

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR p-tert-BUTYLTOLUENE

INTRODUCTION

This guideline summarizes pertinent information about p-tert-butyltoluene for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information is available.

SUBSTANCE IDENTIFICATION

• Formula



• Synonyms

1-Methyl-4-tert-butylbenzene; 1-tert-butyl-4-methylbenzene; 4-tert-butyltoluene; 1-(1,1-dimethyl)-4-methylbenzene; p-methyl-tert-butylbenzene; TBT; p-TBT

• Identifiers

1. CAS No.: 98-51-1
2. RTECS No.: XS8400000
3. DOT UN (for butyltoluenes): 2667 27
4. DOT label (for butyltoluenes): St. Andrew's Cross

• Appearance and odor

p-tert-Butyltoluene is a clear, colorless, combustible liquid with a gasoline-like odor. The odor threshold is reported to be 5 parts per million (ppm) parts of air.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 148.3
2. Boiling point (at 760 mm Hg): 192.8°C (379°F)

3. Specific gravity (water = 1): 0.86 at 20°C (68°F)
4. Vapor density (air = 1 at boiling point of p-tert-butyltoluene): 4.6
5. Melting point: -55°C (-67°F)
6. Vapor pressure at 25°C (77°F): 0.65 mm Hg
7. Solubility: Insoluble in water; slightly soluble in alcohol; very soluble in ether; miscible with most common industrial solvents
8. Evaporation rate (butyl acetate = 1): Very low

• Reactivity

1. Conditions contributing to instability: Heat, sparks, and open flame
2. Incompatibilities: Fires and explosions may result from contact of p-tert-butyltoluene with oxidizing materials.
3. Hazardous decomposition products: Toxic gases (such as carbon monoxide and carbon dioxide) may be released when p-tert-butyltoluene decomposes.
4. Special precautions: None

• Flammability

The National Fire Protection Association has not assigned a flammability rating to p-tert-butyltoluene. Other sources rate p-tert-butyltoluene's fire hazard as moderate.

1. Flash point: 68°C (155°F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air: Data not available
4. Extinguishant: Use carbon dioxide, dry chemical, foam, or water fog to fight fires involving p-tert-butyltoluene. Do not use a solid stream of water because the stream will scatter and spread the fire.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health
Division of Standards Development and Technology Transfer

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

EXPOSURE LIMITS

• OSHA PEL

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for p-tert-butyltoluene is 10 ppm (60 mg/m³) as an 8-hr time-weighted average (TWA) concentration and 20 ppm (120 mg/m³) as a short-term exposure limit (STEL). A STEL is a 15-min TWA exposure that should not be exceeded at any time during a workday [29 CFR 1910.1000, Table Z-1-A].

• NIOSH REL

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) of 10 ppm (60 mg/m³) as an 8-hr TWA and 20 ppm (120 mg/m³) as a STEL [NIOSH 1992].

• ACGIH TLV[®]

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned p-tert-butyltoluene a threshold limit value (TLV) of 10 ppm (61 mg/m³) as a TWA for a normal 8-hr workday and a 40-hr workweek, and a STEL of 20 ppm (121 mg/m³) for periods not to exceed 15 min [ACGIH 1991b].

• Rationale for limits

The limits are based on the risk of irritation, nausea, and central nervous system and cardiovascular effects associated with exposure to p-tert-butyltoluene.

HEALTH HAZARD INFORMATION

• Routes of exposure

Exposure to p-tert-butyltoluene can occur through inhalation, ingestion, and eye or skin contact.

• Summary of toxicology

1. *Effects on Animals:* p-tert-Butyltoluene is a mild eye, skin, and respiratory tract irritant and a central nervous system depressant in animals acutely exposed; chronic exposure causes lung, brain, liver, and kidney damage. p-tert-Butyltoluene caused slight and transient eye irritation in rats and mild skin irritation in rabbits [NIOSH 1991; Grant 1986]. The dermal LD₅₀ in rabbits is 19,600 mg/kg, and the LC₅₀ in rats is 934 ppm for 1 hr [NIOSH 1991]. The oral LD₅₀ in rats is 1,800 mg/kg. Acutely poisoned animals showed signs of eye and respiratory tract irritation and central nervous system effects including convulsions before death [Hine et al. 1954]. Rats repeatedly inhaling 25 or 50 ppm for 1 to 7 hr showed an increase in hemoglobin and a decrease in both erythrocyte and leukocyte counts [Clayton and Clayton 1981]. Repeated exposure of rats to 50 ppm caused liver and kidney changes and lesions of the brain and spinal cord [Hine

et al. 1954]. Rats repeatedly exposed to 850 ppm for 1 hr progressively showed tremor, clonic movements, and flexor paralysis; pulmonary edema and pneumonia were the most frequent causes of death in animals after 10 such exposures [NLM 1990].

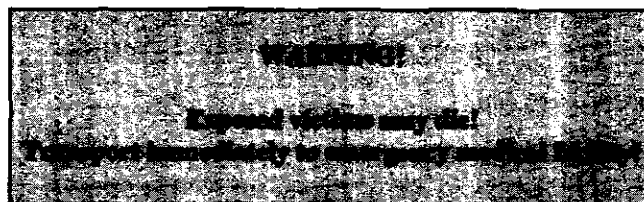
2. *Effects on Humans:* p-tert-Butyltoluene causes eye, skin, and upper respiratory tract irritation and central nervous system effects in humans. The irritant dose for the human eye is 5 ppm for 2 hr [NIOSH 1991]. The lowest acute toxic concentration in humans is 20 ppm for 5 min; central nervous system effects are seen at this concentration. Volunteers exposed for 5 min to p-tert-butyltoluene at concentrations ranging from 5 to 160 ppm reported experiencing nausea, upper respiratory tract irritation, and a metallic taste in the mouth. Volunteers exposed to the 160-ppm concentration became giddy and had increased pulse rates [Hine et al. 1954]. Workers chronically exposed to concentrations that were generally below 10 ppm reported anxiety and experienced decreased blood pressure, increased pulse rate, tremor, hematologic changes, and skin irritation [Hine et al. 1954].

• Signs and symptoms of exposure

1. *Acute exposure:* Acute exposure to p-tert-butyltoluene can cause contact irritation, runny nose, scratchy throat, headache, tiredness, giddiness, anxiety, nausea, metallic taste, weakness, tremor, ataxia, increased pulse rate, decreased blood pressure, dizziness, confusion, hallucinations, dysarthria, convulsions, dyspnea, increased breathing effort, temporary loss of consciousness, and death from possible respiratory failure [NLM 1990].

2. *Chronic exposure:* Repeated or prolonged contact of p-tert-butyltoluene causes defatting and irritation of the skin. It can also cause tremor, decreased blood pressure, elevated pulse rate, and blood changes.

• Emergency procedures



Keep unconscious victims warm and on their sides to avoid choking if vomiting occurs. Initiate the following emergency procedures:

1. *Eye exposure:* Tissue irritation may result from exposure to concentrated solutions, vapors, mists, or aerosols of p-tert-butyltoluene. **Immediately and thoroughly** flush eyes with large amounts of water, occasionally lifting the upper and lower eyelids.

2. *Skin exposure*: Skin irritation may result. *Immediately* remove contaminated clothing and *thoroughly* wash contaminated skin with soap and water.

3. *Inhalation exposure*: If vapors, mists, or aerosols of p-tert-butyltoluene are inhaled, move the victim to fresh air *immediately*. Have the victim blow his or her nose to remove residues from nostrils.

If the victim is not breathing, clean any chemical contamination from the victim's lips and perform cardiopulmonary resuscitation (CPR); if breathing is difficult, give oxygen.

4. *Ingestion exposure*: Take the following steps if p-tert-butyltoluene or a solution containing it is ingested:

—Do *not* induce vomiting.

—Have the victim rinse the contaminated mouth cavity several times with a fluid such as water.

5. *Rescue*: Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the material safety data sheet required by OSHA's hazard communication standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures and the location and proper use of emergency equipment.

EXPOSURE SOURCES AND CONTROL METHODS

The following operations may involve p-tert-butyltoluene and may result in worker exposures to this substance:

—Production of resins

—Use of p-tert-butyltoluene as a primary intermediate and as a solvent in the chemical and pharmaceutical industries

The following methods are effective in controlling worker exposures to p-tert-butyltoluene, depending on the feasibility of implementation:

—Process enclosure

—Local exhaust ventilation

—General dilution ventilation

—Personal protective equipment

Good sources of information about control methods are as follows:

1. ACGIH [1992]. Industrial ventilation—a manual of recommended practice. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

2. Burton DJ [1986]. Industrial ventilation—a self study companion. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

3. Alden JL, Kane JM [1982]. Design of industrial ventilation systems. New York, NY: Industrial Press, Inc.

4. Wadden RA, Scheff PA [1987]. Engineering design for control of workplace hazards. New York, NY: McGraw-Hill.

5. Plog BA [1988]. Fundamentals of industrial hygiene. Chicago, IL: National Safety Council.

MEDICAL MONITORING

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, placement of workers in jobs that do not jeopardize their safety or health, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical monitoring program is intended to supplement, not replace, such measures. To place workers effectively and to detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

• Preplacement medical evaluation

Before a worker is placed in a job with a potential for exposure to p-tert-butyltoluene, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the eyes, skin, respiratory system, blood, and central nervous system. Medical monitoring for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society [ATS 1987].

A preplacement medical evaluation is recommended to assess an individual's suitability for employment at a specific job and to detect and assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to p-tert-butyltoluene at or below the prescribed exposure limit. The licensed health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable

medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with eye, skin, respiratory system, blood, or central nervous system diseases.

- **Periodic medical examinations and biological monitoring**

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to p-tert-butyltoluene exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of p-tert-butyltoluene on the eyes, skin, respiratory system, blood, and central nervous system. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for p-tert-butyltoluene.

- **Medical examinations recommended at the time of job transfer or termination**

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of job placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared with those expected for a suitable reference population. Because occupational exposure to p-tert-butyltoluene may cause diseases with prolonged latent periods, the need for medical monitoring may extend well beyond the termination of employment.

WORKPLACE MONITORING AND MEASUREMENT

A worker's exposure to airborne p-tert-butyltoluene is determined by using charcoal tubes (100/50-mg sections, 20/40 mesh). Samples are collected at a maximum flow rate of 0.2 liter/min until a maximum air volume of 29 liters is collected. The samples are desorbed with carbon disulfide. Analysis is conducted by gas chromatography using a flame ionization detector. The limit of detection for this procedure is 0.001 to 0.01 mg per sample. This method is described in

Method No. 1501 of the *NIOSH Manual of Analytical Methods* [NIOSH 1984].

PERSONAL HYGIENE

If p-tert-butyltoluene contacts the skin, workers should flush the affected areas immediately with plenty of water for 15 min, followed by washing with soap and water.

Clothing and shoes contaminated with p-tert-butyltoluene should be removed immediately, and provisions should be made for safely removing this chemical from these articles. Persons laundering contaminated clothing should be informed of the hazardous properties of p-tert-butyltoluene, particularly its potential for causing irritation of the eyes and skin.

A worker who handles p-tert-butyltoluene should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, or using toilet facilities.

Workers should not eat, drink, or use tobacco products in areas where p-tert-butyltoluene or a solution containing p-tert-butyltoluene is handled, processed, or stored.

STORAGE

p-tert-Butyltoluene should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's hazard communication standard [29 CFR 1910.1200]. The storage area must meet OSHA requirements for a Class IIIA flammable liquid [29 CFR 1910.106]. Ventilation fans and other electrical service must be of explosionproof design. Containers of p-tert-butyltoluene should be protected from physical damage and should be stored separately from oxidizers, heat, sparks, and open flame. Containers of p-tert-butyltoluene should be routinely inspected for leaks. To prevent static sparks, metal containers and equipment must be grounded and bonded during transfers. Because containers that formerly contained p-tert-butyltoluene may still hold product residues, they should be handled appropriately.

SPILLS AND LEAKS

In the event of a spill or leak involving p-tert-butyltoluene, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup is complete. The following steps should be undertaken following a spill or leak:

1. Do not touch the spilled material; stop the leak if it is possible to do so without risk.
2. Notify safety personnel.
3. Remove all sources of heat and ignition.
4. Ventilate potentially explosive atmospheres.

5. Use water spray to reduce vapors, but be aware that the spray may not prevent ignition in closed spaces.
6. Use only nonsparking tools for cleanup.
7. Absorb small liquid spills with sand or other noncombustible absorbent material and place the material in a covered container for later disposal.
8. For large liquid spills, build dikes far ahead of the spill to contain the p-tert-butyltoluene for later reclamation or disposal.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

• Emergency planning requirements

p-tert-Butyltoluene is not subject to EPA emergency planning requirements under the Superfund Amendments and Reauthorization Act (SARA) [42 USC 11022].

• Reportable quantity requirements for hazardous releases

Employers are not required by the emergency release notification provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [40 CFR 355.40] to notify the National Response Center of an accidental release of p-tert-butyltoluene; there is no reportable quantity for this substance.

• Community right-to-know requirements

Employers are not required by Section 313 of SARA to submit a Toxic Chemical Release Inventory Form (Form R) to EPA reporting the amount of p-tert-butyltoluene emitted or released from their facility annually.

• Hazardous waste management requirements

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. Although p-tert-butyltoluene is not specifically listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], EPA requires employers to treat waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are

conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (800) 424-9346 or at (202) 382-3000 in Washington, D.C. In addition, relevant State and local authorities should be contacted for information about their requirements for waste removal and disposal.

RESPIRATORY PROTECTION

• Conditions for respirator use

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of p-tert-butyltoluene exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should use only respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

• Respiratory protection program

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's respiratory protection standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the *NIOSH Respirator Decision Logic* [NIOSH 1987b] and the *NIOSH Guide to Industrial Respiratory Protection* [NIOSH 1987a].

PERSONAL PROTECTIVE EQUIPMENT

Protective clothing should be worn to prevent prolonged or repeated skin contact with p-tert-butyltoluene. Gloves, aprons, boots, and other protective clothing and equipment should be used as necessary to prevent skin contact. Chemical protective clothing should be selected on the basis of available performance data, manufacturers' recommendations, and evaluation of the clothing under actual conditions of use. The following materials have been tested against

permeation by p-tert-butyltoluene and have demonstrated good-to-excellent resistance for periods greater than 8 hr: polyvinyl alcohol and Viton[®]. Nitrile rubber may withstand permeation for more than 4 but fewer than 8 hr. Butyl rubber, natural rubber, and neoprene have demonstrated poor resistance to permeation by p-tert-butyltoluene.

If p-tert-butyltoluene is dissolved in an organic solvent, the permeation properties of both the solvent and the mixture must be considered when selecting personal protective equipment and clothing.

Safety glasses, goggles, or face shields should be worn during operations in which p-tert-butyltoluene might contact the eyes (e.g., through splashes of solution). Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or skin contact with p-tert-butyltoluene. Contact lenses should not be worn if the potential exists for exposure to p-tert-butyltoluene.

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