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Caustic soda (NaOH) safe storage and handling

Scope

The current TIP provides basic information for personnel to unload and store bulk concentrated caustic soda safely. It is vitally important that any new bulk concentrated caustic soda facility design be undertaken with the advice from a producer of bulk concentrated caustic soda in order to cover all of the unique design parameters for bulk concentrated caustic soda. Users of caustic soda are urged to comply with these standards and to periodically review their practices to ensure that they remain in compliance. It is imperative that personnel working with or around caustic soda be familiar with the Material Safety Data Sheet (MSDS) and fully understand the hazards associated with this chemical.

Definition

Tank trucks, tank railcars, and barges deliver caustic soda as a 50% solution in water. Its primary uses are for controlling alkalinity of the process, for recovery process make up, and to solubilize organic material in the bleach plant.

Properties of Caustic Soda

Properties	
Chemical name	Sodium hydroxide solution (50%)
Common name or synonym	Caustic, Caustic Soda, lye, Caustic Lye, Alkali
Formula	NaOH
Molecular weight	40
Physical state 50% NaOH solution @ 20°C	Liquid (viscous)
Color	Clear colorless
Odor	Odorless (None)
Boiling point	130-140°C (266-284 °F)
Freezing point	10-12°C (50-54 °F)
Vapor pressure	1.5 mm Hg, 0.2 kPa @ 20°C
Specific Gravity @ 20°C	1.52 g/mL

NOTE 1: All comments contained in this document refer to 50% caustic soda, the general product of commerce. Safety and handling information is similar for other concentration, but the users should obtain particular information for the specific concentrations handled in their facilities.

Caustic soda reacts readily with many organic compounds, metals and animal tissue. Contact with water, acids, flammable liquids, and organic halogen compounds, especially trichloroethylene, may cause fires and explosions. Contact with metals such as aluminum, tin, and zinc and alloys containing these metals causes formation of flammable hydrogen gas. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Sodium hydroxide, even in fairly dilute solution, reacts readily with various sugars to produce carbon monoxide. Caustic soda absorbs carbon dioxide from the atmosphere forming sodium carbonate (soda ash). Caustic

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soda reacts violently with all acids and forms flammable hydrogen (H₂) with aluminum, tin, zinc, and many brass and bronze alloys. Caustic soda can react violently with water if not properly added and mixed (see below).

Safety precautions

Hazards and personnel protection

The U.S. Department of Transportation (DOT) defines caustic soda as a corrosive liquid, UN1824.

CAS registry number is 1310-73-2.

NEPA Rating: Health - 3; Flammability - 0; Reactivity - 1

HMIS Rating: Health - 3; Flammability - 0; Reactivity - 1

Health hazards

Being virtually colorless and odorless, it has no built in warning signs.

Caustic soda reacts rapidly and irreversibly with human tissue, causing severe irritation and/or chemical burns.

Eye exposure: Caustic soda exposure to the eye is extremely serious. It causes severe irritation and/or burns and immediate pain. Direct contact may cause impairment of vision and corneal damage. Immediate first aid is necessary to prevent permanent impairment of vision, up to and including blindness. This is the most serious danger to persons working with caustic soda. Contact lenses should not be worn when working with this material.

Skin exposure: A single, short exposure of caustic soda to the skin can result in severe irritation and/or burns. Dermal exposure is characterized by redness, swelling, and scab formation.

Inhalation: Inhalation of caustic soda mists, or dust from solid (100%) caustic soda products, can cause severe irritation to the upper respiratory tract (nose, mouth, throat, and lungs). Effects from inhalation of the dusts, mists, or spray will vary from mild irritation to destructive burns depending on the severity of exposure. Symptoms may include sneezing, sore throat, runny nose, shortness of breath, wheezing, choking, or chest pain. Severe pneumonitis may occur.

Ingestion: May cause stomach irritation or ulceration and severe burns to the mouth and throat.

Systemic effects: None known.

Protective equipment

Eye protection: Protecting the eyes from exposure to caustic soda is vital. Anyone working with or around caustic soda should wear close-fitting, fully enclosed chemical workers' mono goggles at all times.

Skin protection: Clothing impervious to caustic soda should be worn when working with caustic soda. These include hard hats, plastic face shields, Neoprene boots, Neoprene gloves, Neoprene apron or Neoprene slicker suit depending on the operation and the potential for caustic soda exposure. Pants, cuffs and coat sleeves should be worn outside of boots and gloves.

Respiratory protection: A NIOSH approved dust/mist respirator (NIOSH N95 filter respirator, or better) must be employed if caustic soda mists or dusts are present. Use local exhaust ventilation to maintain levels to below the TLV.