Occupational Health Guideline for o-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: C₄H₄Cl₂
- Synonyms: 1,2-Dichlorobenzene; o-dichlorobenzol
- Appearance and odor: Colorless to pale yellow liquid with a pleasant aromatic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for o-dichlorobenzene is a ceiling of 50 parts of o-dichlorobenzene per million parts of air (ppm). This may also be expressed as 300 milligrams of o-dichlorobenzene per cubic meter of air (mg/m³).

HEALTH HAZARD INFORMATION

- Routes of exposure
  o-Dichlorobenzene can affect the body if it is inhaled, if it comes in contact with the eyes or skin, or if it is swallowed. It may also be absorbed through the skin.
- Effects of overexposure
  1. Short-term Exposure: o-Dichlorobenzene vapor may cause irritation of the upper respiratory tract and eyes. Higher concentrations may cause drowsiness, unconsciousness, and death. The liquid may cause burning of the skin. The liquid may also cause burning of the eyes with tissue damage.
  2. Long-term Exposure: Prolonged or repeated contact with o-dichlorobenzene may cause skin irritation. Prolonged or repeated inhalation of high concentrations of vapor might cause liver or kidney injury.

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 o-dichlorobenzene.

- Recommended medical surveillance
  The following medical procedures should be made available to each employee who is exposed to o-dichlorobenzene 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 o-dichlorobenzene exposure.
     - Liver disease: o-Dichlorobenzene is known as a liver toxin in animals. 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: o-Dichlorobenzene is known as a kidney toxin in animals. The importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.
     - Skin disease: o-Dichlorobenzene may cause sensitization dermatitis and blistering of the skin. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.
  2. Periodic Medical Examination: Any employee developing the above-listed conditions should be referred for further medical examination.
- Summary of toxicity
  o-Dichlorobenzene vapor at high concentrations is toxic to the liver and kidneys in animals. Rats died from exposure to 977 ppm for 7 hours, but survived when exposed for only 2 hours; animals survived exposure to 539 ppm for 3 hours and at necropsy showed marked centrolobular necrosis of the liver, as well as cloudy swelling of the tubular epithelium of the kidneys. Several species of animals exposed repeatedly to 93 ppm for 7 hours daily showed no adverse effects. The liquid instilled in the rabbit eye produced apparent distress and slight conjunctival irritation. Eye irritation is not

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

September 1978
usually evident below 20 ppm but becomes noticeable at 25 to 30 ppm and painful to some at 60 to 100 ppm if exposures are for more than a few minutes duration. Some acclimatization may occur, but its extent is not great. Workers exposed daily to an average of 15 ppm showed no indication of injury. The liquid left on the skin may produce blistering. Sensitization dermatitis has been reported.

CHEMICAL AND PHYSICAL PROPERTIES

- Physical data
  1. Molecular weight: 147
  2. Boiling point (760 mm Hg): 180 °C (356 °F)
  3. Specific gravity (water = 1): 1.3
  4. Vapor density (air = 1 at boiling point of o-
     dichlorobenzene): 5.1
  5. Melting point: —17.6 °C (0.5 °F)
  6. Vapor pressure at 20 °C (68 °F): 1.2 mm Hg
  7. Solubility in water, g/100 g water at 20 °C (68 °F): 0.015
  8. Evaporation rate (butyl acetate = 1): Less than 1

- Reactivity
  2. Incompatibilities: Contact with strong oxidizers or
     with hot aluminum or aluminum alloys may cause fires
     and explosions.
  3. Hazardous decomposition products: Toxic gases
     and vapors (such as hydrogen chloride, chlorine, and
     carbon monoxide) may be released in a fire involving o-
     dichlorobenzene.
  4. Special precautions: Liquid o-dichlorobenzene
     will attack some forms of plastics, rubber, and coatings.
- Flammability
  1. Flash point: 66 °C (151 °F) (closed cup)
  2. Autoignition temperature: 648 °C (1198 °F)
  3. Flammable limits in air, % by volume: Lower: 2.2;
     Upper: 9.2
- Extinguisher: Dry chemical, foam, carbon dioxide
- Warning properties
  1. Odor Threshold: 2 to 4 ppm, according to the
     AIHA Hygienic Guide; 50 ppm, according to May and
     Patty.
  2. Eye Irritation Level: 20 to 30 ppm according to
     the AIHA Hygienic Guide.
  3. Evaluation of Warning Properties: Since the odor
     threshold of o-dichlorobenzene and the concentration
     causing eye irritation are at or below the permissible
     exposure, it is treated as a material with adequate
     warning properties.

MONITORING AND MEASUREMENT PROCEDURES

- Ceiling Evaluation
  Measurements to determine employee ceiling exposure
  are best taken during periods of maximum expected
  airborne concentrations of o-dichlorobenzene. 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 vapors using an adsorption tube with subsequent
  desorption with carbon disulfide and gas chromatogra-
  phic analysis. Also, detector tubes certified by NIOSH
  under 42 CFR Part 84 or other direct-reading devices
  calibrated to measure o-dichlorobenzene may be used.
  An analytical method for o-dichlorobenzene 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. How-
  ever, 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 Enforce-
  ment and Safety Administration) or by the National
  Institute for Occupational Safety and Health.
- In addition to respirator selection, a complete respira-
  tory 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 o-dichlorobenzene.
- Clothing wet with liquid o-dichlorobenzene should
  be placed in closed containers for storage until it can be
  discarded or until provision is made for the removal of
  o-dichlorobenzene from the clothing. If the clothing is
  to be laundered or otherwise cleaned to remove the
  o-dichlorobenzene, the person performing the operation
  should be informed of o-dichlorobenzene's hazardous
  properties.
- Non-impervious clothing which becomes contaminated with liquid o-dichlorobenzene should be removed promptly and not reworn until the o-dichlorobenzene is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid o-dichlorobenzene may contact the eyes.

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

<table>
<thead>
<tr>
<th>Operation</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use in cleaning and degreasing of metal, leather, wool, paper, dry cleaning, brick, and upholstery</td>
<td>General dilution ventilation; personal protective equipment</td>
</tr>
<tr>
<td>Use as fumigant for poultry houses and stockyards for termites, moths, and beetles</td>
<td>Personal protective equipment</td>
</tr>
<tr>
<td>Use in application or removal of surface coatings</td>
<td>General dilution ventilation; personal protective equipment</td>
</tr>
<tr>
<td>Use in maintenance of equipment containing heat-transfer agents</td>
<td>Personal protective equipment</td>
</tr>
<tr>
<td>Use in organic synthesis in pesticides, herbicides, dyestuffs, and pharmaceuticals; chemical intermediate in manufacture of toluene-diisocyanate and extractive distillation of ethyl benzene from xylene; use as a deodorizing agent</td>
<td>General dilution ventilation</td>
</tr>
</tbody>
</table>

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 liquid o-dichlorobenzene gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention. Contact lenses should not be worn when working with this chemical.
- **Skin Exposure**
  If liquid o-dichlorobenzene gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If liquid o-dichlorobenzene soaks through the clothing, remove the clothing promptly 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 o-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 o-dichlorobenzene has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.
- **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 o-dichlorobenzene 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 reclaimed or collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

- Waste disposal methods:
  o-Dichlorobenzene 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 equipped with an effluent gas cleaning device.

REFERENCES
# RESPIRATORY PROTECTION FOR o-DICHLOROBENZENE

<table>
<thead>
<tr>
<th>Condition</th>
<th>Minimum Respiratory Protection* Required Above 50 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapor Concentration</td>
<td></td>
</tr>
<tr>
<td>1000 ppm or less</td>
<td>A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).</td>
</tr>
<tr>
<td>1700 ppm or less</td>
<td>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.</td>
</tr>
<tr>
<td>Greater than 1700 ppm or entry and escape from unknown concentrations</td>
<td>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.</td>
</tr>
<tr>
<td>Fire Fighting</td>
<td>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</td>
</tr>
<tr>
<td>Escape</td>
<td>Any gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.</td>
</tr>
</tbody>
</table>

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