

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND  
SUPPORTING DOCUMENTATION FOR

\*\*\* NITROTOLUENE \*\*\*

NIOSH/OSHA Draft Technical Standard  
and Supporting Documentation for NITROTOLUENE

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 NITROTOLUENE.

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 nitrotoluene not in excess of 5 parts per million (ppm) (30 milligrams 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 nitrotoluene.

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

(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 nitrotoluene;

(ii) Any measurements of nitrotoluene taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to nitrotoluene; 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 nitrotoluene 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 nitrotoluene 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 nitrotoluene 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 nitrotoluene 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 nitrotoluene 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 nitrotoluene below the action level, the employer may terminate measurement for the employee.

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(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 nitrotoluene above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of nitrotoluene 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 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 or static pressure 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 nitrotoluene.

(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 not feasible; or

(iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of nitrotoluene to at or below the permissible exposure; or

(iv) For operations which require entry into tanks or closed vessels; or

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(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 NITROTOLUENE

| CONDITION                                                                                        | PERMISSIBLE RESPIRATORY PROTECTION                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vapor or Particulate Concentration                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 50 ppm or less<br>(280 mg/M3)                                                                    | Any supplied-air respirator.<br>Any self-contained breathing apparatus.                                                                                                                                                                                                                                                                                                                                                 |
| 200 ppm or less<br>(1120 mg/M3)                                                                  | Any supplied-air respirator with a full facepiece, helmet, or hood.<br>Any self-contained breathing apparatus with a full facepiece.<br>A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.                                                                                                                                                                |
| Greater than 200 ppm or<br>(1120 mg/M3)<br>entry and<br>escape from<br>unknown<br>concentrations | Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.<br>A combination respirator which includes a Type C supplied air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode. |
| Fire Fighting                                                                                    | Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.                                                                                                                                                                                                                                                                                                   |
| Escape                                                                                           | Any gas mask providing protection against organic vapors and particulates.<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).

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(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 nitrotoluene.

(2) For the purpose of compliance with \$1910.309, locations classified as hazardous locations due to the presence of nitrotoluene shall be Class I, Group D.

(3) For the purpose of compliance with \$ 1910.157, nitrotoluene 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 nitrotoluene shall be Class I, Group D.

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

(6) Nitrotoluene shall be stored so as not to come in contact with strong oxidizers or sulfuric acid.

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use appropriate protective clothing necessary to prevent repeated or prolonged skin contact with solid or liquid nitrotoluene. Face shields shall comply with \$ 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

(2) Employers shall ensure that non-impervious clothing which becomes contaminated with nitrotoluene be removed promptly and not reworn until the nitrotoluene is removed from the clothing.

(3) Employers shall provide and ensure that employees use safety goggles which comply with \$ 1910.133(a)(2)-(a)(6) where solid or liquid nitrotoluene may contact the eyes.

(g) Spills and disposal. In the event that nitrotoluene 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 contaminated with nitrotoluene promptly wash or shower with soap or mild detergent and water to remove any nitrotoluene from the skin.

(2) Employers shall ensure that employees do not eat or smoke in areas where solid nitrotoluene is handled, processed or stored.

(3) Employers shall ensure that employees who handle solid or liquid nitrotoluene wash their hands thoroughly with soap or mild detergent and water before eating or smoking.

(i) Training and information. (1) Each employer who has a workplace in which nitrotoluene 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 nitrotoluene above the action level without regard to the use of respirators, or employees who may have repeated or prolonged skin contact, or who may have eye contact with solid or liquid nitrotoluene, or employees who work where a spill of nitrotoluene may occur, shall annually:

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

(ii) Advise affected employees as to the signs and symptoms of exposure to nitrotoluene.

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(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of overexposure to nitrotoluene 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 nitrotoluene.

(j) Medical surveillance. (1) The employer shall provide 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 examinations. The employer shall make available to each employee who is exposed, or will be exposed, to nitrotoluene or liquids containing nitrotoluene or airborne concentrations of nitrotoluene at or above the action level, without regard to the use of respirators, a preplacement medical examination which must include the following:

(i) A medical history and physical examination with emphasis on the blood, heart, skin, gastrointestinal system and nervous system;

(ii) A 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 nitrotoluene or liquids containing nitrotoluene or airborne concentrations of nitrotoluene at or above the action level, without regard to the use of respirators, 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, heart, skin, gastrointestinal system and nervous system.

(ii) A 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 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 methemoglobin determination for the employee if the employee informs the employer of any of the signs or symptoms of exposure to nitrotoluene which are listed in Appendix A or if overexposure to nitrotoluene is suspected.

(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 nitrotoluene;

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

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

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(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.

(8) Physician's written opinion. i) the physician's written opinion by the examining physician shall specifically state:

(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 nitrotoluene;

(B) Any recommended limitations upon the employee's exposure to nitrotoluene, 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 the employee's employment.

(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 for inclusion in the employee's medical record:

(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 nitrotoluene in such a way as would put the employee at increased risk of material impairment of his health from such exposure. The employer shall base this decision on any information available, including 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.

(13) The employer shall provide emergency medical treatment for any employee injured through exposure to nitrotoluene.

(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.

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

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to nitrotoluene which are being monitored;

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

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

(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 nitrotoluene;

(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.

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(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 nitrotoluene.

(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 nitrotoluene which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to nitrotoluene 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 nitrotoluene that are being performed at the place of exposure; and

(iii) Record the results obtained.

NOTE: The information contained in the following appendix for nitrotoluene is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligation. To the extent that the information supplements this regulation for nitrotoluene, it is advisory in nature.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET  
FOR NITROTOLUENE

I. SUBSTANCE IDENTIFICATION

A. Substance: Nitrotoluene

B. Permissible Exposure: 5 parts of nitrotoluene per million parts of air (ppm) (30 milligrams of nitrotoluene per cubic meter of air (mg/M3)) averaged over an eight-hour work shift.

C. Appearance and Odor: Ortho: Yellow liquid or solid with a weak aromatic odor; Meta: Yellow liquid or solid with a weak aromatic odor; Para: Pale yellow solid with a weak aromatic odor.

II. HEALTH HAZARD DATA

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- A. Ways in which the chemical affects your body: Nitrotoluene 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.
- B. Effects of Overexposure:
  - 1. Nitrotoluene may affect the ability of the blood to carry oxygen. This may cause a bluish discoloration of the skin, irritability, drowsiness, nausea, rapid pulse, headache, weakness, shortness of breath and unconsciousness.
  - 2. 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 nitrotoluene.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If solid or liquid nitrotoluene gets 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 solid or liquid nitrotoluene gets on your skin, immediately wash the contaminated skin using soap or mild detergent and water. If solid or liquid nitrotoluene penetrates 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 nitrotoluene 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 solid or liquid nitrotoluene has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.
- 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 emergency rescue equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. Respirators: Respirators are not the best way to control exposure to nitrotoluene. 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 Administration (MESA) or National Institute for Occupational Safety and

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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 nitrotoluene 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 appropriate protective clothing and equipment to prevent repeated or prolonged skin contact with solid or liquid nitrotoluene. Replace or repair impervious clothing that has developed leaks.
- C. Eye Protection: You must wear splash-proof safety goggles where liquid nitrotoluene may contact your eyes. You must wear dust-resistant safety goggles where solid nitrotoluene may contact your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Nitrotoluene is combustible and its vapors can form explosive mixtures with air at elevated temperatures.
- B. Nitrotoluene must be stored in tightly closed containers in a cool, well ventilated area away from heat, strong oxidizers or sulfuric acid.
- C. Sources of ignition such as smoking and open flames are prohibited wherever nitrotoluene is handled, used or stored in a manner that could create a potential fire or explosion hazard.
- D. You must promptly remove any non-impervious clothing that becomes contaminated with nitrotoluene and this clothing must not be reworn until the nitrotoluene is removed from the clothing.
- E. If your skin becomes contaminated with nitrotoluene, you must promptly wash or shower with soap or mild detergent and water to remove the nitrotoluene from your skin.
- F. You must not eat or smoke in areas where solid nitrotoluene is handled, processed or stored.
- G. If you handle solid or liquid nitrotoluene, you must wash your hands thoroughly with soap or mild detergent and water before eating or smoking.
- H. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
- I. Ask your supervisor where nitrotoluene 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 nitrotoluene. In addition, your employer must instruct you in the safe use of nitrotoluene, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to nitrotoluene. You or your representative have the right to observe employee exposure measurements and to record

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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 physicians written opinion for any physical examination required by this standard.

NOTE: The information contained in the following appendix for nitrotoluene is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligation. To the extent that the information supplements this regulation for nitrotoluene, it is advisory in nature.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES  
FOR NITROTOLUENE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

- 1. Synonyms: Orthonitrotoluene; o-nitrotoluol; metanitrotoluene; m-nitrotoluol; paranitrotoluene; p-nitrotoluol
- 2. Formula: Ortho: 2-NO<sub>2</sub>C<sub>6</sub>H<sub>4</sub>CH<sub>3</sub>; Meta: 3-NO<sub>2</sub>C<sub>6</sub>H<sub>4</sub>CH<sub>3</sub>; Para: 4-NO<sub>2</sub>C<sub>6</sub>H<sub>4</sub>CH<sub>3</sub>
- 3. Molecular weight: 137.1

B. Physical Data

- 1. Boiling point (760 mm Hg): Ortho: 222 C (432 F); Meta: 232 C (450 F); Para: 238 C (460 F)
- 2. Specific gravity (water = 1): Ortho: 1.16; Meta: 1.16; Para: 1.3
- 3. Vapor density (air = 1 at boiling point of nitrotoluene): 4.
- 4. Melting point: Ortho: -4 C (25 F); Meta: 16 C (61 F); Para: 52 C (126 F)
- 5. Vapor pressure at 20 C (68 F): Ortho and meta: 0.15 mm Hg; para: 0.12 mm Hg
- 6. Solubility in water, % by weight at 20 C (68 F): Ortho: 0.06; Meta: 0.05; Para: 0.004

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7. Evaporation rate (butyl acetate = 1): Not applicable
8. Appearance and odor: Ortho: Yellow liquid or solid with a aromatic odor; Meta: Yellow liquid or solid with a weak aromatic odor; Para: Pale yellow solid with a weak aromatic odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: Ortho: 106 C (223 F) (closed cup); Meta: 101 C (214 F); Para: 106 C (223 F)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Lower: Ortho: 2.2 (meta and para: 1.6 (calculated))
4. Extinguishing media: Carbon dioxide, dry chemical, foam
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: Nitrotoluene is combustible. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where nitrotoluene is used, handled or stored in a manner that could create a potential fire or explosion hazard.
7. For purposes of complying with the requirements of 29 CFR 1910.106, liquid nitrotoluene is classified as a Class IIIB combustible liquid.
8. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electrical Code for nitrotoluene shall be Class I, Group D.

B. Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizers or sulfuric acid may cause fire and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving nitrotoluene.
4. Special precautions: Nitrotoluene will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

A. If nitrotoluene is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.
2. For small quantities of liquid nitrotoluene, absorb on paper towels. For small quantities of solid nitrotoluene, sweep onto paper or other suitable material. Remove to a safe place (such as a fume hood) and burn the paper. Large quantities of liquid nitrotoluene can be collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. Large quantities of solid nitrotoluene can be reclaimed; however, if this is not practical, dissolve in a flammable solvent (such as

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alcohol) and 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 or leaks until cleanup has been completed.
- C. Waste disposal methods: Nitrotoluene may be disposed of:
  - 1. For liquid nitrotoluene, by absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
  - 2. By atomizing liquid nitrotoluene in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.
  - 3. By making packages of solid nitrotoluene in paper or other suitable material or by dissolving in a flammable solvent (such as alcohol) and burning 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 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 (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 gas and vapor adsorption tubes with subsequent chemical analysis. The method of measurement must determine the concentration of nitrotoluene 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 above. More than three (3) measurements should be taken during the work shift so that increased confidence may be placed in the judgement that the employee has or has not, in fact, been exposed in excess of the permissible limit. Samples should be collected as described in 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 nitrotoluene 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 2" (Order number XXXXXXXXXX).
- D. QUALIFIED PERSONS: Since many of the duties relating to employee protection are dependent on the results of

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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

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

VI. COMMON OPERATIONS

Common operations in which exposure to nitrotoluene may occur are: During its production and use; as an intermediate in the synthesis of dyes; in the manufacture of toluidines, o-toluidine, dinitrotoluene, nitrotoluene-sulfonic acids; and in other organic synthesis.

NOTE: The information contained in the following appendix is neither intended, by itself, to create any additional obligations nor otherwise impose or detract from any existing obligations and to the extent the information supplements this regulation for nitrotoluene, it is advisory in nature.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; skin absorption.

II. TOXICOLOGY

Nitrotoluene, whether absorbed as vapor by inhalation or as liquid through the skin, has a potential for producing methemoglobin and subsequent anoxia. Signs and symptoms of overexposure are due to the loss of oxygen carrying capacity of the blood. The onset of symptoms of methemoglobinemia is insidious and may be delayed up to 4 hours; headache is commonly the first symptom and may become quite intense as the severity of methemoglobinemia progresses. Cyanosis occurs when the methemoglobin concentration is 15 percent or more. Cyanosis develops early in the course of intoxication, first in the lips, the nose, and the ear lobes, and is usually recognized by fellow workers. Until the methemoglobin concentration approaches approximately 40 percent, the individual usually feels well, has no complaints, and will insist that nothing is wrong. At methemoglobin concentrations of over 40 percent there usually is weakness and dizziness; at up to 70 percent concentration there may be ataxia, dyspnea on mild exertion, tachycardia, nausea, vomiting, and drowsiness.

III. SIGNS AND SYMPTOMS

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Signs of anoxia including cyanosis of lips, nose, and ear lobes and headache. At higher methemoglobin concentrations, weakness, dizziness, atoxia, dyspnea, tachycardia, nausea, and vomiting may occur.

IV. SPECIAL TESTS

Methemoglobin concentration in the blood should be determined when nitrotoluene intoxication is suspected, and at regular intervals until the methemoglobin has been fully reduced to normal hemoglobin.

V. TREATMENT

Remove from exposure. If swallowed and the person is conscious, induce vomiting. Give artificial resuscitation if indicated. 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 to hemoglobin; however, the use of this agent is controversial due to its toxic effects.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Nitrotoluene is capable of causing methemoglobinemia but is of relatively low potency. Skin absorption is known to occur. It is important that the physician become familiar with plant operating conditions in which exposure to nitrotoluene 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 nitrotoluene:

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, nervous system, gastrointestinal system, and cardiovascular system should be stressed. The skin should be examined for evidence of chronic disorders.
2. A complete blood count -- Nitrotoluene has been shown to cause methemoglobinemia. Persons with blood disorders may be

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at increased risk from exposure. A complete blood count must be performed including a red cell count, a white cell count, a differential count of a stained smear, as well as hemoglobin and hematocrit.

C. PERIODIC EXAMINATIONS

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

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Nitrotoluene," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 190.

2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 2105-2123, 2130-2131, 2148-2150.

3. Lynch, A.L.: "Biological Monitoring for Industrial Exposure to Cyanogenic Aromatic Nitro and Amino Compounds," American Industrial Hygiene Association Journal, 35:426-432, 1974.

4. Mangelsdorff, A.F.: "Treatment of Methemoglobinemia," A.M.A. Archives of Industrial Health, 14:148-153, 1956.

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REFERENCES AND SOURCES  
NITROTOLUENE  
1910.1000

- (e) Fire and Safety  
(1) Electrical hazard classification based on "Fire Hazard Classification of Chemical Vapors Relative to Explosion-proof Electrical Equipment," No. CG-D-92-74, May, 1973, p. 31 (nitroaliphatic family).
- (f) Personal Protective Equipment, and, (h) Sanitation  
Eye: Grant, "Toxicology of the Eye"  
Skin: American Conference of Governmental Industrial Hygienists, "Documentation of the Threshold Limit Values for Substances in Workroom Air;" Hamilton and Hardy, "Industrial Toxicology;" Stauden, "Kirk-Othmer, "Encyclopedia of Chemical Technology;" ILO, "Encyclopedia of Occupational Health and Safety;" Sax, "Dangerous Properties of Industrial Materials;" Patty, "Industrial Hygiene and Toxicology"  
Ingestion: Stauden, "Kirk-Othmer Encyclopedia of Chemical Technology;" Baskin, "Handling Guide for Potentially Hazardous Commodities;" Sax, "Dangerous Properties of Industrial Materials;" Christensen, "NIOSH Toxic Substances List"

COMMENTS

Eye - Classification: 2 and 6

Output statement numbers: 10 and 12 combined

Exceptions: None

The fat-soluble properties of the aromatic nitro compounds indicate little damage to the exposed eye. By analogy with toluene, Grant states that "injury of human eyes from liquid toluene has so far not been serious," and has produced only "transient conjunctival irritation in rabbit eyes. Two patients accidentally splashed with toluene are reported to have suffered transient disturbance . . . with healing complete within forty-eight hours."

In general, Grant states, "a splash of a chemically inert solvent usually causes immediate stinging and smarting pain, and it may cause loss of some or all of the corneal epithelium, particularly if it is a good fat solvent, but as a general rule it does not damage the corneal stroma underlying the epithelium. Even if all the epithelium is lost from the cornea as a result of splash of ordinary organic solvents, it generally regenerates in a few days without residual permanent damage. While the epithelium is missing, the corneal stroma may be slightly swollen and the posterior surface of the cornea may appear wrinkled."

There is no indication that this compound causes any permanent injury on direct contact with the eye. It is, therefore, assigned classifications of 2 and 6.

Skin - Classification: 2 and 6

Output statement numbers: 2, 17g, 17i, 20a

Exceptions: None

The ACGIH states that "according to von Oettingen cases of poisoning from nitrotoluene are uncommon. Some authorities consider it only slightly toxic, especially in comparison with

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nitrobenzene. There is some evidence that the different isomers vary somewhat in toxicity. Patty states that nitrotoluene is a methemoglobin former of apparently low grade."

According to Hamilton and Hardy, "methemoglobinemia is considered to be the outstanding acute reaction to most nitro aromatic compounds. Recovery is usually rapid and spontaneous disappearance of cyanosis may occur in hours. With high levels of methemoglobin . . . , twenty-four or more hours may be required."

Stauden reports "the toxic properties of these substances are similar to those of nitrobenzene but less pronounced. The nitrotoluenes cause the same bodily reactions and are readily absorbed by contact with the skin."

On a scale of 1 (slight) to 6 (severe), the ILO gives the "cyanosis hazard" as 5, the "anaemia" hazard as 3, and the "overall toxic hazard" as 5.

Sax lists the acute and chronic effects by skin absorption as "unknown" for humans. He says, however, that it can be absorbed through the skin.

Patty notes that, "in general, those compounds that are soluble in the common organic solvents . . . are fat-soluble or fat-solvent and insoluble in water. Such compounds usually penetrate the intact skin readily."

The melting point of the ortho, meta and para isomers varies from 25 degrees F to 61 degrees F to 126 degrees F. All have a vapor pressure at 20 degrees C of less than 1 mm of Hg and range in solubility in water from 0.06% to 0.004%. Their flash points range from 214 to 223 degrees F.

These compounds, as reported above, are readily absorbed through the skin but are methemoglobin formers of only low grade. Classifications of 2 and 6 are, therefore, concluded to be adequate to prevent symptoms of intoxication. Statement 7a is not considered necessary due to the low vapor pressure.

Ingestion - Classification: 2 and 6

Output statement numbers: 19, 20b

Exceptions: None

Stauden says that the nitrotoluenes can cause the same bodily reactions as those associated with nitrobenzene "and are readily absorbed by . . . ingestion." Stecher notes "ingestion may cause vomiting, followed by liver injury" and "jaundice."

Baskin lists the symptoms of acute poisoning by swallowing as "cyanosis, headache, shallow breathing, dizziness, confusion, decreased blood pressure, convulsions, coma, jaundice, painful urination" and may later result in "anemia."

Sax lists the acute and chronic systemic effect as of moderate toxic hazard. The ILO gives the anemia hazard as a 3 on a scale of 1 to 6.

Christensen gives the oral LD50 for the rat as 1072 mg/kg, the mouse as 330 mg/kg, the rabbit as 2400 mg/kg and for the guinea pig as 3600 mg/kg.

Classifications of 2 and 6 are concluded to be adequate to prevent intoxication.

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SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

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

Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 13, p. 847 - 849 (K-O)

Sources of data items used:

- I. A. 1. Synonyms: NFPA-325M  
2. Formula: K-O  
3. Molecular weight: ADL
- B. 1. Boiling point: NFPA-325M, K-O  
2. Specific gravity: NFPA-325M  
3. Vapor density: NFPA-325M  
4. Melting point: NFPA-325M, NFPA-49, K-O  
5. Vapor pressure: Extrapolated from the CRC Handbook data  
6. Solubility in water: K-O  
7. Evaporation rate: Not applicable  
8. Appearance and odor: K-O
- II. A. 1. Flash point: NFPA-325M, K-O  
2. Autoignition temperature: Data not available  
3. Flammable limits: Calculated  
4. Extinguishing media: NFPA-49, ADL  
5. Special fire fighting procedures: NFPA-49, ADL  
6. Unusual fire and explosion hazards: NFPA-325M, K-O
- B. 1. Conditions contributing to instability: ADL  
2. Incompatibilities: NFPA-491M  
3. Hazardous decomposition products: NFPA-49  
4. Special precautions: ADL
- III. A. Steps if released or spilled: ADL  
C. Waste disposal method: ADL
- V. Miscellaneous precautions: NFPA-49, ADL

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

Baskin, A. D. - editor, "Handling Guide for Potentially Hazardous Commodities," Railway Systems and Management Assoc., Chicago, 1972 (Baskin)

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

Hawley, G. G., "The Condensed Chemical Dictionary," 8th edition, Van Nostrand Reinhold, 1971 (Hawley)

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

Jacobs, M. B., "The Analytical Chemistry of Industrial Poisons, Hazards, and Solvents," Interscience, 2nd edition, 1956 (Jacobs)

Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience, 1st edition, 1954 (Chem Tech); 2nd edition, 1972 (K-O)

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

- "Nitrotoluene," Hazard Process Index, Hazard Entry No. 142, NIOSH-HSM-99-73-62 (HPI)

Shreve, R. N., "Chemical Process Industries," McGraw Hill, 1956 (Shreve)

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

Stanford Research Institute, "Chemical Origins and Markets," Chemical

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Information Services, Menlo Park, California, 1967 (Origins)

References for Specific Use/Exposure

1. HPI, K-O, Chem Tech, Baskin
2. HPI, Hawley, Chem Tech, K-O, Considine, Origins
3. HPI, Hawley, K-O, Origins
4. HPI, Hawley, Chem Tech, K-O, Jacobs, Origins
5. SRI, HPI, Shreve, Chem Tech
6. HPI, Hawley, Merck, Chem Tech

References for Specific Control Methods

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

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RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Nitrotoluene

D. O. L. STANDARD: 5 ppm

WARNING PROPERTIES:

Odor Threshold: Information is not available for the odor threshold of nitrotoluene.

Eye Irritation Level: Nitrotoluene is not known to be an eye irritant.

Evaluation of Warning Properties: This substance is treated as a material with poor warning properties. Gas sorbent respiratory equipment is not permitted.

IDLH: 200 ppm

Basis for IDLH Value: By analogy with nitrobenzene.

Other Toxicological Information: The Documentation of TLV's states that "According to von Ottingen cases of poisoning from nitrotoluene are uncommon. Some authorities considered it only slightly toxic, especially in comparison with nitrobenzene. There is some evidence that the different isomers vary somewhat in toxicity. Patty stated that nitrotoluene is a methemoglobin former of apparently low grade.

"A TLV of 5 ppm, comparable to that of aniline, and higher than that for nitrobenzene, is recommended to prevent formation of methemoglobin and other toxic effects."

Stauden states that the "toxic properties of these substances (the mononitrotoluene) are similar to those of nitrobenzene, but less pronounced."

The NIOSH Toxic Substances List gives the following oral LD50's for the 3 isomers of nitrotoluene:

|                |            |            |
|----------------|------------|------------|
| m-nitrotoluene | rat        | 1072 mg/kg |
|                | mouse      | 330 mg/kg  |
|                | rabbit     | 2400 mg/kg |
| o-nitrotoluene | guinea pig | 3600 mg/kg |
|                | rat        | 891 mg/kg  |
|                | mouse      | 2462 mg/kg |
| p-nitrotoluene | rat        | 2144 mg/kg |
|                | mouse      | 1231 mg/kg |

LFL: Data not available

VAPOR PRESSURE AT 20 C: Less than 1 mm Hg  
0.15 mm Hg  
0.12 mm Hg

SATURATED CONCENTRATION:

o and m-nitrotoluene 197 ppm

p-nitrotoluene 158 ppm

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|     | Use/Exposure                                                                                                                                                                                                                                                                              | Principal Route of Entry | Currently Used Control Methods                                                                                                                                                                             |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | Inhalation of dust or vapor and skin contact with solid or liquid during manufacture and distribution and during maintenance of equipment and storage containers                                                                                                                          | A,D                      | Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, shoes, sleeves, aprons); good personal hygiene practice |
| 2.  | Inhalation of dust or vapor and skin contact with solid or liquid during use in manufacture of toluidines (used for production of azo, sulfur, and triphenylmethane dyes; intermediates for vulcanization accelerators, gasoline inhibitors and flotation agents; as analytical reagent)  | A,D                      | Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, shoes, sleeves, aprons); good personal hygiene practice |
| 3.  | Inhalation of dust or vapor and skin contact with solid or liquid during use for manufacture of o-tolidine (used for production of azo dyes; as urethane resin curing agent; as analytical reagent)                                                                                       | A,D                      | Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, shoes, sleeves, aprons); good personal hygiene practice |
| 4.  | Inhalation of dust or vapor and skin contact with solid or liquid during use for manufacture of dinitrotoluenes (used for production of explosives(TNT), intermediates for azo dyes (Fast Scarlet G Base), intermediates for polyurethane foams, resins, and elastomers (toluenediamine)) | A,D                      | Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, shoes, sleeves, aprons); good personal hygiene practice |
| -5. | Inhalation of dust or vapor and skin contact with solid or liquid during use for manufacture of nitrotoluene-sulfonic acids (used for production of azo and stilbene                                                                                                                      | A,D                      | Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, shoes,                                                  |

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dyes (Direct Yellow R))

sleeves, aprons); good  
personal hygiene practice

6. Inhalation of dust or vapor and skin contact with solid or liquid during use for organic synthesis (production of nitrobenzoic acids (dye intermediates, manufacture of sunscreens agents and anesthetics); nitrobenzaldehyde (manufacture of azo dyes, indigo and derivatives); fuchsin - a red dye used in the textile and leather industries; nitrochlorotoluenes (manufacture of azo and triphenylmethane dyes))
- A,D
- Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, shoes, sleeves, aprons); 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