

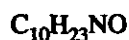
OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR 2-n-DIBUTYLAMINOETHANOL

INTRODUCTION

This guideline summarizes pertinent information about 2-n-dibutylaminoethanol for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments in these fields; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information is available.

SUBSTANCE IDENTIFICATION

- Formula



- Structure



- Synonyms

2-Dibutylaminoethanol; N,N-di-n-butylaminoethanol; beta-n-dibutylaminoethyl alcohol; N,N-dibutylethanolamine; N-N-dibutyl-n-(2-hydroxyethyl)amine; DBAE

- Identifiers

1. CAS No.: 102-81-8

2. RTECS No.: KK3850000

3. DOT UN: 2873 55

4. DOT label: St. Andrew's Cross

- Appearance and odor

2-n-Dibutylaminoethanol is a combustible, colorless liquid with a faint, amine-like odor.

CHEMICAL AND PHYSICAL PROPERTIES

- Physical data

1. Molecular weight: 173.3

2. Boiling point (760 mm Hg): 224° to 232°C (435° to 450°F)

3. Specific gravity (water = 1): 0.86 at 20°C (68°F)

4. Vapor density (air = 1 at boiling point of 2-n-dibutylaminoethanol): 6.0

5. Melting point: Data not available

6. Vapor pressure at 20°C (68°F): 0.1 mm Hg

7. Solubility: Slightly soluble in water; soluble in methanol, ethyl ether, acetone, gasoline, benzene, and ethyl acetate.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Education and Information Division

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

8. Evaporation rate: Data not available

• **Reactivity**

1. Conditions contributing to instability: Heat, sparks, and open flame
2. Incompatibilities: Contact of 2-n-dibutylaminoethanol with oxidizing materials causes a violent reaction.
3. Hazardous decomposition products: Toxic gases (such as carbon dioxide and oxides of nitrogen) may be released in a fire involving 2-n-dibutylaminoethanol.
4. Special precautions: None reported

• **Flammability**

The National Fire Protection Association has assigned a flammability rating of 2 (moderate fire hazard) to 2-n-dibutylaminoethanol.

1. Flash point: 93°C (200°F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air: Data not available
4. Extinguishant: Use dry chemical, water spray, or foam to fight fires involving 2-n-dibutylaminoethanol.

Fires involving 2-n-dibutylaminoethanol should be fought upwind from the maximum distance possible. Isolate the hazard area and deny access to unnecessary personnel. Emergency personnel should stay out of low areas and ventilate closed spaces before entering. Containers of 2-n-dibutylaminoethanol may explode in the heat of the fire and should be moved from the fire area if it is possible to do so safely. If this is not possible, cool containers from the sides with water until well after the fire is out. Stay away from the ends of containers. Firefighters should wear a full set of protective clothing and self-contained breathing apparatus when fighting fires involving 2-n-dibutylaminoethanol. Chemical protective clothing that is specifically recommended for 2-n-dibutylaminoethanol may not provide thermal protection unless so stated by the clothing manufacturer. Structural firefighters' protective clothing is not effective against fires involving 2-n-dibutylaminoethanol.

EXPOSURE LIMITS

• **OSHA PEL**

The Occupational Safety and Health Administration (OSHA) has not promulgated a permissible exposure limit (PEL) for 2-n-dibutylaminoethanol [29 CFR 1910.1000, Table Z-1].

• **NIOSH REL**

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) of 2 ppm (14 mg/m³) as a TWA for up to a 10-hr workday and a 40-hr workweek. The NIOSH REL also bears a "Skin" notation, which indicates that the cutaneous route of exposure (including mucous membranes and eyes) contributes to overall exposure [NIOSH 1992].

• **ACGIH TLV**

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned 2-n-dibutylaminoethanol a threshold limit value (TLV) of 2 ppm (14 mg/m³) as a TWA for a normal 8-hr workday and a 40-hr workweek. The ACGIH also assigns a "Skin" notation to 2-n-dibutylaminoethanol [ACGIH 1993].

• **Rationale for limits**

The NIOSH limit is based on acetylcholinesterase inhibition in vitro and weight loss in animals associated with 2-n-dibutylaminoethanol [NIOSH 1992].

HEALTH HAZARD INFORMATION

• **Routes of exposure**

Exposure to 2-n-dibutylaminoethanol can occur through inhalation, ingestion, and eye or skin contact.

• **Summary of toxicology**

1. *Effects on Animals:* 2-n-Dibutylaminoethanol causes irritation of the eyes and skin on acute exposure and liver and kidney damage on longer exposure. In contact with the skin of rabbits, 2-n-dibutylaminoethanol caused severe irritation [NIOSH 1993]. Application of 0.005 ml undiluted 2-n-dibutylaminoethanol to the

eyes of rabbits caused severe corneal injury [Grant 1986]. The oral LD₅₀ in rats is 1,070 mg/kg, and the dermal LD₅₀ in rabbits is 1,680 mg/kg [NIOSH 1993]. One of 5 rats exposed to a 70-ppm concentration of 2-n-dibutylaminoethanol for 6 hours/day, 5 days/week for 1 week died; in addition, compared with controls, exposed rats had a 57-percent average body weight loss, a 2-fold increase in liver- and kidney-to-body weight ratios, a 10-fold increase in serum bilirubin, a slightly elevated clotting time, and an elevated hematocrit. Exposure to a 22-ppm concentration of 2-n-dibutylaminoethanol on the same regimen for 27 weeks produced no changes in exposed rats [ACGIH 1991]. Rats fed 2-n-dibutylaminoethanol for 5 weeks at doses greater than 0.13 g/kg/day had elevated kidney-to-body weight ratios at autopsy, although no histologic changes were evident [ACGIH 1991].

2. *Effects on Humans:* Exposure to 2-n-dibutylaminoethanol causes irritation of the eyes, nose, throat, and skin in humans [NJDH 1987]. By analogy with the effects caused by chemically similar compounds, exposure to 2-n-dibutylaminoethanol may also cause allergic reactions, such as asthma or skin rashes [NJDH 1987]. In vitro studies show that 2-n-dibutylaminoethanol inhibits the enzyme acetylcholinesterase [ACGIH 1991].

• Signs and symptoms of exposure

1. *Acute exposure:* The signs and symptoms of acute exposure to 2-n-dibutylaminoethanol include redness and inflammation of the eyes and eyelids, runny nose, scratchy throat, redness and inflammation of the skin, and acetylcholinesterase inhibition. Symptoms of acetylcholinesterase inhibition include headache, sweating, nausea, vomiting, diarrhea, muscle twitching, coma, and death.

2. *Chronic exposure:* Based on effects seen in animals, the signs and symptoms of chronic exposure to 2-n-dibutylaminoethanol may include abdominal tenderness, enlarged liver, jaundice, and pus or blood in the urine.

• Emergency procedures

WARNING!

Seek immediate medical attention for severely affected victims or for victims with signs and symptoms of toxicity or irritation!

Keep unconscious victims warm and on their sides to avoid choking if vomiting occurs. Initiate the following emergency procedures:

1. *Eye exposure:* Irritation may result from exposure to concentrated solutions, vapors, mists, or aerosols of 2-n-dibutylaminoethanol. **Immediately and thoroughly** flush the eyes with large amounts of water, occasionally lifting the upper and lower eyelids.
2. *Skin exposure:* Irritation may result. **Immediately** remove contaminated clothing and **thoroughly** wash contaminated skin with soap and water.
3. *Inhalation exposure:* Move the victim to fresh air **immediately**.

If the victim is not breathing, clean any chemical contamination from the victim's lips and perform cardiopulmonary resuscitation (CPR); if breathing is difficult, give oxygen.

4. *Ingestion exposure:* Take the following steps if 2-n-dibutylaminoethanol or any material containing it is ingested:

—Have the victim rinse the contaminated mouth cavity several times with a fluid such as water.

—Have the victim drink a glass (8 oz) of fluid such as water.

—Induce vomiting by giving syrup of ipecac as directed on the package. If ipecac is unavailable, have the victim touch the back of the throat with a finger until productive vomiting ceases.

—Do **not** force an unconscious or convulsing person to drink fluid or to vomit.

5. *Rescue:* Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the material safety data sheet required by OSHA's hazard communication standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures, the location and proper use of emergency equipment, and methods of protecting themselves during rescue operations.

EXPOSURE SOURCES AND CONTROL METHODS

The following operation may involve 2-n-dibutyl-

aminoethanol and lead to worker exposure to this substance:

—Organic synthesis

The following methods are effective in controlling worker exposures to 2-n-dibutylaminoethanol, depending on the feasibility of implementation:

—Process enclosure

—Local exhaust ventilation

—General dilution ventilation

—Personal protective equipment

Good sources of information on control methods are as follows:

1. ACGIH [1992]. *Industrial ventilation—a manual of recommended practice*. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
2. Burton DJ [1986]. *Industrial ventilation—a self study companion*. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
3. Alden JL, Kane JM [1982]. *Design of industrial ventilation systems*. New York, NY: Industrial Press, Inc.
4. Wadden RA, Scheff PA [1987]. *Engineering design for control of workplace hazards*. New York, NY: McGraw-Hill.
5. Plog BA [1988]. *Fundamentals of industrial hygiene*. Chicago, IL: National Safety Council.

MEDICAL MONITORING

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical monitoring program is intended to supplement, not replace, such mea-

asures. To place workers effectively and to detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

• Preplacement medical evaluation

Before a worker is placed in a job with a potential for exposure to 2-n-dibutylaminoethanol, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the liver, kidneys, respiratory system, and skin. Medical monitoring for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society [ATS 1987].

A preplacement medical evaluation is recommended to detect and assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to 2-n-dibutylaminoethanol at or below the prescribed exposure limit. The health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with allergies or with diseases of the liver, kidneys, respiratory system, or skin.

• Periodic medical examinations and biological monitoring

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to 2-n-dibutylaminoethanol exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of 2-n-dibutylaminoethanol on the liver, kidneys, respiratory system, or skin. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for 2-n-dibutylaminoethanol.

- **Medical examinations recommended at the time of job transfer or termination**

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination to determine the worker's medical status at the end of his or her employment. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

WORKPLACE MONITORING AND MEASUREMENT

Determination of a worker's exposure to airborne 2-n-dibutylaminoethanol is made using a silica gel tube (300/150 mg sections, 45/60 mesh). Samples are collected at a maximum flow rate of 0.2 liter/min until a maximum air volume of 24 liters is collected. Immediately after sampling, each section of the tube should be transferred to a separate vial containing 2 milliliters of desorbing solution (0.12 M HCl in 4:1 methanol:water). Analysis is conducted by gas chromatography using a flame ionization detector. This method is described in the OSHA Computerized Information System [OSHA 1992] and in Method No. 2007 of the *NIOSH Manual of Analytical Methods* [NIOSH 1984].

PERSONAL HYGIENE

If 2-n-dibutylaminoethanol contacts the skin, workers should flush the affected areas immediately with plenty of water for 15 minutes, and then wash with soap and water.

Clothing contaminated with 2-n-dibutylaminoethanol should be removed immediately, and provisions should be made for the safe removal of the chemical from the clothing. Persons laundering the clothes should be informed of the irritant properties of 2-n-dibutylaminoethanol.

A worker who handles 2-n-dibutylaminoethanol should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, using toilet facilities, or applying cosmetics.

Workers should not eat, drink, use tobacco products, or apply cosmetics in areas where 2-n-dibutylaminoethanol is handled, processed, or stored.

STORAGE

2-n-Dibutylaminoethanol should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's hazard communication standard [29 CFR 1910.1200]. Containers of 2-n-dibutylaminoethanol should be protected from physical damage and should be stored separately from oxidizers (such as perchlorates, peroxides, and permanganates), heat, sparks, and open flame. To prevent static sparks, all equipment used in the manufacturing, use, or storage of this substance should be grounded and bonded. Because containers that formerly contained 2-n-dibutylaminoethanol may still hold product residues, they should be handled appropriately.

SPILLS AND LEAKS

In the event of a spill or leak involving 2-n-dibutylaminoethanol, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup has been completed. The following steps should be undertaken following a spill or leak:

1. Do not touch the spilled material; stop the leak if it is possible to do so without risk.
2. Notify safety personnel.
3. Remove all sources of heat and ignition.
4. Ventilate the area of the spill or leak.
5. Use water spray to reduce vapors.
6. For small liquid spills, take up with sand or other noncombustible absorbent material and place into closed containers for later disposal.
7. For large liquid spills, build dikes far ahead of the spill to contain the 2-n-dibutylaminoethanol for later reclamation or disposal.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of

hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

- **Emergency planning requirements**

2-n-Dibutylaminoethanol is not subject to EPA emergency planning requirements under the Superfund Amendments and Reauthorization Act (SARA) [42 USC 11022].

- **Reportable quantity requirements for hazardous releases**

Employers are not required by the emergency release notification provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [40 CFR 355.40] to notify the National Response Center of an accidental release of 2-n-dibutylaminoethanol; there is no reportable quantity for this substance.

- **Community right-to-know requirements**

Employers are not required by Section 313 of SARA to submit a Toxic Chemical Release Inventory form (Form R) to EPA reporting the amount of 2-n-dibutylaminoethanol emitted or released from their facility annually.

- **Hazardous waste management requirements**

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity, as defined in 40 CFR 261.21-261.24. Although 2-n-dibutylaminoethanol is not specifically listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], EPA requires employers to treat any waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (800) 424-9346 or at (202) 382-3000 in Washington, D.C. In addi-

tion, relevant State and local authorities should be contacted for information about their requirements for waste removal and disposal.

RESPIRATORY PROTECTION

- **Conditions for respirator use**

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of 2-n-dibutylaminoethanol exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should use only respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

- **Respiratory protection program**

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's respiratory protection standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, respirator fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information about the selection and use of respirators and about the medical screening of respirator users, consult the *NIOSH Respirator Decision Logic* [NIOSH 1987b] and the *NIOSH Guide to Industrial Respiratory Protection* [NIOSH 1987a].

PERSONAL PROTECTIVE EQUIPMENT

Protective clothing (gloves, boots, aprons, and gauntlets, as necessary) should be worn to prevent prolonged or repeated skin contact with 2-n-dibutylaminoethanol. Chemical protective clothing should be selected on the

basis of available performance data, manufacturers' recommendations, and evaluation of the clothing under actual conditions of use. No reports have been published on the resistance of various protective clothing materials to 2-n-dibutylaminoethanol permeation. If permeability data are not readily available, protective clothing manufacturers should be requested to provide information on the best chemical protective clothing for workers to wear when they are exposed to 2-n-dibutylaminoethanol.

If 2-n-dibutylaminoethanol is dissolved in water or an organic solvent, the permeation properties of both the solvent and the mixture must be considered when selecting personal protective equipment and clothing.

Safety glasses, goggles, or face shields should be worn during operations in which 2-n-dibutylaminoethanol might contact the eyes (e.g., through splashes of solution). Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or skin contact with 2-n-dibutylaminoethanol. Contact lenses should not be worn when working around this material.

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