**Section 370.1021 Dechlorination**

a) General

Dechlorination of sewage plant effluents may be required to reduce toxicity due to chlorine residuals.

b) Feed Equipment

1) Type

The common types of dechlorination feed equipment using sulfur compounds include:

A) Vacuum solution feed of sulfur dioxide gas.

B) Positive displacement pump feed or aqueous solutions of sulfite or bisulfite products.

2) Selection of Feed Equipment

The selection of the type of feed equipment using sulfur compounds shall include consideration of operator safety and overall public safety relative to the proximity of the sewage treatment plant to populated areas and the security of the gas cylinder storage. The selection and design of sulfur dioxide feeding equipment shall take into account the fact that the gas reliquifies very easily.

c) Output Capacity of Sulfur Dioxide Cylinders

The number of feed cylinders or containers necessary to meet the design delivery rates shall be based on the physical, thermodynamic and chemical properties for sulfur dioxide. Refer to the Compressed Gas Association publication CGA G-3-1988 "Sulfur Dioxide" or other standard reference sources for information on sulfur dioxide properties.

d) Standby Equipment and Spare Parts

Standby equipment should be available of sufficient capacity to replace the largest unit during shutdown. Spare parts to replace parts that are subject to wear and breakage shall be available for all sulfonators.

e) Potable Water Supply

An ample supply of water shall be available for operating the sulfonator. Where a booster pump is required duplicate equipment should be provided and, when necessary, standby power. (Refer to Section 370.550(a)(4).) Protection of the potable water supply shall conform to the requirements of Section 370.550(b)(6). In-line back flow preventers may not be used.

f) Sulfur Dioxide Gas Supply

1) Cylinders

The use of 1-ton containers should be considered where the average daily sulfur dioxide consumption is over 150 pounds. All upright sulfur dioxide cylinders shall be strapped securely to prevent tipping.

2) Tank Cars

A) The use of tank cars, generally accompanied by evaporators, may be considered for large installations. Areawide public safety shall be evaluated as part of the considerations. Continuity of sulfur dioxide supply shall be maintained during tank car switching.

B) The tank car being used for the sulfur dioxide supply shall be located on a dead end, level track that is a dedicated siding. The tank car shall be protected from accidental bumping by other railway cars by a locked de-rail device, a closed lock switch, or both. The area shall be clearly posted "DANGER SULFUR DIOXIDE." The tank car shall be secured by adequate fencing with locked gates for personnel and rail access.

C) The tank car site shall be provided with an operating platform at the unloading point that allows for easy access to the protective housing on the tank car for flexible feed line connection and valve operation. Area lighting adequate for night time operation and maintenance shall be provided.

3) Scales

A) Scales shall be provided for weighing cylinders or containers at all plants using sulfur dioxide gas.

B) At large plants indicating and recording scales are recommended. At a minimum, a platform scale shall be provided. Scales shall be made of corrosion resistant material. Scales should be recessed unless hoisting equipment is provided or the scales are low enough to allow the cylinders to be rolled onto them.

4) Evaporator

Where the manifolding of several cylinders or containers will be required to evaporate sufficient sulfur dioxide, consideration should be given to liquid drawoff and installation of an evaporator. A liquid nitrogen gas padding system to enhance the liquid sulfur dioxide delivery rate should be considered.

5) Leak Detection and Controls

Sulfur dioxide leak detection equipment shall be provided which has a sensitivity level equal to that of ambient air pollution monitoring equipment. Where cylinders, one-ton containers and tank cars are used, a leak repair kit that is compatible for use with sulfur dioxide gas shall be provided. Leak repair kits used for chlorine gas (Section 370.1020(f)(5)) equipped with gasket materials suitable for service with sulfur dioxide may be used. (See paragraphs 10.4 and 13.2 of "Sulfur Dioxide," Compressed Gas Association, Inc., Publication CGA G-3-1988 for a discussion of suitable materials.) Refer to Section 370.560.

g) Piping and Connections

1) Piping systems should be as simple as possible, with a minimum number of joints, and shall be suitable for sulfur dioxide service. Piping should be well supported and protected against temperature extremes.

2) The piping for the sulfur dioxide system shall be color-coded and labeled to distinguish it from chlorine piping, and the system shall be designed so that interconnections with chlorine piping cannot occur.

h) Housing

1) Container and Equipment Location

Containers and feed equipment should be located inside a fire resistant building. Gas cylinders and containers should be protected from direct sunlight.

A) Isolation

If gas sulfonation equipment and sulfur dioxide cylinders will be located in a building also used for other purposes, the sulfur dioxide equipment and containers shall be located in an isolated room that shall not contain any chlorination equipment, chlorine containers or any other equipment unrelated to sulfonation. Common walls to other areas of the building shall be gastight. Doors to the room shall open only to the outside and shall be equipped with panic hardware. Rooms shall be at ground level and shall allow easy access to all equipment. Storage areas should be separated from feed areas; sulfur dioxide and chlorine cylinders shall be stored in separate areas.

B) Inspection Window

A clear gastight window shall be installed in the sulfonate room to permits the units to be viewed and gauges to be read without entering the room.

2) Heat

Sulfonator housing facilities shall be provided with a means of heating so that cylinder temperatures can be maintained in the range of 90 to 100° F when sulfur dioxide is to be withdrawn from the cylinder. The sulfonator room shall be protected from excessive heat.

3) Ventilation for Sulfur Dioxide Systems

A) Forced, mechanical ventilation that will provide one complete air change per minute shall be installed in the sulfonator room. The entrance to the exhaust duct from the room shall be within 12 inches from the floor and the point of discharge shall be located so as not to contaminate the air in the immediate vicinity of the door to the sulfonator room or ventilation inlet to any buildings or inhabited areas.

B) The air inlets to the sulfator room shall be located so as to provide cross ventilation with air and at temperatures that will not adversely affect the sulfonation equipment. The vent hose from the sulfonator shall discharge to the outside atmosphere above grade.

4) Electrical Controls

Controls for fans and lights shall be located at the entrances to the sulfonation room and shall automatically operate when the door is opened and continue in operation when the operator enters the room and the door is closed. Provision shall be made for operation of the fans and lights from the outside without opening the door.

i) Respiratory Protection Equipment

Respiratory protection equipment meeting the requirements of NIOSH shall be available at all installations where sulfur dioxide gas is handled and shall be stored in a convenient location outside of any room where sulfur dioxide is used or stored. The units shall use compressed air, shall have at least a 30-minute capacity and shall be the same as or compatible with NIOSH-approved units used by the local fire department. Instructions for using, testing and replacing mask parts shall be posted. At large installations, providing acid suits and fire suits should be considered.

j) Application of Sulfonation Chemicals

1) Contact Period and Reaeration

A minimum contact period of 30 seconds, including mixing time, at design peak hourly flow or maximum pumpage rate shall be provided. Mechanical mixers are required unless the mixing facility will provide the necessary hydraulic turbulence to assure thorough mixing. A means of reaeration shall be provided to insure maintenance of the required dissolved oxygen concentration in the effluent and the receiving stream after sulfonation. When choosing a reaeration method the fact that excess sulfur dioxide, formed when the dechlorinating chemicals are dissolved in water, may be expected to consume 1 mg of dissolved oxygen for every 4 mg of sulfur dioxide should be taken into account.

2) Sulfonation Dosing Rate Capacity

A) Capacity

Sulfonators shall be designed to have a capacity adequate to produce an effluent that meets the applicable chlorine residual effluent limits. Where necessary to meet the operating ranges, multiple units shall be provided for adequate peak capacity and to provide a sufficiently low feed rate on turn down to avoid depletion of the dissolved oxygen concentrations in the receiving waters. The sulfonator system shall be designed on a rational basis and calculations justifying the equipment sizing and number of units shall be submitted for the entire operating range, including the minimum turn down capability for the type of control to be used. System considerations shall include the sensitivity and location of the controlling sewage flow meter, the telemetering equipment and sulfonator controls.

B) Dosing Rates

The design dosage rate of the sulfonation equipment shall be based on the particular dechlorinating chemical used and the applicable residual chlorine limits. The following theoretical amounts of the commonly used dechlorinating chemicals may be used for initial approximations to size feed equipment.

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| --- | --- |
|  | Theoretical mg/l required to neutralize 1 mg/l Cl2 |
| Sulfur dioxide (gas) | 0.90 |
| Sodium meta bisulfite (solution) | 1.34 |
| Sodium bisulfite (solution) | 1.46 |

The design shall take into account the fact that under good mixing conditions approximately 10% more dechlorinating chemical than theoretical value is required for satisfactory results.

C) Liquid Solution Tanks

Mixing and dilution tanks for dechlorinating feed solutions shall be provided as necessary to mix dry compounds and to dilute liquid compounds to provide for proper dosage. Solution tanks should be covered to minimize evaporation. The mixing and dilution tanks should be sized to provide sufficient feed solution for several days of operation. The tanks shall be made of materials that will withstand the corrosive nature of the solutions. Refer to Section 370.560.

(Source: Added at 21 Ill. Reg. 12444, effective August 28, 1997)