

VII. APPENDIX I

AIR SAMPLING PRACTICES FOR SODIUM HYDROXIDE

General Requirements

In order to evaluate conformance with the workplace environmental limit, 15-minute breathing-zone samples representative of the individual worker's exposure shall be collected. Sampling data sheets shall include:

- (a) The date and time of sample collection
- (b) Sampling duration
- (c) Volumetric flowrate of sampling
- (d) A description of the sampling location
- (e) Other pertinent information

Air Sampling

(a) Fifteen-minute breathing-zone samples representative of worker exposure shall be collected to characterize the exposures of workers in each job or specific operation in each production area.

(b) Samples shall be collected using a portable sampling pump plus a cellulose membrane filter with a pore size of 0.8 μm or less mounted with backup pad in a 2- or 3-piece closed-face cassette.

(c) The sampler shall be operated at a flowrate of 2 liters/min and samples shall be taken for 15 minutes.

(d) A minimum of 3 samples shall be taken for each operation or process.

(e) If 20 or fewer samples are taken, 3 blank filters shall be carried in closed cassettes to the sampling site and shall be provided to the analytical laboratory for determination of the background correction which must be applied to the results of analysis. One additional blank shall be provided for each 10 samples in excess of the first 20.

Calibration of Sampling Trains

Since the accuracy of an analysis can be no greater than the accuracy of the measurement of the volume of air which is sampled, the accurate calibration of a sampling pump is essential for the correct interpretation of the volume indicator. The necessary frequency of calibration is dependent on the use, care, and handling to which the pump has been subjected. In addition, pumps should be recalibrated if they have been subjected to misuse, received from a manufacturer, or repaired. If the pump receives hard usage, more frequent calibration may be necessary.

Ordinarily, pumps should be calibrated in the laboratory both before they are used in the field and at frequent intervals if they are used to collect numerous field samples. The accuracy of calibration is dependent on the type of calibrating instrument used as a reference. The choice of calibrating instrument may depend largely upon where the calibration is to be performed. For laboratory testing, a 1- or 2-liter buret or a wet-test meter is recommended, although other standard calibrating instruments such as a spirometer, Marriott's bottle, or dry-gas meter can be used.

Instructions for calibration with the soapbubble flowmeter follow. However, if an alternative calibration device is selected, equivalent

procedures should be used. The calibration setup for personal sampling pumps with a cellulose membrane filter is shown in Figure X-1. Since the flowrate indicated by the flowmeter of the pump is dependent on the pressure drop across the sampling device, a membrane filter with appropriate backup pad, the pump flowmeter must be calibrated while operating with a representative filter and backup pad in the line.

(1) While the pump is running, the voltage of the pump battery is measured with a voltmeter to assure that the battery is charged adequately for calibration.

(2) Place the cellulose membrane filter with backup pad in the filter cassette.

(3) The calibration setup is assembled as shown in Figure X-1.

(4) The pump is turned on and the inside of the soapbubble meter is moistened by immersing the buret in the soap solution and drawing bubbles up the tube until they are able to travel the entire length of the buret without bursting.

(5) The pump is adjusted to provide a flowrate of 2.0 liters/min.

(6) The water manometer is checked to ensure that the pressure drop across the sampling train does not exceed 13 conventional inches of water at 2 liters/min.

(7) A soapbubble is started up the buret and the time it takes the bubble to travel a minimum of 1.0 liter is measured with a stopwatch.

(8) The procedure in (7) above is repeated at least 3 times, the results are averaged, and the flowrate is calculated by dividing the volume between the preselected marks by the time required for the soapbubble to travel the distance.

(9) Data for the calibration should include the volume of air measured, elapsed time, pressure drop, air temperature, atmospheric pressure, serial number of the pump, date, and name of the person performing the calibration.

VIII. APPENDIX II
ANALYTICAL METHOD FOR SODIUM HYDROXIDE IN AIR

Principle of the Method [73,74,78]

Sodium hydroxide collected on membrane filters is dissolved in distilled water and the sodium content is determined by means of atomic absorption spectrophotometry. For maximum sensitivity, the 589.6-nm line is used; for higher concentrations of sodium, the less sensitive 330.2-nm line may be used instead of diluting the sample.

Interferences

Absorption of radiation by sodium is enhanced in the presence of rubidium, potassium, lithium, and cesium, especially in a high-temperature flame. It is unlikely that most industrial exposures to sodium hydroxide will involve more than trace quantities of these metals, so this type of interference will ordinarily be negligible. Any other compounds containing sodium will also be determined by this procedure, and therefore the method cannot be considered specific for sodium hydroxide when sodium chloride or other sodium salts are present. Whenever it is likely that appreciable quantities of other sodium salts are present, it may be appropriate to take bulk samples at the sources of sodium emissions to determine the fraction of sodium present as sodium hydroxide. Such an analysis may be accomplished by acid-base titration and total sodium assay.

Equipment and Reagents

Any suitable atomic absorption spectrophotometer and related accessories suitable for an air-acetylene flame may be used.

Water should be freshly distilled in an all-glass still and stored in polyethylene bottles.

Standard Solutions

Stock solution: Dissolve 2.542 g of NaCl (analytical reagent grade, dried at 140 C) in sufficient distilled water to make up 1 liter of solution. One milliliter equals 1 mg of sodium (1000 mg/liter). Prepare dilutions of the stock solution to be used as calibration standards at the time of analysis.

Procedure

Remove filters from the cassette with tweezers and place them in a clean, dry 25-ml Erlenmeyer flask. Add approximately 5 ml of distilled water, swirl the flask, place it on hot plate, and bring the solution to a boil. Remove the flask from the hot plate, allow it to cool; then transfer the liquid to a 10-ml volumetric flask and dilute to volume. Aspirate the sample into the flame in accordance with appropriate procedures for the instrument used and compare the absorbance of the sample solution with that of standard solutions which have been similarly treated.

Range and Sensitivity

Using the 589.6-nm line, the sensitivity is 0.02 μg sodium/ml, and the optimum concentration range is 0.02-5 μg sodium/ml. If 30 liters of

air are sampled, this range corresponds to airborne concentrations of about 12-3000 μg sodium hydroxide/cu m.

Precision and Accuracy

Data on precision and accuracy have not been developed but it is presumed that good precision and accuracy are obtainable.

IX. APPENDIX III
MATERIAL SAFETY DATA SHEET

The following items of information which are applicable to a specific product or material shall be provided in the appropriate block of the Material Safety Data Sheet (MSDS).

The product designation is inserted in the block in the upper left corner of the first page to facilitate filing and retrieval. Print in upper case letters in as large type size as possible. It should be printed to read upright with the sheet turned sideways. The product designation is that name or code designation which appears on the label, or by which the product is sold or known by employees. The relative numerical hazard ratings and key statements are those determined by the guidelines in Chapter V, Part B, of the NIOSH publication, "An Identification System for Occupationally Hazardous Materials." The company identification may be printed in the upper right corner if desired.

(a) Section I. Product Identification

The manufacturer's name, address, and regular and emergency telephone numbers (including area code) are inserted in the appropriate blocks of Section I. The company listed should be a source of detailed backup information on the hazards of the material(s) covered by the MSDS. The listing of suppliers or wholesale distributors is discouraged. The trade name should be the product designation or common name associated with the material. The synonyms are those commonly used for the product, especially formal chemical nomenclature. Every known chemical designation or competitor's trade name need not be listed.

(b) Section II. Hazardous Ingredients

The "materials" listed in Section II shall be those substances which are part of the hazardous product covered by the MSDS and individually meet any of the criteria defining a hazardous material. Thus, one component of a multicomponent product might be listed because of its toxicity, another component because of its flammability, while a third component could be included both for its toxicity and its reactivity. Note that a MSDS for a single component product must have the name of the material repeated in this section to avoid giving the impression that there are no hazardous ingredients.

Chemical substances should be listed according to their complete name derived from a recognized system of nomenclature. Where possible, avoid using common names and general class names such as "aromatic amine," "safety solvent," or "aliphatic hydrocarbon" when the specific name is known.

The "%" may be the approximate percentage by weight or volume (indicate basis) which each hazardous ingredient of the mixture bears to the whole mixture. This may be indicated as a range or maximum amount, ie, "10-40% vol" or "10% max wt" to avoid disclosure of trade secrets.

Toxic hazard data shall be stated in terms of concentration, mode of exposure or test, and animal used, eg "500 mg/kg-lowest lethal dose published-oral-rabbit" or "permissible exposure from 29 CFR 1910.1000," or if not available, from other sources of publications such as the American Conference of Governmental Industrial Hygienists or the American National Standards Institute, Inc. Flammability or reactivity data could be flash point, shock sensitivity, or other brief data indicating nature of the hazard.

(c) Section III. Physical Data

The data in Section III should be for the total mixture and should include the boiling point and melting point in degrees Fahrenheit (Celsius in parentheses); vapor pressure, in conventional millimeters of mercury (mmHg); vapor density of gas or vapor relative to the density of air; solubility in water, in parts/hundred parts of water by weight; specific gravity (water = 1); percent volatiles (indicated whether by weight or by volume) at 70 degrees Fahrenheit (21.1 degrees Celsius); evaporation rate for liquids or sublimable solids, relative to the evaporation rate for butyl acetate; and appearance and odor. These data are useful for the control of toxic substances. Boiling point, vapor density, percent volatiles, vapor pressure, and evaporation are useful for designing proper ventilation equipment. This information is also useful for design and deployment of adequate fire and spill containment equipment. The appearance and odor may facilitate identification of substances stored in improperly marked containers, or when spilled.

(d) Section IV. Fire and Explosion Data

Section IV should contain complete fire and explosion data for the product, including flash point and autoignition temperature in degrees Fahrenheit (Celsius in parentheses); flammable limits, in percent by volume in air; suitable extinguishing media or materials; special fire fighting procedures; and unusual fire and explosion hazard information. If the product presents no fire hazard, insert "NO FIRE HAZARD" on the line labeled "Extinguishing Media."

(e) Section V. Health Hazard Information

The "Health Hazard Data" should be a combined estimate of the hazard of the total product. This can be expressed as a TWA concentration, as a permissible exposure, or by some other indication of an acceptable standard. Other data are acceptable, such as lowest LD50 if multiple components are involved.

Under "Routes of Exposure," comments in each category should reflect the potential hazard from absorption by the route in question. Comments should indicate the severity of the effect and the basis for the statement if possible. The basis might be animal studies, analogy with similar products, or human experiences. Comments such as "yes" or "possible" are not helpful. Typical comments might be:

Skin Contact--single short contact, adverse effects certain; prolonged or repeated contact, severe damage may result.

Eye Contact--no initial pain, but blindness may result.

"Emergency and First Aid Procedures" should be written in lay language and should primarily represent first aid treatment that could be provided by paramedical personnel or individuals trained in first aid.

Information in the "Notes to Physician" section should include any special medical information which would be of assistance to an attending physician including required or recommended preplacement and periodic medical examinations, diagnostic procedures, and medical management of overexposed workers.

(f) Section VI. Reactivity Data

The comments in Section VI relate to safe storage and handling of

hazardous, unstable substances. It is particularly important to highlight instability or incompatibility to common substances or circumstances such as water, direct sunlight, steel or copper piping, acids, alkalies, etc. "Hazardous Decomposition Products" shall include those products released under fire conditions. It must also include dangerous products produced by aging, such as peroxides in the case of some ethers. Where applicable, shelf life should also be indicated.

(g) Section VII. Spill or Leak Procedures

Detailed procedures for cleanup and disposal should be listed with emphasis on precautions to be taken to protect workers assigned to cleanup detail. Specific neutralizing chemicals or procedures should be described in detail. Disposal methods should be explicit including proper labeling of containers holding residues and ultimate disposal methods such as "sanitary landfill," or "incineration." Warnings such as "comply with local, state, and federal anti-pollution ordinances" are proper but not sufficient. Specific procedures shall be identified.

(h) Section VIII. Special Protection Information

Section VIII requires specific information. Statements such as "Yes," "No," or "If Necessary" are not informative. Ventilation requirements should be specific as to type and preferred methods. Respirators shall be specified as to type and NIOSH or US Bureau of Mines approval class, ie, "Supplied air," "Organic vapor canister," "Suitable for dusts not more toxic than lead," etc. Protective equipment must be specified as to type and materials of construction.

(i) Section IX. Special Precautions

"Precautionary Statements" shall consist of the label statements selected for use on the container or placard. Additional information on any aspect of safety or health not covered in other sections should be inserted in Section IX. The lower block can contain references to published guides or in-house procedures for handling and storage. Department of Transportation markings and classifications and other freight, handling, or storage requirements and environmental controls can be noted.

(j) Signature and Filing

Finally, the name and address of the responsible person who completed the MSDS and the date of completion are entered. This will facilitate the correction of any errors and identify a source of additional information.

The MSDS shall be filed in a location readily accessible to workers potentially exposed to the hazardous material. The MSDS can be used as a training aid and basis for discussion during safety meetings and training of new employees. It should assist management by directing attention to the need for specific control engineering, work practices, and protective measures to ensure safe handling and use of the material. It will aid the safety and health staff in planning a safe and healthful work environment and in suggesting appropriate emergency procedures and sources of help in the event of harmful exposure of employees.

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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

MANUFACTURER'S NAME	REGULAR TELEPHONE NO EMERGENCY TELEPHONE NO
ADDRESS	
TRADE NAME	
SYNONYMS	

II HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	%	HAZARD DATA

III PHYSICAL DATA

BOILING POINT, 760 MM HG		MELTING POINT
SPECIFIC GRAVITY (H ₂ O=1)		VAPOR PRESSURE
VAPOR DENSITY (AIR=1)		SOLUBILITY IN H ₂ O, % BY WT
% VOLATILES BY VOL		EVAPORATION RATE (BUTYL ACETATE=1)
APPEARANCE AND ODOR		

IV FIRE AND EXPLOSION DATA

FLASH POINT (TEST METHOD)		AUTOIGNITION TEMPERATURE	
FLAMMABLE LIMITS IN AIR, % BY VOL.	LOWER		UPPER
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARD			

V HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA
ROUTES OF EXPOSURE
INHALATION
SKIN CONTACT
SKIN ABSORPTION
EYE CONTACT
INGESTION
EFFECTS OF OVEREXPOSURE
ACUTE OVEREXPOSURE
CHRONIC OVEREXPOSURE
EMERGENCY AND FIRST AID PROCEDURES
EYES
SKIN
INHALATION
INGESTION
NOTES TO PHYSICIAN

VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

INCOMPATIBILITY

HAZARDOUS DECOMPOSITION PRODUCTS

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

NEUTRALIZING CHEMICALS

WASTE DISPOSAL METHOD

VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY (SPECIFY IN DETAIL)

EYE

GLOVES

OTHER CLOTHING AND EQUIPMENT

IX SPECIAL PRECAUTIONS

**PRECAUTIONARY
STATEMENTS**

**OTHER HANDLING AND
STORAGE REQUIREMENTS**

PREPARED BY

ADDRESS

DATE

X. TABLES AND FIGURE

TABLE X-1

CHEMICAL AND PHYSICAL PROPERTIES OF SODIUM HYDROXIDE

	50% Solution	73% Solution	Anhydrous
Physical state at 25 C	Liquid	Solid	Solid, flake, ground, powdered
Explosive limits	None	None	None
Flash point	None Noncombustible	None Noncombustible	None Noncombustible
Autoignition temperature	None	None	None
Boiling point (760 mmHg)	142-148 C (288-298 F)	188-198 C (370-388 F)	1390 C (2534 F)
Color	Clear and colorless to slightly colored and turbid	Clear and colorless to slightly colored and turbid	White to slightly colored
Corrosivity (all commercial grades)	Noncorrosive to rubber at atmospheric temperatures. Solutions are slowly corrosive to iron and copper; they may pick up quantities of these and other metals harmful for some uses. Attacks wool and leather clothing and a few metals, such as aluminum, tin, and zinc, and alloys containing these metals.		
Deliquescence	Yes	Yes	Yes
Hygroscopicity	Yes	Yes	Yes

TABLE X-1 (CONTINUED)

CHEMICAL AND PHYSICAL PROPERTIES OF SODIUM HYDROXIDE

	50% Solution	73% Solution	Anhydrous
Melting point (freezing point) crystallization begins at	12-15 C (54-59 F)	63 C (145 F)	310-320 C (590-608 F)
Solidifies at	5 C (41 F)	62 C (144 F)	
Reactivity	Considerable heat is generated when water is added to caustic soda; boiling and spattering of hot caustic solution may result. Caustic soda can react violently or explosively with many organic chemicals.		

Derived from reference 91

TABLE X-2

COMMERCIAL USES OF SODIUM HYDROXIDE
IN 1969 IN THE UNITED STATES

End Use	Percentage of Total
Chemicals	42.5
Pulp and Paper	13.6
Rayon	5.4
Aluminum	7.4
Textiles	3.9
Petroleum	3.8
Soap and Detergents	4.8
Cellophane	2.1
Export	1.3
Miscellaneous	<u>15.2</u>
Total	100.0

Derived from reference 8

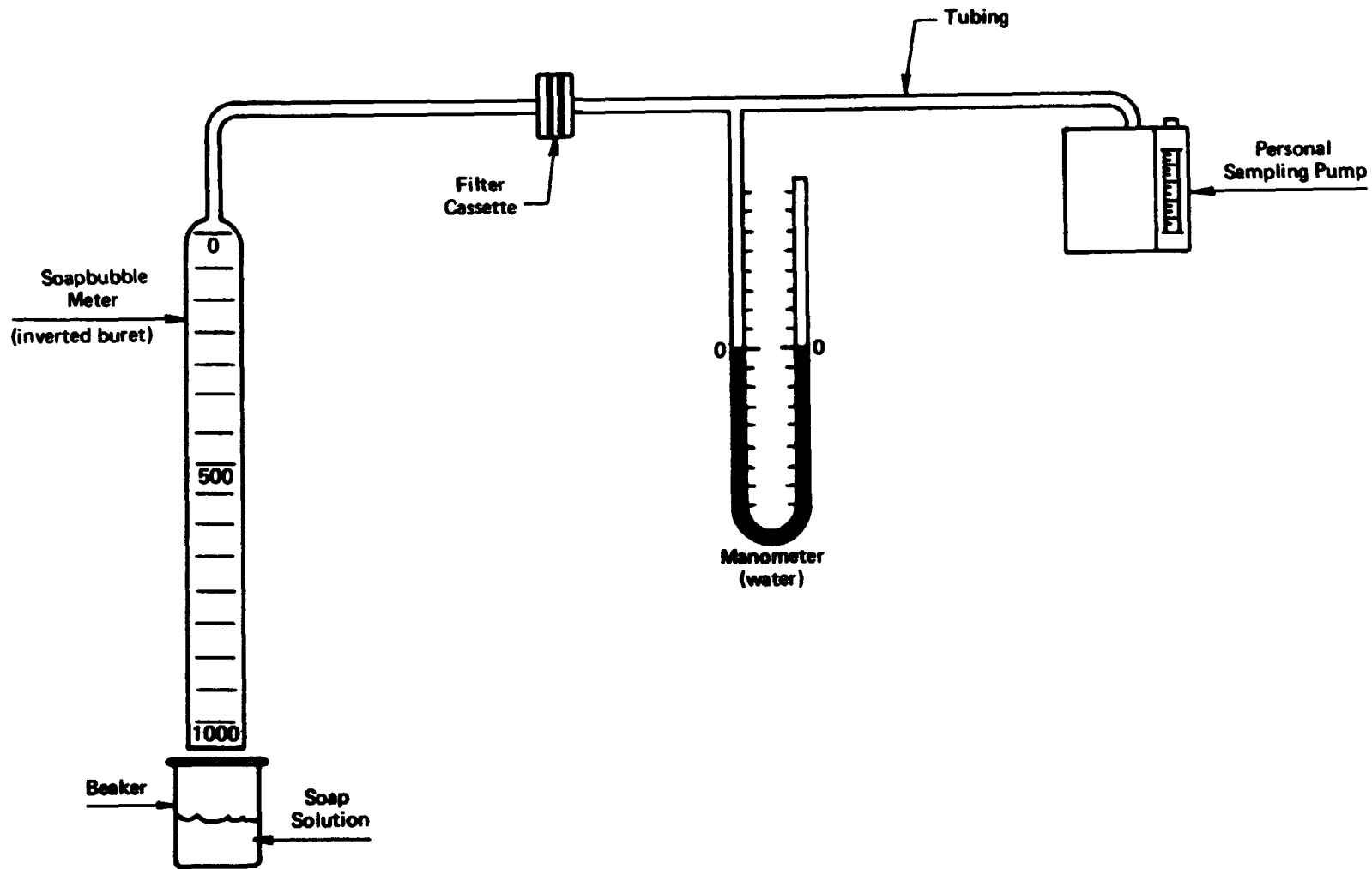
TABLE X-3

OCCUPATIONS WITH POTENTIAL EXPOSURE TO SODIUM HYDROXIDE

bleachers	paint makers
bleach makers	paint removers
bronzers	paper makers
cellulose workers	perfume makers
degreasers	petroleum refinery workers
detergent makers	photoengravers
dye makers	pharmaceutical workers
electroplaters	printers
enamellers	printing ink makers
engravers	pulp makers
etchers	rayon makers
furniture polishers	rubber makers
glass makers	rubber reclaimers
housekeepers	soap makers
laboratory workers, chemical	sodium hydroxide workers
laundry workers	tannery workers
lithographers	textile bleachers
matchmakers	transparent-wrapping-material workers
mercerizers	varnish makers
oxalic acid makers	vegetable oil refiners

Derived from references 9,10

FIGURE X - 1. CALIBRATION SETUP FOR PERSONAL SAMPLING PUMP WITH FILTER CASSETTE



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