

Occupational Health Guideline for Turpentine

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: $C_{10}H_{16}$ (approximately); minimum alpha-pinene content 40% by weight
- Synonyms: Gum spirits of turpentine; turps; wood turpentine; spirits of turpentine; sulfate wood turpentine; sulfate turpentine; gum turpentine; steam-distilled turpentine
- Appearance and odor: Colorless liquid with a characteristic, paint odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for turpentine is 100 parts of turpentine per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 560 milligrams of turpentine per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

Turpentine can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed. It may enter the body through the skin.

• Effects of overexposure

1. *Short-term Exposure:* Overexposure to turpentine may cause irritation of the eyes, nose, throat, lungs, and skin. It may also cause headache, dizziness, and painful urination or dark-red urine. Greater exposure may cause unconsciousness and death.

2. *Long-term Exposure:* Prolonged overexposure causes skin irritation. Skin sensitization can occur.

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 turpentine.

• Recommended medical surveillance

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

—Skin disease: Turpentine is a skin defatting agent and sensitizer 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 turpentine 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: Turpentine has been reported to cause albuminuria and hematuria in humans and special consideration should be given to those with a history of impaired renal function.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of turpentine 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

Turpentine vapor is a mucous membrane irritant and, at higher concentrations, a convulsant. The LC50 for rats is 3590 ppm for 1 hour and 2150 ppm for 6 hours; hyperpnea, ataxia, tremors, and convulsions were noted. In cats, 1440 ppm produced disturbances in equilibrium and convulsions in 30 to 60 minutes; paralysis occurred in 150 to 180 minutes. In human subjects,

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.

750 to 1000 ppm for several hours caused irritation of the eyes, headache, dizziness, nausea, and tachycardia; 1878 ppm for 1 to 4 hours was considered definitely toxic. Heavy overexposure is also reported to cause irritation of the nose and throat, cough, headache, vertigo, and irritation of the kidneys and bladder manifested by transient albuminuria and hematuria. However, there is little evidence that turpentine vapor at lower concentrations is a chronic systemic poison. Liquid in the eye causes conjunctivitis and corneal burns; a vapor concentration of 75-200 ppm is said to be moderately irritating. The liquid is also a defatting agent and causes skin irritation. Some persons may develop skin hypersensitivity. Mild intoxication from skin absorption has been reported.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 136 (approximately)
2. Boiling point (760 mm Hg): 150 to 180 C (302 to 356 F)
3. Specific gravity (water = 1): 0.864
4. Vapor density (air = 1 at boiling point of turpentine): 4.7
5. Melting point: -50 to -60 C (-58 to -76 F)
6. Vapor pressure at 25 C (77 F): 5 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble

8. Evaporation rate (butyl acetate = 1): Data not available

• Reactivity

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

• Flammability

1. Flash point: 35 C (95 F) (closed cup)
2. Autoignition temperature: 253 C (488 F)
3. Flammable limits in air, % by volume: Lower: 0.8
4. Extinguishant: Dry chemical, foam, carbon dioxide

• Warning properties

1. Odor Threshold: Patty states that "the odor of 200 ppm turpentine in air is readily noticeable."
2. Eye Irritation Level: Patty states that 200 ppm "is moderately irritating to the eyes and mucous membranes of the nasal passages."
3. Evaluation of Warning Properties: Through its odor and irritant effects, turpentine can be detected at a level within twice the permissible exposure limit. For the purposes of this guideline, turpentine 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 turpentine 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 turpentine may be used. An analytical method for turpentine 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 turpentine.

• Clothing wet with liquid turpentine should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of turpentine from the clothing. If the clothing is to be laundered or

otherwise cleaned to remove the turpentine, the person performing the operation should be informed of turpentine's hazardous properties.

- Any clothing which becomes wet with liquid turpentine should be removed immediately and non-impervious clothing which becomes contaminated with turpentine should be removed promptly and such clothing should not be reworn until the turpentine is removed from the clothing.

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

SANITATION

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

- Employees who handle liquid turpentine should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use in manufacture of synthetic pine oil; insecticides; and in beta-pinene resins, flavors, and perfumes	Local exhaust ventilation; process enclosure; personal protective equipment
Use in preparation of polishes; use in manufacture of synthetic camphor, and use in paints	Local exhaust ventilation; process enclosure; 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 turpentine gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If turpentine gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If turpentine soaks through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of turpentine, 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 turpentine 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 turpentine 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. Turpentine should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

- Waste disposal methods:

Turpentine 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.

REFERENCES

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RESPIRATORY PROTECTION FOR TURPENTINE

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).
1900 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 1900 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.