be vented to the atmosphere at a point outside any building. Bags, fiber drums and steel drums should be stored on pallets.

#### 8.23.2 Chemical feed equipment and methods

In addition to the requirements of Part 8, fluoride feed equipment shall meet the following requirements:

- a. scales, loss-of-weight recorders or liquid level indicators, as appropriate, accurate to within five percent of the average daily change in reading shall be provided for chemical feeds,
- b. feeders shall be accurate to within five percent of any desired feed rate,
- c. fluoride compound shall not be added before lime-soda softening or ion exchange softening,
- d. the point of application of fluorosilicic acid, if into a horizontal pipe, shall be in the lower half of the pipe,
- e. a fluoride solution shall be applied by a positive displacement pump having a stroke rate not less than 20 strokes per minute, and at a feed rate not less than 20 percent of the rated capacity of the feed pump,
- f. A spring opposed diaphragm type anti-siphon device shall be provided for all fluoride feed lines and dilution water lines,
- g. except for constant flow systems, a device to measure the flow of water to be treated is required,

- h. the dilution water pipe shall terminate at least two pipe diameters above the solution tank,
- i. water used for sodium fluoride dissolution shall be softened if hardness exceeds 75 mg/l as calcium carbonate,
- j. fluoride solutions shall be injected at a point of continuous positive pressure or a suitable air gap provided,
- k. the electrical outlet used for the fluoride feed pump should have a nonstandard receptacle and shall be interconnected with the well or service pump,
- l. saturators should be of the upflow type and be provided with a meter and backflow protection on the makeup water line,
- m. consideration shall be given to providing a separate room for fluorosilicic acid storage and feed.

#### 8.23.3 Secondary controls

Secondary control systems for fluoride chemical feed devices shall be provided as a means of reducing the possibility for overfeed; these may include flow or pressure switches or other devices.

#### 8.23.4 Protective equipment

Personal protective equipment as outlined in Section 5.3.4 shall be provided for operators handling fluoride compounds. Deluge showers and eye wash devices shall be provided at all fluorosilicic acid installations.

#### 8.23.5 Dust control

- a. Provision must be made for the transfer of dry fluoride compounds from shipping containers to storage bins or hoppers in such a way as to minimize the quantity of fluoride dust which may enter the room in which the equipment is installed. The enclosure shall be provided with an exhaust fan and dust filter which place the hopper under a negative pressure. Air exhausted from fluoride handling equipment shall discharge through a dust filter to the outside atmosphere of the building.
- b. Provision shall be made for disposing of empty bags, drums or barrels in a manner which will minimize exposure to fluoride dusts. A floor drain should be provided to facilitate the hosing of floors.

#### 8.23.6 Testing equipment

Equipment shall be provided for measuring the quantity of fluoride in the water. Such equipment shall be subject to the approval of the reviewing authority.