

Sodium Hypochlorite

Properties & Hazards



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Presentation Overview

- General Information
- Physical & Chemical Properties
- Health Hazards

General Information

Sodium Hypochlorite



Common Uses

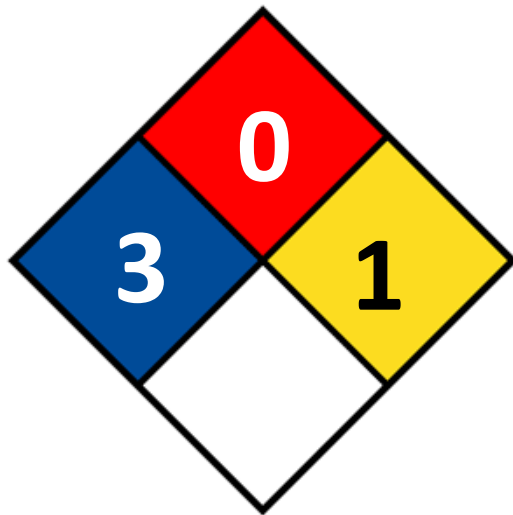
- Disinfection/sanitizing
 - Drinking water and wastewater
 - Cooling towers
 - Swimming pool treatment
 - Restaurants, hospitals and food processing equipment
- Bleaching/disinfection
 - Laundry
- Bleaching
 - Pulp and paper
- Elimination/control
 - Quagga and zebra mussels
 - Mold, fungus and algae

NOTE: Product must be a registered pesticide for some applications.



Sodium Hypochlorite Basics

NFPA Diamond



UN Placard



GHS Pictogram



Additional Information

Solutions are commonly called:

- Hypo
 - Bleach
 - Liquid Bleach
- Acceptable**

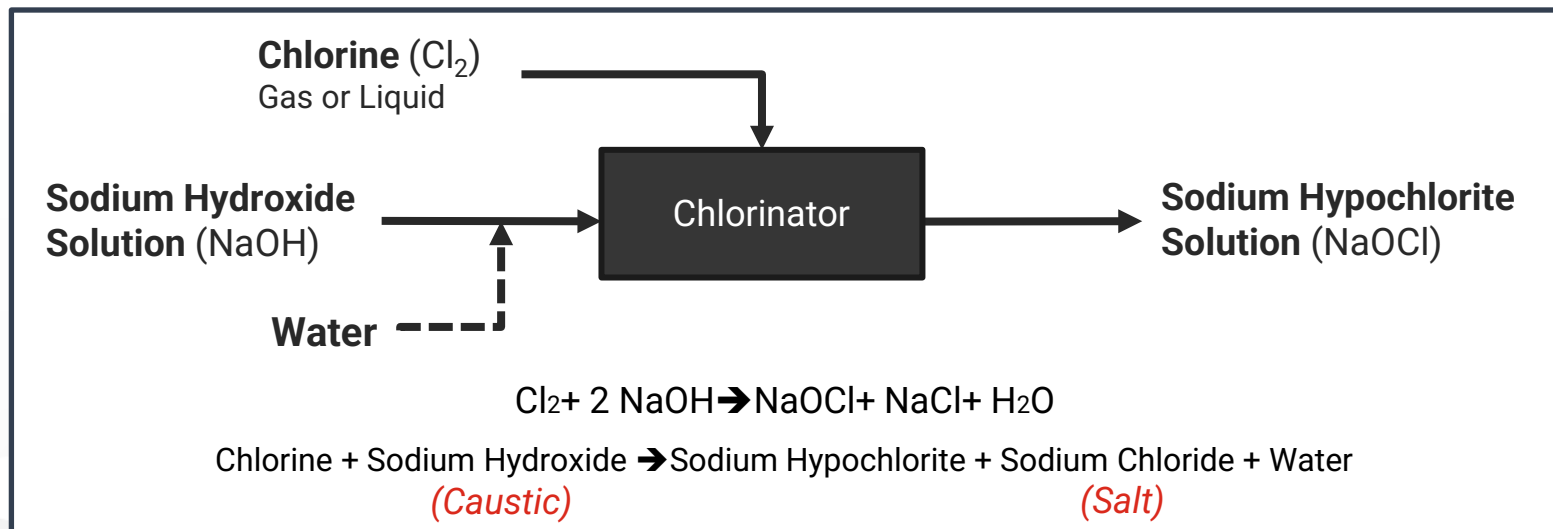
Should NOT be called:

- Chlorine
 - Liquid Chlorine
- 

Using these terms is very confusing to others, especially Emergency Response Personnel

Manufacturing Process

Sodium Hypochlorite (NaOCl) is a solution made from reacting Chlorine with a diluted Sodium Hydroxide (caustic) solution



Physical and Chemical Properties

Sodium Hypochlorite

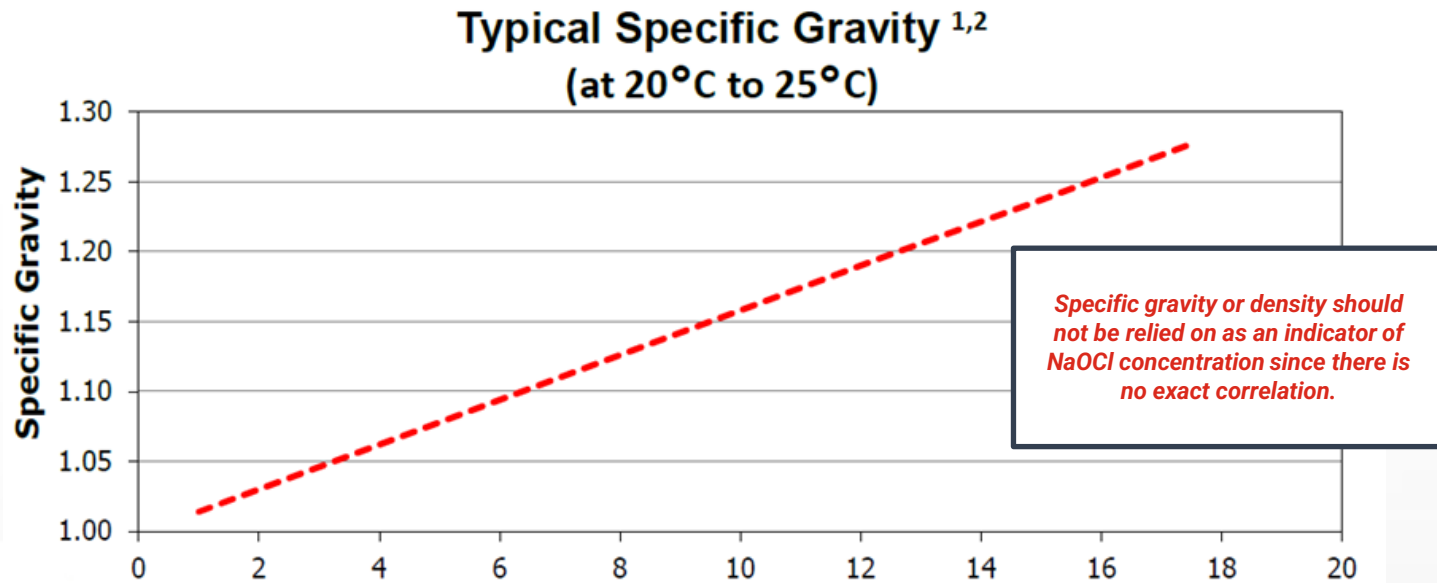


Physical Properties

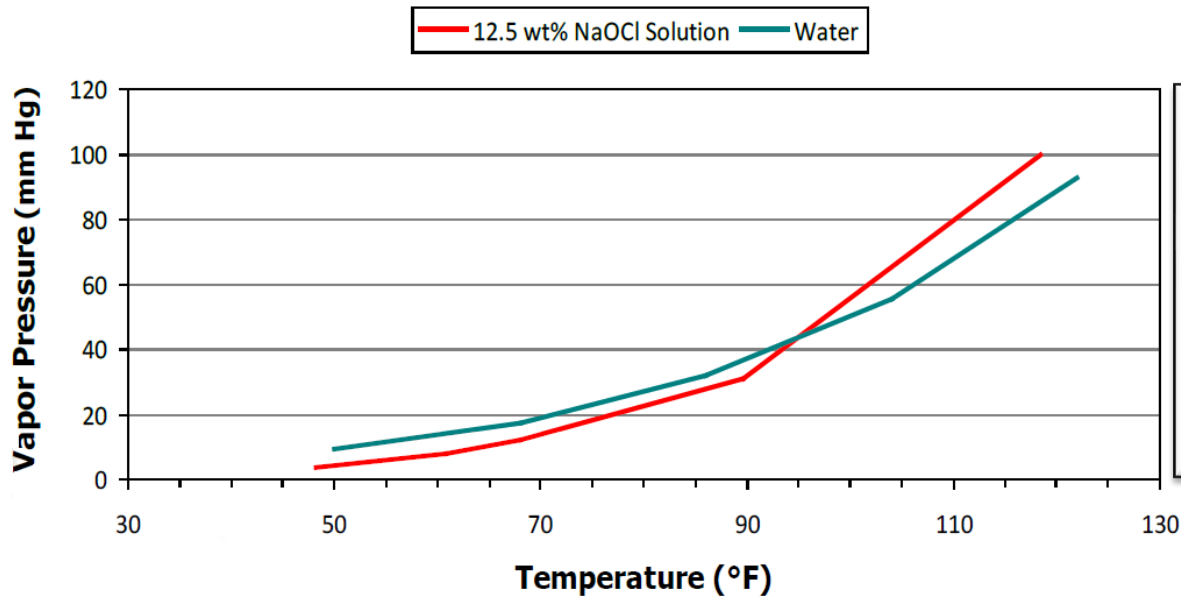
- Yellow-green to pale green liquid
 - Contamination can tint solutions
- “Chlorine” type odor
 - Generally thought to be hypochlorous acid
- Soluble in water
- Stable
- Similar to water (i.e. color, smell, density, physical attributes, etc.) in lower concentrations



Specific Gravity



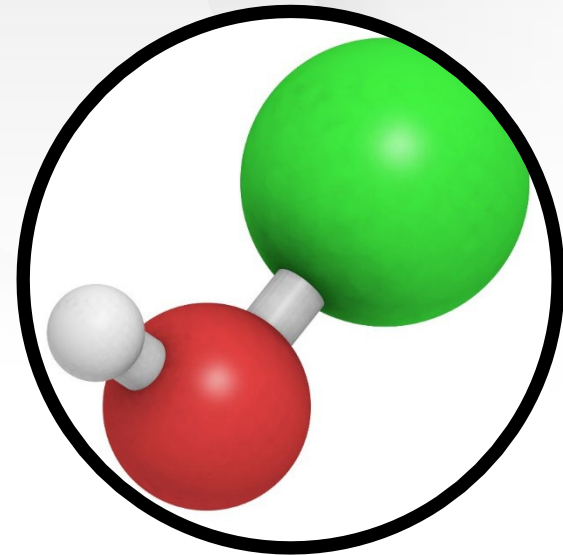
Vapor Pressure



The vapor pressures of Sodium Hypochlorite Solutions is not significantly different than water: above 90°F, there is more potential for «chlorine» odor

Based on data from Pamphlet N° 96, Ed. 4, October 2011, The Chlorine Institute

Chemical Properties



Reactivity

- Oxidizer/Highly Reactive
- Corrosive

Decomposition

- Chemistry
 - Concentration

Stability

- Metals
- Temperature
- Alkalinity/pH Effect

Chemical Properties

Oxidizer/Highly Reactive

Sodium Hypochlorite (NaOCl) is **not** compatible with:

- Oxidizers, acid, reducing agents
- Organic compounds/materials
 - Oils, greases, fuels, solids
 - Rags, wood fibers, paper
- Nitrogen containing compounds
 - May generate chlorinated nitrogen compounds



Chemical Properties

Oxidizer/Highly Reactive

Sodium Hypochlorite (NaOCl) is **not** compatible with:

- Solid or dissolved metals such as copper, nickel or cobalt
- Most metals and their alloys, act as catalyst for the decomposition
- Iron solids if present as iron oxide

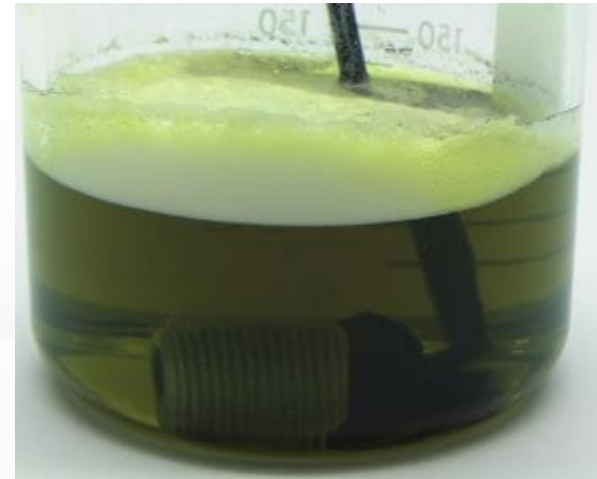


Chemical Properties

Stability

All hypochlorite solutions decompose over time:

- Some dissolved metals will catalyze the decomposition of NaOCl
 - Common metals: Nickel, Copper
 - Iron (when present as an oxide) increases the decomposition rate of NaOCl
- Decomposition of NaOCl solutions caused by trace metals can potentially produce significant quantities of oxygen gas



Chemical Properties

Sodium hypochlorite is an oxidizer and is highly reactive

- Contact with any acid or acidic compound **will** liberate chlorine gas



Chemical Properties

Decomposition

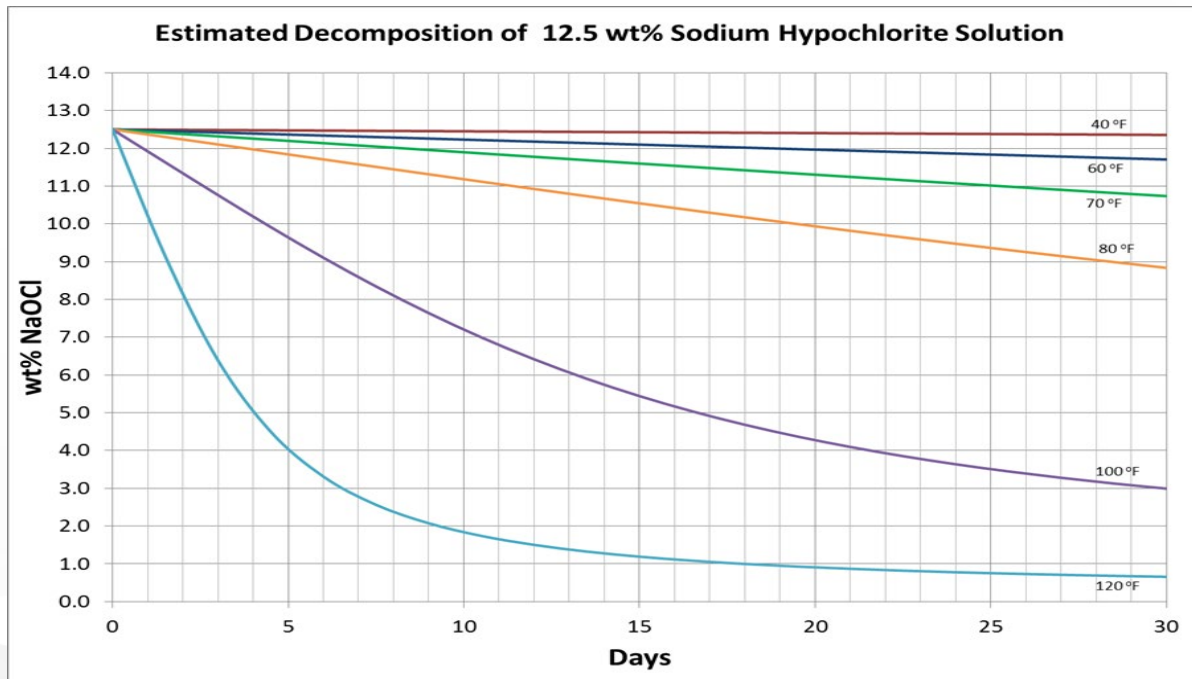
Factors affecting decomposition/stability rates:

- Temperature
- Bleach concentration
- Metals contamination
- U.V. light exposure
- Alkalinity/pH
- Ionic concentration
 - Also called the salt factor



Chemical Properties

Stability - Temperature Effect



The decomposition rate of NaOCl solutions increases by a factor of 2 to 4 for every 18 °F rise in solution temperature

Chemical Properties

Alkalinity/pH Effect:

- Solutions typically require at least **0.1 wt.%** alkalinity (pH >11) as free NaOH to be stable
- Caustic concentrations greater than **0.2 wt.%** do not measurably increase the product stability
- Caustic concentrations of about **5%** or greater can decrease the product stability

Chemical Properties

Decomposition Chemistry

In a Basic Solution (pH > 7) – usually “slow” decomposition

- Salt and Sodium Chlorate are formed as dissolved salts
 - $3 \text{ NaOCl} \longrightarrow 2\text{NaCl} + \text{NaClO}_3$
- Oxygen is formed as a gas and Salt is formed as a dissolved salt (normally, the minor reaction)
 - $2 \text{ NaOCl} \longrightarrow \text{O}_2 + 2 \text{ NaCl}$
- Certain trace metals greatly accelerate this decomposition

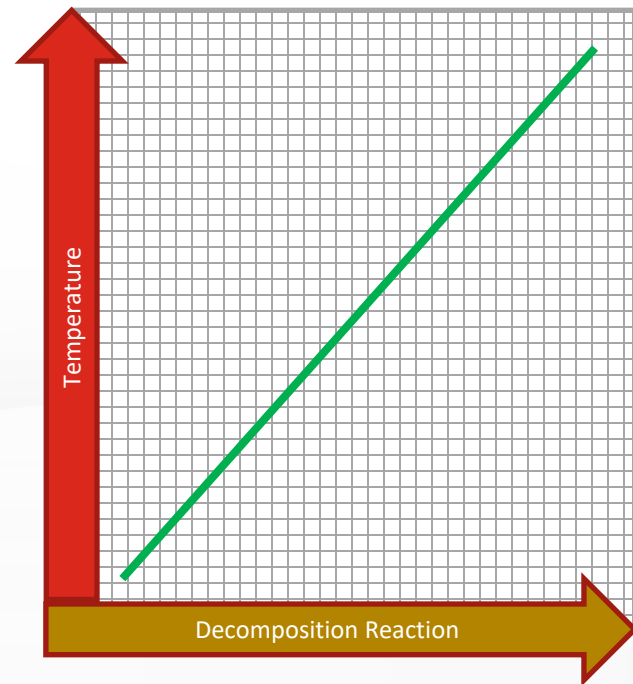
Chemical Properties

Decomposition Chemistry

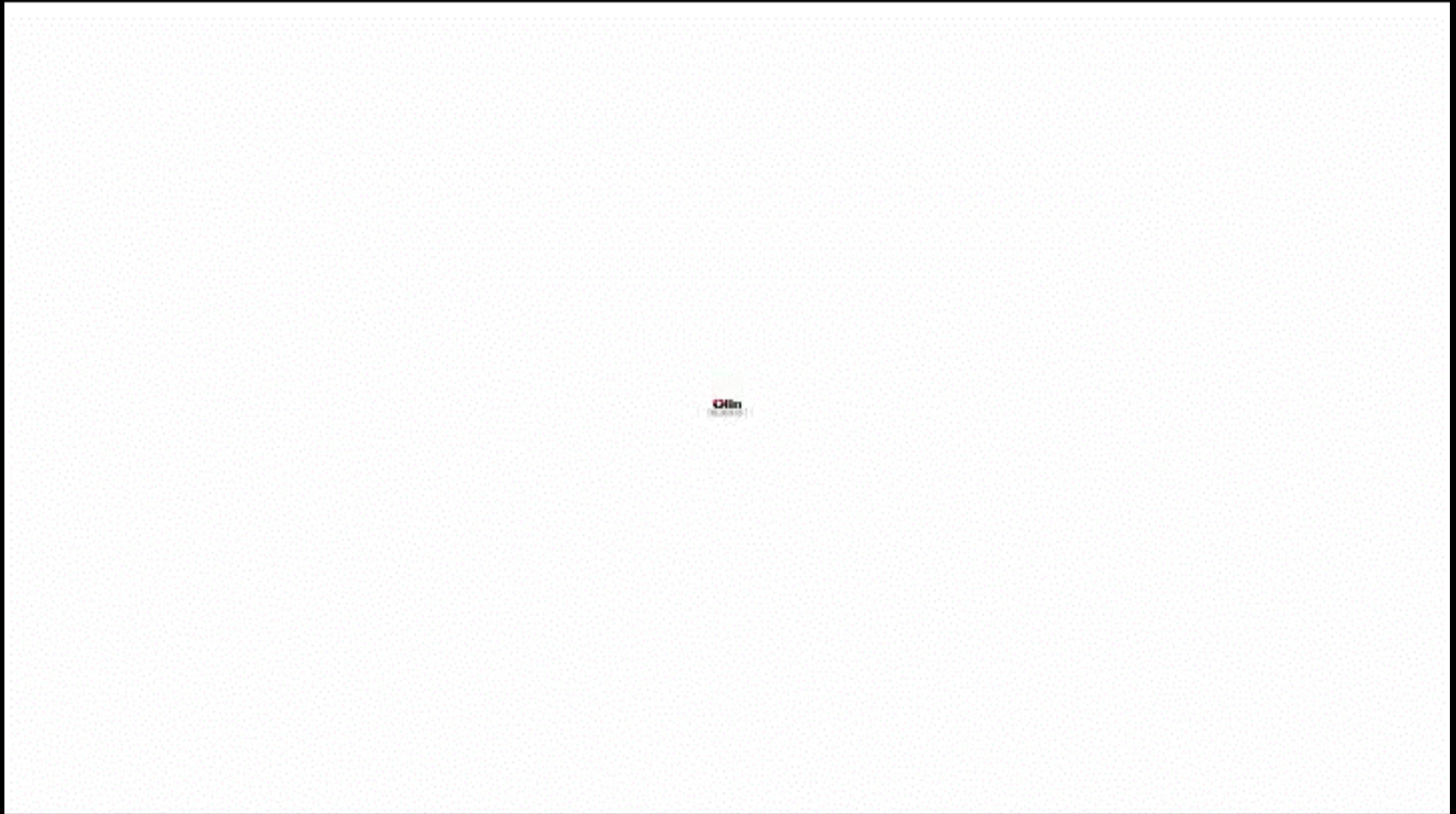
All hypochlorite solutions decompose over time:

- In an acid solution ($\text{pH} < 7$) – much faster decomposition
 - O_2 and **Cl_2 are formed as gases (can be a significant quantity)**
 - NaClO_3 is formed as a dissolved salt

Higher temperatures increase all decomposition reactions



Physical Properties Video



Health Hazards

Sodium Hypochlorite



Health Hazards

- Sodium Hypochlorite (NaOCl) is an aggressive Corrosive Chemical and will attack:
 - Eyes
 - Skin
 - By inhalation
 - By ingestion

Health Hazards

Eye Contact

- Sodium Hypochlorite (NaOCl) can irritate and burn the eyes
- Very corrosive, may cause corneal scarring and clouding
- Risk of blindness

Health Hazards

Recommended treatment for eye exposure

- Wash hands before touching face or eyes
- Flush with running water for at least 15 minutes
- Hold eyelids apart to ensure rinsing of the entire eye surface and lids
- DO NOT attempt to neutralize with chemical agents
- Seek advice for treatment, immediately

Health Hazards

Skin Contact

- Sodium Hypochlorite (NaOCl) is corrosive and can severely irritate the skin or cause burning pain, inflammation and blisters
- Skin damage may not be immediately apparent and may continue to develop over time

Health Hazards

Recommended treatment for skin exposure

- Flush with running water for at least 15 minutes
- Remove contaminated clothing
- DO NOT attempt to neutralize with chemical agents
- Seek advice for treatment, immediately

Health Effects

Inhalation

- Sodium Hypochlorite (NaOCl) can cause severe irritation of the nose, throat and respiratory tract
- Can cause headache and dizziness
- Can irritate the lungs causing coughing, shortness of breath and pulmonary edema

Health Hazards

Recommended treatment for inhalation

- Remove victim from area
- If breathing is difficult, oxygen may be beneficial
- If breathing has stopped, administer artificial respiration
- Seek advice for treatment, immediately



Health Hazards

Ingestion

- Sodium Hypochlorite (NaOCl) is corrosive and can cause chemical burns in the mouth, throat and digestive tract
- Risk of perforation of the esophagus and the stomach lining
- Nausea, vomiting and diarrhea
- Coma and death

Health Hazards

Recommended treatment for ingestion

- DO NOT INDUCE VOMITING
- Rinse mouth
- Give large amounts of water
- If vomiting occurs spontaneously, keep airway clear
- If person is unconscious, do not administer anything by mouth
- Seek advice for treatment, immediately

Key Points to Remember

- Sodium Hypochlorite should never be referred to as Chlorine
- Avoid contact with acids/oxidizers
- The density of sodium hypochlorite is not an accurate means to gauge strength
- Hypochlorite will decompose over time
- Avoiding contact with metals

Questions?

Sodium Hypochlorite



Useful References

- Pamphlet Nº 65
 - Personal Protective Equipment for Chlor-Alkali Chemicals,
- Pamphlet Nº 96
 - Sodium Hypochlorite Manual
- The Chlorine Institute, DVD
 - Handling Sodium Hypochlorite Safely
- Bulletin
 - Sodium Hypochlorite Incompatibility Chart

