

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND  
SUPPORTING DOCUMENTATION FOR

\*\*\* BENZOYL PEROXIDE \*\*\*

NIOSH/OSHA Draft Technical Standard  
and Supporting Documentation for BENZOYL PEROXIDE

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 BENZOYL PEROXIDE.

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 benzoyl peroxide not in excess of 5 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 benzoyl peroxide averaged over an eight-hour work shift.

(b) Initial determination and exposure measurement. (1) Each employer who has a place of employment in which benzoyl peroxide is released into the workplace air shall determine if there is any possibility that any employee may be exposed to airborne concentrations of benzoyl peroxide above the permissible level. The initial determination shall be made each time there is a change in production, process, or control measures which may result in an increase in airborne concentrations of benzoyl peroxide.

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

(i) Any information, observations, or calculations which may indicate employee exposure to benzoyl peroxide;

(ii) Any measurements of benzoyl peroxide taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to benzoyl peroxide; and

(iv) Date of initial determination, work being performed at the time, location within work site, and employees considered.

(3) If the employer determines that any employee may be exposed to benzoyl peroxide above the permissible exposure, 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 benzoyl peroxide above the action level, the employer shall:

(i) Identify all employees who may be exposed above the permissible level; and

(ii) Measure the exposure of the employees so identified.

(5) If an employee exposure measurement reveals that an employee is exposed to benzoyl peroxide above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every three months.

(6) If an employee exposure measurement reveals that an employee is exposed to benzoyl peroxide 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 benzoyl peroxide above the permissible exposure. The employee shall also be notified of the results of the exposure measurements and of the corrective action being taken to reduce the exposure to below the permissible exposure.

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to benzoyl peroxide 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 benzoyl peroxide above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of benzoyl peroxide 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 local exhaust 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 benzoyl peroxide.

(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 benzoyl peroxide to at or below the permissible exposure; or

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- (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. When an employee informs his employer that he is experiencing eye irritation from benzoyl peroxide while wearing a respirator allowed in Table 2, the employer shall provide and ensure that the employee use an equivalent respirator with a full facepiece, helmet or hood.

TABLE 2      RESPIRATORY PROTECTION FOR BENZOYL PEROXIDE

| CONDITION                                                               | PERMISSIBLE RESPIRATORY PROTECTION                                                                                                                                                            |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Particulate Concentration                                               |                                                                                                                                                                                               |
| 25 mg/M3 or less                                                        | Any dust and mist respirator, except single use respirator.*                                                                                                                                  |
| 50 mg/M3 or less                                                        | Any dust and mist respirator except single use or quarter mask respirator.*                                                                                                                   |
|                                                                         | Any fume or high efficiency particulate respirator.*                                                                                                                                          |
|                                                                         | Any supplied-air respirator.                                                                                                                                                                  |
|                                                                         | Any self-contained breathing apparatus.                                                                                                                                                       |
| 250 mg/M3 or less                                                       | A high efficiency particulate filter respirator with full facepiece.*                                                                                                                         |
|                                                                         | Any supplied-air respirator with a full facepiece, helmet or hood.                                                                                                                            |
|                                                                         | Any self-contained breathing apparatus with a full facepiece.                                                                                                                                 |
| 5000 mg/M3 or less                                                      | A powered air-purifying respirator with a full facepiece helmet or hood and high efficiency particulate filter.*                                                                              |
| 7000 mg/M3 or less                                                      | A Type C supplied-air respirator with a full facepiece operated in pressure demand or other positive pressure mode or with a full facepiece, helmet or hood operated in continuous-flow mode. |
| Greater than 7000 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                 |

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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.

Any dust and mist respirator except single use respirator.\*

Escape

Any escape self-contained breathing apparatus.

\*Benzoyl peroxide is a strong oxidizer and should not come in contact with  
oxidizable materials. Some cartridges and canisters may contain activated  
charcoal and shall not be used to provide protection against benzoyl  
peroxide. Only non-oxidizable sorbents are allowed.

(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).

(a) Fire and safety. (1) The employer shall familiarize himself with  
the information contained in the Substance Technical Guidelines (Appendix B  
of this section) for benzoyl peroxide.

(2) Benzoyl peroxide shall be stored away from heat and so as not to  
come in contact with combustible substances, acids and oxidizable  
materials.

(3) For the purpose of compliance with § 1910.309, locations classified  
as hazardous locations due to the presence of benzoyl peroxide shall be  
Class II, Group G.

(4) For the purpose of compliance with § 1910.157, benzoyl peroxide is  
classified as a Class A fire hazard.

(5) For the purpose of compliance with § 1910.178, locations classified  
as hazardous locations due to the presence of benzoyl peroxide shall be  
Class II, Group G.

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

(7) Non-sparking tools shall be used to open and close containers of  
benzoyl peroxide.

(8) Solid benzoyl peroxide shall be stored and handled so as to prevent  
any physical damage to the container.

(f) Personal protective equipment. (1) Employers shall provide and  
ensure that employees use appropriate protective clothing and equipment  
necessary to prevent repeated or prolonged skin contact with benzoyl  
peroxide or liquids containing benzoyl peroxide. 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 solid benzoyl peroxide change into uncontaminated  
clothing before leaving the work premises.

(3) Employers shall ensure that clothing contaminated with benzoyl  
peroxide is placed in closed containers for storage until it can be  
discarded or until the employer provides for the removal of benzoyl  
peroxide from the clothing. If the clothing is to be laundered or

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otherwise cleaned to remove the benzoyl peroxide, the employer shall inform the person performing the operation of the hazardous properties of benzoyl peroxide.

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

(5) Employers shall provide and ensure that employees use safety goggles which comply with § 1910.133(a)(2)-(a)(6) where benzoyl peroxide or liquids containing benzoyl peroxide may contact the eyes.

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

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

(3) Employers shall ensure that employees who handle benzoyl peroxide or liquids containing benzoyl peroxide 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 benzoyl peroxide 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 benzoyl peroxide 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 benzoyl peroxide or liquids containing benzoyl peroxide, or employees who work where benzoyl peroxide presents a fire or explosion hazard, shall annually:

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

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

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of overexposure to benzoyl peroxide which are listed in Appendix A of the section; and

(iv) Instruct affected employees to inform the employer if they develop any of the medical conditions listed in paragraph (j)(2) of this section; and

(v) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to benzoyl peroxide.

(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) Each employer who has employees exposed to airborne concentrations of benzoyl peroxide above the action level, without regard to the use of

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respirators, or employees who may have repeated or prolonged skin contact or who may have eye contact with benzoyl peroxide or liquids containing benzoyl peroxide shall obtain information as to whether such employee has a history of any of the following medical conditions:

(i) Chronic lung disease

(ii) Skin disease

(3) The employer shall provide a medical examination for the employee if:

(i) The employee provides a history of any of the medical conditions listed in paragraph (j)(2) of this section; or

(ii) The employee informs the employer of the development of any of the medical conditions listed in paragraph (j)(2) of this section or any of the signs or symptoms of exposure to benzoyl peroxide which are listed in Appendix A which the employee suspects are caused by exposure to benzoyl peroxide.

(4) The employer shall provide to the examining physician the following information:

(i) A copy of this regulation with Appendixes A, B and C for benzoyl peroxide;

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

(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; and

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

(5) Where a medical examination is required by paragraph (j)(3) of this section, following such examination the employer shall obtain a written opinion from the examining physician which conforms with paragraph (j)(6) of this section.

(6)(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 benzoyl peroxide;

(B) Any recommended limitations upon the employee's exposure to benzoyl peroxide 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.

(7) No employee shall be exposed to benzoyl peroxide or liquids containing benzoyl peroxide or airborne concentrations of benzoyl peroxide 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.

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(8) The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to the employee's employment.

(9) 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.

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

(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 benzoyl peroxide.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to benzoyl peroxide 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 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 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 of the employee;

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(B) Information concerning medical conditions obtained from the employee pursuant to paragraph (j)(2) of this section;

(C) Any employee medical complaints relative to exposure to benzoyl peroxide;

(D) A copy of information provided to the physician pursuant to paragraph (j)(4)(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 one year 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 benzoyl peroxide.

(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 benzoyl peroxide which is conducted pursuant to this section.

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

(iii) Record the results obtained.

NOTE: The information contained in the following appendix for benzoyl peroxide 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 benzoyl peroxide, it is advisory in nature.

APPENDIX A

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SUBSTANCE SAFETY DATA SHEET  
FOR BENZOYL PEROXIDE

I. SUBSTANCE IDENTIFICATION

- A. Substance: Benzoyl peroxide
- B. Permissible Exposure: 5 milligrams of benzoyl peroxide per cubic meter of air (mg/M3) averaged over an eight-hour work shift.
- C. Appearance and Odor: Colorless, odorless solid

II. HEALTH HAZARD DATA

- A. Ways in which the chemical affects your body: Benzoyl peroxide can affect your body if you inhale it or if it comes in contact with your eyes or skin. It may also affect your body if you swallow it.
- B. Effects of Overexposure:
  - 1. Short-term Exposure: Benzoyl peroxide causes irritation of the eyes, nose, throat and skin.
  - 2. Long-term Exposure: Repeated exposure may cause an allergic 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 benzoyl peroxide.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If benzoyl peroxide or liquids containing benzoyl peroxide get into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If benzoyl peroxide or liquids containing benzoyl peroxide get on your skin, promptly wash the contaminated skin using soap or mild detergent and water. If benzoyl peroxide or liquids containing benzoyl peroxide penetrate through your clothing, remove the clothing promptly and wash the skin using soap or mild detergent and water. If irritation is present after washing, get medical attention.
- C. Swallowing: When benzoyl peroxide or liquids containing benzoyl peroxide have 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.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. Respirators: Respirators are not the best way to control exposure to benzoyl peroxide. 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 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 benzoyl peroxide or liquids containing benzoyl peroxide. Replace or repair impervious clothing that has developed leaks.
- C. Eye Protection: You must wear splash-proof safety goggles where liquids containing benzoyl peroxide may contact your eyes. You must wear dust-resistant safety goggles where solid benzoyl peroxide may contact your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Benzoyl peroxide, when in the dry state, is a highly flammable solid and at elevated temperatures becomes unstable and spontaneously explosive.
- B. Benzoyl peroxide must be stored in tightly closed containers in a cool, well ventilated area away from heat, combustible substances, acids and oxidizable materials.
- C. Sources of ignition such as smoking and open flames are prohibited wherever benzoyl peroxide is handled, used or stored in a manner that could create a potential fire or explosion hazard.
- D. You must use non-sparking tools when opening or closing containers of benzoyl peroxide.
- E. Solid benzoyl peroxide must be stored so as to prevent physical damage to the container.
- F. If your work clothing may have become contaminated with solid benzoyl peroxide, you must change into uncontaminated clothing before leaving the work premises.
- G. You must promptly remove any non-impervious clothing that becomes contaminated with benzoyl peroxide and this clothing must not be reworn until the benzoyl peroxide is removed from the clothing.
- H. If your skin becomes contaminated with benzoyl peroxide, you must promptly wash or shower with soap or mild detergent and water to remove the benzoyl peroxide from your skin.
- I. You must not eat or smoke in areas where solid benzoyl peroxide is handled, processed or stored.
- J. If you handle benzoyl peroxide or liquids containing benzoyl peroxide, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.
- K. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
- L. Ask your supervisor where benzoyl peroxide is used in your work area and for any additional safety and health rules.

VI. ACCESS TO INFORMATION

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- A. Each year your employer is required to inform you of the information contained in this Substance Safety Data Sheet for benzoyl peroxide. In addition, your employer must instruct you in the safe use of benzoyl peroxide, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to benzoyl peroxide. 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 one year 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 benzoyl peroxide 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 benzoyl peroxide, it is advisory in nature.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES  
FOR BENZOYL PEROXIDE

I. PHYSICAL AND CHEMICAL DATA

- A. Substance Identification
  - 1. Synonyms: Dibenzoyl peroxide
  - 2. Formula:  $(C_6H_5CO)_2O_2$
  - 3. Molecular weight: 242
- B. Physical Data
  - 1. Boiling point (760 mm Hg): Not applicable
  - 2. Specific gravity (water = 1): 1.33
  - 3. Vapor density (air = 1 at boiling point of benzoyl peroxide): Not applicable
  - 4. Melting point: 103 C (217 F) decomposes

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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): Less than 1
7. Evaporation rate (butyl acetate = 1): Not applicable
8. Appearance and odor: Colorless, odorless solid

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Autoignition temperature: 103 C (217 F) (ignites and/or explodes)
2. Flammable limits in air, % by volume: Not available
3. Extinguishing media: Water
4. Special fire-fighting procedures: In advanced or massive fires, the area should be evacuated. Use water spray to cool containers exposed to a fire.
5. Unusual fire and explosion hazards: In the dry state benzoyl peroxide is highly flammable. At elevated temperatures can be unstable and is spontaneously explosive. All ignition sources must be controlled where benzoyl peroxide is used, handled or stored in a manner that could create a potential fire or explosion hazard.
6. 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 benzoyl peroxide shall be Class II, Group G.

B. Reactivity

1. Conditions contributing to instability: Benzoyl peroxide decomposes when heated above 75 C (167 F) and will explode when subjected to shock and friction.
2. Incompatibilities: Benzoyl peroxide is a powerful oxidizer and contact with wood, paper, and other combustible substances may cause fire and explosion. Contact with oxidizable materials such as lithium aluminum hydride may also cause fire and explosion. In the dry state benzoyl peroxide is highly flammable. At elevated temperatures can be unstable and is spontaneously explosive.
3. Hazardous decomposition products: Toxic gases and vapors (such as benzoic acid smoke and carbon monoxide) may be released in a fire involving benzoyl peroxide.
4. Special precautions: Benzoyl peroxide will attack some forms of plastics, rubber and coatings; fire and explosion may result.

III. SPILL AND DISPOSAL PROCEDURES

A. If benzoyl peroxide is spilled, the following steps should be taken:

1. Ventilate area of spill.
2. Submerge in excess of water. Treat small portions at a time of the slurry with about ten times its weight of 10% sodium hydroxide solution. This slurry can then be disposed in a secured sanitary landfill.

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3. Do not use spark generating or cellulosic materials (paper, wood, etc.) for sweeping or handling spilled benzoyl peroxide.
  4. Or, for liquids containing benzoyl peroxide add vermiculite or perlite to spill in at least equal weight to the spill. Drain off water and burn carefully in a suitable unconfined (open) 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: See A above.

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 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 particulates using a high efficiency membrane filter with subsequent chemical analysis. The method of measurement must determine the concentration of benzoyl peroxide 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 benzoyl peroxide 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 R" (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

- A. Store benzoyl peroxide in tightly closed containers in a cool, well ventilated area.
- B. Sparks from static electricity or other sources may ignite benzoyl peroxide. All metal surfaces with which benzyl chloride comes in contact should be bonded and grounded.

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- D. The maximum contents of benzoyl peroxide in a single container should be one pound.
- E. Never grind solid benzoyl peroxide.
- F. Employers should advise employees of all areas and operations where their exposure to benzoyl peroxide could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to benzoyl peroxide is likely to occur are: During its production and its use as a catalyst for vinyl polymerization and curing of unsaturated polyester resins; for bleaching oils, fats, and waxes; in rubber compounding; as a catalyst in the synthesis of pharmaceuticals and other organic compounds; and in the manufacture of plastics, textiles, and inks.

NOTE: The information contained in the following appendix for benzoyl peroxide 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 benzoyl peroxide, it is advisory in nature.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Benzoyl peroxide dust causes primary irritation of skin and mucous membranes and sensitization dermatitis. Application to the face as a lotion for acne treatment in 2 individuals caused facial erythema and edema; patch tests with benzoyl peroxide were positive. In contact with the eyes it may produce irritation and if allowed to remain on the skin it may produce inflammation. Workers exposed to 12.2 mg/M3 experienced pronounced irritation of the nose and throat. When repeatedly applied to the skin of mice, it was not carcinogenic.

III. SIGNS AND SYMPTOMS

Primary irritation of skin and mucous membranes; sensitization dermatitis; eye irritation.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Immediately flush eyes with water and wash skin with soap or mild detergent and water. If swallowed and the person is

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conscious, induce vomiting. Give artificial resuscitation and administer oxygen if indicated.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of benzoyl peroxide are caused by its capability to produce both primary irritation and sensitization dermatitis. The chief hazards result from its flammable and explosive properties at elevated temperatures. It is important that the physician become familiar with plant operating conditions in which exposure to benzoyl peroxide 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

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

1. Skin disease -- Benzoyl peroxide is a primary skin irritant and a skin sensitizer. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.
2. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of benzoyl peroxide might cause exacerbation of symptoms due to its irritant properties.

C. PERIODIC EXAMINATIONS

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

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Benzoyl Peroxide," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, pp. 23-24.
2. Manufacturing Chemists Association, Inc: Chemical Safety Data Sheet SD-81, Benzoyl Peroxide, Washington, D.C., 1960, pp. 3-4, 10.

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3. Eaglstein, W.H.: "Allergic Contact Dermatitis to Benzoyl Peroxide - Report of Cases," Archives of Dermatology, 97:527, 1968.
4. Van Duuren, B.L., et al: "Carcinogenicity of Epoxides, Lactones, and Peroxy Compounds," Journal of the National Cancer Institute, 31:41-55, 1963.
5. Grant, W. Morton: Toxicology of the Eye (2d ed.), Charles C. Thomas, Springfield, Illinois, 1974, pp. 183, 1196.

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REFERENCES AND SOURCES  
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- (f) Personal Protective Equipment, and, (h) Sanitation
- Eye: Manufacturing Chemists' Association, "Chemical Safety Data Sheets;" Baskin, "Handling Guide for Potentially Hazardous Commodities;" Grant, "Toxicology of the Eye;" International Labour Office, "Encyclopedia of Occupational Health and Safety"
- Skin: Manufacturing Chemists' Association, "Chemical Safety Data Sheets;" Sax, "Dangerous Properties of Industrial Materials;" American Conference of Governmental Industrial Hygienists, "Documentation of Threshold Limit Values for Substances in Workroom Air;" Gleason, "Clinical Toxicology of Commercial Products;" Stecher, "The Merck Index," eighth edition; International Labour Office, "Encyclopedia of Occupational Health and Safety"
- Ingestion: American Conference of Governmental Industrial Hygienists, "Documentation of Threshold Limit Values for Substances in Workroom Air;" International Labour Office, "Encyclopedia of Occupational Health and Safety"

COMMENTS

Eye - Classification: 2 and 6

Output statement numbers: 10 and 12 combined

Exceptions: None

According to the MCA, "on contact with the eyes," this substance "may cause inflammation."

Baskin reports the "acute local effects are . . . eye inflammation upon contact, "but the "exposure irritates," and "only minor residual injury" develops.

Grant reports, when "applied experimentally to animal eyes, it produces superficial opacities in the cornea and inflammation of the conjunctiva according to one investigator, but according to another no injury results from single application of a 93% pure powder or a 50% paste in dimethyl phthalate to rabbit eyes."

The ILO simply states that "splashes in the eye can be damaging."

Since there is no clear indication that the substance causes anything more than inflammation and reversible injury, it is assigned classifications of 2 and 6.

Skin - Classification: 2 and 6

Output statement numbers: 2, 5b, 7a, 17g, 17i, 20a

Exceptions: None

The MCA says that the substance "wet with 30% water may contain traces of hydrochloric acid which give it, upon long exposure . . . , a corrosive action." On contact with the skin, it "may cause irritation. If allowed to remain on the skin," the substance "may cause redness as well as other signs of irritation."

Sax rates it as an acute local irritant of moderate toxic hazard.

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According to the ACGIH, "its principal toxicity is related to irritation and sensitization upon contact with the skin."

Gleason reports that when the "dry substance was placed on the skin of guinea pigs, only slight irritation followed, but when dissolved as a 10% solution in propylene glycol, slight to moderate erythema and edema were observed without systemic toxicity." The substance has also been "reported as an allergen responsible for skin sensitization in man."

Stecher reports that the substance "has been used topically for burns and dermatitis (alone, as a dusting powder; in 10% ointment, or in 2% olive oil solution) and for poison ivy (as a paste)."

According to the ILO, in general, the main effect of peroxides is "irritation to skin. Prolonged skin contact with clothing contaminated with peroxides may cause irritation and blistering."

The melting point of benzoyl peroxide is 217 degrees F. Its vapor pressure is much less than 1 mm Hg at 20 degrees C, and it is less than 1% soluble in water. The substance may explode if subjected to shock and friction under particular conditions.

It is clear from the above that prolonged or repeated contact with this substance can cause significant effects.

It is, therefore, assigned classifications of 2 and 6.

Ingestion - Classification: 2 and 6

Output statement numbers: 19, 20a

Exceptions: None

According to the ACGIH, Roudabush reported that the substance "was tolerated by rats in oral dosages of 950 mg/kg," but that systemic effects in man "has not been reported." The ILO says that animal toxicity studies "have indicated . . . that the effects of organic peroxides may be cumulative." The ACGIH further adds that "effects of repeated exposure to four related organic peroxides were cumulative either by oral and intraperitoneal routes; doses one-fifth the LD50 thrice weekly for seven weeks resulted in death of rats when none were to be expected if the effects were not cumulative. If benzoyl peroxide behaves similarly, as might be expected, it would be classed as moderately toxic on a subchronic basis in conformity with the judgment of Gleason et al."

Classifications of 2 and 6 are concluded to be appropriate to prevent the possibility of ingestion of harmful amounts.

#### SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

- National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1975 (NFPA)
- Manufacturing Chemists' Association, Chemical Safety Data Sheet SD-81 (MCA)
- Lucidol Division, Pennwalt Corp., "Lucidol Organic Peroxides" (Luc)

Sources of data items used:

- I. A. 1. Synonyms: NFPA-49, MCA

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

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

- Apps, E. A., "Ink Technology for Printers and Students," Chemical Publishing Co., 1964 (Apps)
- Armitage, J. B. and Strauss, H. W., "Safety Considerations in Industrial Use of Organic Peroxides," Ind. Eng. Chem, 56(12), p. 28 - 32, 1964 (Armitage)
- Baskin, A. D. - editor, "Handling Guide for Potentially Hazardous Commodities," Railway Systems and Management Assoc., Chicago, 1972 (Baskin)
- "Benzoyl Peroxide," Aztec Chemicals, Technical Data Bulletins PB-2, 2A, 3, 3A, 3B; "Aztec Benzoyl Peroxide" (Aztec)
- "Benzoyl Peroxide," Hazard Process Index, Hazard Entry No. 21, NIOSH-HSM-99-73-62 (HPI)
- "Benzoyl Peroxide," Manufacturing Chemists' Association, Chemical Safety Data Sheet SD-81, 1960 (MCA)
- "Benzoyl Peroxide," Pennwalt Corp., Lucidol Div., Organic Peroxide Bulletin 1.100, September 1969 (Pennwalt)
- "Benzoyl Peroxide," Pennwalt Corp., "Lucidol Chemicals" (Lucidol)
- Considine, D. M., "Chemical and Process Technology Encyclopedia," McGraw Hill, 1974 (Considine)
- Eaglstein, W. H., "Dermatitis to Benzoyl Peroxide," Archives of Dermatology 97, p. 527, 1968 (NIOSH Technical Information Service NIOSH 8651)
- Ellis, C., "Printing Inks," Reinhold, 1940 (Ellis)
- International Labour Office, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)
- Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, 1st edition, 1954 (Chem Tech); 2nd edition, 1972 (K-O)
- "Merck Index of Chemicals and Drugs," 8th edition, 1968 (Merck)

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National Fire Codes, Volume 3, "Combustible Solids, Dusts and Explosives," NFPA-49, National Fire Protection Association, Boston, 1973 (NFPA-49)  
Noller, D. C. and D. J. Bolton, "Safe-Handling and Storage of Organic Peroxide in the Laboratory," Anal. Chem. 35, 887-93 (1963) (Noller)  
Pace, W. E., "A Benzoyl Peroxide - Sulfur Cream for Acne Vulgaris," Canadian Med. Assoc. J. 93, p. 252 - 4, 1965 (NIOSH Technical Information Service NIOSH 7435)  
"Safety Equipment for Handling Benzoyl Peroxide," Safety Maintenance 125(2), p. 51, 1963 (NIOSH Technical Information Service NIOSH 35829)  
Vasarinsh, P., "Benzoyl Peroxide Sulfur Lotions: A Histological Study," Archives of Dermatology 98, p. 183 - 7, 1968 (NIOSH Technical Information Service NIOSH 8792)

References for Specific Use/Exposure

1. HPI, ILO, Considine, Armitage, K-O, Pennwalt
2. HPI, ILO, Considine, Pennwalt, Lucidol
3. K-O, ILO, Chem Tech, Pennwalt
4. ILO, Chem Tech, Pennwalt
5. HPI, K-O, NIOSH 33554, Chem Tech, ILO, Pennwalt
6. HPI, Armitage, MCA, Baskin, NFPA-49, Pennwalt, Aztec, Chem Tech
7. Chem Tech, NIOSH 7435, 8792, Merck, Pennwalt
8. Pennwalt, Apps, Chem Tech, Ellis
9. Pennwalt, Chem Tech

References for Specific Control Methods

MCA, Pennwalt, Baskin, NIOSH 8651, 35821, Noller and ILO were the references used in all the Specific Control Methods.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Benzoyl peroxide

D. O. L. STANDARD: 5 mg/M3

Eye Irritation Level: According to Grant, "the dust irritates the eyes, respiratory mucous membranes and skin. Applied experimentally to animal eyes, it produces superficial opacities in the cornea and inflammation of the conjunctiva according to one investigator, but according to another no injury results from single application of a 937 pure powder or a 50% paste in dimethyl phthalate to rabbit eyes."

For the purposes of this standard, half-facepiece respirators are allowed up to 50 mg/M3 (PF = 10). If eye irritation occurs, however, full facepiece respirators must be worn.

Use of Air Purifying Devices: Benzoyl peroxide is a strong oxidizer and should not come in contact with oxidizable materials. Some cartridges and canisters may contain activated charcoal and shall not be used to provide protection against benzoyl peroxide. Only non-oxidizable sorbents are allowed.

IDLH: 7000 mg/M3 (approximately 700 ppm)

Basis for IDLH Value: The chosen IDLH is based upon the estimated 4-hour, mouse LC50 of 700 ppm for benzoyl peroxide which is given in the Documentation of TLV's. This concentration is not an actual LC50 value for benzoyl chloride, however. It was estimated by analogy from data concerning LC50's for other related organic peroxides.

Other Toxicological Information: The Documentation of TLV's states that "the principal hazards of benzoyl peroxide are due to its flammable and explosive properties. Its principal toxicity is related to

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irritation and sensitization upon contact with the skin. Roudabush stated that benzoyl peroxide was tolerated by rats in oral dosages of 950 mg/kg. The intraperitoneal injection of 250 mg/kg resulted in the death of adult mice. No experimental inhalation toxicity data are available; however, toxicity studies on four related organic peroxides showed a fair correlation between toxicity from inhalation and from oral or intraperitoneal injection. Organic peroxides with an intraperitoneal LD50 of about 90 mg/kg had an LC50 by inhalation in the range of 220 - 500 ppm for four-hour exposure. The intraperitoneal value of benzoyl peroxide is about 2.5 times greater than the intraperitoneal LD50 of these peroxides that possess an average LC50 of about 275 ppm; therefore, its LC50 would be about 700 ppm. This would place benzoyl peroxide in a moderately toxic category on an acute basis.

"Kayanovitch et al. reported neurovegetative symptoms, irritation to the respiratory tract and disturbances in ventilatory function and monocytosis in workers exposed to benzoyl chloride and phosgene in the production of benzoyl peroxide, but presumably these manifestations are mainly the result of exposure to the starting products.

"In an investigation made in a plant located in New York State where benzoyl peroxide formulations were being processed, Moskowitz and Grabois experienced no objectionable subjective symptoms when exposed to dust concentrations ranging from 1.34 to 5.25 mg of benzoyl peroxide per cubic meter of air. Concentrations of 12.2 mg/M3 and higher resulted in pronounced irritation of the nose and throat. The airborne dust contained potassium alum in addition to benzoyl peroxide but the effect produced by the alum was considered to be negligible.

"A TLV of 5 mg/M3 is recommended. It should be sufficiently low to prevent irritation. Whether it is low enough to prevent cumulative effects in man is not known, but no cases of chronic effects have been reported.

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

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|    | Use/Exposure                                                                                                                                                                                                                                                                                                     | Principal Route<br>of Entry | Currently Used<br>Control Methods                                                                                    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------|
| 1. | Inhalation of dust or skin contact with solid or solution during extensive use in manufacture of a variety of plastics (a free radical initiator for polymerization of many vinyl monomers - vinyl acetate, vinyl chloride, vinylidene chloride, methyl methacrylate, styrene, ethylene, etc.)                   | A,B                         | Local exhaust ventilation; personal protective equipment (gloves, goggles, face shields, protective clothing, shoes) |
| 2. | Inhalation of dust or vapor and skin contact with solid or solution during manufacture and use of polyester resins (initiator for polymerization of unsaturated polyesters; room temperature curing agent for polyester resins - auto-body repair kits, optical and dental castings, other molding applications) | A,B                         | Local exhaust ventilation; personal protective equipment (gloves, goggles, face shields, protective clothing, shoes) |
| 3. | Inhalation of dust or vapor and skin contact with solid or liquid during use in vulcanization of natural and synthetic rubber (rubber cements, silicone rubbers, polyester rubbers)                                                                                                                              | A,B                         | Local exhaust ventilation; personal protective equipment (gloves, goggles, face shields, protective clothing, shoes) |
| 4. | Inhalation of dust or vapor and skin contact with solid or solution during use in textile manufacture (burn-out agent for cellulose acetate in mixed fabrics with viscose, silk, or cotton to produce lace -                                                                                                     | A,B                         | Local exhaust ventilation; personal protective equipment (gloves, goggles, face shields, protective clothing, shoes) |

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like appearance; used  
in printing paste)

- |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |                                                                                                                      |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------------------------------------------------|
| 5. | Inhalation of dust or vapor and skin contact with solid or solution during use as bleaching agent (for flour, cheese, fats, oils, and waxes - linseed oil and lecithin)                                                                                                                                                                                                                                                                             | A,B | Local exhaust ventilation; personal protective equipment (gloves, goggles, face shields, protective clothing, shoes) |
| 6. | Inhalation of dust or vapor and skin contact with solid or solution during manufacture and distribution and during maintenance of equipment and storage containers. Because of spontaneous combustion and explosion hazard, this compound is often used as a wet powder or paste and is sold only in one pound containers. Commercial benzoyl peroxide ranges from 50 - 99% in various diluents (water, stearic acid, camphor, tricresyl phosphate) | A,B | Local exhaust ventilation; personal protective equipment (gloves, goggles, face shields, protective clothing, shoes) |
| 7. | Inhalation of dust or vapor and skin contact with solid or solution during use in manufacture of pharmaceuticals (an ingredient of skin creams for burns, dermatitis, poison ivy, external wounds)                                                                                                                                                                                                                                                  | A,B | Local exhaust ventilation; personal protective equipment (gloves, goggles, face shields, protective clothing, shoes) |
| 8. | Inhalation of dust or vapor and skin contact with solid or solution during use in manufacture of special fast-drying printing inks (for printing on difficult plastic surfaces)                                                                                                                                                                                                                                                                     | A,B | Local exhaust ventilation; personal protective equipment (gloves, goggles, face shields, protective clothing, shoes) |
| 9. | Inhalation of dust or vapor and skin contact with solid or solution                                                                                                                                                                                                                                                                                                                                                                                 | A,B | Local exhaust ventilation; personal protective equipment (gloves, goggles,                                           |

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during use for organic  
synthesis (useful initiator  
for addition and substitu-  
tion reactions)

face shields, protective  
clothing, shoes)

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

----- JES2 JOB STATISTICS -----

1,344 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

