

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND  
SUPPORTING DOCUMENTATION FOR

\*\*\* P-NITROCHLOROBENZENE \*\*\*

NIOSH/OSHA Draft Technical Standard  
and Supporting Documentation for P-NITROCHLOROBENZENE

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 P-NITROCHLOROBENZENE.

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" means exposure of employees to airborne concentrations of p-nitrochlorobenzene not in excess of 1 milligram per cubic meter (mg/M3) averaged over an eight-hour work shift (time weighted average), as stated in § 1910.1000, Table Z-1.

(2) "Action level" means one half of the permissible exposure for p-nitrochlorobenzene.

(b) Exposure determination and measurement. (1) Each employer who has a place of employment in which p-nitrochlorobenzene is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of p-nitrochlorobenzene 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 p-nitrochlorobenzene.

(2) A written record of the determination shall be made and shall contain at least the following information:

(i) Any information, observations, or calculations which may indicate employee exposure to p-nitrochlorobenzene;

(ii) Any measurements of p-nitrochlorobenzene taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to p-nitrochlorobenzene; and

(IV) Date of determination, work being performed at the time, location within work site, name, and social security number of each employee considered.

(3) If the employer determines that any employee may be exposed to p-nitrochlorobenzene at or above the action level, the exposure of the employee in each work operation who is believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum eight-hour time weighted average exposure of the employee.

(4) If the exposure measurement taken pursuant to paragraph (b) (3) of this section reveals employee exposure to p-nitrochlorobenzene 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.

(5) If an employee exposure measurement reveals that an employee is exposed to p-nitrochlorobenzene 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.

(6) If an employee exposure measurement reveals that an employee is exposed to p-nitrochlorobenzene above the permissible exposure, the employer shall:

(i) Measure the exposure monthly of the employee so exposed; and

(ii) Institute control measures as required by paragraph (d) of this section; and

(iii) Individually notify, in writing, within five days, every employee who is found to be exposed to p-nitrochlorobenzene above the permissible exposure. The employee shall also be notified of the corrective action being taken to reduce the exposure to at or below the permissible exposure.

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to p-nitrochlorobenzene

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below the action level, the employer may terminate measurement for the employee.

(8) For purposes of this paragraph, employee exposure is that which would occur if the employee were not using a respirator.

(c) Methods of measurement. (1) 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 (See Appendix B (IV) of this section).

(2) The method of measurement shall have an accuracy, to a confidence level of 95 percent, of not less than that given in Table 1.

Table 1

| Concentration                                                  | Required Accuracy |
|----------------------------------------------------------------|-------------------|
| Above permissible exposure                                     | $\pm 25\%$        |
| At or below permissible exposure<br>and above the action level | $\pm 35\%$        |

At or below the action level  $\pm 50\%$

(d) Compliance. (1) No employee shall be exposed to p-nitrochlorobenzene above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of p-nitrochlorobenzene shall be controlled to at or below the permissible exposure by engineering and work practice controls:

(i) Engineering and work practice controls shall be instituted to reduce exposures to at or below the permissible exposure, except to the extent that such controls are not technically feasible.

(ii) Wherever engineering and work practice controls are not sufficient to reduce exposures to at or below the permissible exposure, they shall nonetheless be used to reduce exposure to the lowest level feasible and shall be supplemented by respirators in accordance with paragraph (d)(4) of this section.

(3) Engineering controls. When mechanical ventilation is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity, static pressure, or air volume, shall be made at least every three months. Measurements of system effectiveness shall also be made within five days of any change in production, process, or control which might result in an increase in airborne concentrations of p-nitrochlorobenzene.

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

(i) During the time period necessary to install or implement engineering or work practice controls; or

(ii) In work situations in which engineering and work practice controls are technically not feasible; or

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- (iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of p-nitrochlorobenzene to at or below the permissible exposure; or
  - (iv) For operations which require entry into tanks or closed vessels; or
  - (v) In emergencies.
- (5) Where respirators are needed and permitted under this paragraph to reduce employee exposure, the employer shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.

TABLE 2 RESPIRATORY PROTECTION FOR P-NITROCHLOROBENZENE

| CONDITION                                                               | PERMISSIBLE RESPIRATORY PROTECTION                                                                                                                                                                                                |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Particulate Concentration                                               |                                                                                                                                                                                                                                   |
| 5 mg/M3 or less                                                         | Any dust and mist respirator, except single use.                                                                                                                                                                                  |
| 10 mg/M3 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/M3 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/M3 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/M3 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 |

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|               |                                                                                                                       |
|---------------|-----------------------------------------------------------------------------------------------------------------------|
|               | 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.<br>Any escape self-contained breathing apparatus.                    |

(6) Respirators shall be approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) or by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(7) The employer shall institute a respiratory protection program in accordance with § 1910.134(b), (d), (e), and (f).

(e) Fire and safety. (1) The employer shall familiarize himself with the information contained in the Substance Technical Guidelines (Appendix B of this section) for p-nitrochlorobenzene.

(2) For the purpose of compliance with § 1910.309, locations classified as hazardous locations due to the presence of p-nitrochlorobenzene shall be Class II, Group G.

(3) For the purpose of compliance with § 1910.157, p-nitrochlorobenzene is classified as a Class B fire hazard.

(4) For the purpose of compliance with § 1910.178, locations classified as hazardous locations due to the presence of p-nitrochlorobenzene shall be Class II, Group G.

(5) Sources of ignition such as smoking or open flames are prohibited where p-nitrochlorobenzene presents a fire or explosion hazard.

(6) p-Nitrochlorobenzene shall be stored so as not to come in contact with strong oxidizers.

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees 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. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

(2) Employers shall ensure that employees whose clothing may have become contaminated with p-nitrochlorobenzene change into uncontaminated clothing before leaving the work premises.

(3) Employers shall ensure that clothing contaminated with p-nitrochlorobenzene is placed in closed containers for storage until it can be discarded or until the employer provides 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 employer shall inform the person performing the operation of the hazardous properties of p-nitrochlorobenzene.

(4) Where exposure of an employee's body to liquids containing p-nitrochlorobenzene may occur, employers shall provide facilities for quick drenching of the body within the immediate work area for emergency use.

(5) Employers shall ensure that non-impervious clothing which becomes wet with liquids containing p-nitrochlorobenzene be removed immediately and

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that non-impervious clothing which becomes contaminated with p-nitrochlorobenzene be removed promptly and such clothing shall not be reworn until the p-nitrochlorobenzene is removed from the clothing.

(g) Spills and disposal. In the event that p-nitrochlorobenzene is spilled the employer shall immediately provide available ventilation and then clean up the spill.

(h) Sanitation. (1) Employers shall ensure that employees whose skin becomes wet with liquids containing p-nitrochlorobenzene immediately wash or shower with soap or mild detergent and water to remove any p-nitrochlorobenzene from the skin.

(2) Employers shall ensure that employees whose skin becomes contaminated with p-nitrochlorobenzene promptly wash or shower with soap or mild detergent and water to remove any p-nitrochlorobenzene from the skin.

(3) Employers shall ensure that all employees subject to skin contact with p-nitrochlorobenzene 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.

(4) Employers shall ensure that employees do not eat or smoke in areas where p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene are handled, processed or stored.

(5) Employers shall ensure that employees who handle p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene wash their hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.

(i) Training and information. (1) Each employer who has a workplace in which p-nitrochlorobenzene is present shall keep a copy of this regulation with Appendixes A, B and C at the workplace. This material shall be made readily available to affected employees.

(2) Each employer who has employees exposed to p-nitrochlorobenzene above the action level or employees who may have skin or eye contact with p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene, or employees who work where a spill of p-nitrochlorobenzene may occur, shall annually:

(i) Inform affected employees of the information contained in the Substance Safety Data Sheet for p-nitrochlorobenzene (Appendix A of this section);

(ii) Advise affected employees as to the signs and symptoms of exposure to p-nitrochlorobenzene.

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of exposure to p-nitrochlorobenzene which are listed in Appendix A of the section; and

(iv) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to p-nitrochlorobenzene.

(j) Medical surveillance. (1) The employer shall provide medical procedures as required by this paragraph. All medical procedures shall be performed by or under the supervision of a physician at no cost to the employee.

(2) Preplacement medical examination. The employer shall make available to each employee who is exposed, or will be exposed, to p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene or airborne

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concentrations of p-nitrochlorobenzene at or above the action level a preplacement medical examination which must include the following:

(i) A medical history and physical examination with emphasis on the blood, liver, kidneys and heart

(ii) Complete blood count to include at least red and white cell count, a differential smear, hemoglobin and hematocrit.

(3) Periodic medical examination. The employer shall make available to each employee exposed to p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene or airborne concentrations of p-nitrochlorobenzene at or above the action level, twelve months from the date of the employee's first exposure, and every twelve months thereafter, a periodic medical examination which must include the following:

(i) A medical history and physical examination with emphasis on the blood, liver, kidneys and heart;

(ii) Complete blood count to include at least red and white cell count, a differential smear, hemoglobin and hematocrit.

(4) Alternative medical procedures. If the examining physician chooses to use alternative medical procedures to those specified in paragraphs (j)(2) and (j)(3) of this section, the employer may accept such alternative medical procedures as meeting the requirements of this section provided that the employer:

(i) Obtains a statement from the examining physician setting forth the alternative medical procedures, the rationale for substitution, and evidence that they will be equally effective;

(ii) Informs each exposed worker of the fact that alternative medical procedures to those required in paragraphs (j)(2) and (j)(3) of this section are to be made available.

(5) Interim medical examination. The employer shall provide an interim medical examination including a methemoglobin determination for the employee if the employee informs the employer of any of the signs or symptoms of exposure to p-nitrochlorobenzene which are listed in Appendix A which the employee suspects are caused by exposure to p-nitrochlorobenzene.

(6) Informing the physician. The employer shall provide to the physician performing any medical examination required by this section the following information:

(i) A copy of this regulation with Appendixes A, B, and C for p-nitrochlorobenzene;

(ii) A description of the affected employee's duties as they relate to his exposure to p-nitrochlorobenzene;

(iii) A description of any personal protective equipment and respirators required to be used;

(iv) The results of any measurements which may indicate the affected employee's exposure;

(v) The affected employee's anticipated exposure level; and

(vi) Upon request of the physician, any available information from previous medical examinations of the affected employee.

(7) Where a medical examination is required by paragraphs (j)(2), (j)(3), or (j)(5) of this section, following such examination the employer shall obtain from the examining physician a written opinion which conforms with paragraph (j)(8) of this section.

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(8) Physician's written opinion. 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 condition which would place the employee at increased risk of material impairment of the employee's health from exposure to p-nitrochlorobenzene or would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to p-nitrochlorobenzene, including limitations upon the use of personal protective equipment and respirators;

(C) That the employee has been informed by the physician of any detected medical conditions which require further medical examination or treatment.

(ii) The physician's written opinion shall not reveal specific medical findings or diagnoses unrelated to exposure to p-nitrochlorobenzene.

(iii) The employer shall provide the employee with a copy of the physician's written opinion.

(9) Results of tests. Where a preplacement or periodic medical examination is required by paragraphs (j)(2) or (j)(3) of this section, following such examination the employer shall obtain from the examining physician:

(i) A recording of the blood tests;

(ii) Where alternative medical procedures have been performed in accordance with paragraph (j)(4) of this section, a recording of such alternative procedures.

(10) No employee shall be exposed to p-nitrochlorobenzene in such a way as would put the employee at increased risk of material impairment of his health from such exposure. This determination may be based on the physician's written opinion.

(11) No medical procedure which would be performed pursuant to paragraphs (j)(2) or (j)(3) of this section need be performed if records of a previous such procedure performed within the past six months are acceptable to the examining physician.

(12) 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 risk involved by refusal to be examined.

(k) Recordkeeping. (1) Exposure determination. (i) The employer shall keep an accurate record of all determinations required to be made pursuant to paragraph (b)(1) of this section.

(ii) This record shall include the written determination required in paragraph (b)(2) of this section.

(iii) This record shall be maintained until replaced by a more recent record.

(2) Exposure measurements. (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to p-nitrochlorobenzene.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to p-nitrochlorobenzene which are being monitored;

(C) Sampling and analytical method used and evidence of their accuracy;

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

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(E) Name, social security number and exposure of the employee monitored.

(iii) This record shall be maintained until replaced by a more recent record but in no event for less than one year.

(3) Mechanical ventilation. (i) When mechanical ventilation is used as an engineering control, the employer shall maintain an accurate record of the measurements demonstrating the effectiveness of such ventilation required by paragraph (d)(3) of this section.

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

(C) Result of measurement.

(iii) These records shall be maintained for at least one year.

(4) Employee training and information. (i) The employer shall keep an accurate record of all employee training and information required by paragraph (i) of this section.

(ii) This record shall include:

(A) Date of training;

(B) Name and social security number of employee trained;

(C) Content or scope of training provided.

(iii) This record shall be maintained until replaced by a more recent record.

(5) Medical surveillance. (i) The employer shall keep an accurate record of employee medical surveillance required by paragraph (j) of this section.

(ii) This record shall include:

(A) The name and social security number of the employee;

(B) Results of tests required by paragraph (j)(2) and (j)(3) of this section and results of any tests conducted pursuant to paragraphs (j)(4) of this section;

(C) Any employee medical complaints relative to exposure to p-nitrochlorobenzene;

(D) A copy of information provided to the physician pursuant to paragraph (j)(6)(ii), (iii), (iv), (v), and (vi) of this section.

(E) Physician's written opinion; and

(F) A signed statement of any refusal to be examined.

(iii) This record shall be maintained for the duration of and for five years after termination 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 of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.

(ii) Each employee or former employee shall have access to the exposure determination and exposure measurement records required to be maintained by this section which indicate his own exposure to p-nitrochlorobenzene.

(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.

(1) Employee observation of measurement. (1) The employer shall give each employee or his representative an opportunity to observe any measurement of his exposure to p-nitrochlorobenzene which is conducted pursuant to this section.

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(2) When observation of measurement of employee exposure to p-nitrochlorobenzene requires entry into an area where the use of personal protective devices, including respirators, is required, the observer shall be provided with and required to use such equipment and comply with all other applicable safety procedures.

(3) Without interfering with the measurement, observers shall be entitled to:

- (i) Receive an explanation of the measurement procedure.
- (ii) Visually observe all steps related to the measurement of the airborne concentration of p-nitrochlorobenzene that are being performed at the place of exposure; and
- (iii) Record the results obtained.

NOTE: The information contained in the following appendixes is advisory in nature and is not intended, by itself, to create any additional obligations not otherwise imposed or detract from any existing obligation.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET  
FOR p-NITROCHLOROBENZENE

I. SUBSTANCE IDENTIFICATION

- A. Substance: p-Nitrochlorobenzene
- B. Permissible Exposure: 1 milligram of p-nitrochlorobenzene per cubic meter of air (mg/M3) averaged over an eight-hour work shift.
- C. Appearance and odor: Yellow solid with a sweet odor.

II. HEALTH HAZARD DATA

- A. Ways in which the chemical affects your body: p-Nitrochlorobenzene can affect your body if you inhale it or if it comes in contact with your eyes or skin or if you swallow it. It is readily absorbed through your skin. Even a small amount absorbed from the clothes or shoes may cause toxic symptoms.
- B. 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

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effects of p-nitrochlorobenzene. The earliest effect may be a bluish color of the skin, especially 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: You should inform your employer if you develop any signs or symptoms and suspect that they are caused by exposure to p-nitrochlorobenzene.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene get into your eyes, wash your 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.
- B. Skin Exposure: If p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene get on your skin, immediately wash the contaminated skin using soap or mild detergent and water. If p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene penetrate through your clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. Get medical attention immediately.
- C. Breathing: If you or any other 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.
- D. Swallowing: When p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene have been swallowed, 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.
- 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 p-nitrochlorobenzene. You can only be required to wear them for routine use if your employer is in the process of installing controls or 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

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Administration (MESA) or National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.) For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where their use is required. If you can smell p-nitrochlorobenzene while wearing a respirator, the respirator is not working correctly; go immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

B. Protective Clothing: You must wear impervious clothing, gloves, face shield or other appropriate protective clothing to prevent skin contact with p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene where skin contact may occur. Replace or repair impervious clothing that has developed leaks.

C. Eye Protection: Not applicable.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

A. p-Nitrochlorobenzene is a combustible solid. At elevated temperatures its vapors can form explosive mixtures with air.

B. p-Nitrochlorobenzene must be stored in tightly closed containers in a cool, well ventilated area away from strong oxidizers.

C. Sources of ignition such as smoking and open flames are prohibited wherever p-nitrochlorobenzene is handled, used or stored in a manner that could create a potential fire or explosion hazard.

D. If your work clothing may have become contaminated with p-nitrochlorobenzene, you must change into uncontaminated clothing before leaving the work premises.

E. You must immediately remove any non-impervious clothing that becomes wet with liquids containing p-nitrochlorobenzene and you must promptly remove any non-impervious clothing that becomes contaminated with p-nitrochlorobenzene. This clothing must not be reworn until the p-nitrochlorobenzene is removed from the clothing.

F. If your skin becomes wet with liquids containing p-nitrochlorobenzene, you must immediately wash or shower with soap or mild detergent and water to remove the p-nitrochlorobenzene from your skin.

G. If your skin becomes contaminated with p-nitrochlorobenzene, you must promptly wash or shower with soap or mild detergent and water to remove the p-nitrochlorobenzene from your skin.

H. If you are subject to skin contact with p-nitrochlorobenzene, at the end of each work day you must wash with soap or mild detergent and water any areas of your body that may have contacted p-nitrochlorobenzene.

I. You must not eat or smoke in areas where p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene are handled, processed or stored.

J. If you handle p-nitrochlorobenzene or liquids containing p-nitrochlorobenzene, you must wash your hands thoroughly with

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- soap or mild detergent and water before eating, smoking or using toilet facilities.
- K. Fire extinguishers and quick drenching facilities, where provided, must be readily available and you should know where they are and how to operate them.
- L. Ask your supervisor where p-nitrochlorobenzene is used in your work area and for any additional safety and health rules.

VI. ACCESS TO INFORMATION

- A. Each year your employer is required to inform you of the information contained in this Substance Safety Data Sheet for p-nitrochlorobenzene. In addition, your employer must instruct you in the safe use of p-nitrochlorobenzene, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to p-nitrochlorobenzene. You or your representative have the right to observe employee exposure measurements and to record the results obtained. If your employer determines that you are being overexposed, he is required to inform you of the exposure and the actions which are being taken to reduce your exposure.
- C. Your employer is required to keep records of your exposure and medical examinations. Your employer is required to keep exposure data for at least one year and to keep medical data during your employment, and for a period of five years following your termination of employment. Your employer is required to make the exposure data available to you upon your request. Your employer is also required to release your medical records to your physician upon your written request.
- D. Your employer must give you a copy of the physician's written opinion for any physical examination required by this standard.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES  
FOR P-NITROCHLOROBENZENE

I. PHYSICAL AND CHEMICAL DATA

- A. Substance Identification
1. Synonyms: PNCB; 4-chloronitrobenzene; PCNB; P-chloronitrobenzene; 1-chloro-4-nitrobenzene
  2. Formula:  $1,4\text{-ClC}_6\text{H}_4\text{NO}_2$
  3. Molecular weight: 157.6
- B. Physical Data
1. Boiling point (760 mm Hg): 242 C (468 F)

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2. Specific gravity (water = 1): 1.37
3. Vapor density (air = 1 at boiling point of p-nitrochlorobenzene): 5.4
4. Melting point: 83 C (181 F)
5. Vapor pressure at 20 C (68 F): Much less than 1 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.003
7. Evaporation rate (butyl acetate = 1): Not applicable
8. Appearance and odor: Yellow solid with a sweet odor.

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

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. Extinguishing media: Foam, carbon dioxide, dry chemical
5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: p-Nitrochlorobenzene is a combustible solid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where p-nitrochlorobenzene is used, handled or stored in a manner that could create a potential fire or explosion hazard. When p-nitrochlorobenzene burns, a heavy sooty smoke is formed.
7. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electric Code for p-nitrochlorobenzene shall be Class II, Group G.

B. Reactivity

1. Conditions contributing to instability: None hazardous.
2. Incompatibilities: Contact with strong oxidizers may cause fire and explosion.
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.

III. SPILL AND DISPOSAL PROCEDURES

A. 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

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- atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.
- B. Persons not wearing protective equipment should be restricted from areas of spills until cleanup has been completed.
- C. 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.

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 such that the average eight-hour exposure may be determined from a single eight-hour sample or 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). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR part 84, portable direct-reading instruments, dosimeters, or by collection of the particulates using a high efficiency membrane filter with subsequent chemical analyses. The method of measurement must determine the concentration of p-nitrochlorobenzene to plus or minus 35%.
- B. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring and measurements under this section should be essentially the same as described under paragraph IV. A. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The method of measurement must determine the concentration of p-nitrochlorobenzene to plus or minus 25%.
- C. METHODS: Methods meeting these accuracy requirements are available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 under the title "NIOSH Analytical Methods for Set P" (Order number XXXXXXXXXX).
- D. QUALIFIED PERSONS: Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

V. MISCELLANEOUS PRECAUTIONS

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- A. Store p-nitrochlorobenzene in tightly closed containers in a cool, well ventilated area.
- B. Employers should advise employees of all areas and operations where exposure to p-nitrochlorobenzene could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to p-nitrochlorobenzene is likely to occur are: During its production; during its use as an intermediate in the manufacture of dyes, drugs, photographic chemicals, pesticides, pharmaceuticals, rubber chemicals, and as corrosion inhibitors.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; skin absorption.

II. TOXICOLOGY

Absorption of p-nitrochlorobenzene, whether from inhalation of vapor or dust, or skin absorption of the solid, causes anoxia due to the formation of methemoglobin. Application of the solid dissolved in 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 percent or more. The individual may feel well, have no complaints, and may insist that nothing is wrong until the methemoglobin concentration approaches approximately 40 percent. At methemoglobin concentrations of over 40 percent there usually is weakness and dizziness; up to 70 percent 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.

III. SIGNS AND SYMPTOMS

Signs of anoxia from methemoglobin formation; unpleasant taste in mouth; mild anemia; by analogy to effects caused in animals it may cause hematuria and hemoglobinuria.

IV. SPECIAL TESTS

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Determination of methemoglobin concentration in the blood when p-nitrochlorobenzene intoxication is suspected, and at regular intervals until the methemoglobin is fully reduced to normal hemoglobin.

V. TREATMENT

Remove from exposure. If swallowed and the person is conscious, induce vomiting. Give artificial resuscitation if indicated. Any p-nitrochlorobenzene on the body must be removed. Immediately remove all contaminated clothing, including shoes, and wash entire body with plenty of soap or mild detergent and water. Scrub hands. Shampoo hair and scalp. Clean finger and toe nails. Clean nostrils and ear canals. Give oxygen and confine to bed. In case of eye splashes, flush with water. Determine methemoglobin in blood and repeat every 3 to 6 hours for 18 to 24 hours. Repeat showers and skin cleansing if methemoglobin appears to rise after 3 to 4 hours. Consideration may be given to the intravenous administration of methylene blue at high levels of methemoglobin in an attempt to accelerate the conversion of methemoglobin to hemoglobin; however, the use of this agent is controversial due to its toxic effects.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of p-nitrochlorobenzene are caused by its capacity to produce anoxia due to formation of methemoglobin. It readily penetrates shoes, clothing, and leather gloves, so that a small area of contamination on clothing or gloves will produce evidence of poisoning if left in contact with the skin for several hours since skin absorption may be the major route of entry. It is important that the physician become familiar with plant operating conditions in which exposure to p-nitrochlorobenzene 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

The following medical procedures must be made available to each employee who is exposed to p-nitrochlorobenzene:

1. A complete history and physical examination -- The purpose is to detect preexisting 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.
2. A complete blood count -- p-Nitrochlorobenzene has been shown to cause methemoglobinemia and anemia. Those with blood disorders may be at increased risk. A complete blood count must be performed including a red cell count, a white cell

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count, a differential count of a stained smear, as well as hemoglobin and hematocrit. Observe for Heinz bodies.

C. PERIODIC EXAMINATIONS

The above medical examinations are to be repeated on an annual basis. Methemoglobin determinations shall be performed at any time overexposure is suspected or signs and symptoms of toxicity occur.

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "p-Nitrochlorobenzene," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 184.
2. Pacseri, I., et al: "Threshold and Toxic Limits of Some Amino and Nitro Compounds," A.M.A. Archives of Industrial Health, 18:1-8, 1958.
3. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 2105-2118, 2130-2131.
4. Renshaw, A. and G.V. Ashcroft: "Four Cases of Poisoning by Mononitrochlorobenzene and One by Acetanilide Occurring in a Chemical Works: With an Explanation of the Toxic Symptoms Produced," Journal of Industrial Hygiene, 8:67-73, 1926.
5. Lynch, A.L.: "Biological Monitoring for Industrial Exposure to Cyanogenic Aromatic Nitro and Amino Compounds," American Industrial Hygiene Association Journal, 35:426-432, 1974.
6. Mangelsdorff, A.F.: "Treatment of Methemoglobinemia," A.M.A. Archives of Industrial Health, 14:148-153, 1956.
7. Watrous, R.M. and H.N. Schulz: "Cyclohexylamine, p-Chloronitrobenzene, 2-Aminopyridine: Toxic Effects in Industrial Use," Industrial Medicine and Surgery, 19:317-320, 1950.

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REFERENCES AND SOURCES  
P-NITROCHLOROBENZENE

1910.1000

- (f) Personal Protective Equipment, and, (h) Sanitation  
Eye: Grant, "Toxicology of the Eye"  
Skin: Sax, "Dangerous Properties of Industrial Materials;" Baskin, "Handling Guide for Potentially Hazardous Commodities;" American Conference of Governmental Industrial Hygienists, "Documentation of the Threshold Limit Values for Substances in Workroom Air;" Gleason, "Toxicology of Commercial Products;" International Labour Office, "Encyclopedia of Occupational Health and Safety"  
Ingestion: Von Oettingen, "Poisoning;" Gleason, "Clinical Toxicology of Commercial Products;" Christensen and Luginbyhl, "NIOSH Toxic Substances List," 1974; Baskin, "Handling Guide for Potentially Hazardous Commodities;" National Fire Protection Association, "National Fire Codes"

COMMENTS

Eye - Classification: 0

Output statement numbers: None

Exceptions: None

According to Grant, nitrochlorobenzene has "been observed to cause methemoglobinemia, with discoloration of the conjunctiva reflecting the change in color of the blood." This condition, however, is indicative of a systemic effect, rather than the result of direct eye contact with this compound.

Specific data concerning the effects of eye contact with this substance could not be found in the literature. Since the substance is insoluble and unreactive in water, there would not appear to be justification for requiring eye protection.

Skin - Classification: 2 and 6

Output statement numbers: 2, 5b, 7a, 8b, 14g and 17g combined, 14i, 15, 17i, 20a

Exceptions: See below

Baskin says generally that even short exposures could "seriously injure" a person, "even if promptly treated," and further notes, "acute poisoning by skin absorption can cause 'cyanosis, headache, shallow breathing, dizziness, confusion, decreased blood pressure, (and) painful urination' and anemia may later appear." Repeated or prolonged exposure may lead to "weight loss, anemia, weakness and irritability."

The ACGIH notes that nitrochlorobenzene "may be absorbed through the lungs and skin giving rise to methemoglobin." In a study in which 1.5 g suspended in olive oil was applied on the skin of rabbits, it was "noted that methemoglobin increased in several hours, decreased after about 12 hours, then increased again 18 to 24 hours following exposure. Heinz bodies . . . formed during the second period of increasing methemoglobin. Clinical symptoms, such as anemia, hematuria and hemoglobinuria were noted."

Gleason reports "severe allergic dermatitis (is) frequent after skin contact. Systemic effects are like aniline (methemo-

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globin) but perhaps cardiac disorders (are) more severe."

ILO states "in addition to cyanogenic potential, the nitrochlorobenzenes as a class are also skin irritants." On a scale of 1 (slight) to 6 (severe), it lists the cyanosis hazard of this compound as a 4, the anemia hazard as 2, and the overall toxic hazard as 3.

Sax considers the acute and chronic effects of skin absorption to be of high toxic hazard. In general he states "poisoning with the solid nitro compounds is usually slower and less severe than is the case with the liquid nitro and amino benzenes since absorption is less rapid. Thus, chronic poisoning occurs more frequently than acute, the picture in the chronic form being one of anemia, moderate cyanosis, fatigue, slight dizziness, headache, insomnia and loss of weight. Prolonged chronic exposure may result in damage to the liver and kidneys, with production of acute yellow atrophy, toxic hepatitis, and fatty degeneration of the kidneys."

Para-nitrochlorobenzene has a melting point of 181 degrees F. At 20 degrees C, its vapor pressure is much less than 1 mm Hg. Its solubility in water is but 0.003%.

The above data clearly indicate that skin absorption is a significant route of entry and that the acute and chronic systemic effects of such exposures can be severe. To prevent these effects, it is concluded that overall classifications of 2 and 6 are most appropriate. However, because of the hazards and properties of the substance, the following exceptions are made. Statement 2 is modified to prevent skin contact where it may occur. Statement 8b is used for liquids containing the substances since the presence of a vehicle may increase the rapidity of skin absorption. This follows from the comments of Sax. Similarly, statements 14g and 14i are used where clothing or skin becomes wet with such a liquid. Finally, statement 15 is specified based on recommendations in the literature concerning these substances in general (see Patty).

Ingestion - Classification: 1 and 5

Output statement numbers: 19, 20a

Exceptions: None

Von Oettingen states, "the ingestion of p-nitrochlorobenzene has been followed by pallor, cyanosis because of methemoglobinemia, dyspnea, irregular pulse, staggering gait, and motor unrest which may pass into excitement and hallucinations, and later may result in anemia."

Gleason reports the systemic effects somewhat like aniline poisoning in that methemoglobin production and cardiac disorders result, "but perhaps cardiac disorders are more severe."

Von Oettingen further notes that "following nitrochlorobenzene poisoning, cardiac complications are said to be more frequent and more serious than after aniline poisoning. There may be injury of the kidneys and alimentary glucosuria.

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Repeated attacks of moderate poisoning were followed in one instance by hemolytic anemia."

NIOSH gives the oral LD50 for the rat at 420 mg/kg, and for the mouse at 1414 mg/kg.

Baskin gives the symptoms for acute poisoning by swallowing as the same as skin absorption, and the NFPA says nitrochlorobenzene is "a cumulative poison by inhalation or ingestion."

Literature sources state that nitrochlorobenzene is a toxic material capable of producing serious internal disorders, including "severe cardiac complications," and in one instance "hemolytic anemia." Classifications of 1 and 5 are, therefore, concluded to be appropriate.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1975 (NFPA)

E. I. duPont de Nemours and Co., Material Safety Data Sheet (duP)

Monsanto Co., Material Safety Data Sheet (Mons)

"Lange's Handbook of Chemistry," 11th edition (Lange)

Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 13, p. 840 (K-O)

Sources of data items used:

- I. A. 1. Synonyms: NFPA-325M; Mons  
2. Formula: Lange  
3. Molecular weight: Lange
- B. 1. Boiling point: NFPA-325M, Mons, Lange  
2. Specific gravity: NFPA-325M  
3. Vapor density: calculated  
4. Melting point: Lange, Mons  
5. Vapor pressure: Mons  
6. Solubility in water: Mons  
7. Evaporation rate: Not applicable  
8. Appearance and odor: Mons
- II. A. 1. Flash point: NFPA-325M, K-O  
2. Autoignition temperature: Data not available  
3. Flammable limits: Not applicable  
4. Extinguishing media: Mons  
5. Special fire fighting procedures: Mons  
6. Unusual fire and explosion hazards: Mons. ADL
- B. 1. Conditions contributing to instability: ADL  
2. Incompatibilities: Mons  
3. Hazardous decomposition products: Mons  
4. Special precautions: ADL
- III. A. Steps if released or spilled: Mons  
C. Waste disposal method: Mons. duP
- V. Miscellaneous precautions: ADL

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

Considine, D. M., "Chemical and Process Technology Encyclopedia," McGraw Hill, 1974 (Considine)

Hawley, G. G., "The Condensed Chemical Dictionary," 8th edition, Van Nostrand

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Reinhold, 1971 (Hawley)

International Labour Organization, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)

Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, 2nd edition, 1972 (K-O)

"Merck Index of Chemicals and Drugs," 8th edition, 1968 (Merck)

"p-Nitrochlorobenzene," Baskin, A. D. - editor, "Handling Guide for Potentially Dangerous Commodities," Railway Systems and Management Association, Chicago, 1972 (Baskin)

"p-Nitrochlorobenzene," Chemical Profile, October 1, 1971, Schnell Publishing Co., (Profile)

"p-Nitrochlorobenzene," E. I. duPont de Nemours Co., Material Safety Data Sheet (duPont MSDS)

"p-Nitrochlorobenzene," Monsanto Co., Material Safety Data Sheet, January 14, 1972 (Monsanto MSDS)

Stanford Research Institute, "Chemical Economics Handbook," Menlo Park, California (SRI)

References for Specific Use/Exposure

1. Profile, K-O, Considine, SRI
2. Profile, K-O, Considine, Baskin, SRI
3. K-O, Baskin
4. Profile, Merck, K-O, Considine
5. Profile, K-O, Merck, Hawley, Considine
6. Considine, Profile, Merck, K-O

References for Specific Control Methods

ILO, Monsanto MSDS, Baskin, duPont MSDS and K-O were the references used in all the Specific Control Methods.

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RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: p-Nitrochlorobenzene

D. O. L. STANDARD: 1 mg/M3

Eye Irritation Level: 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. For the purposes of this standard, quarter- and half-facepiece respirators are permitted.

IDLH: 1000 mg/M3

Basis for IDLH Value: There are no acute inhalation toxicity data available upon which to base an IDLH concentration for NCB. The chosen IDLH (1000 mg/M3) is based upon an analogy with nitrobenzene and chlorobenzene.

Concerning nitrobenzene, the Documentation of TLV's states that "Henderson and Haggard reported that 200 ppm is the maximum concentration that can be inhaled for one hour without serious disturbance." Concerning chlorobenzene, the AIHA Hygienic Guides state that 8000 ppm (36,600 mg/M3) is fatal to cats in 1 hour, and Patty states that exposure of cats to 2400 - 2900 ppm (11,000 mg/M3 - 13,300 mg/M3) for 1 hour causes unsteadiness, tremor, and twitching.

Other Toxicological Information: The Documentation of TLV's states that "parachloronitrobenzene (p-NCB), like nitrobenzene, may be absorbed through the lungs and skin giving rise to methemoglobin. The para compound is thought to be less toxic than the ortho compound. Chloraniline, also a toxic compound, is one of the urinary metabolites. Saita reported a case of a workman who cleaned a spill of approximately 50 kg. The next morning he was cyanotic and complained of a headache. Renshaw reported four workmen who were hospitalized as the result of exposure from p-NCB while nitrating chlorobenzene. These cases resulted from two to four days exposure and all were cyanotic; headache and weakness accompanied the cyanoses. Blood was the chief tissue affected. Anemia developed gradually, recovery was slow, requiring several weeks.

"Kubota studied the effect of p-NCB by subcutaneous injection of 1.5g suspended in olive oil and by application on the skin of rabbits. He noted that methemoglobin increased in several hours, decreased after about 12 hours, then increased again 18 to 24 hours following exposure. Heinz bodies (granules containing oxidized hemoglobin) formed during the second period of increasing methemoglobin. Clinical symptoms, such as anemia, hematuria and hemoglobinuria were noted. Kubota suggested that protein degradation be prevented following exposure. Frenkel determined that the subcutaneous injection of 500 to 600 mg/kg of p-NCB in white male and female rats produced a decrease in adrenalin.

"Pacséri et al. studied the effects of workmen exposed at average concentrations of p-NCB of 8.6, 19.6 and 22.3 mg/M3 and at a mixed exposure of 3.6 mg/M3 p-NCB and nitrophenetole. These environmental data were compared with physiologic effects studied over a period of time. They found that no chronic intoxication occurred with the 3.6 mg/M3 exposure, although changes, such as increased methemoglobin, the appearance of Heinz bodies, headache, vertigo,

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and a few cases of eczema occurred. Because skin absorption could not be determined with any degree of precision, the authors concluded that it was impossible to determine precisely whether an air concentration of 3.6 mg/M3 of p-NCB or skin absorption caused the symptoms. The exposures at higher concentrations were apparently intermittent. Their data would seem to be compatible with the TLV of 1 mg/M3, if blood changes and mild symptoms such as headache are to be prevented."

The NIOSH Toxic Substances List gives oral LD50's of 420 mg/kg for the rat and 1414 mg/kg for the mouse.

VAPOR PRESSURE AT 20 C: Much less than 1 mm Hg

NOTE: Additional toxicological information is needed to set a more accurate ID

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|    | Use/Exposure                                                                                                                                                                                              | Principal Route<br>of Entry | Currently Used<br>Control Methods                                                                                                                                                                         |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Inhalation of vapor and skin contact with solid during use for production of chemical intermediates for the manufacture of pesticides (ethyl and methyl parathion and other fungicides and preservatives) | A,B,D                       | Process enclosure; local exhaust ventilation; personal protective equipment (respiratory protective devices, complete body protection, impervious gloves, shoes, goggles); good personal hygiene practice |
| 2. | Inhalation of vapor and skin contact with solid during use for production of chemical intermediates for manufacture of sulfur and azo dyes (Fast Red GG Base, Fast Red R Base, Fast Bordeaux GP Base)     | A,B,D                       | Process enclosure; local exhaust ventilation; personal protective equipment (respiratory protective devices, complete body protection, impervious gloves, shoes, goggles); good personal hygiene practice |
| 3. | Inhalation of vapor and skin contact with solid during manufacture and distribution and during maintenance of equipment and storage containers                                                            | A,B,D                       | Process enclosure; local exhaust ventilation; personal protective equipment (respiratory protective devices, complete body protection, impervious gloves, shoes, goggles); good personal hygiene practice |
| 4. | Inhalation of vapor and skin contact with solid during use for the production of chemical intermediates for the manufacture of pharmaceuticals (phenacetin; sulfanilamide derivatives)                    | A,B,D                       | Process enclosure; local exhaust ventilation; personal protective equipment (respiratory protective devices, complete body protection, impervious gloves, shoes, goggles); good personal hygiene practice |
| 5. | Inhalation of vapor and skin contact with solid during use for production of chemical intermediates for manufacture of rubber, chemicals, antioxidants, gasoline gum inhibitors, corrosion inhibitors     | A,B,D                       | Process enclosure; local exhaust ventilation; personal protective equipment (respiratory protective devices, complete body protection, impervious gloves, shoes, goggles); good personal hygiene practice |

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practice

6. Inhalation of vapor and skin contact with solid during use for the production of intermediates for manufacture of photographic chemicals

A,B,D

Process enclosure; local exhaust ventilation; personal protective equipment (respiratory protective devices, complete body protection, impervious gloves, shoes, goggles); good personal hygiene practice

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