

Occupational Health Guideline for Propyl Alcohol

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: $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- Synonyms: n-Propyl alcohol; 1-propanol; ethyl carbinol
- Appearance and odor: Colorless liquid with a mild, non-residual, alcoholic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for propyl alcohol is 200 parts of propyl alcohol per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 500 milligrams of propyl alcohol per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

- **Routes of exposure**
Propyl alcohol can affect the body if it is swallowed, is inhaled, or comes in contact with the skin or eyes.
- **Effects of overexposure**
 1. **Short-term Exposure:** Exposure to high air concentrations of propyl alcohol may cause mild irritation of the eyes, nose, and throat. Drowsiness, headaches, and incoordination may also occur. Swallowing propyl alcohol may cause drowsiness, unconsciousness, and death. Gastrointestinal pain, cramps, nausea, vomiting, and diarrhea may also result from swallowing this alcohol.
 2. **Long-term Exposure:** Prolonged skin exposure may cause drying and cracking 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 propyl alcohol.

- **Recommended medical surveillance**

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

—Skin disease: Propyl alcohol 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 propyl alcohol 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 propyl alcohol 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.

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

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

- **Summary of toxicology**

The principal action of propyl alcohol is that of a mild narcotic, but it may also act as an upper respiratory tract irritant. Mice exposed to vapor developed ataxia in 90 to 120 minutes at 3250 ppm; deep narcosis occurred after 240 minutes' exposure at 4100 ppm. Propyl alcohol is absorbed, oxidized, and eliminated more rapidly than

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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is ethyl alcohol. Skin absorption has been demonstrated in animals, as well as mild irritation of the skin on repeated exposure due to defatting action. No chronic systemic effects have been reported in humans.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 60
2. Boiling point (760 mm Hg): 97 C (207 F)
3. Specific gravity (water = 1): 0.8
4. Vapor density (air = 1 at boiling point of propyl alcohol): 2.1
5. Melting point: -126 C (-195 F)
6. Vapor pressure at 20 C (68 F): 15 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Miscible in all proportions

8. Evaporation rate (butyl acetate = 1): 1.3

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving propyl alcohol.
4. Special precautions: Propyl alcohol will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: 15 C (59 F) (closed cup)
2. Autoignition temperature: 440 C (824 F)
3. Flammable limits in air, % by volume: Lower: 2.1; Upper: 13.5
4. Extinguishant: Alcohol foam, dry chemical, carbon dioxide

• Warning properties

1. Odor Threshold: Both Summer and May report odor thresholds of 30 ppm.
2. Eye Irritation Level: n-Propyl alcohol, according to Grant, resembles "ethyl alcohol in physical and toxic properties." Grant states that a vapor concentration of 2500 ppm has "no notable effect on the eyes." The AIHA *Hygienic Guide* notes that above 5500 ppm, some eye and nasal irritation occur.
3. Evaluation of Warning Properties: Since the odor threshold of n-propyl alcohol is below the permissible exposure limit (200 ppm), it 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 propyl alcohol vapors using an adsorption tube with subsequent desorption with 2-propanol in 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 propyl alcohol may be used. An analytical method for propyl alcohol 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).

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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 propyl alcohol.

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

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

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

SANITATION

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

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Liberation and use during spray application of surface coatings containing solvent, polystyrene coatings, and dopes	Local exhaust ventilation; personal protective equipment
Liberation during use as a chemical intermediate in organic synthesis	Local exhaust ventilation; general dilution ventilation
Use during printing on plastic film and sheeting with polyamide-based inks	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use during textile and leather processing	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in application of surface coatings other than spray or heat in nitrocellulose lacquers, dopes, and polystyrene coatings	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in manufacture and packaging of surface coatings as a solvent in nitrocellulose lacquers, dopes, polystyrene coatings, inks, dyes, textiles, leather finishes, and artists' fixatives; manufacture of cleaning preparations and polishing agents	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in extraction of vegetable oils, castor oil, and pharmaceuticals; use during cleaning and degreasing operations	Local exhaust ventilation; general dilution ventilation; personal protective equipment

Operation

Use during cellulose processing; spinning of acrylonitrile; manufacture of brake fluids

Controls

Local exhaust ventilation; general dilution ventilation; 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 propyl alcohol 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 propyl alcohol gets on the skin, flush the contaminated skin with water. If propyl alcohol 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 propyl alcohol, 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 propyl alcohol 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 propyl alcohol 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. Propyl alcohol should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

- Waste disposal methods:

Propyl alcohol 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 PROPYL ALCOHOL

Condition	Minimum Respiratory Protection* Required Above 200 ppm
Vapor Concentration	
1000 ppm or less	Any chemical cartridge respirator with an organic vapor cartridge(s).
2000 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
4000 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 4000 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.