

# Occupational Health Guideline for p-Nitrochlorobenzene

## 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-ClC<sub>6</sub>H<sub>4</sub>NO<sub>2</sub>
- Synonyms: PNCB; 4-chloronitrobenzene; PCNB; p-chloronitrobenzene; 1-chloro-4-nitrobenzene
- Appearance and odor: Yellow solid with a sweet odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for p-nitrochlorobenzene is 1 milligram of p-nitrochlorobenzene per cubic meter of air (mg/m<sup>3</sup>) averaged over an eight-hour work shift.

## HEALTH HAZARD INFORMATION

### • Routes of exposure

p-Nitrochlorobenzene can affect the body if it is inhaled, comes in contact with the eyes or skin, or swallowed. It is readily absorbed through the skin. Even a small amount absorbed from clothes or shoes may cause toxic symptoms.

### • Effects of overexposure

**1. Short-term Exposure:** p-Nitrochlorobenzene affects the ability of the blood to carry oxygen normally. A bluish discoloration of the skin may occur with headache, irritability, dizziness, weakness, nausea, vomiting, shortness of breath, drowsiness, and unconsciousness. If treatment is not given promptly, death may occur. The onset of symptoms may be delayed. p-Nitrochlorobenzene may also cause an unpleasant taste. The ingestion of alcohol may cause increased susceptibility to the effects of p-nitrochlorobenzene. The earliest effect may

be a bluish color of the skin, especially of the lips. If the lack of oxygen becomes severe, drowsiness, headache, nausea, and vomiting may occur. If oxygen lack is very severe, it may cause unconsciousness and even death. It will also cause the mouth and breath to smell of bitter almonds.

**2. Long-term Exposure:** Repeated or prolonged exposure to p-nitrochlorobenzene may cause anemia and skin rash.

**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 p-nitrochlorobenzene.

### • Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to p-nitrochlorobenzene 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 blood, liver, kidneys, and cardiovascular system should be stressed.

—A complete blood count: p-Nitrochlorobenzene has been shown to cause methemoglobinemia and anemia. Those with blood disorders may be at increased risk from exposure. A complete blood count should be performed including a red cell count, a white cell count, a differential count of a stained smear, as well as hemoglobin and hematocrit. Observe for Heinz bodies.

**2. Periodic Medical Examination:** The aforementioned medical examinations should be repeated on an annual basis. Methemoglobin determinations should be performed at any time overexposure is suspected or signs and symptoms of toxicity occur.

### • Summary of toxicology

Absorption of p-nitrochlorobenzene, whether by inhalation of vapor or dust or by absorption of the solid through the skin, causes anoxia due to the formation of methemoglobin. Application of the solid dissolved in

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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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olive oil to the skin of rabbits caused methemoglobinemia, the formation of Heinz bodies in erythrocytes, anemia, hematuria, and hemoglobinuria. Signs and symptoms of overexposure are due to the loss of oxygen-carrying capacity of the blood. Rapid absorption through the intact skin is frequently the main route of entry. The onset of symptoms of methemoglobinemia is often insidious and may be delayed for up to 4 hours; headache is commonly the first symptom and may become quite intense as the severity of methemoglobinemia progresses. Cyanosis develops early in the course of intoxication, first in the lips, the nose, and the ear lobes, and may be recognized by fellow workers. Cyanosis occurs when the methemoglobin concentration is 15% or more. The individual may feel well, have no complaints, and may insist that nothing is wrong until the methemoglobin concentration approaches approximately 40%. At methemoglobin concentrations of over 40% there usually is weakness and dizziness; at up to 70% concentration there may be ataxia, dyspnea on mild exertion, tachycardia, nausea, vomiting, and drowsiness. The ingestion of alcohol aggravates the toxic effects of p-nitrochlorobenzene. Four workers exposed for a period of 2 to 4 days to an unmeasured concentration of the vapor developed methemoglobinemia; an unpleasant taste in mouth and anemia developed during the week after exposure.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 157.6
2. Boiling point (760 mm Hg): 242 C (468 F)
3. Specific gravity (water = 1): 1.37
4. Vapor density (air = 1 at boiling point of p-nitrochlorobenzene): 5.4
5. Melting point: 83 C (181 F)
6. Vapor pressure at 20 C (68 F): Much less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.003
8. Evaporation rate (butyl acetate = 1): Not applicable

### • Reactivity

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

### • Flammability

1. Flash point: 127 C (261 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available

4. Extinguishant: Foam, carbon dioxide, dry chemical

### • Warning properties

According to Grant, nitrochlorobenzene (NCB), "like nitrobenzene, has been observed to cause methemoglobinemia, with discoloration of the conjunctiva reflecting the change in the color of the blood." NCB is not known to be an eye irritant, however.

## 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 p-nitrochlorobenzene in an absorption tube containing silica gel, followed by desorption with methanol, and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure p-nitrochlorobenzene may be used. An analytical method for p-nitrochlorobenzene 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 skin contact with p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene, where skin contact may occur.
- If employees' clothing may have become contaminated with p-nitrochlorobenzene, employees should change into uncontaminated clothing before leaving the work premises.
- Clothing contaminated with p-nitrochlorobenzene should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of p-nitrochlorobenzene from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the p-nitrochlorobenzene, the person performing the operation should be informed of p-nitrochlorobenzene's hazardous properties.
- Where exposure of an employee's body to liquids containing p-nitrochlorobenzene may occur, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.
- Non-impervious clothing which becomes wet with liquids containing p-nitrochlorobenzene should be removed immediately and not reworn until the p-nitrochlorobenzene is removed from the clothing.

## SANITATION

- Skin that becomes wet with liquids containing p-nitrochlorobenzene should be immediately washed or showered with soap or mild detergent and water to remove any p-nitrochlorobenzene.
- Skin that becomes wet with p-nitrochlorobenzene should be promptly washed or showered with soap or mild detergent and water to remove any p-nitrochlorobenzene.
- Workers subject to skin contact with p-nitrochlorobenzene should wash with soap or mild detergent and water any areas of the body which may have contacted p-nitrochlorobenzene at the end of each work day.
- Eating and smoking should not be permitted in areas where p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene are handled, processed, or stored.
- Employees who handle p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene 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 p-nitrochlorobenzene may occur and control methods which may be effective in each case:

### Operation

Use in production of chemical intermediates for manufacture of pesticides, fungicides, and preservatives; production of chemical intermediates for manufacture of sulfur and azo-fast dyes; synthesis of intermediates in manufacture of pharmaceuticals, rubber chemicals, antioxidants, gasoline gum inhibitors, corrosion inhibitors, and photographic chemicals

### Controls

Process enclosure; local exhaust 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-nitrochlorobenzene or liquids containing p-nitrochlorobenzene get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

### • Skin Exposure

If p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene get on the skin, immediately wash the contaminated skin using soap or mild detergent and water. If p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene penetrate through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. Get medical attention immediately.

### • Breathing

If a person breathes in large amounts of p-nitrochlorobenzene, 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-nitrochlorobenzene or liquids containing p-nitrochlorobenzene have 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-nitrochlorobenzene 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, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

- Waste disposal methods:

p-Nitrochlorobenzene may be disposed of:

1. By making packages of p-nitrochlorobenzene 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-nitrochlorobenzene in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

## REFERENCES

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## RESPIRATORY PROTECTION FOR p-NITROCHLOROBENZENE

Condition	Minimum Respiratory Protection* Required Above 1 mg/m <sup>3</sup>
Particulate Concentration	
5 mg/m <sup>3</sup> or less	Any dust and mist respirator, except single-use.
10 mg/m <sup>3</sup> or less	Any dust and mist respirator, except single-use or quarter-mask respirator. Any fume respirator or high efficiency particulate filter respirator. Any supplied-air respirator. Any self-contained breathing apparatus.
50 mg/m <sup>3</sup> 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.
1000 mg/m <sup>3</sup> or less	A powered air-purifying respirator with a high efficiency particulate filter. A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 1000 mg/m <sup>3</sup> 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.

