

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** DIPHENYL ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIPHENYL

The basic text of this document contains the draft technical standard approved by the Joint Review Committee of the NIOSH/OSHA Standards Completion Program and the supporting documentation for the substance DIPHENYL.

The SCP draft technical standards are recommendations to the Department of Labor for its consideration in rulemaking and have no legal status until final rules have been promulgated by that agency. This draft standard is provided for your information only.

The References and Sources, Respirator Table Documentation and Use/Exposure and Control Documentation are the working documents used by the various SCP working groups during the development of the draft technical standard and serve as the technical foundation for the standard. The classification for each substance and the regulatory statements were derived following a decision logic established for the various sections of the standard.

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(a) DEFINITIONS

- (1) PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of diphenyl in concentrations not in excess of 0.2 parts per million (ppm) (1 milligram per cubic meter, mg/cu.m.) averaged over an 8-hour work shift, as stated in section 1910.93, Table G-1.
- (2) ACTION LEVEL - "Action Level" means one half (1/2) of the permissible exposure for diphenyl.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which diphenyl is present shall:

- (1) STANDARD AVAILABILITY - Keep a copy of this section with its appendices at the workplace. This material shall be made readily available to affected employees; and
- (2) PRESENCE OF DIPHENYL - Inform affected employees of the quantity, location, and manner of use or storage of diphenyl.

(c) EXPOSURE MEASUREMENT

- (1) INITIAL DETERMINATION - Each employer who has a place of employment in which diphenyl is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of diphenyl at or above the action level. The determination shall be made each time there is a change in production, process, or control measures which could result in an increase in airborne concentrations of diphenyl. A written determination shall be made and it shall contain at least the following information:

- (i) Any information, observations, or calculations which would indicate employee exposure to diphenyl;
- (ii) Any measurements of airborne concentrations of diphenyl taken;
- (iii) Any employee complaints of symptoms which may be attributable to exposure to diphenyl; and
- (iv) Date of determination, work being performed at the time, location within work site, name, and social security number of each employee considered.

- (2) INITIAL EXPOSURE MEASUREMENT - If the employer determines that any employee may be exposed to airborne concentrations of diphenyl at or above the action level, the exposure of the employee believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum exposure of the employee.

- (3) IDENTIFICATION OF EXPOSED EMPLOYEES - If the exposure measurement taken under paragraph (c)(2) of this section reveals employee exposure to airborne concentrations of diphenyl at or above the action level, the employer shall:

- (i) Identify all employees who may be exposed at or above the action level; and
- (ii) Measure the exposure of the employees so identified.

- (4) EXPOSURE ABOVE THE ACTION LEVEL - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of diphenyl at or above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every two months.

- (5) EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE - If an employee exposure measurement reveals that an employee is exposed to airborne

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concentrations of diphenyl above the permissible exposure, the employer shall:

- (i) Inform the employee of the exposure as required by paragraph (N)(1) of this section; and
- (ii) Measure the exposure of the employee at least monthly; and
- (iii) Institute control measures as required by paragraph (E) of this section.

(6) **TERMINATION OF EXPOSURE MEASUREMENT** - If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to airborne concentrations of diphenyl below the action level, the employer may terminate measurement for the employee. For purposes of this subparagraph, use of respirators shall not constitute reduction of employee exposure below the action level.

(d) **METHODS OF MEASUREMENT** - An employee's exposure shall be obtained by any combination of long term or short term samples which represents the employee's actual exposure averaged over an eight hour work shift (Appendix B (iv)). The method of measurement shall have an accuracy, to a confidence level of 95%, of not less than that given in Table 1 below.

Table 1

Concentration	Required Accuracy
Above permissible exposure	Plus or Minus 25%
At or below permissible exposure and above the action level	Plus or Minus 35%
At or below the action level	Plus or Minus 50%

(e) **Methods of compliance**

(1) **Engineering controls** - No employee shall be exposed to diphenyl above the permissible limit as defined in paragraph (a)(1) of this section. Engineering and work practice controls shall be used to reduce exposure to diphenyl to at or below the permissible exposure.

(i) When mechanical ventilation is used to control exposure, measurements which demonstrate system efficiency (For example: air velocity, static pressure, or air volume) shall be made at least every three months. Measurements of system efficiency shall also be made within five work days of any change in production, process or control which might result in a reduction in control.

(2) **Respirators**

(i) Compliance with the permissible exposure may not be achieved by the use of respirators except:

- (a) During the time period necessary to install engineering controls; or
- (b) In work situations in which engineering controls are technically not feasible; or
- (c) In work situations in which feasible engineering and work practice controls are insufficient to reduce employee exposure to at or below the permissible exposure. Where technically feasible engineering and work practice controls are not sufficient to reduce exposure to at or below permissible exposure, they shall be used to reduce exposure to the lowest level feasible; or

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- (d) For operations not exceeding 40 hours per year; or
- (e) In emergencies.
- (ii) Respirators shall be jointly approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) and by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.
- (iii) Employers shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.
- (iv) Employers shall institute a respiratory protection program in accordance with sections 1910.134(b), (d), (e), (f) and (g).

TABLE 2. RESPIRATORY PROTECTION FOR DIPHENYL

Condition	Permissible Respiratory Protection
Dust or Vapor Concentration	
Equal to or Less than 10 mg/m ³ or 2 ppm	Any supplied air respirator.
Equal to or Less than 50 mg/m ³ or 10 ppm	A gas mask with a chin-style or front or back mounted organic vapor canister and high efficiency filter. Any supplied-air respirator with a full facepiece. Any self-contained breathing apparatus with a full facepiece.
Equal to or Less than 100 mg/m ³ or 20 ppm	operated in pressure-demand (positive pressure) mode or with a full facepiece, hood, or helmet operated in continuous flow mode.
Greater than 100 mg/m ³ or 20 ppm or Entry & Escape from Unknown Concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand (positive pressure) mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand (positive pressure) or continuous flow mode and an auxiliary self-contained air supply operated in pressure-demand mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand (positive pressure)

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mode.

Escape Any escape self-contained breathing apparatus.
Any gas mask providing protection against organic vapors and particulates.

(f) Fire and Safety

Employers shall familiarize themselves with the information contained in the Substance Technical Guidelines for diphenyl which is contained in Appendix B in order to ensure the safe handling and use of diphenyl. tf

- (1) Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of diphenyl shall be Class II Group G.
- (2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, diphenyl is classified as a Class B fire hazard.
- (3) Powered industrial trucks - For the purposes of compliance with section 1910.178, locations classified as hazardous locations due to the presence of diphenyl shall be Class II Group G.
- (4) Sources of ignition - Sources of ignition such as smoking or open flames are prohibited where diphenyl is used, handled or stored in a manner so as to create a potential fire or explosion hazard. tu (g)

(1) Skin Contact

- (i) Employers shall provide, and require employees to use, impervious clothing, gloves, face shields (8 inch minimum) and other appropriate protective clothing necessary to prevent any possibility of skin contact to molten diphenyl. Face shields shall comply with section 1910.133(a)(6).
- (ii) Employers shall provide, and require employees to use, impervious clothing, gloves, face shields (8 inch minimum) and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact to diphenyl dust or solutions containing diphenyl. Face shields shall comply with section 1910.133(a)(6).
- (iii) Employers shall ensure that clothing contaminated with diphenyl is placed in closed containers. Employers shall provide for the cleaning or disposal of such clothing and if the clothing is to be laundered or otherwise cleaned, shall inform the person performing this operation of the hazardous properties of diphenyl.
- (iv) Where there is any possibility of exposure of an employee's body to molten diphenyl, employers shall provide facilities for quick drenching of the body within the immediate work area for emergency use.
- (v) Employers shall ensure that non-impervious clothing contaminated with diphenyl be promptly removed and not reworn until the diphenyl is removed from the clothing.

(2) Eye Contact

- (i) Employers shall provide, and require employees to use, splash-proof safety goggles (cup-cover type dust and splash

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safety goggles), which comply with section 1910.133(a)(6), where there is any possibility of liquid molten diphenyl contacting the eye.

- (ii) Employers shall provide, and require employees to use, splash-proof safety goggles (cup-cover type dust and splash safety goggles), which comply with section 1910.133(a)(6), where eye contact to solutions containing diphenyl may occur.
- (iii) Employers shall provide, and require employees to use, dust-proof safety goggles (cup-cover type dust and splash safety goggles), which comply with section 1910.133(a)(6), where eye contact to diphenyl dust may occur.
- (iv) Where there is any possibility that an employee's eyes may be exposed to molten diphenyl, employers shall provide an eye wash fountain within the immediate work area for emergency use.

(h) Spills

- (1) Spills of diphenyl shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.

(i) Sanitation

- (1) Employers shall ensure that employees whose skin becomes contaminated with molten diphenyl immediately wash or shower to remove any diphenyl from the skin.
- (2) Employers shall ensure that employees whose skin becomes contaminated with diphenyl dust or solutions containing diphenyl promptly wash or shower to remove any diphenyl from the skin.
- (3) Where skin contamination may occur and showers are required for adequate cleaning of the body, employers shall provide showers as described in section 1910.141(d)(3).
- (4) Employers shall ensure that employees do not eat or smoke in areas where diphenyl is handled, processed or stored.
- (5) Employers shall ensure that employees who handle diphenyl wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

(j) Training and Information - Each employer who has employees exposed to diphenyl in excess of the action level, or employees who may have skin or eye contact with molten diphenyl, diphenyl dust or solutions containing diphenyl, or employees who work where accidental release, spill, fire, or explosion of diphenyl may occur, shall annually:

- (1) Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for diphenyl, which is contained in Appendix A; and

(2) Medical -

- (I) Advise employees as to the signs and symptoms of exposure to diphenyl.
- (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to diphenyl which are listed in Appendix A.
- (III) Instruct the employees to inform the employer if they develop any of the medical conditions listed in (k)(2) of this section; and

(3) Procedures -

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- (I) Provide training to insure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to diphenyl.
- (II) The procedures required by (j)(1), (2), and (3)(I) shall be provided to employees at the expense of the employer during the employee's normal working hours.
- (k) Medical Surveillance
 - (1) The employer shall provide medical procedures as required by paragraph (k). These procedures shall be provided at no cost to the employee.
 - (2) Preplacement Questionnaire - The employer shall obtain from each employee who will be exposed to diphenyl in excess of the action level, or who may have skin contact with molten diphenyl, diphenyl dust or solutions containing diphenyl, a written statement as to whether such employee has a history of any of the following:
 - (i) Kidney disease
 - (ii) Liver disease
 - (iii) Central nervous system disorders
 - (iv) Skin disease
 - (3) Preplacement Medical Examination - The employer shall provide a medical examination for an employee if the employee provides a history of any of the conditions named in paragraph (k)(2).
 - (4) Results of Preplacement Examination - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(3).
 - (5) Periodic Medical Examinations - The employer shall provide a medical examination for an employee if the employee advises the employer of the development of:
 - (i) Any of the medical conditions listed in (k)(2),
 - (ii) Signs and symptoms listed in Appendix A which the employee suspects may be caused by exposure to diphenyl.
 - (6) Results of Periodic Examinations - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(5).
 - (7) Exclusion or Removal from Exposure - No employee shall be exposed to diphenyl if such exposure could place the employee at increased risk of material impairment of his health.
 - (8) Emergency Procedures - The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to diphenyl.
 - (9) Informing the Physician - The employer shall provide to the examining physician the following information:
 - (i) A copy of this regulation for diphenyl;
 - (ii) A description of the employee's duties as they relate to his exposure to diphenyl;
 - (iii) A description of any personal protective equipment required to be used;
 - (iv) The results of any employee's exposure measurement, if available;
 - (v) The employee's anticipated exposure level; and
 - (vi) Upon request of the physician, information from previous medical examination of the employee.
 - (10) Physician's Written Opinion

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(i) The physician's written opinion shall be a signed statement by the examining physician specifically stating:

(a) Whether the employee has any detected medical conditions which could be directly or indirectly aggravated by exposure to diphenyl or which could significantly interfere with the ability of the employee to follow recommended or required procedures for protecting himself from unusual or emergency exposure.

(b) Any recommended limitations upon the employee's exposure to diphenyl.

(c) The employee has been informed by the physician of any detected medical conditions which required further medical examination or treatment.

(ii) The written opinion shall not reveal medical information unrelated to exposure to diphenyl.

(11) Refusal to be Medically Examined - If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and obtain a signed statement from the employee indicating that the employee understands the risks involved by refusing to be examined.

(1) Recordkeeping.

(i) Initial determination.

(i) The employer shall keep an accurate record of all initial determinations required to be made pursuant to paragraph (c)(1) of this section.

(ii) The record shall include the written determination and any supporting documentation as required in paragraph (c)(1) of this section.

(iii) This record shall be maintained for at least one year.

(2) Exposure measurements.

(i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to diphenyl (biphenyl).

(ii) This record shall include:

(a) The date of measurement;

(b) A reference to the subparagraph of this regulation which required the measurement, if any;

(c) Operations involving exposure to diphenyl (biphenyl) which are being monitored;

(d) Sampling and analytical methods used and evidence of their accuracy;

(e) Number, duration, and results of samples taken;

(f) Name, Social Security number, and exposure of the employee monitored.

(iii) This record shall be maintained for one year.

(3) Mechanical ventilation.

(i) When mechanical ventilation is used as an engineering control, the employer shall maintain a record of measurements demonstrating the effectiveness of such ventilation as required by paragraph (e)(1)(i) of this section.

(ii) This record shall include:

(a) Date of measurement;

(b) Type of measurement taken;

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- (c) Result of measurement.
- (iii) This record shall be maintained for one year.
- (4) Training and information.
 - (i) The employer shall keep an accurate record of all employee training and advice required by paragraph (j) of this section.
 - (ii) The record shall include:
 - (a) Date of training;
 - (b) Name and Social Security number of employees trained;
 - (c) Substance of training provided.
 - (iii) This record shall be maintained for at least one year.
- (5) Medical records.
 - (i) The employer shall keep an accurate medical record for each employee.
 - (ii) The record shall include:
 - (a) Physician's written opinion;
 - (b) Preplacement questionnaire;
 - (c) Any employee medical complaints relative to exposure to dip
 - (d) A signed statement of any refusal to be examined;
 - (e) A copy of information provided to the physician pursuant to paragraph (k)(9) of this section.
 - (iii) This record shall be maintained for the duration of the employment of the affected employee.
- (6) Access to records.
 - (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary and the Director.
 - (ii) Employee exposure measurement records required to be maintained by this section shall be made available to employees and former employees and their designated representatives.
 - (iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.
- (m) Observation of monitoring.
 - (1) Duty.

The employer shall give affected employees or their representatives an opportunity to observe any monitoring of employee exposure to diphenyl (biphenyl) which is conducted pursuant to this section.
 - (2) Exercise of opportunity to observe monitoring.
 - (i) When observation of the monitoring of employee exposure to diphenyl (biphenyl) requires entry into an area where the use of personal protective devices is required, the observer shall use such equipment and comply with all other applicable safety procedures.
 - (ii) Without interfering with the measurement, observers shall be entitled to:
 - (a) Receive an explanation of the measurement procedures;
 - (b) Visually observe all steps related to the measurement of exposure to diphenyl (biphenyl) that are being performed at the place of exposure.
 - (c) Record the results obtained.

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(n) Employee notification.

- (1) The employer shall notify in writing, within five work days, every employee who is found to be exposed to diphenyl (biphenyl) above the permissible exposure. The employee shall also be notified of the level of his exposure and the corrective action being taken to reduce the exposure to at or below the permissible exposure.
- (2) Pursuant to paragraph (k) of this Section, when an employee is medically examined the employer shall provide the employee with a copy of the physician's written opinion.

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APPENDIX A

SUBSTANCE SAFETY DATA SHEET

I. SUBSTANCE IDENTIFICATION

SUBSTANCE: Diphenyl

PERMISSIBLE EXPOSURE: 0.2 parts of diphenyl vapor per million parts of air (ppm) or 1 milligram of diphenyl vapor per cubic meter of air (mg/cu m).

APPEARANCE AND ODOR: Colorless to pale yellow solid with a characteristic odor.

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Diphenyl can affect your body if you inhale it, swallow it, or if it comes in contact with your eyes or skin. (It may be absorbed through the skin.)

B. Effects of Overexposure:

1. Short-Term Effects: Exposure to diphenyl may cause irritation of the eyes, and throat.
2. Long-Term Effects: Repeated exposure to diphenyl may cause headache, nausea, indigestion, abdominal pain, fatigue, numbness and aching of the limbs (nervous system damage), and liver damage.
3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with diphenyl exposure.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If diphenyl gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If diphenyl gets on your non-impervious clothing or skin remove and clean the contaminated clothing and flush the contaminated skin with water immediately. When there is skin irritation, get medical attention.
- C. Breathing: If you or any other person breathes in large amounts of diphenyl remove the exposed person to fresh air at once. If

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breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

D. Swallowing: If diphenyl has been swallowed, do not cause vomiting. Get medical attention immediately.

E. Rescue: Move 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 yourself. Understand your emergency rescue procedures and know the locations of the equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

A. RESPIRATORS: Respirators are not the best way to control exposure to diphenyl. You can only be required to wear them for routine use if your employer is in the process of installing controls or other control measures prove inadequate. You may be required to wear respirators for non-routine activities or in emergencies. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA)/National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.)

If you experience difficulty breathing while wearing a respirator, tell your employer.

B. PROTECTIVE CLOTHING: You must wear impervious clothing, gloves, face shield, and other appropriate protective clothing over any parts of your body that could repeatedly be exposed to Diphenyl dust, liquid, or solutions of diphenyl.

C. EYE PROTECTION: You must wear splash-proof safety goggles if it is possible that molten diphenyl, diphenyl dust, or solutions containing diphenyl may get into your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Diphenyl is a combustible material. You must keep open flames away from dust clouds of diphenyl which may arise from agitation of the solid or condensation of the vapors. If your clothing is expected to become contaminated with diphenyl, you must change into clean work clothing before work and into street clothing before going home. Clothing contaminated with diphenyl must not be worn home. You must wash or shower immediately if your skin becomes contaminated with diphenyl. Do not smoke or eat in areas where solid diphenyl is handled, stored, or used. If you handle diphenyl, you must wash your hands thoroughly with soap and water before smoking, eating, or using toilet facilities. Fire extinguishers, where provided, must be readily available, and you should know where they are and how to operate them. Ask your supervisor where diphenyl is used in your work area, and for any additional plant safety rules.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
DIPHENYL

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Biphenyl; phenylbenzene
2. Formula: $C_6H_5C_6H_5$ or $C_{12}H_{10}$

B. Physical Data

1. Boiling point (760 mm Hg): 254 C (489 F)
2. Specific gravity (water=1): 1.04
3. Vapor density (air=1): not applicable
4. Melting point: 69 C (156 F)
5. Vapor pressure at 20 C (68 F): Very low
6. Solubility in water, % by weight at 20 C (68 F): Insoluble
7. Evaporation rate (butyl acetate=1): Not applicable
8. Appearance and odor: Colorless to pale yellow solid with a very characteristic odor.

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 113 C (235 F) (closed cup)
2. Autoignition temperature: 538 C (1004 F)
3. Flammable limits in air, % by volume: Lower: 0.6 at 111 C (232 F) Upper: 5.8 at 155 C (311 F)
4. Extinguishing media: Water, dry chemical, carbon dioxide and foam.
5. Special fire-fighting procedures: Do not use solid stream of water, as frothing may occur. Use water spray to keep containers cool.
6. Unusual fire and explosion hazards: Diphenyl is a combustible solid. Its vapors can form explosive mixtures in air at elevated temperatures. All ignition sources must be controlled when diphenyl is used, handled, and stored. Diphenyl vapors are heavier than air; thus the vapors may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which the Diphenyl is handled.
7. For the purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electrical Code for diphenyl shall be Class II, Group G.

B. Reactivity

1. Conditions contributing to instability: heat

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2. Incompatibilities: Contact with oxidizing agents may cause fire and explosions.
3. Hazardous Decomposition Products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving diphenyl.
4. Special Precautions: none

III. SPILL AND LEAK PROCEDURES

- A. If diphenyl 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, sweep onto paper or other suitable material, place in an appropriate container and place in a safe place (such as a fume hood) and burn. Large quantities may be reclaimed; however, if this is not practical use a procedure similar to that for small quantities.

- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.

- C. Waste Disposal Methods:

Diphenyl may be disposed of:

1. By making packages of diphenyl in paper or other flammable material and burning in a suitable combustion chamber.
2. By dissolving diphenyl in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber.

IV. MONITORING AND MEASUREMENT PROCEDURES

- a. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken in a fashion such that the average 8-hour exposure may be determined from a single sample or two (2) 4-hour samples. Short term interval samples (up to 30 minutes) may also be used to determine average exposure level if a minimum of five (5) measurements are taken in a random manner over the 8-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random equal duration samples taken on one (1) work shift is an estimate of an employee's average level of exposure for that work shift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR Part 84, portable direct-reading instruments, gas and vapor adsorption tubes with subsequent chemical analyses, or dosimeters. The method of measurement must determine the concentration of diphenyl to plus or minus 35%.

- b. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring under this section should be essentially the same as described under paragraph VI.A.. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement must determine the concentration of diphenyl to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

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- A. Diphenyl dust clouds may be ignited by hot objects (650 C; 1202 F). Dust usually forms by condensation of hot vapors, and not just by agitation of solid.
- B. Employers must advise employees of all plant areas and operations where exposure to diphenyl could occur.

VI. COMMON OPERATIONS

Some common operations in which exposure to diphenyl is likely to occur are where it is manufactured from benzene, it is used as a heat-transfer fluid, particularly as a major component of "Dowtherm", is used for the preparation of chlorinated biphenyls (PCB), and for impregnation of papers for wrapping citrus fruits.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. Route of Entry

Inhalation; skin absorption

II. Toxicology

At concentrations of 5 mg/m³ or higher for diphenyl, irritation of the eyes and throat has been reported. Employees with repeated exposure to higher concentrations had gastrointestinal symptoms as well as polyneuritic complaints, with abnormalities of both the electroencephalogram and the electromyogram. Some showed hepatic damage detected by liver function tests and biopsy, and one fatal case of liver necrosis with some areas of cirrhosis occurred in an individual who had been exposed regularly to concentrations of vapor in air of approximately 100 mg/m³. At higher concentrations, mice and rats showed damage to the liver and kidney, as well as bronchopulmonary effects.

III. Signs and Symptoms

Irritation of the throat and eyes. Chronic exposure to concentrations in excess of 5 mg/m³ may result in headache, nausea, excessive fatigue, and numbness with aching of the limbs. Signs of liver damage.

IV. Special Tests

None in common usage at exposure levels near the permissible exposure level. Individuals with overexposure should have tests of pulmonary and liver function, as well as electroencephalogram and electromyogram.

V. Treatment

None specific. Remove from exposure, give artificial resuscitation if indicated, and wash eyes and contaminated skin. Recovery is usually rapid and complete.

VI. Surveillance and Preventive Considerations

A. General

Although diphenyl has been reported to cause central nervous system and liver damage, most reported effects are caused by its irritant properties. It is important that the physician become familiar with plant operating conditions in which exposure to diphenyl occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. Preplacement

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Routine medical histories and physical examinations are not required. However the employer must screen employees for history of certain medical conditions (listed below) which might place the employee at increased risk from diphenyl exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Liver disease -- Exposure to high concentrations of vapor may incur damage to the liver to which individuals with pre-existing liver disease may be more susceptible.
2. Skin disease -- Diphenyl can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of exposure.
3. Central nervous system disorders -- Exposure to high concentrations of vapor may cause damage to the central nervous system, to which individuals with pre-existing conditions may be more susceptible.
4. Renal disease -- Although diphenyl is not known as a kidney toxin, the importance of the organ in the elimination of toxic substances justifies special consideration in those with possible impairment of renal function.

C. Periodic Examinations

Routine periodic examinations are not required. However, if the employer becomes aware of an employee with the above-listed conditions, he must refer such employee for further medical examination.

References

1. Hakkinen, I., et al.: "Diphenyl Poisoning in Fruit Paper Production", Archives of Environmental Health, 26:70-74, 1973.
2. Hygienic Guide Series: "Diphenyl", American Industrial Hygiene Assoc, September-October, 1964.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIPHENYL

USE/EXPOSURE AND CONTROL DOCUMENT
DIPHENYL

Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1. Inhalation and skin contact with vapor and dust during measuring and mixing of diphenyl for paper impregnation process	A,B	Local exhaust ventilatio personal protective equi
2. Inhalation of vapor during impregnation process for producing wrapping paper	A	
3. Inhalation and skin contact with vapor during wrapping and packaging of citrus with diphenyl-impregnated paper	A,B	Local exhaust ventilatio personal protective equi (gloves)
4. Inhalation of vapor during use as dye carrier for dyeing plastics and synthetic resins	A	General dilution ventila
5. Inhalation of vapor during production of diphenyl derivatives, such as diphenyl oxide	A	General dilution ventila
6. Inhalation of vapor and skin contact with liquid during use as heat-transfer medium	A,B	General dilution ventila personal protective equi (gloves)
7. Inhalation of vapor during solvent applications in producing allyl alcohol from propylene oxide or phenal	A	General dilution ventila

- A -- Inhalation
- B -- Skin contact resulting in localized irritation
- C -- Ingestion
- D -- Skin contact resulting in absorption and subsequent systemic poisoning