OEHHA

Sodium Hydroxide

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

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Recognizing "NaOH"

Appearance: Sodium hydroxide (NaOH) is found as solid white granules, chips, or pellets. Solid forms rapidly absorb water vapor from the air. This process generates heat and results in the formation of concentrated solutions of NaOH. Concentrated solutions of NaOH in water are clear in color.

Odor & Odor Threshold: Not applicable. NaOH is not volatile and is odorless at room temperature.

Odor Safety Class: NaOH is odorless. **Note:** Odor provides no warning of hazard. Irritation of the nose and throat provides an indication of exposure to a concentration of dust, or fumes if heated, that is sufficient to produce initial symptoms of toxicity.

Containers & Packaging

Commercial: NaOH is one of several alkaline materials referred to as "lye". It is also packaged as caustic soda or soda lye. Commercial products in solid form include Red Devil® Lye and Drano® drain opener (Figure 1, A & B), while liquids include Easy Off® oven cleaner and Liquid-Plummer® drain opener. Concentrated solutions of sodium hydroxide in water are available from commercial chemical supply companies.

Pharmaceutical: There are no pharmaceutical uses of sodium hydroxide.

Figure 1: Commercial drain openers such as Red Devil® Lye **[A]** and Drano® **[B]** contain sodium hydroxide which can be used in the illegal synthesis of methamphetamine. *Photographers, Charles Salocks and Caron Poole.*

Role in Drug Synthesis

Sodium hydroxide is used to make sodium, an alkali metal that functions as a catalyst in the anhydrous ammonia/ alkali metal ("Nazi") method. NaOH is also used in a number of synthesis methods to raise the pH of methamphetamine reaction solutions.

Health Hazards

General: NaOH is highly corrosive. It is a powerful irritant by all routes of exposure. Low level exposure causes irritation, burning, and inflammation of the skin, eyes, nose, throat, windpipe and lungs. Higher level exposure causes severe burns resulting in permanent damage to all tissue it contacts. The mechanism of damage is two-fold: 1) thermal burns result from heat generated when NaOH combines with moisture in the body, and 2) chemical burns result from reaction with organic molecules. NaOH produces damage on contact, often very quickly; but, it does not go on to cause systemic toxicity, i.e., damage other places in the body.

Inhalation Exposure: Acute, high concentration exposures cause severe burns, swelling of the voice-box, lung edema (accumulation of fluid), and irreversible obstructive pulmonary disease. Long-term lower level exposure can result in chest pains, shortness of breath, ulceration of the nasal passages, persistent hoarseness, and reactive airway dysfunction syndrome (RADS), a chemical-induced asthma.

Skin Exposure: Concentrated NaOH causes deep, serious, painful, soft, and moist burns. Dilute solutions may not produce pain initially but can result in serious burns if allowed to remain on the skin. Chronic effects include dermatitis.

Eye Contact: Tissue damage, inflammation, and opacification of the cornea may occur. Cataracts, glaucoma, adhesion of the lid to the eye, eye loss, and blindness may result. Damage may progress for 72 hours or more following exposure.

Ingestion: Severe injury to the mouth, esophagus, and stomach may result. Symptoms of injury include vomiting, drooling, pain, rapid and feeble pulse, collapse, and shock.

Clandestine Labs/ "Meth": Sodium Hydroxide

Environmental Concerns

General: As a contaminant in surface water, NaOH would be expected to raise the pH. NaOH is highly reactive and is rapidly neutralized by organic chemicals in soil. For this reason, it is not expected to significantly contaminate ground water or soil. Sodium hydroxide in air is subject to wet deposition (washout by rainfall) and dry deposition. NaOH readily combines with water vapor. The resulting aerosol or mist is corrosive.

Indoors: Sodium hydroxide may be found as a solid or a concentrated liquid on indoor surfaces. Solid forms may slowly "melt" by absorbing water vapor from air, forming a highly concentrated solution. If contamination occurs, NaOH would be expected to persist. The persistence of solid or liquid residues will depend on the nature of the surface and to what degree it is porous. Skin contact and ingestion resulting from hand-to-mouth activity could occur. Clean-up standards for NaOH on surfaces have not been established.

Handling & Safety

Chemical Hazards

Reactivity: Mixed with water, solid forms and concentrated solutions (>40%) of NaOH may generate enough heat to ignite combustible materials. NaOH reacts with all mineral and organic acids, forming the corresponding salts. The heat generated may be sufficient to raise the temperature of liquids above the boiling point. This could result in sporadic, dangerous "bumping" of solutions. NaOH reacts with metals, such as aluminum, tin, and zinc generating flammable hydrogen gas.

Flammability: Sodium hydroxide is noncombustible. However, if solid NaOH is mixed with water or acid it may generate enough heat to ignite combustible materials.

Chemical Incompatibilities: Sodium hydroxide is corrosive to most metals. Sodium hydroxide is incompatible with acids, halogenated organic compounds, and nitromethane. Mixing NaOH with acid may generate substantial heat. Reaction with trichloroethylene (TCE) spontaneously forms dichloroacetylene, which is flammable. Reaction with metals, such as aluminum, tin, and zinc generates flammable hydrogen gas.

First Aid

Inhalation Exposure: Move to fresh air. If victim has difficulty breathing, give oxygen. If not breathing, give artificial respiration. Keep victim in a half upright position. Get medical attention immediately.

Contact with Clothing or Skin (Dermal Exposure): Rapid decontamination is critical. Remove contaminated clothing and shoes. Flush exposed skin and hair with water for 15 minutes or more. Get medical attention.

Contact with Eyes: Flush eyes with water for at least 15 minutes. Get medical attention immediately.

Ingestion (Oral) Exposure: Do not induce vomiting. If victim is conscious, give 4-8 ounces water or milk. Do not administer activated charcoal or attempt to neutralize. Seek immediate medical attention.

Special Concerns for Children: Stomach acid in children may not be not strong enough or present in great enough amounts to neutralize even small amounts of NaOH. Therefore, toxic effects in children may be greater. The behavior patterns of children may also result in more frequent contact with contaminated surfaces.

Exposure Limits

Occupational Exposure Limits (NIOSH, OSHA, & ACGIH)
Ceiling Limit (C): 2 mg/m^3
Short-Term Exposure Limit (STEL): not established
8-Hr Time Weighted Average (TWA): 2 mg/m^3
10-Hr Time Weighted Average (TWA): not established
Immediately Dangerous (IDLH): 10 mg/m^3

Preliminary Remediation Goals (PRGs)
(U.S. EPA, Reg. 9): Air, Soil, & Water: not established

More Information

Office of Environmental Health Hazard Assessment (OEHHA)
www.OEHHA.CA.Gov

Department of Toxic Substances Control (DTSC)
www.DTSC.CA.Gov

Authors: Karlyn Black Kaley, PhD, DABT & Charles Salocks, PhD, DABT • Graphic Design: Karlyn Black Kaley, PhD, DABT