

Occupational Health Guideline for Ethyl Acetate

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: $\text{CH}_3\text{COOC}_2\text{H}_5$
- Synonyms: Acetic ester; acetic ether; ethyl ethanoate
- Appearance and odor: Colorless liquid with a pleasant, fruity odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for ethyl acetate is 400 parts of ethyl acetate per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 1400 milligrams of ethyl acetate per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Ethyl acetate can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed.
- **Effects of overexposure**
 1. **Short-term Exposure:** Overexposure to ethyl acetate may cause irritation of the eyes, nose, and throat. Severe overexposure may cause weakness, drowsiness, and unconsciousness.
 2. **Long-term Exposure:** Prolonged overexposure may produce irritation of the skin.
 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 acetate.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to ethyl acetate 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 acetate exposure.

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

—Skin disease: Ethyl acetate 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.

—Liver disease: Although ethyl acetate 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.

—Kidney disease: Although ethyl acetate 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 impaired renal function.

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

- **Summary of toxicology**

Ethyl acetate vapor is irritating to the eyes and respiratory passages of man at concentrations above 400 ppm. In animals it has a narcotic effect at concentrations of over 5000 ppm. Due to its irritating properties, employees will not voluntarily remain in such high concentrations. Repeated exposures of rabbits to 4450 ppm for 1 hour daily for 40 days resulted in anemia with leukocytosis, and damage to liver and kidneys. Animals exposed to lethal concentrations died with pulmonary edema

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.

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and hemorrhage. This substance is a defatting agent, and prolonged exposure may cause irritation of the skin. Painful conjunctival irritation may occur from splashes in the eye. No chronic systemic effects have been reported in humans.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 88
2. Boiling point (760 mm Hg): 77 C (171 F)
3. Specific gravity (water = 1): 0.9
4. Vapor density (air = 1 at boiling point of ethyl acetate): 3.0
5. Melting point: -83 C (-117 F)
6. Vapor pressure at 20 C (68 F): 76 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 8.7
8. Evaporation rate (butyl acetate = 1): 6

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with nitrates, strong oxidizers, strong alkalis, or strong acids 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 acetate.
4. Special precautions: Ethyl acetate will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: -4.4 C (24 F) (closed cup)
2. Autoignition temperature: 427 C (800 F)
3. Flammable limits in air, % by volume: Lower: 2.2; Upper: 11
4. Extinguishant: Alcohol foam, carbon dioxide, dry chemical

• Warning properties

1. Odor Threshold: May and Summer report odor thresholds for ethyl acetate of 0.0056 ppm and 50 ppm, respectively.
2. Eye Irritation Level: Grant states that "a concentration of 400 ppm in air causes a sensation of irritation in human eyes." Animals exposed to much higher concentrations developed no corneal damage, only conjunctival irritation.
3. Evaluation of Warning Properties: Through its odor and irritant effects, ethyl acetate can be detected below or at the permissible exposure limit. For the purposes of this guideline, ethyl acetate is treated as a material with good 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 acetate 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 acetate may be used. An analytical method for ethyl acetate 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 acetate.

• Clothing wet with liquid ethyl acetate should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of ethyl acetate from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the ethyl acetate, the person performing the operation should be informed of ethyl acetate's hazardous properties.

• Any clothing which becomes wet with liquid ethyl acetate should be removed immediately and not reworn until the ethyl acetate is removed from the clothing.

- Employees should be provided with and required to use splash-proof safety goggles where liquid ethyl acetate may contact the eyes.

SANITATION

- Skin that becomes wet with liquid ethyl acetate should be promptly washed or showered to remove any ethyl acetate.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Liberation during use of shellacs, lacquers, dopes, varnishes, and stains	Local exhaust ventilation; general dilution ventilation
Liberation during manufacture of smokeless powder; during manufacture of artificial leather; during preparation of photographic films	Process enclosure; general dilution ventilation
Liberation and use as a solvent during application of coatings containing nitrocellulose, cellulose acetate, shellac, synthetic rubber, vinyl resins, and inks	Process enclosure; general dilution ventilation
Use as a cleaning agent in textile industry	Process enclosure; general dilution ventilation
Liberation during manufacture of photographic film	Process enclosure; general dilution ventilation
Liberation during manufacture of linoleum and plastic wood; during manufacture of dyes, drug intermediates, ethyl acetoacetate, etc.; during use of duplicator fluid	Process enclosure; general dilution ventilation
Liberation during use of varnish removers	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 acetate 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 acetate gets on the skin, promptly flush the contaminated skin with water. If ethyl acetate soaks through the clothing, remove the clothing immediately and flush the skin with water. If there is skin irritation, get medical attention.

• Breathing

If a person breathes in large amounts of ethyl acetate, 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

When ethyl acetate has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

• 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 acetate 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. Ethyl acetate should not be allowed

to enter a confined space, such as a sewer, because of the possibility of an explosion.

- Waste disposal methods:

Ethyl acetate 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.

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RESPIRATORY PROTECTION FOR ETHYL ACETATE

Condition	Minimum Respiratory Protection* Required Above 400 ppm
Vapor Concentration	
1000 ppm or less	Any chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
5000 ppm or less	A gas mask with a chin-style organic vapor canister.
10,000 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 10,000 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.