

Occupational Health Guideline for Ethyl Benzene

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: $C_2H_5C_6H_5$
- Synonyms: Phenylethane; ethylbenzol
- Appearance and odor: Colorless liquid with an aromatic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for ethyl benzene is 100 parts of ethyl benzene per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 435 milligrams of ethyl benzene per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

Ethyl benzene can affect the body if it is inhaled, is swallowed, or comes in contact with the eyes or skin.

• Effects of overexposure

1. *Short-term Exposure:* Ethyl benzene causes irritation of the eyes, nose, throat, and skin. With exposure to high concentrations, irritating effects are more pronounced, and a person may begin to feel weak, dizzy, drowsy, and become unconscious.

2. *Long-term Exposure:* Prolonged or repeated ethyl benzene exposure of the skin may cause skin rash.

3. *Reporting Signs and Symptoms:* A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to ethyl benzene.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to ethyl benzene at potentially hazardous levels:

1. *Initial Medical Screening:* Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from ethyl benzene exposure.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of ethyl benzene might cause exacerbation of symptoms due to its irritant properties or psychic reflex bronchospasm.

—Kidney disease: Although ethyl benzene is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with possible impairment of renal function.

—Liver disease: Although ethyl benzene is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.

—Skin disease: Ethyl benzene is a defatting agent and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

2. *Periodic Medical Examination:* Any employee developing the above-listed conditions should be referred for further medical examination.

• Summary of toxicology

Ethyl benzene is primarily an irritant of skin and, to some degree, of eyes and upper respiratory tract. Systemic absorption causes depression of the central nervous system with narcosis at very high concentrations. Aspiration of small amounts causes extensive edema and hemorrhage of lung tissue. It is readily metabolized and excreted chiefly as mandelic acid in the urine.

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR

Occupational Safety and Health Administration

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 106
2. Boiling point (760 mm Hg): 136 C (277 F)
3. Specific gravity (water = 1): 0.865
4. Vapor density (air = 1 at boiling point of ethyl benzene): 3.66
5. Melting point: -95 C (-139 F)
6. Vapor pressure at 20 C (68 F): 7.1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.015
8. Evaporation rate (butyl acetate = 1): Less than 1

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizing agents may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving ethyl benzene.
4. Special precautions: None

• Flammability

1. Flash point: 15 C (59 F) (closed cup)
2. Autoignition temperature: 432 C (810 F)
3. Flammable limits in air, % by volume: Lower: 1.0; Upper: 6.7
4. Extinguishant: Dry chemical, foam, or carbon dioxide

• Warning properties

1. Odor Threshold: According to the Department of Transportation's *CHRIS Hazardous Chemical Data*, ethyl benzene has an odor threshold of 140 ppm.
2. Eye Irritation Level: According to the AIHA *Hygienic Guide*, "the vapor caused a noticeable eye irritation in humans at concentrations of 200 ppm."
3. Evaluation of Warning Properties: Through its odor and irritant effects, ethyl benzene can be detected at a concentration less than twice the permissible exposure limit. Therefore, for the purposes of this guideline, ethyl benzene is treated as a material with adequate warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on 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).

• Method

Sampling and analyses may be performed by collection of ethyl benzene vapors using an adsorption tube with subsequent desorption with carbon disulfide and gas chromatographic analysis. Also, detector tubes certified

by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure ethyl benzene may be used. An analytical method for ethyl benzene is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

RESPIRATORS

- Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.
- In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

- Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid ethyl benzene.
- Clothing wet with liquid ethyl benzene should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of ethyl benzene from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the ethyl benzene, the person performing the operation should be informed of ethyl benzene's hazardous properties.
- Non-impervious clothing which becomes contaminated with liquid ethyl benzene should be removed promptly and not reworn until the ethyl benzene is removed from the clothing.
- Any clothing which becomes wet with liquid ethyl benzene should be removed immediately and not reworn until the ethyl benzene is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid ethyl benzene may contact the eyes.

SANITATION

• Skin that becomes contaminated with liquid ethyl benzene should be promptly washed or showered with soap or mild detergent and water to remove any ethyl benzene.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to ethyl benzene may occur and control methods which may be effective in each case:

Operation	Controls
Liberation during manufacture of styrene monomer	Local exhaust ventilation
Use during spray application of vinyl resin surface coating	Local exhaust ventilation; personal protective equipment
Liberation during manufacture of paints, varnishes, and other surface coatings	Local exhaust ventilation; general dilution ventilation
Use in manufacture and application of rubber adhesives	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use during electroplating of aluminum on copper or steel	Local exhaust ventilation for open-surface tanks
Liberation during oven baking and drying of surface coatings	Local exhaust ventilation for ovens
Liberation during application of surface coatings by dipping, flow coatings, and roller coating	Local exhaust ventilation
Liberation during use as an intermediate in dye manufacture	General dilution ventilation
Use as a heat-transfer medium; use as a dielectric	General dilution ventilation; personal protective equipment
Liberation during production of acetophenone by oxidation of ethyl benzene	General dilution ventilation

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If ethyl benzene gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If ethyl benzene gets on the skin, promptly flush the contaminated skin with water. If ethyl benzene soaks through the clothing, remove the clothing immediately and flush the skin with water. When there is skin irritation, get medical attention.

• Breathing

If a person breathes in large amounts of ethyl benzene, 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.

• Swallowing

If ethyl benzene has been swallowed, do not induce vomiting. Get medical attention immediately.

• Rescue

Move the 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. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

• Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

• If ethyl benzene is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.

2. Ventilate area of spill or leak.

3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be collected and atomized in a suitable combustion chamber. Combustion may be improved by mixing with a more flammable liquid. Ethyl benzene should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

• Waste disposal methods:

Ethyl benzene may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.

2. By atomizing in a suitable combustion chamber. Combustion may be improved by mixing with a more flammable liquid.

REFERENCES

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RESPIRATORY PROTECTION FOR ETHYL BENZENE

Condition	Minimum Respiratory Protection* Required Above 100 ppm
Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
2000 ppm or less	A gas mask with a chin-style or a front- or back-mounted organic vapor canister. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 2000 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. 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.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.