Occupational Health Guideline for Dibutylphthalate

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: \( C_8H_{12}(CO_2C_8H_{18})_2 \)
- Synonyms: DBP; dibutyl 1,2-benzenedicarboxylate
- Appearance and odor: Colorless, oily liquid with a very weak, aromatic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)
The current OSHA standard for dibutylphthalate is 5 milligrams of dibutylphthalate per cubic meter of air (mg/m\(^3\)) averaged over an eight-hour work shift.

HEALTH HAZARD INFORMATION
- Routes of exposure
Dibutylphthalate can affect the body if it is swallowed, comes in contact with the eyes or skin, or is inhaled as a mist or spray.
- Effects of overexposure
Swallowing dibutylphthalate may cause nausea, dizziness, light sensitivity, and watering and redness of the eyes. Overexposure to hot vapors or mists of dibutylphthalate may cause nose and throat 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 dibutylphthalate.
- Recommended medical surveillance
Routine medical examinations should be provided to each employee who is exposed to dibutylphthalate at potentially hazardous levels.
- Summary of toxicology
Extensive experience with dibutylphthalate as an insect repellant has shown that it is relatively non-irritating to the skin, eyes, and mucous membranes. Aerosols from heated dibutylphthalate may cause irritation of the eyes and upper respiratory tract. In one report of a human case, accidental ingestion of ten grams of this compound by a chemical operator produced nausea and dizziness with lacrimation, photophobia, and conjunctivitis, but recovery was prompt and uneventful. Animal experiments to determine dermal and oral toxicity of dibutylphthalate showed that extremely high doses were considered necessary to produce toxic effects. Dibutylphthalate was found to be teratogenic by intraperitoneal injection of doses representing \( \frac{1}{10} \), \( \frac{1}{5} \), and \( \frac{1}{3} \) of the LD50 value into female rats at the 5th, 10th, and 15th day of gestation. This probably is of no significance in industrial exposures.

CHEMICAL AND PHYSICAL PROPERTIES
- Physical data
  1. Molecular weight: 278
  2. Boiling point (760 mm Hg): 335°C (635°F)
  3. Specific gravity (water = 1): 1.05
  4. Vapor density (air = 1 at boiling point of dibutylphthalate): 9.6
  5. Melting point: -37°C (-35°F)
  6. Vapor pressure at 20°C (68°F): Less than 0.01 mm Hg
  7. Solubility in water, g/100 g water at 20°C (68°F): 0.45
  8. Evaporation rate (butyl acetate = 1): Almost zero
- Reactivity
  1. Conditions contributing to instability: None
  2. Incompatibilities: Contact with nitrates, strong oxidizers, strong alkalis, and strong acids may cause fires and explosions.
  3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving dibutylphthalate.

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

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4. Special precautions: None

- Flammability
  1. Flash point: 157 °C (315 °F) (closed cup)
  2. Autoignition temperature: 403 °C (757 °F)
  3. Flammable limits in air, % by volume: Lower: 0.5
     (calculated at flash point)
  4. Extinguishment: Dry chemical, foam, carbon dioxide

- Warning properties
  According to Grant, "contact with the surface
  of human eyes has occurred by accidental droplet splash
  as well as by experimental application, and this has
  caused immediate, severe, stinging pain. The pain
  stimulated profuse tearing, which washed the oily
  liquid away, and the eyes were not appreciably damaged."

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 dibutylphthalate on a filter, followed by extraction
  with carbon disulfide, and gas chromatographic analysis.
  An analytical method for dibutylphthalate 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 splash-proof safety goggles where liquid dibu-
  tylphthalate may contact the eyes.

COMMON OPERATIONS AND CONTROLS

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

<table>
<thead>
<tr>
<th>Operation</th>
<th>Controls</th>
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</thead>
<tbody>
<tr>
<td>Liberation during spray application of polyvinyl acetate surface coatings by spraying, dipping, or crushing</td>
<td>Local exhaust ventilation; personal protective equipment</td>
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<tr>
<td>Liberation during spray application of polyester and epoxy resins</td>
<td>Local exhaust ventilation; personal protective equipment</td>
</tr>
<tr>
<td>Liberation during hand and dip applications of polyvinyl acetate, and polyester and epoxy resins</td>
<td>General dilution ventilation</td>
</tr>
<tr>
<td>Liberation during molding and forming of cellulose acetate butyrate, acetate, propionate, and polyvinyl acetate</td>
<td>Local exhaust ventilation; personal protective equipment</td>
</tr>
<tr>
<td>Liberation during application of polyvinyl acetate adhesives, both solvent and hot-melt types</td>
<td>General dilution ventilation</td>
</tr>
<tr>
<td>Liberation during manufacture of nitrile rubber; during molding of polyester and epoxy articles</td>
<td>General dilution ventilation</td>
</tr>
<tr>
<td>Liberation during manufacture of polyvinyl acetate surface coatings</td>
<td>General dilution ventilation</td>
</tr>
<tr>
<td>Use during spray application of nitrocellulose lacquer surface coatings, including paper coatings</td>
<td>Local exhaust ventilation</td>
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</table>
Operation

Liberation during forming of ethyl cellulose articles; during production of polyvinyl acetate; during production of cellulose acetate butyrate, cellulose acetate propionate, and polyvinyl acetate adhesives

Liberation during brush application of nitrocellulose surface coatings; during manufacture of polyester and epoxy resins; during manufacture of nitrocellulose surface coatings

Liberation during manufacture of explosives and propellants

Controls

General dilution ventilation

General dilution ventilation

Local exhaust ventilation

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 dibutylphthalate gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention if any discomfort continues. Contact lenses should not be worn when working with this chemical.

- **Skin Exposure**
  If dibutylphthalate saturates the clothing, remove and clean the clothing before wearing it again. Wash any dibutylphthalate from the skin regularly, particularly when there has been much skin contact. If there is skin irritation, get medical attention.

- **Breathing**
  If a person breathes in large amounts of dibutylphthalate, 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 dibutylphthalate 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 respiratory protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.**
- If dibutylphthalate 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 collected and atomized in a suitable combustion chamber.
- **Waste disposal methods:**
  Dibutylphthalate 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.

REFERENCES

<table>
<thead>
<tr>
<th>Condition</th>
<th>Minimum Respiratory Protection* Required Above 5 mg/m³</th>
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<tbody>
<tr>
<td>Particulate Concentration</td>
<td></td>
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<tr>
<td>250 mg/m³ or less</td>
<td>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.</td>
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<tr>
<td>9300 mg/m³ or less</td>
<td>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.</td>
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<tr>
<td>Greater than 9300 mg/m³ 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>
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<tr>
<td>Fire Fighting</td>
<td>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</td>
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*Only NIOSH-approved or MSHA-approved equipment should be used.