

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND  
SUPPORTING DOCUMENTATION FOR

\*\*\* SODIUM HYDROXIDE \*\*\*

NIOSH/OSHA Draft Technical Standard  
and Supporting Documentation for SODIUM HYDROXIDE

The basic text of this document contains the draft technical standard approved by the Joint Review Committee of the NIOSH/OSHA Standards Completion Program and the supporting documentation for the substance SODIUM HYDROXIDE.

The SCP draft technical standards are recommendations to the Department of Labor for its consideration in rulemaking and have no legal status until final rules have been promulgated by that agency. This draft standard is provided for your information only.

The References and Sources, Respirator Table Documentation and Use/Exposure and Control Documentation are the working documents used by the various SCP working groups during the development of the draft technical standard and serve as the technical foundation for the standard. The classification for each substance and the regulatory statements were derived following a decision logic established for the various sections of the standard.

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(a) Definitions. (1) "Permissible exposure" means exposure of employees to airborne concentrations of sodium hydroxide not in excess of 2. milligrams per cubic meter (mg/M3) averaged over an eight-hour work shift (time weighted average), as stated in § 1910.1000, Table Z-1.

(2) "Action level" means one-half of the permissible exposure for sodium hydroxide averaged over an eight-hour work shift.

(b) Initial determination and exposure measurement. (1) Each employer who has a place of employment in which sodium hydroxide is released into the workplace air shall determine if there is any possibility that any employee may be exposed to airborne concentrations of sodium hydroxide above the permissible level. The initial determination shall be made each time there is a change in production, process, or control measures which may result in an increase in airborne concentrations of sodium hydroxide.

(2) A written record of the initial determination shall be made and shall contain at least the following information:

(i) Any information, observations, or calculations which may indicate employee exposure to sodium hydroxide;

(ii) Any measurements of sodium hydroxide taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to sodium hydroxide; and

(iv) Date of initial determination, work being performed at the time, location within work site, and employees considered.

(3) If the employer determines that any employee may be exposed to sodium hydroxide above the permissible exposure, the exposure of the employee in each work operation who is believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum eight-hour time weighted average exposure of the employee.

(4) If the exposure measurement taken pursuant to paragraph (b) (3) of this section reveals employee exposure to sodium hydroxide above the action level, the employer shall:

(i) Identify all employees who may be exposed above the permissible level; and

(ii) Measure the exposure of the employees so identified.

(5) If an employee exposure measurement reveals that an employee is exposed to sodium hydroxide above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every three months.

(6) If an employee exposure measurement reveals that an employee is exposed to sodium hydroxide above the permissible exposure, the employer shall:

(i) Measure the exposure monthly of the employee so exposed; and

(ii) Institute control measures as required by paragraph (d) of this section; and

(iii) Individually notify, in writing, within five days, every employee who is found to be exposed to sodium hydroxide above the permissible exposure. The employee shall also be notified of the results of the exposure measurements and of the corrective action being taken to reduce the exposure to below the permissible exposure.

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to sodium hydroxide below the action level, the employer may terminate measurement for the employee.

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(8) For purposes of this paragraph, employee exposure is that which would occur if the employee were not using a respirator.

(c) Methods of measurement. (1) An employee's exposure shall be obtained by any combination of long term or short term samples which represents the employee's actual exposure averaged over an eight-hour work shift (See Appendix B (IV) of this section).

(2) The method of measurement shall have an accuracy, to a confidence level of 95 percent, of not less than that given in Table 1.

Table 1

| Concentration                                                  | Required Accuracy<br>(Percent of True Value) |
|----------------------------------------------------------------|----------------------------------------------|
| Above permissible exposure                                     | $\pm 25$                                     |
| At or below permissible exposure<br>and above the action level | $\pm 35$                                     |

At or below the action level  $\pm 50$

(d) Compliance. (1) No employee shall be exposed to sodium hydroxide above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of sodium hydroxide shall be controlled to at or below the permissible exposure by engineering and work practice controls.

(i) Engineering and work practice controls shall be instituted to reduce exposures to at or below the permissible exposure, except to the extent that such controls are not feasible.

(ii) Wherever engineering and work practice controls are not sufficient to reduce exposures to at or below the permissible exposure, they shall nonetheless be used to reduce exposure to the lowest level feasible and shall be supplemented by respirators in accordance with paragraph (d)(4) of this section.

(3) Engineering controls. (i) When local exhaust is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity or static pressure shall be made at least every three months. Measurements of system effectiveness shall also be made within five days of any change in production, process, or control which might result in an increase in airborne concentrations of sodium hydroxide.

(ii) Open-surface tank operations shall be performed in accordance with § 1910.94(d).

(4) Compliance with the permissible exposure shall not be achieved by the use of respirators except:

(i) During the time period necessary to install or implement engineering or work practice controls; or

(ii) In work situations in which engineering and work practice controls are not feasible; or

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- (iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of sodium hydroxide to at or below the permissible exposure; or
  - (iv) For operations which require entry into tanks or closed vessels; or
  - (v) In emergencies.
- (5) Where respirators are needed and permitted under this paragraph to reduce employee exposure, the employer shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.

TABLE 2     RESPIRATORY PROTECTION FOR SODIUM HYDROXIDE

| CONDITION                                                              | PERMISSIBLE RESPIRATORY PROTECTION*                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -----                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Particulate Concentration                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 100 mg/M3 or less                                                      | <p>A high efficiency particulate filter respirator with a full facepiece.</p> <p>-----</p> <p>Any supplied-air respirator with a full facepiece, helmet or hood.</p> <p>-----</p> <p>Any self-contained breathing apparatus with a full facepiece.</p> <p>-----</p>                                                                                                                                                                                          |
| 250 mg/M3 or less                                                      | <p>A powered air-purifying respirator with a full facepiece, helmet or hood and a high efficiency particulate filter.</p> <p>-----</p> <p>A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet or hood operated in continuous-flow mode.</p> <p>-----</p>                                                                                                     |
| Greater than 250 mg/M3 or entry and escape from unknown concentrations | <p>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</p> <p>-----</p> <p>A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.</p> <p>-----</p> |
| Fire Fighting                                                          | <p>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</p> <p>-----</p>                                                                                                                                                                                                                                                                                                                    |
| Escape                                                                 | <p>Any dust and mist respirator with full facepiece except single-use.</p> <p>-----</p> <p>Any escape self-contained breathing apparatus with full</p>                                                                                                                                                                                                                                                                                                       |

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facepiece.

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\* Use of supplied-air suits may be necessary to prevent skin contact and respiratory exposure from airborne concentrations of sodium hydroxide. Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitation and potential life endangering characteristics of supplied-air suits. Where supplied-air suits are used above a concentration which may be immediately dangerous to life and health (250 mg/M3), an auxiliary positive-pressure self-contained breathing apparatus must also be worn.

(6) Respirators shall be approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) or by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(7) The employer shall institute a respiratory protection program in accordance with § 1910.134(b), (d), (e), and (f).

(e) Fire and safety. (1) The employer shall familiarize himself with the information contained in the Substance Technical Guidelines (Appendix B of this section) for sodium hydroxide.

(2) Sodium hydroxide shall be stored so as not to come in contact with water, acids, organic halogen compounds, flammable liquids, nitromethane and chemically active metals such as aluminum, tin and zinc.

(3) Dip tank operations shall be performed in accordance with § 1910.94(d).

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use appropriate protective clothing and equipment necessary to prevent any possibility of skin contact with sodium hydroxide or solutions of sodium hydroxide. Face shields shall comply with § 1910.133 (a)(2), (a)(4), (a)(5), and (a)(6).

(2) Employers shall ensure that employees whose clothing may have become contaminated with solid sodium hydroxide change into uncontaminated clothing before leaving the work premises.

(3) Employers shall ensure that clothing contaminated with sodium hydroxide is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of sodium hydroxide from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the sodium hydroxide, the employer shall inform the person performing the operation of the hazardous properties of sodium hydroxide.

(4) Where there is any possibility of exposure of an employee's body to sodium hydroxide or solutions of sodium hydroxide, employers shall provide facilities for quick drenching of the body within the immediate work area for emergency use.

(5) Employers shall ensure that non-impervious clothing which becomes contaminated with sodium hydroxide be removed immediately and not reworn until the sodium hydroxide is removed from the clothing.

(6) Employers shall provide and ensure that employees use safety goggles which comply with § 1910.133 (a)(2)-(a)(6) where there is any possibility of sodium hydroxide or solutions of sodium hydroxide contacting the eyes.

(7) Where there is any possibility that an employee's eyes may be exposed to sodium hydroxide or solutions of sodium hydroxide, employers

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shall provide an eye-wash fountain within the immediate work area for emergency use.

(g) Spills and disposal. In the event that sodium hydroxide is spilled the employer shall immediately clean up the spill.

(h) Sanitation. (1) Employers shall ensure that employees whose skin becomes contaminated with sodium hydroxide immediately wash or shower to remove any sodium hydroxide from the skin.

(2) Employers shall ensure that employees do not eat or smoke in areas where sodium hydroxide or solutions containing sodium hydroxide are stored.

(i) Training and information. (1) Each employer who has a workplace in which sodium hydroxide is present shall keep a copy of this regulation with Appendixes A, B and C at the workplace. This material shall be made readily available to affected employees.

(2) Each employer who has employees exposed to sodium hydroxide above the action level without regard to the use of respirators, or employees who may have any possibility of skin or eye contact with sodium hydroxide or solutions containing sodium hydroxide, or employees who work where a potentially hazardous spill of sodium hydroxide may occur shall annually:

(i) Inform affected employees of the information contained in the Substance Safety Data Sheet for sodium hydroxide (Appendix A of this section);

(ii) Advise affected employees as to the signs and symptoms of exposure to sodium hydroxide.

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of overexposure to sodium hydroxide which are listed in Appendix A of the section; and

(iv) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to sodium hydroxide.

(j) Medical surveillance. (1) The employer shall provide medical procedures as required by this paragraph. All medical procedures shall be performed by or under the supervision of a physician at no cost to the employee.

(2) Preplacement medical examination. The employer shall make available to each employee who is exposed, or will be exposed, to airborne concentrations of sodium hydroxide above the action level, without regard to the use of respirators, or employees who may have any possibility of skin or eye contact with sodium hydroxide or solutions containing sodium hydroxide, a preplacement medical examination which must include the following:

(i) A medical history and physical examination with emphasis on the eyes, lungs, esophagus and skin;

(ii) Forced vital capacity (FVC) and forced expiratory volume-one second (FEV (1 second)) tests;

(iii) 14" x 17" chest roentgenogram.

(3) Periodic medical examination. The employer shall make available to each employee exposed to airborne concentrations of sodium hydroxide above the action level, without regard to the use of respirators, or employees who may have any possibility of skin or eye contact with sodium hydroxide or solutions containing sodium hydroxide, twelve months from the date of the employee's first exposure, and every twelve months thereafter, a periodic medical examination which must include the following:

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(i) A medical history and physical examination with emphasis on the eyes, lungs, esophagus and skin;

(ii) Forced vital capacity (FVC) and forced expiratory volume-one second (FEV (1 second)) tests;

(iii) A 14" x 17" chest roentgenogram, if pulmonary function tests show significant abnormalities.

(4) Alternative medical procedures. If the examining physician chooses to use alternative medical procedures to those specified in paragraphs (j)(2) and (j)(3) of this section, the employer may accept such alternative medical procedures as meeting the requirements of this section provided that the employer:

(i) Obtains a statement from the examining physician setting forth the alternative medical procedures, the rationale for substitution, and evidence that they will be equally effective;

(ii) Informs each exposed worker of the fact that alternative medical procedures to those required in paragraphs (j)(2) and (j)(3) of this section are to be made available.

(5) Interim medical examination. The employer shall provide an interim medical examination for the employee if the employee informs the employer of any of the signs or symptoms of exposure to sodium hydroxide which are listed in Appendix A which the employee suspects are caused by exposure to sodium hydroxide.

(6) Informing the physician. The employer shall provide to the physician performing any medical examination required by this section the following information:

(i) A copy of this regulation with Appendixes A, B, and C for sodium hydroxide;

(ii) A description of the affected employee's duties as they relate to his exposure to sodium hydroxide;

(iii) A description of any personal protective equipment and respirators required to be used;

(iv) The results of any measurements which may indicate the affected employee's exposure;

(v) The affected employee's anticipated exposure level; and

(vi) Upon request of the physician, any available information from previous medical examinations of the affected employee.

(7) Where a medical examination is required by paragraphs (j)(2), (j)(3), or (j)(5) of this section, following such examination the employer shall obtain from the examining physician a written opinion which conforms with paragraph (j)(8) of this section.

(8) Physician's written opinion. (i) The physician's written opinion by the examining physician shall specifically state:

(A) Whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of the employee's health from exposure to sodium hydroxide;

(B) Any recommended limitations upon the employee's exposure to sodium hydroxide, including limitations upon the use of personal protective equipment and respirators;

(C) That the employee has been informed by the physician of any detected medical conditions which require further medical examination or treatment.

(ii) The physician's written opinion shall not reveal specific medical findings or diagnoses unrelated to the employee's employment.

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(iii) The employer shall provide the employee with a copy of the physician's written opinion.

(9) Results of tests. Where a preplacement or periodic medical examination is required by paragraphs (j)(2) or (j)(3) of this section, following such examination the employer shall obtain from the examining physician for inclusion in the employee's medical record:

(i) A recording of the results of the pulmonary function tests;

(ii) The 14" x 17" chest roentgenogram when required, or a medically acceptable copy;

(iii) Where alternative medical procedures have been performed in accordance with paragraph (j)(4) of this section, a recording of such alternative procedures.

(10) No employee shall be exposed to sodium hydroxide in such a way as would put the employee at increased risk of material impairment of his health from such exposure. The employer shall base this decision on any information available including the physician's written opinion.

(11) No medical procedure which would be performed pursuant to paragraphs (j)(2) or (j)(3) of this section need be performed if records of a previous such procedure performed within the past six months are acceptable to the examining physician.

(12) If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and obtain a signed statement from the employee indicating that the employee understands the risk involved by refusal to be examined.

(13) The employer shall provide emergency medical treatment for any employee injured through exposure to sodium hydroxide.

(k) Recordkeeping. (1) Exposure determination. (i) The employer shall keep an accurate record of all determinations required to be made pursuant to paragraph (b)(1) of this section.

(ii) This record shall include the written determination required in paragraph (b)(2) of this section.

(iii) This record shall be maintained until replaced by a more recent record.

(2) Exposure measurements. (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to sodium hydroxide.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to sodium hydroxide which are being monitored;

(C) Sampling and analytical method used and evidence of their accuracy;

(D) Number, duration, and results of samples taken; and

(E) Name, social security number and exposure of the employee monitored.

(iii) This record shall be maintained until replaced by a more recent record but in no event for less than one year.

(3) Mechanical ventilation. (i) When mechanical ventilation is used as an engineering control, the employer shall maintain an accurate record of the measurements demonstrating the effectiveness of such ventilation required by paragraph (d)(3) of this section.

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

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(C) Result of measurement.

(iii) These records shall be maintained for at least one year.

(4) Employee training and information. (i) The employer shall keep an accurate record of all employee training and information required by paragraph (i) of this section.

(ii) This record shall include:

(A) Date of training;

(B) Name and social security number of employee trained;

(C) Content or scope of training provided.

(iii) This record shall be maintained until replaced by a more recent record.

(5) Medical surveillance. (i) The employer shall keep an accurate record of employee medical surveillance required by paragraph (j) of this section.

(ii) This record shall include:

(A) The name and social security number of the employee;

(B) Results of tests required by paragraph (j)(2) and (j)(3) of this section and results of any tests conducted pursuant to paragraphs (j)(4) of this section;

(C) Any employee medical complaints relative to exposure to sodium hydroxide;

(D) A copy of information provided to the physician pursuant to paragraph (j)(6)(ii), (iii), (iv), (v), and (vi) of this section.

(E) Physician's written opinion; and

(F) A signed statement of any refusal to be examined.

(iii) This record shall be maintained for the duration of and for thirty years after termination of the employment of the affected employee.

(6) Access to records. (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.

(ii) Each employee or former employee shall have access to the exposure determination and exposure measurement records required to be maintained by this section which indicate his own exposure to sodium hydroxide.

(iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.

(1) Employee observation of measurement. (1) The employer shall give each employee or his representative an opportunity to observe any measurement of his exposure to sodium hydroxide which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to sodium hydroxide requires entry into an area where the use of personal protective devices, including respirators, is required, the observer shall be provided with and required to use such equipment and comply with all other applicable safety procedures.

(3) Without interfering with the measurement, observers shall be entitled to:

(i) Receive an explanation of the measurement procedure.

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- (ii) Visually observe all steps related to the measurement of the airborne concentration of sodium hydroxide that are being performed at the place of exposure; and
- (iii) Record the results obtained.

NOTE: The information contained in the following appendix for sodium hydroxide is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligations. To the extent the information supplements this regulation for sodium hydroxide, it is advisory in nature.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET  
FOR SODIUM HYDROXIDE

- I. SUBSTANCE IDENTIFICATION
  - A. Substance: Sodium hydroxide
  - B. Permissible Exposure: 2 milligrams of sodium hydroxide per cubic meter of air (mg/M3) averaged over an eight-hour work shift.
  - C. Appearance and Odor: Colorless, odorless solid
- II. HEALTH HAZARD DATA
  - A. Ways in which the chemical affects your body: Sodium hydroxide can affect your body if you inhale it or if it comes in contact with your eyes or skin. It may also affect your body if you swallow it.
  - B. Effects of Overexposure:
    - 1. Sodium hydroxide is a strong alkali and is corrosive to any tissue with which it comes in contact. Effects from inhalation of the dusts and mists will vary from mild irritation to destructive burns depending on the severity of exposure. Severe pneumonitis may occur. Sodium hydroxide as a solid or in dusts, mists or solutions may cause irritation of the eyes and, with greater exposure, severe burns with possible blindness. Contact of the skin with sodium hydroxide as a solid or in dusts, mists or solutions may cause skin irritation and, with greater exposure, severe burns with scarring. Swallowing solid sodium hydroxide or solutions of sodium hydroxide may cause severe burns of the mouth, throat and stomach. Death may result. Severe scarring of the throat may occur on recovery after swallowing sodium hydroxide. An increased number of esophageal cancer cases have been reported to occur in individuals who

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have scarring of the esophagus from swallowing sodium hydroxide.

2. Reporting Symptoms: You should inform your employer if you develop any signs or symptoms and suspect that they are caused by exposure to sodium hydroxide.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If sodium hydroxide, as a solid or in dusts, mists or solutions, gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If sodium hydroxide, as a solid or in dusts, mists or solutions, gets on your skin, immediately flush the contaminated skin with water. If sodium hydroxide, as a solid or in dusts, mists or solutions, penetrates your clothing, remove the clothing immediately and flush the skin with water. Get medical attention immediately.
- C. Breathing: If you or any other person breathes in large amounts of sodium hydroxide move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.
- D. Swallowing: When solutions of sodium hydroxide have been swallowed and the person is conscious, give the person large quantities of water immediately to dilute the sodium hydroxide. Do not make the exposed person vomit. Get medical attention immediately.
- E. Rescue: Move affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the locations of the emergency rescue equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. Respirators: Respirators are not the best way to control exposure to sodium hydroxide. You can only be required to wear them for routine use if your employer is in the process of installing controls or control measures prove inadequate. You may be required to wear respirators for non-routine activities or in emergencies. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA) or National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.) For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where there use is required. If you experience difficulty breathing while wearing a respirator, tell your employer.
- B. Protective Suits: In some work situations the wearing of supplied-air suits or other impervious coverings such as acid

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suits may be necessary. Your employer should instruct you in their proper use and operation.

- C. Protective Clothing: You must wear appropriate protective clothing and equipment to prevent any possibility of skin contact with sodium hydroxide or solutions of sodium hydroxide. Replace or repair impervious clothing that has developed leaks.
- D. Eye Protection: You must wear splash-proof safety goggles where there is any possibility of solutions of sodium hydroxide contacting your eyes. You must wear dust-resistant safety goggles where there is any possibility of sodium hydroxide contacting your eyes.
- E. Where there is any possibility that an employee's eyes may be exposed to sodium hydroxide, employers shall provide an eye-wash fountain within the immediate work area for emergency use.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Sodium hydroxide must be stored in tightly closed containers in a well-ventilated area away from water, acids, organic halogen compounds, chemically active metals such as aluminum, tin and zinc, and nitromethane.
- B. If your work clothing may have become contaminated with sodium hydroxide, you must change into uncontaminated clothing before leaving the work premises.
- C. You must immediately remove any non-impervious clothing that becomes contaminated with sodium hydroxide and this clothing must not be reworn until the sodium hydroxide is removed from the clothing.
- D. If your skin becomes contaminated with sodium hydroxide, you must immediately wash or shower to remove any sodium hydroxide from your skin.
- E. Employers shall insure that employees do not eat or smoke in areas where sodium hydroxide is handled, processed or stored.
- F. Quick drenching facilities and eye flushing facilities, where provided, must be readily available and you should know where they are and how to operate them.
- G. Ask your supervisor where sodium hydroxide is used in your work area and for any additional safety and health rules.

VI. ACCESS TO INFORMATION

- A. Each year your employer is required to inform you of the information contained in this Substance Safety Data Sheet for sodium hydroxide. In addition, your employer must instruct you in the safe use of sodium hydroxide, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to sodium hydroxide. You or your representative have the right to observe employee exposure measurements and to record the results obtained. If your employer determines that you are being overexposed, he is required to inform you of the exposure and the actions which are being taken to reduce your exposure.

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- C. Your employer is required to keep records of your exposure and medical examinations. Your employer is required to keep exposure data for at least one year and to keep medical data during your employment, and for a period of thirty years following your termination of employment. Your employer is required to make the exposure data available to you upon your request. Your employer is also required to release your medical records to your physician upon your written request.
- D. Your employer must give you a copy of the physicians written opinion for any physical examination required by this standard.

NOTE: The information contained in the following appendix for sodium hydroxide is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligations. To the extent the information supplements this regulation for sodium hydroxide, it is advisory in nature.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES  
FOR SODIUM HYDROXIDE

- I. PHYSICAL AND CHEMICAL DATA
  - A. Substance Identification
    - 1. Synonyms: Caustic soda, soda lye, lye
    - 2. Formula: NaOH
    - 3. Molecular weight: 40
  - B. Physical Data
    - 1. Boiling point (760 mm Hg): 1390 C (2534 F)
    - 2. Specific gravity (water = 1): 2.13
    - 3. Vapor density (air = 1 at boiling point of sodium hydroxide): Not applicable
    - 4. Melting point: 310 C (590 F)
    - 5. Vapor pressure at 20 C (68 F): Essentially zero
    - 6. Solubility in water, grams of sodium hydroxide in 100 grams of water at 20 C (68 F): 50
    - 7. Evaporation rate (butyl acetate = 1): Not applicable
    - 8. Appearance and odor: Colorless, odorless solid
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
  - A. Fire
    - 1. Not combustible
  - B. Reactivity
    - 1. Conditions contributing to instability: None
    - 2. Incompatibilities: Contact with water, acids, flammable liquids, and organic halogen compounds, especially

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trichloroethylene, may cause fires and explosions. Contact with metals such as aluminum, tin, and zinc causes formation of flammable hydrogen gas. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts.

3. Hazardous decomposition products: None.
4. Special precautions: Sodium hydroxide will attack some forms of plastics, rubber and coatings.

III. SPILL AND DISPOSAL PROCEDURES

- A. If sodium hydroxide is spilled, the following steps should be taken:
  1. Ventilate area of spill.
  2. Dilute with water and neutralize with 6 molar hydrochloric acid.
- B. Persons not wearing protective equipment should be restricted from areas of spills until cleanup has been completed.
- C. Waste disposal methods: Sodium hydroxide may be disposed of in sealed containers in a secured sanitary landfill.

IV. MONITORING AND MEASUREMENT PROCEDURES

- A. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the eight-hour exposure may be determined from a single eight-hour sample or two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses of particulates may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR part 84, portable direct-reading instruments, dosimeters, or by collection of particulates using a high efficiency membrane filter with subsequent chemical analysis. The method of measurement must determine the concentration of sodium hydroxide to plus or minus 35%.
- B. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring and measurements under this section should be essentially the same as described under paragraph IV. A. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The method of measurement must determine the concentration of sodium hydroxide to plus or minus 25%.
- C. METHODS: Methods meeting these accuracy requirements are available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 under the title "NIOSH Analytical Methods for Set W" (Order number XXXXXXXXXX).
- D. QUALIFIED PERSONS: Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a

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competent industrial hygienist or other technically qualified person.

V. MISCELLANEOUS PRECAUTIONS

- A. Store sodium hydroxide in tightly closed containers in a cool, well ventilated area.
- B. Use of supplied-air suits or other impervious coverings (such as acid suits) may be necessary to prevent skin irritation from sodium hydroxide. Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life endangering characteristics of supplied-air suits.
- C. Employers should advise employees of all areas and operations where their exposure to sodium hydroxide could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to sodium hydroxide is likely to occur are during: General chemical manufacturing, pulp and paper production, petroleum refining, soap and detergents manufacturing, textile operations, food, aluminum manufacturing and, rayon and celluloisics production, etc.

NOTE: The information contained in the following appendix for sodium hydroxide is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligations. To the extent the information supplements this regulation for sodium hydroxide, it is advisory in nature.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Sodium hydroxide is a strong alkali; the mist, dust and solutions cause severe injury to the eyes, mucous membranes, and skin. Although inhalation is usually of secondary importance in industrial exposures, the effects from the dust or mist will vary from mild irritation of the nose at 2 mg/M3 to severe pneumonitis, depending on the severity of exposure. The greatest industrial hazard is rapid tissue destruction of eyes or skin upon contact with either the solid or with concentrated solutions. Contact with the eyes causes disintegration and sloughing of conjunctival and corneal epithelium, corneal opacification, marked edema and ulceration; after 7 to 13 days either gradual recovery begins, or there is progression of ulceration and corneal opacification. Complications of severe eye burns are symblepharon with overgrowth of the cornea by a vascularized membrane, progressive or recurrent corneal ulceration, and permanent corneal opacification. On the skin, solutions of 25 to 50 percent cause the sensation of irritation within about 3 minutes; with solutions of 4 percent, this does not occur until after several hours. If not removed from the skin, severe burns with deep

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ulceration will occur; exposure to the dust or mist may cause multiple small burns, with temporary loss of hair. Ingestion produces severe pain in the esophagus and stomach, corrosion of the lips, mouth, tongue, and pharynx and the vomiting of large pieces of mucosa; cases of squamous cell carcinoma of the esophagus have occurred with latent periods of 12 to 42 years after ingestion; these cancers may have been sequelae of tissue destruction and possibly scar formation rather than from a direct carcinogenic action of sodium hydroxide itself.

III. SIGNS AND SYMPTOMS

Irritation of the nose; pneumonitis; severe burns of the eyes and skin; temporary loss of hair.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Immediately flush eyes and skin with water. If swallowed and the person is conscious, immediately administer water orally. Give artificial resuscitation and administer oxygen if indicated. Consideration should be given to hospitalization and observation for the onset of pneumonitis.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Sodium hydroxide is a strong caustic alkali and causes severe burns of tissue. Contact with the eyes, either in solid form or in solution, very rapidly causes severe damage. On the skin it can cause severe injury without irritation or pain. It is important that the physician become familiar with plant operating conditions in which exposure to sodium hydroxide occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. PREPLACEMENT

The following medical procedures must be made available to each employee who is exposed to sodium hydroxide:

1. A complete history and physical examination -- The purpose is to detect preexisting conditions that might place the exposed employee at increased risk, and to establish a baseline for

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future health monitoring. Examination of the eyes and respiratory tract should be stressed. The skin should be examined for evidence of chronic disorders.

2. 14" x 17" chest roentgenogram -- Sodium hydroxide causes human lung damage. Surveillance of the lungs is indicated.
3. FVC and FEV (1 sec) -- Sodium hydroxide is a respiratory irritant. Persons with impaired pulmonary function may be at increased risk from exposure. Periodic surveillance is indicated.

C. PERIODIC EXAMINATIONS

The above medical examinations are to be repeated on an annual basis, except that an x-ray is required only when indicated by the results of pulmonary function testing, or by signs and symptoms of respiratory disease.

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Sodium Hydroxide," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 345.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 867-868.
3. National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare: Criteria for a Recommended Standard....Occupational Exposure to Sodium Hydroxide, No. (NIOSH) 76-105, U.S. Government Printing Office, Washington, D.C., 1975.
4. Manufacturing Chemists Association, Inc.: Chemical Safety Data Sheet SD-9, Caustic Soda, Washington, D.C., 1968, pp. 5, 16-17.

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REFERENCES AND SOURCES  
SODIUM HYDROXIDE  
1910.1000

- (f) Personal Protective Equipment, and, (h) Sanitation  
Eye: Grant, "Toxicology of the Eye;" Manufacturing Chemists' Association, Chemical Safety Data Sheets; Von Oettingen, "Poisoning;" Hamilton and Hardy, "Industrial Toxicology"  
Skin: Manufacturing Chemists' Association, Chemical Safety Data Sheets; Patty, "Industrial Hygiene and Toxicology"  
Ingestion: Manufacturing Chemists' Association, Chemical Safety Data Sheets; Gleason, "Clinical Toxicology of Commercial Products;" Commonwealth of Pennsylvania, "Hygienic Information Guide No. 36;" Christensen, "NIOSH Toxic Substances List"

COMMENTS

Eye - Classifications: 1 and 5  
Output statement numbers: 9 and 11 combined, 13  
Exceptions: None

Grant reports that the substance "causes some of the most severe injuries of the eye. Damage of the cornea, conjunctiva, and episcleral tissues is usual, but damage of intra-ocular structures is relatively rare. In one unusual case a localized burn of the retina has been noted by Reinecke after a patient accidentally allowed a particle of solid sodium hydroxide to remain in the lower conjunctival cul-de-sac. The particle caused deep localized erosion of both bulbar and palpebral conjunctiva but no significant damage of the cornea or disturbance of vision."

According to the MCA, "severe burns not only result from contact with the solid alkali, but also from solutions of this compound. Even dilute solutions, on prolonged contact, exert a destructive effect on tissues. This chemical is a strong primary irritant. Contact with the eyes, either in solid form or solution, very rapidly 'causes severe eye damage.'" Hamilton and Hardy report "fatal burns or blindness" associated with the compound.

Von Oettingen reports "splashes of lye solutions in the eye result in severe conjunctivitis, chemosis, and ulceration and necrosis of the conjunctiva and cornea, which are more severe than with acids, and the sequelae are usually much more serious."

Sodium hydroxide and other alkalies may produce devastating injuries of the eye. This compound is, therefore, assigned classifications of 1 and 5.

Skin - Classifications: 1 and 5  
Output statement numbers: 1, 5b, 7a, 8a, 14g, 14i  
Exceptions: See below

According to the MCA, "it exerts a marked corrosive action on those tissues with which it comes in contact, with resulting burns, frequently deep ulceration and ultimate scarring. Severe burns result not only from contact with the solid alkali, but also from solutions of this compound. Even

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dilute solutions, on prolonged contact, exert a destructive effect on tissues. This chemical is a strong, primary irritant. Multiple small burns may result from exposure to its dust or mist. The chronic local effects, i.e., those arising from repeated contact with dilute solutions, may consist of multiple areas of superficial destruction of the skin or of primary irritant dermatitis."

According to Patty, "the caustic alkalies, in solid form or concentrated liquid solution, have a more corrosive local action on the tissues than do most acids . . . Strong alkalies combine with tissue to form albuminates, and with natural fats to form soaps. They gelatinize tissue to form soluble compounds and by doing so may produce deep and painful destruction of tissue . . . Even dilute solutions . . . tend to soften the epidermis and emulsify or dissolve the skin fats."

Sodium hydroxide has a boiling point of 2534 degree F, a melting point of 590 degrees F, and a vapor pressure at 20 degrees C of essentially zero. It is 50% soluble in water.

It is clear that the solid and concentrated solutions of the compound can cause severe burns to the skin. Classifications of 1 and 5 are, therefore, concluded to be appropriate. However, the nature of the substance indicates that statements 5b and 7a are more appropriate for use than 5a and 6 respectively. Amounts so little as to go undetected would not cause significant injury. Since the compound would react rapidly with the skin of the hands, statement 20a is not specified.

Ingestion - Classification: 0

Output statement numbers: 19

Exceptions: See below

According to the MCA, "ingestion, either of the solid form or of the solution, results in severe damage to the mucous membranes or deeper tissues with which contact is made. As a result, perforation of these tissues may follow, or there may occur subsequent severe and extensive scar formation. Death may result if penetration into vital areas results. Scarring may so constrict or destroy damaged tissues that extensive corrective surgery may be required."

Gleason reports, "usually the first mouthful of lye solution makes further swallowing impossible because of intense pain and spasm . . . As with most caustic solutions concentration is more critical than volume. In the rabbit esophagus a 10 minute exposure to a 1N solution of sodium hydroxide (4 per cent) produced necrosis of the mucosa and submucosa with some involvement of the inner longitudinal layers. With a 3N solution necrotic damage extended to the circular muscle. A 5N solution damaged the outer longitudinal muscle, and with 7N . . . necrosis extended throughout the esophageal wall and into the periesophageal tissues. In terms of total dose caustic alkalis have killed adult humans who ingested less than 10 grams . . . Death after lye ingestion may result from any one of several complications:

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circulatory shock, asphyxia due to glottic or laryngeal edema, perforation of the esophagus," or pneumonia.

The Penna. Hygienic Information Guide says "if ingested, approximately one ounce will produce death within 24 hours."

Christensen lists the oral rabbit LDLo as 500 mg/kg.

Because of the lack of systemic effects via ingestion of this compound, and its effects upon oral tissues, it is concluded that ingestion, specifically in the context of this standard, would not present a significant hazard in the industrial environment. However, due to the extreme caustic nature of sodium hydroxide and because accidental ingestion may occur, it is considered advisable to include statement 19 as an exception.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1975 (NFPA)

Manufacturing Chemists' Association, Chemical Safety Data Sheets SD-9 (MCA)

Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition, vol. 1, p. 740 (K-O)

Sources of data items used:

- I. A. 1. Synonyms: NFPA-49, MCA  
2. Formula: NFPA-49  
3. Molecular weight: ADL
- B. 1. Boiling point: MCA  
2. Specific gravity: K-O  
3. Vapor density: Not applicable  
4. Melting point: MCA  
5. Vapor pressure: ADL  
6. Solubility in water: K-O  
7. Evaporation rate: Not applicable  
8. Appearance and odor: NFPA-49
- II. A. 1. Not combustible
- B. 1. Conditions contributing to instability: ADL  
2. Incompatibilities: MCA, NFPA-491M  
3. Hazardous decomposition products: None  
4. Special precautions: MCA
- III. A. Steps if released or spilled: NFPA-49, MCA  
C. Waste disposal method: MCA
- V. Miscellaneous precautions: MCA

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

American National Standards Institute, ANSI Standard Z9.1, Table A3, 1971 (ANSI)

Artur D. Little, Inc., "Development Document for Effluent Limitations Guidelines and Standards of Performance, Textile Industry," EPA-68-01-1515, 1973 (ADL)

Baskin, A. D., ed., "Handling Guide for Potentially Hazardous Commodities," Railway Syst. and Management Assoc., 1972 (Baskin)

Considine, D. M., "Chemical and Process Technology Encyclopedia," McGraw Hill, 1974 (Considine)

Faith, W. L., D. P. Keyes, and R. L. Clark, "Industrial Chemicals,"

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- Wiley, 1965 (Faith)
- Feiner, B. and S. Marlow, "Industrial Hygiene in Pulp Mills," New York State Dept. Labor Monthly Review 35 (7), 25-8 (1956) (NIOSH Technical Information Service NIOSH 8212)
- Greenwood, M. R. and T. W. Clarkson, "Cleaning of Mercury and Silicone Grease Contaminated Glassware," AIHA Journal 31, 532-3 (1970) (NIOSH Technical Information Service NIOSH 11752)
- International Labour Office, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)
- Kirk, R. and D. Othmer, "Encyclopedia of Chemical Technology," Interscience, first edition (Chem Tech); second edition (K-O)
- Loucks, C. M., "Boosting Capacities with Chemicals," Chem. Eng., Feb. 26, 1973 (Loucks)
- Patty, F. A., "Industrial Hygiene and Toxicology," Vol. II, Interscience, 1962, (Patty)
- Schweisheimer, W., "Checking Skin Irritations in Pulp and Paper Operations," Canadian Pulp and Paper Industry 9, 44 (1956) (NIOSH Technical Information Service NIOSH 8542)
- Sodium Hydroxide: Dow Chem. Co., "Caustic Soda," 1971 (NIOSH Technical Information Service NIOSH 47911)
- Sodium Hydroxide: Kaiser Chemicals, "Caustic Soda," 1971 (Kaiser)
- Sodium Hydroxide: Manufacturing Chemists Assoc., Chemical Safety Data Sheet SD "Caustic Soda," 1974 (MCA)
- Sodium Hydroxide: Olin Chemicals, "Caustic Soda," 1961 (NIOSH Technical Information Service NIOSH 47910)
- Sodium Hydroxide: Commonwealth of Pennsylvania, Dept. Natural Resources, Occupational Health, Hygiene Information Guide No. 36, July, 1971, (Penna #36)
- Sodium Hydroxide: P. P. G. Industries, "Caustic Soda," 1969 (NIOSH Technical Information Service NIOSH 47909)
- Stanley, J. A., "Strong Alkali Burns of the Eye," N. E. Journal Med. 273 (23), 1265-6 (1965) (NIOSH Technical Information Service NIOSH 772)

References for Specific Use/Exposure

1. Chem Tech, K-O, Penna #36, Kaiser, SRI
2. Kaiser, Patty, Chem Tech, Considine, SRI
3. Considine, SRI, Kaiser, Patty, Feiner (8212), Schweisheimer (8542), Chem
4. Baskin, MCA, Faith, Patty, K-O, PPG (47909), Dow (47911), Considine
5. Kaiser, Patty, Considine, ILO, ANSI
6. Kaiser, Considine, Chem Tech
7. Kaiser, Patty, Chem Tech, ADL
8. Kaiser, Patty, Chem Tech, Considine
9. Patty, K-O, Stanley (772), Greenwood (11752), Loucks
10. Considine
11. Considine

References for Control Methods

Baskin, Penna #36, ILO, MCA, Olin (47910), Considine

RESPIRATOR TABLE DOCUMENTATION

—SUBSTANCE: Sodium hydroxide

D. O. L. STANDARD: 2 mg/M3

Eye Irritation Level: Grant states that sodium hydroxide "is severely injurious to all tissues, and causes some of the most severe injuries of the eye. The serious problem presented by sodium hydroxide and other alkalis which cause devastating injuries of the eye

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have been succinctly and well described by Stanley, emphasizing particularly the dangers of caustic household drain cleaners that contain sodium hydroxide.

"The effects of splashes of sodium hydroxide on the eyes of human beings have been described innumerable times . . . Damage of the cornea, conjunctiva, and episcleral tissues is usual, but damage of intraocular structures is relatively rare."

For the purposes of this standard, only full facepiece respirators are permitted.

IDLH; 250 mg/M3

Basis for IDLH Value: There are no acute inhalation toxicity data available upon which to base the IDLH for sodium hydroxide. The chosen IDLH, therefore, has been estimated from the mouse intraperitoneal LD50 of 40 mg/kg given in the NIOSH Toxic Substances List.

Other Toxicological Information: The Documentation of TLV's states that "caustic dusts are irritating to the upper respiratory system. Although prolonged exposure to high concentrations may cause discomfort and even ulceration of nasal passages, subjective symptoms are often relied upon as an indication for the need for control. Patty, on the basis of the irritant effects of caustic mists encountered in concentrations of 1 to 40 mg/M3 or air, believed that 2 mg sodium hydroxide/M3 air presented a concentration that was noticeably, but not excessively, irritant."

The Hygienic Information Guide of the Pennsylvania Department of Environmental Resources, Occupational Health Division, states that "sodium hydroxide, in solid form or as soda-lye, acts as a solvent on the natural oils of the skin causing an irritant dermatitis with dilute solutions. Concentrated solutions are extremely caustic and produce ulceration and burns. If ingested, approximately one ounce will produce death within 24 hours. Inhalation effects vary from mild irritation of the mucous membranes to severe irritation of the lung tissues. Prolonged contact with even dilute solutions has a destructive effect on tissues. Although ingestion is rare, in cases where it does occur there are pains in the mouth, difficulty in swallowing, abdominal pains and diarrhea. The expression is apprehensive and the pulse is rapid and weak. Other shock symptoms are also present."

The NIOSH Toxic Substances List gives a mouse, intraperitoneal LD50 of 40 mg/Kg.

VAPOR PRESSURE AT 20 C: Essentially zero

NOTE: Additional inhalation toxicologic information is needed to establish a more accurate IDLH for sodium hydroxide.

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USE/EXPOSURE AND CONTROL DOCUMENT  
SODIUM HYDROXIDE

|    | Use/Exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Principal Route<br>of Entry | Currently Used<br>Control Methods                                                                                                                                                |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Inhalation of dust, mist or vapor and skin contact with solid or liquid during use in chemicals manufacture (clinical test tablets for urine sugar tests; sodium salts; precipitation of alkaloids; manufacture of explosives; PH control; use in boiler water; sodium phosphates) and as a laboratory reagent (drying agent; regeneration of ion exchange resins; PH regulation). Widely used for PH control in the textile, paper, and chemical industries. The chief hazard is in preparation of solution. | A,B                         | Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective device, gloves, goggles, face shield, boots, protective clothing) |
| 2. | Inhalation of dust, mist or vapor and skin contact with solid or liquid during use in manufacture of synthetic fibers and plastics: viscose rayon, cellophane, polyvinyl alcohol (for vinyl fiber production), mercerized cotton, synthetic rubber; sodium hydroxide is often recycled for further use.                                                                                                                                                                                                       | A,B                         | Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective device, gloves, goggles, face shield, boots, protective clothing) |
| 3. | Inhalation of dust, mist or vapor and skin contact with solid or liquid during use in manufacture of pulp and paper: in pulping (Kraft process), manufacture of insulating board.                                                                                                                                                                                                                                                                                                                             | A,B                         | Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective device, gloves, goggles, face shield, boots, protective clothing) |
| 4. | Inhalation of dust, mist, or vapor and skin contact with solid or liquid during manufacture, distribution, handling, and equipment maintenance; sold as lumps, chips, pellets, sticks, or solution.                                                                                                                                                                                                                                                                                                           | A,B                         | Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective device, gloves, goggles, face shield, boots, protective clothing) |
| 5. | Inhalation of dust, mist or                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | A,B                         | Local exhaust ventilation;                                                                                                                                                       |

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vapor and skin contact with solid or liquid during use in metal processing and refining: Bayer process for bauxite ores; electrolytic extraction of zinc; tin plating; oxide coating; precipitation of most metals from solution (as hydroxide); electroplating processes.

general dilution ventilation; personal protective equipment (respiratory protective device, gloves, goggles, face shield, boots, protective clothing)

- |     |                                                                                                                                                                                                                                                                                     |     |                                                                                                                                                                                  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.  | Inhalation of dust, mist or vapor and skin contact with solid or liquid during use in petroleum refining: removal of sulfur compounds (hydrogen sulfide, mercaptans); removal of organic acids (sulfuric and others); flotation reagent; modifier and slime depressant; PH control. | A,B | Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective device, gloves, goggles, face shield, boots, protective clothing) |
| 7.  | Inhalation of dust, mist, or vapor and skin contact with solid or liquid during use in textile processing (woven fabric finishing - scouring, Kier boiling, mercerizing, saturating with caustic): manufacture of sulfur dyes; vat dyeing.                                          | A,B | Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective device, gloves, goggles, face shield, boots, protective clothing) |
| 8.  | Inhalation of dust, mist or vapor and skin contact with solid or liquid during use in manufacture of soaps and detergents (sodium hydroxide is used as saponifying agent for most soap manufacture).                                                                                | A,B | Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective device, gloves, goggles, face shield, boots, protective clothing) |
| 9.  | Inhalation of dust, mist or vapor and skin contact with solid or liquid during manufacture and use in metal cleaning, laundering, bleaching, dishwashing (used largely in mechanical bottle and glass washing and metal cleaning; in drain cleaners; oven cleaners).                | A,B | Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective device, gloves, goggles, face shield, boots, protective clothing) |
| 10. | Inhalation of dust, mist, or vapor and skin contact with solid or liquid during use in                                                                                                                                                                                              | A,B | Local exhaust ventilation; general dilution ventilation; personal protective equipment                                                                                           |

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food processing: used to peel  
fruits and vegetables; process  
olives; refine vegetable oil.

(respiratory protective device,  
gloves, goggles, face shield,  
boots, protective clothing)

11. Inhalation of dust, mist, or A,B  
vapor and skin contact with  
solid or liquid during use in  
glass manufacture (source of  
NA2O).

Local exhaust ventilation;  
general dilution ventilation;  
personal protective equipment  
(respiratory protective device,  
gloves, goggles, face shield,  
boots, protective clothing)

- A -- Inhalation
- B -- Skin and eye contact resulting  
in localized irritation
- C -- Ingestion
- D -- Skin contact resulting in  
absorption and subsequent  
systemic poisoning

----- JES2 JOB STATISTICS -----

1,379 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

