

Occupational Health Guideline for Terphenyls

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: $C_{18}H_{14}$
- Synonyms: ortho-Terphenyl; meta-terphenyl; para-terphenyl; mixed terphenyls; diphenylbenzenes; tri-phenyls
- Appearance: Colorless or light yellow solids.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for terphenyls is a ceiling of 1 part of terphenyls per million parts of air (ppm). This may also be expressed as 9 milligrams of terphenyls per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists has recommended for terphenyls a Threshold Limit Value of 0.5 ppm as a ceiling value.

HEALTH HAZARD INFORMATION

• Routes of exposure

Terphenyls can affect the body if they are inhaled, come in contact with the eyes or skin, or are swallowed.

• Effects of overexposure

Exposure to terphenyls may cause eye, skin, and respiratory irritation.

• 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 terphenyls.

• Recommended medical surveillance

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

—Skin disease: The hot vapors of the terphenyls have a primary irritant effect on the skin. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Chronic respiratory disease: Persons with acute or chronic respiratory diseases may be more susceptible to the effects of terphenyls, since transient changes in the mitochondria of alveolar cells have been demonstrated in the lungs of animals following such exposure.

—Liver disease: Persons with liver disease may be more susceptible to the effects of inhalation of terphenyls, since transient changes in hepatic cells have been demonstrated in the liver of animals following such exposure.

—Kidney disease: Although terphenyls are not recognized as renal toxins, the importance of this organ in the excretion of metabolites formed from absorbed terphenyls justifies special consideration in those with possible impairment of renal function.

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

• Summary of toxicology

Experimental animals show conjunctival irritation from direct contact with terphenyls. Clinical studies of an exposed group of employees showed no ill effects from prolonged exposure to concentrations ranging from 0.1 to $0.9 mg/m^3$. Animals exposed to concentrations of three to five times these levels had slight cellular changes in the lungs and liver, as demonstrated by electron microscopy. Absorbed terphenyls are slowly metabolized and excreted in the urine as phenolic compounds and as glucuronides.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

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

1. Molecular weight: 230
2. Boiling point (760 mm Hg): 333 to 381 C (630 to 718 F)
3. Specific gravity (water = 1): 1.1 to 1.2
4. Vapor density (air = 1 at boiling point of terphenyls): Not applicable
5. Melting point: 56 to 213 C (133 to 415 F)
6. Vapor pressure at 20 C (68 F): Very low
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble

Insoluble

8. Evaporation rate (butyl acetate = 1): Not applicable

• **Reactivity**

1. Conditions contributing to instability: Heat
2. Incompatibilities: None
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving terphenyls.
4. Special precautions: None

• **Flammability**

1. Flash point: 163 to 207 C (325 to 405 F) (open cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
4. Extinguishant: Carbon dioxide or dry chemical

• **Warning properties**

The *Documentation of TLV's* states that "the available toxicologic data indicate that terphenyls may produce eye, skin, and respiratory irritation; they may also cause sensitization, but this has not been shown in man. Workers exposed to dust and vapor experienced marked irritation at concentrations in air above 10 mg/m³. On this basis, a threshold limit value of 1ppm (about 9.4 mg/m³) as a ceiling value is recommended to prevent irritation of the eye and respiratory tract."

MONITORING AND MEASUREMENT PROCEDURES

• **Ceiling Evaluation**

Measurements to determine employee ceiling exposure are best taken during periods of maximum expected airborne concentrations of terphenyls. Each measurement should consist of a fifteen (15) minute sample or series of consecutive samples totalling fifteen (15) minutes in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). A minimum of three (3) measurements should be taken on one work shift and the highest of all measurements taken is an estimate of the employee's exposure.

• **Method**

Sampling and analyses may be performed by collection of terphenyls on a filter, followed by leaching with carbon disulfide, and gas chromatographic analysis. An analytical method for terphenyls 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 any possibility of skin contact with molten terphenyls.

• 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 solid terphenyls or liquids containing terphenyls.

• If employees' clothing may have become contaminated with solid terphenyls, employees should change into uncontaminated clothing before leaving the work premises.

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

• Where there is any possibility of exposure of an employee's body to molten terphenyls, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.

• Non-impervious clothing which becomes contaminated with terphenyls should be removed promptly and not reworn until the terphenyls are removed from the clothing.

• Employees should be provided with and required to use dust- and splash-proof safety goggles where there is any possibility of molten terphenyls contacting the eyes.

• Employees should be provided with and required to use dust- and splash-proof safety goggles where solid

terphenyls or solutions containing terphenyls may contact the eyes.

- Where there is any possibility that employees' eyes may be exposed to molten terphenyls, an eye-wash fountain should be provided within the immediate work area for emergency use.

SANITATION

- Skin that becomes contaminated with terphenyls should be promptly washed or showered with soap or mild detergent and water to remove any terphenyls.
- Employees who handle solid terphenyls or solutions containing terphenyls 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 terphenyls may occur and control methods which may be effective in each case:

| Operation | Controls |
|--|--|
| Use during formulation of waxes, polishes, and resin body paints | Local exhaust ventilation; personal protective equipment |
| Liberation during application of resin body paints, solvents, waxes, and polishes | Personal protective equipment |
| Liberation during maintenance operations or following leaks in heat-transfer systems; during release of high-temperature lubricants; during distillation and other processing operations | Personal protective equipment |
| Liberation during manufacture of plastic scintillators; during process of flaking or crushing to produce solid terphenyls following distillation | 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 terphenyls get 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 these chemicals.

• Skin Exposure

If terphenyls dust or solutions containing terphenyls get on the skin, promptly wash or shower to remove any terphenyls from the skin. If molten terphenyls get on the skin, immediately wash or shower the contaminated skin to remove any terphenyls from the skin. If molten terphenyls soak 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 terphenyls, 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 terphenyls have 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 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 terphenyls are 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, sweep onto paper or other suitable material, place in an appropriate container and burn in a safe place (such as a fume hood). Large quantities may be reclaimed; however, if this is not practical, use a procedure similar to that for small quantities.

- Waste disposal methods:

Terphenyls may be disposed of:

1. By making packages of terphenyls in paper or other flammable material and burning in a suitable combustion chamber.
2. By dissolving terphenyls in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber.

REFERENCES

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RESPIRATORY PROTECTION FOR TERPHENYLS

| Condition | Minimum Respiratory Protection* Required Above 9 mg/m ³ |
|---|---|
| Particulate Concentration | |
| 450 mg/m ³ or less | A high efficiency particulate filter respirator with a full facepiece. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece. |
| 3500 mg/m ³ or less | A powered air-purifying respirator with a full facepiece and a high efficiency particulate filter. 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 3500 mg/m ³ 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 dust and mist respirator, except single-use. Any escape self-contained breathing apparatus. |

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