

Sodium Hypochlorite/Calcium Hypochlorite Safety

This safety program is designed around use and exposure of Sodium Hypochlorite and Calcium Hypochlorite.

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Disclaimer

The information contained here in is drawn from sources believed to be reliable (culmination of information found on MSDS). It should not be assumed that every acceptable precaution and all related information is included, know that special circumstances may warrant modification or additional procedures. The user should be aware that changing technology or regulations might require a change in the following recommendations and precautions.

General Information

The District uses sodium hypochlorite primarily for the purpose of disinfecting drinking water. It is injected into water main near the source or in storage tank recirculation systems by means of chemical injection pump and piping or tubing. Synonyms of sodium hypochlorite can be known as Clorox, bleach, liquid bleach, Liquichlor and liquid chlorine solution.

Calcium Hypochlorite is used in new construction for disinfection of water main. The granular form is placed in lengths of water main during the pipe laying process. The granular form can be mixed into solution and either pumped or injected into the water main. Filling the water main mixes the calcium hypochlorite with the water disinfecting the water main prior to flushing and bacteriological testing. Synonyms of calcium hypochlorite include hypochlorous acid, chlorinated lime, HTH, and chloride of lime. The Granular form can be mixed into solution and either pumped or injected into the water main.

Sodium Hypochlorite and Calcium Hypochlorite contain hypochlorite which in turn contains chlorine, the key to disinfection. This shall not be confused with the purchase and safety requirements of 100 % chlorine liquid/gas. This pure form is often shipped in 150 lb. cylinders and one ton containers. From such containers chlorine is removed in a gaseous form. A person exposed to this form of chlorine use, shall seek out an in depth safety program regarding chlorine gas usage.

Chemical and physical Properties

Sodium Hypochlorite (chemical formula NaOCl) that can be purchased in different strengths measured as percent by volume ranging from commercial/industrial grades to household/consumer grade. Industrial strength has 12.5 % available sodium hypochlorite by weight. It is typically purchased in 55 gallon drums or 5 gallon carboys and accompanied by a Material Safety Data Sheet (MSDS). Household/consumer bleach usually has 5.25 % available sodium hypochlorite by weight and is often packaged in one gallon jugs. MSDS are not provided/required with purchase of consumer products. MSDS type information is listed on the label. On site chlorine generating units typically manufacture sodium hypochlorite at approximate .8 % availability by weight. MSDS sheets are not required by manufactures of sodium hypochlorite in concentrations of less than one percent by volume. All of these forms deteriorate their concentration strength with time, heat, and sunlight. Plus these solutions gas off chlorine odor readily proportionate to their concentrations and decomposition. They are pale yellow-green in color, corrosive and are oxidizers. Solutions have a greater specific gravity than water proportionate to strength, yet they are soluble in water.

Calcium Hypochlorite [chemical formula $\text{Ca}(\text{OCl})_2$] can be purchased in compressed tablet or granular form and is white in color. Most frequently the available active ingredient is between 65 - 89 % available by weight.

An ingredient/component of sodium hypochlorite solution is sodium hydroxide. Its percent by weight is proportionate to chlorine strength. The sodium hydroxide component demands respect and consideration (see table below, information copied from a MSDS). As you can see the sodium hydroxide component is a factor in your handling and dealing with sodium hypochlorite solutions. OSHA has not yet set a permissible exposure limit for sodium hypochlorite but it has for the more dangerous lesser chemical ingredient sodium hydroxide.

Ingredient common name	% by weight	Chemical Abstracts Service (CAS) registry number	Occupational Safety and Health Administration (OSHA) permissible exposure limits (pel)	American Conference of Governmental Industrial Hygienists (ACGIH) Threshold limit values (tlv)
Sodium hypochlorite	9-16	7681-52-9	N/A	N/A (1.45 mg/m ³ as chlorine)
Sodium hydroxide	0.1-2.0	1310-73-2	2mg/m ³	2mg/m ³ ceiling
Inert Ingredients (water)	balance	N/A	N/A	N/A

Note: 1ppm = 2.90 mg/m³

Health Hazards

First Aid assistance: Phone 911

For information or assistance you can call Washington Poison Control at (206) 526-2121 or 1-800-732-6985

Routes of Entry: Eye Contact, Inhalation, Skin Contact, and Ingestion

Acute effects/First Aid and Emergency Procedures:

Eye Contact: Corrosive

Exposure may produce mild irritation to severe burns. Exposure to vapors may produce mild to severe irritation. Heavy exposure and or poor first aid could result in permanent eye damage.

Flush eye(s) thoroughly with running water for at least Fifteen minutes. Get prompt medical attention.

Inhalation: Corrosive

Fumes from spills can cause severe irritation and chemical burns to the nose, throat, and lungs. A lesser risk exists from properly stored solution.

If symptoms occur, remove victim to fresh air. Provide support respiration and get prompt medical attention if necessary.

Skin Contact: Corrosive

May produce mild to severe irritation, reddening of skin, can cause chemical burns.

Rinse thoroughly with running water. If irritation persists contact physician.

Ingestion: Corrosive

Causes burns to mucous membranes. May cause esophageal or gastric perforation, ulceration, laryngeal edema, vomiting, nausea, and could be lethal.

Immediately give large quantities of water or milk to dilute. Do not induce vomiting. Do not give vinegar or other acidic material. Get prompt medical attention.

Chronic effects:

None known. Additionally the ingredients sodium hypochlorite and sodium hydroxide are not known to be carcinogenic.

Precautions for Safe Handling and Use

Precautions:

Varied chlorine strength solutions and usage have varied risk to exposure. Precautions shall be proportionate to risk. The contrast being between some 12.5% solution by weighted volume and some .8% solution by weighted volume.

Eye Protection:

Wearing splash proof chemical resistant goggles is usually adequate protection for the eyes. However, a full face shield in addition to goggles can provide another layer of protect if needed. Be aware that if you are in a situation with pending misting or vapors a full face respirator could guard against vapors reaching the eyes [Particulate respirator/filter that is 99.97 % efficient (with cartridges N100, R100, or P100)].

Note: See safety program regarding respirator use and testing.

Ventilation:

Provide adequate ventilation. Use site exhaust fans where provided.

Respiratory:

Avoid breathing fumes; if the possibility exists of subjection or exposure to misting or vapors wear NIOSH approved respiratory protection [Particulate respirator/filter that is 99.97 % efficient (with cartridges N100, R100, or P100)].

Note: See safety program regarding respirator use and testing.

Gloves:

Wear chemical resistant gloves if your hands will be exposed to the chemical.

Other Protection:

Wear chemical resistant protection (apron or rain gear) if splashing of material may occur.

Hygienic Practices:

Eye wash stations are located at all chlorine use sites. Combination shower/eye wash stations are provided at major exposure sites. Tyvek coveralls are located at all chlorine sites for change of clothing should ones clothes become contaminated. Soiled clothing should be laundered. Use care in handling soiled clothing and wash hands thoroughly after handling.

Chlorine Storage requirements:

Store solutions of sodium hypochlorite in cool, dark place, away from heat, and combustible sources. Keep containers closed and provide adequate ventilation.

Transporting Chlorine:

Employees are not asked to transport large quantities of sodium hypochlorite. Shipping of liquid bleach in quantities of one thousand pounds or more requires driver and vehicle to meet Department of Transportation (DOT) requirements, a commercial hazardous classification drivers' license, vehicle placarding (corrosive 1791) on all sides. Driver must possess MSDS for material, Emergency response information (Guide 154), and bill of lading, with regard to shipping. In the event of a transportation emergency, call Chemtrec at 1 (800) 424-9300

However, when transporting small quantities of sodium hypochlorite solution from site to site it is best transported in a pick up; where a driver is not confined with chemical(s) inside of a vehicle. MSDS should accompany chemical at all times.

Material Safety Data Sheets:

MSDS sheets for these products shall be at the sites where it is used. It shall be the responsibility of the employee to read and understand prior to working with material or at a minimum annually.

Sodium Hypochlorite when it is purchased at the store. The purchaser shall read the label and follow any usage instructions. MSDS sheets can be requested for your use.

Calcium Hypochlorite Granular (60 – 80 % available calcium hypochlorite) is not regularly used by staff.

Incompatibility:

Chemical compounds:

The different active ingredients that can be found in calcium hypochlorite are often not compatible. For example tablets with active ingredient trichloro-s-triazinetriene can not be mixed with granular calcium hypochlorite as explosion and fire may result. Do not mix different brands of calcium hypochlorite or materials with different ingredient listings.

Calcium hypochlorite and sodium hypochlorite are also not compatible with each other and shall not be mixed as explosion may occur. Both are reactive with acids, alcohols, ammonia, hydrocarbons and oxidizable materials

Ammonia:

Sodium Hypochlorite will also react with ammonia or cleaners containing ammonia compounds to produce hazardous gases. Sodium hypochlorite solutions may also react violently with some organic compounds.

Acids:

Contact between acids and sodium hypochlorite will cause chlorine gas and acids to be liberated. Care shall be exercised to keep the two from mixing.

Neutralization of sodium hypochlorite

Combining bleach solutions with certain chemicals can neutralize the chlorine and the sodium hydroxide it contains. However, a chemical reaction is created that can be violent/explosive in nature, producing heat and dangerous gases/vapors. The large variable in reaction is concentrations and volumes. Neutralizing typical chlorine concentrations in drinking water has very little risk compared to neutralizing strong concentrations in a containment area. Neutralizing chlorine in drinking water, to address endangered species and to protect ecosystems is often done with the chemicals from the list that follows. However, neutralizing strong sodium hypochlorite solutions in containment shall always be done with supervision. Three of the commonly used chemicals in the process of neutralization are;

Sodium Thiosulfate ($\text{Na}_2\text{S}_2\text{O}_5 \cdot 5\text{H}_2\text{O}$), about $\frac{1}{2}$ the weight of sodium Thiosulfate is needed to neutralize a whole weight of sodium hypochlorite (1 to 2 ratio).

Sodium Metabisulfite ($\text{Na}_2\text{S}_2\text{O}_5$), about one weight of sodium metabisulfite is needed to neutralize a whole weight of sodium hypochlorite (1 to 1 ratio).

Vita-D-Chlor (Ascorbic Acid), about $2\frac{1}{2}$ weight of ascorbic acid is needed to neutralize a whole weight of sodium hypochlorite (2.5 to 1 ratio).

The neutralizing chemical its self may be in a concentration of something less than 100% in which case proportions would need to be calculated.

Notification: If a large spill occurs, call 911.

Notification to supervisor shall be made as soon as practical. Provide information of size/volume of spill and if contained within facilities containment or if any material has been released offsite.

Clean up:

Wear proper protective clothing/equipment. Do not allow contact with organic materials such as rags, wood fiber, or paper debris, spontaneous combustion (fire) could result.

Sodium Hypochlorite Use Sites

The following is not a procedure for operation and maintenance of sites. It is however an attempt to give a loose description of chemical sites and safety guidance. Any hands on operation, maintenance and repair work involving isolation requires the use of lock out tag out procedures in an effort to reduce the chance of chemical exposure or spill. Personnel Protective Equipment like goggles, face shield, hard hat, gloves, and rain gear should be worn to the degree of possible exposure and risk.

Any on site chlorine generator capable of producing chlorine. Shall have secondary containment in place to reduce exposure and capture chemical spills and aid in clean up.

Any facility where product is transferred from container to container, chemical pump injects product into the source water or mixing batches of chemical have the potential for splatter.

Re-chlorination of storage facilities is sometimes necessary depending on the seasonal temperatures, system demand, tank turn over, and the characteristics of the water source.

Note: this would be the spot to list or explain site specifics for your own water or sewer districts. Such as; listing site names, strength of solutions at the sites, location of storage and brief description of batch mixtures or the system itself.