

Occupational Health Guideline for p-Dichlorobenzene

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: 1,4-C₆H₄Cl₂
- Synonyms: 1,4-Dichlorobenzene; dichlorocide; PDCB
- Appearance and odor: Colorless solid with a moth-ball-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for p-dichlorobenzene is 75 parts of p-dichlorobenzene per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 450 milligrams of p-dichlorobenzene per cubic meter of air (mg/m³).

HEALTH HAZARD INFORMATION

- **Routes of exposure**
p-Dichlorobenzene can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.
- **Effects of overexposure**
Exposure to p-dichlorobenzene may cause irritation of the eyes, nose, and throat. It may also cause headache, swelling around the eyes, and runny nose. In addition, it may cause loss of appetite, nausea, vomiting, weight loss, and liver damage with yellow jaundice and death. Particles of solid p-dichlorobenzene in contact with the eyes may cause pain. The solid material also produces a burning sensation when held in contact with the skin with slight irritation. Warm fumes or strong solutions of p-dichlorobenzene may irritate the skin slightly on

prolonged or repeated contact. Red blotching of the skin due to allergy to p-dichlorobenzene may occur.

- **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 p-dichlorobenzene.

- **Recommended medical surveillance**
The following medical procedures should be made available to each employee who is exposed to p-dichlorobenzene at potentially hazardous levels:

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the liver, respiratory tract, eyes, and kidneys should be stressed. The skin should be examined for evidence of chronic disorders.

—Liver function tests: Since liver damage has been observed in humans exposed to p-dichlorobenzene, a profile of liver function should be obtained by using a medically acceptable array of biochemical tests.

—Urinalysis: Measurement of 2,5-dichlorophenol may serve as an index of exposure.

2. Periodic Medical Examination:

The aforementioned medical examinations should be repeated on an annual basis.

- **Summary of toxicology**

p-Dichlorobenzene vapor irritates the eyes and upper respiratory tract and is toxic to the liver. A group of animals repeatedly exposed to 798 ppm developed eye irritation, marked tremors, weakness, and loss of weight; some died. Reversible, nonspecific changes in the eye grounds were noted in rabbits, but there were no lens changes; other effects were centrolobular necrosis of the liver and mild damage to the lungs and kidneys. In five cases of intoxication from exposure to p-dichlorobenzene used as a mothproofing agent, one person with only moderate exposure complained of severe headache, periorbital swelling, and profuse rhinitis, which subsided 24 hours after cessation of exposure.

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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The other four persons who had more prolonged exposure developed anorexia, nausea, vomiting, weight loss, and hepatic necrosis with jaundice; two died, and another developed cirrhosis. In 58 workers exposed for an average of 4.8 years (range, 8 months to 25 years) to p-dichlorobenzene at levels of 10 to 725 ppm, there was no evidence of hematologic effects; painful irritation of the eyes and nose was recorded at levels between 50 and 80 ppm, and it was severe at 160 ppm. Solid particles of p-dichlorobenzene in the human eye cause pain. The solid material produces a burning sensation when held in contact with the skin, but the resulting irritation is slight; warm fumes or strong solutions may irritate the intact skin slightly on prolonged or repeated contact. A case of allergic purpura induced by p-dichlorobenzene has been reported. In a study of workers engaged in synthesizing or otherwise handling p-dichlorobenzene, it was concluded that urinary excretion of 2,5-dichlorophenol (a metabolite of paradichlorobenzene) can serve as an index of exposure. Published studies of tests for carcinogenicity are considered to have been too short in duration and involved too few animals to have any significance.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 147
2. Boiling point (760 mm Hg): 174 C (345 F)
3. Specific gravity (water = 1): 1.46
4. Vapor density (air = 1 at boiling point of p-dichlorobenzene): 5.1
5. Melting point: 53 C (127 F)
6. Vapor pressure at 20 C (68 F): 0.4 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.008
8. Evaporation rate (butyl acetate = 1): Not applicable

• Reactivity

1. Conditions contributing to instability: None
2. Incompatibilities: None
3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen chloride and carbon monoxide) may be released in a fire involving p-dichlorobenzene.
4. Special precautions: Liquid p-dichlorobenzene will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: 65.6 C (150 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Lower: 2.5 (calculated at flash point)
4. Extinguishant: Foam, carbon dioxide, dry chemical

• Warning properties

1. Odor Threshold: Patty states that "p-dichlorobenzene has a very distinctive aromatic odor. The threshold of detection will vary from 15 to 30 ppm in air. The odor becomes very strong at concentrations between 30

and 60 ppm . . . It should be recognized, however, that a person may become sufficiently accustomed to the odor to tolerate high concentrations."

2. Irritation Levels: Patty states that p-dichlorobenzene "is painful to the eyes and nose at concentrations of 80 to 160 ppm. Above 160 ppm, it is intolerable to any person who has not worked in it long enough to have had some adaptation."

3. Evaluation of Warning Properties: Through its odor and irritant effects, p-dichlorobenzene can be detected within three times the permissible exposure limit. For the purposes of this guideline, therefore, it 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 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 p-dichlorobenzene may be used. An analytical method for p-dichlorobenzene is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 3, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00261-4).

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 solid particles or vapors from the surface of hot p-dichlorobenzene.
- Employees should be provided with and required to use dust- and splash-proof safety goggles where p-dichlorobenzene or liquids containing p-dichlorobenzene may contact the eyes.

SANITATION

- Workers subject to skin contact with p-dichlorobenzene should wash any areas of the body which may have contacted p-dichlorobenzene at the end of each work day.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Formulation for use in moth control; as a deodorant for garbage and rest rooms; as an insecticide for control of fruit borers and ants; use in organic synthesis for preparation of dye intermediates	General dilution ventilation; local exhaust ventilation; personal protective equipment
Manufacture of p-dichlorobenzene	General dilution ventilation; local exhaust ventilation; personal protective equipment
Application as an insecticide, air deodorant, moth and mildew preventive, and household fumigant	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 p-dichlorobenzene or liquids containing p-dichlorobenzene get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get

medical attention. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If p-dichlorobenzene or liquids containing p-dichlorobenzene get on the skin, wash the contaminated skin using soap or mild detergent and water. If p-dichlorobenzene or liquids containing p-dichlorobenzene penetrate through the clothing, remove the clothing 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 p-dichlorobenzene, 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 p-dichlorobenzene has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. 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 AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of spills until cleanup has been completed.

- If p-dichlorobenzene is spilled, the following steps should be taken:

1. Ventilate area of spill.
2. 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, dispose in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device as in below or deposit in a secured sanitary landfill.

- Waste disposal methods:

p-Dichlorobenzene may be disposed of:

1. By making packages of p-dichlorobenzene in paper or other flammable material and burning in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.
2. By dissolving p-dichlorobenzene in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

3. By disposal in a secured sanitary landfill.

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RESPIRATORY PROTECTION FOR p-DICHLOROBENZENE

Condition	Minimum Respiratory Protection* Required Above 75 ppm
Vapor Concentration	
1,000 ppm or less	A chemical cartridge respirator with a full facepiece, an organic vapor cartridge(s), and dust filter. A gas mask with a chin-style or a front- or back-mounted organic vapor canister and dust filter. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 1,000 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 and particulates. Any escape self-contained breathing apparatus.

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

