

Occupational Health Guideline for Ethyl Acrylate

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: $\text{CH}_2=\text{CHCOOC}_2\text{H}_5$
- Synonyms: Ethyl propenoate
- Appearance and odor: Colorless liquid with a sharp, acrid odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for ethyl acrylate is 25 parts of ethyl acrylate per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 100 milligrams of ethyl acrylate per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists has issued a Notice of Intended Changes of their recommended Threshold Limit Value for ethyl acrylate from 25 ppm to 5 ppm with a skin notation.

HEALTH HAZARD INFORMATION

• Routes of exposure

Ethyl acrylate 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 acrylate may cause irritation of the eyes, nose, throat, and lungs. Death may be caused by lung damage from breathing high air levels or from swallowing it.

2. *Long-term Exposure:* Prolonged contact with the skin or eyes may result in severe damage.

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 acrylate.

• Recommended medical surveillance

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

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

—Skin disease: Ethyl acrylate is absorbed through the skin. It also is a defatting agent and may cause dryness or cracking. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Liver disease: Although ethyl acrylate 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 acrylate is not known as a kidney toxin in humans, the importance of this organ in the excretion of certain chemicals and their metabolites should be considered before exposing persons with impaired kidney function.

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

• Summary of toxicology

The vapor of ethyl acrylate is irritating to the conjunctiva and upper respiratory tract. In moderate concentrations there are characteristic lacrimatory effects in man. Animals exposed to high concentrations show marked

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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irritation of the eyes and of the respiratory tract, leading to pulmonary edema. The lowest concentration of vapor producing no significant effect in rodents is 75 ppm. A concentration of 2000 ppm vapor killed rats in 4 hours, with death attributable to severe pulmonary irritation, although 1000 ppm for 4 hours allowed survival. Prolonged contact with the skin in animals causes moderate damage, and skin sensitization may occur. Fatal doses are absorbed through the skin of animals exposed for 24 hours. While there are no reports of injury to man from long-term exposure to concentrations ordinarily encountered in the work situation, common practice suggests that most workmen do not tolerate exposure to 25 ppm for more than a few minutes.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 100
2. Boiling point (760 mm Hg): 99 C (211 F)
3. Specific gravity (water = 1): 0.92
4. Vapor density (air = 1 at boiling point of ethyl acrylate): 3.45
5. Melting point: -75 C (-103 F)
6. Vapor pressure at 20 C (68 F): 29.5 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 1.5
8. Evaporation rate (butyl acetate = 1): 3.3

• Reactivity

1. Conditions contributing to instability: Heat and/or lack of appropriate inhibitor concentration can cause ethyl acrylate to polymerize violently and burst container.

2. Incompatibilities: Contact with oxidizing materials, including peroxides and other initiators of polymerization, strong alkalis, and atmospheric moisture 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 acrylate.

4. Special precautions: Inhibitors do not function in absence of air, so inert gas blankets should not be used.

• Flammability

1. Flash point: 9 C (48 F) (closed cup)
2. Autoignition temperature: 383 C (721 F)
3. Flammable limits in air, % by volume: Lower: 1.8
4. Extinguishant: Dry chemical, foam, carbon dioxide

• Warning properties

1. Odor Threshold: The AIHA *Hygienic Guide* states that "the odor of ethyl acrylate vapor is readily detectable at 1 ppm and was described as fairly strong and moderately irritating at 4 ppm." The Manufacturing Chemists Association reports that an odor of ethyl acrylate can be detected by most persons at 8 ppm.

2. Eye Irritation Level: The AIHA *Hygienic Guide* states that "a concentration of 272 ppm ethyl acrylate vapor caused irritation of the conjunctiva of rabbit eyes,

but 75 ppm did not elicit any observable reaction." According to the MCA, however, irritation of the eyes occurs at about 75 ppm.

3. Other Information: The MCA states that irritation of the mucous membranes occurs at 75 ppm.

The AIHA *Hygienic Guide* states that the TLV (25 ppm) "is considered to be too high to prevent irritating effects in humans."

4. Evaluation of Warning Properties: Through its odor ethyl acrylate can be detected below the permissible exposure limit, and through its irritant effects it can be detected at or just several times above the TLV. Therefore, the substance is considered to have 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 acrylate 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 acrylate may be used. An analytical method for ethyl acrylate 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 acrylate.
- Clothing wet with liquid ethyl acrylate should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of ethyl acrylate from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the ethyl acrylate, the person performing the operation should be informed of ethyl acrylate's hazardous properties.
- Where exposure of an employee's body to liquid ethyl acrylate may occur, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.
- Any clothing which becomes wet with liquid ethyl acrylate or non-impervious clothing which becomes contaminated with liquid ethyl acrylate should be removed immediately and not reworn until the ethyl acrylate is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid ethyl acrylate may contact the eyes.

SANITATION

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

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use in manufacture of acrylic resins for use in paint formulations, industrial coatings, and latexes; use in manufacture of plastics such as ethylene ethyl acrylate	Local exhaust ventilation; personal protective equipment
Use in manufacture of polyacrylate elastomers and acrylic rubber	Local exhaust ventilation; personal protective equipment
Use in forming of denture materials	Personal protective equipment

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 acrylate 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 acrylate gets on the skin, immediately flush the contaminated skin with water. If ethyl acrylate 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 acrylate, 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 acrylate 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 acrylate 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 acrylate should not be allowed

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

• Waste disposal methods:

Ethyl acrylate may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill in an area where the odor will not be objectionable.
2. By atomizing in a suitable combustion chamber.

REFERENCES

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RESPIRATORY PROTECTION FOR ETHYL ACRYLATE

Condition	Minimum Respiratory Protection* Required Above 25 ppm
Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s). 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.
2000 ppm or less	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.
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.

**Use of supplied-air suits may be necessary to prevent skin contact while providing respiratory protection from airborne concentrations of ethyl acrylate; however, this equipment should be selected, used, and maintained under the immediate supervision of trained personnel. Where supplied-air suits are used above a concentration of 2000 ppm, an auxiliary self-contained breathing apparatus operated in positive pressure mode should also be worn.