

Occupational Health Guideline for Benzoyl Peroxide

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: $(C_6H_5CO)_2O_2$
- Synonyms: Dibenzoyl peroxide
- Appearance and odor: Colorless, odorless solid.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for benzoyl peroxide is 5 milligrams of benzoyl peroxide per cubic meter of air (mg/m^3) averaged over an eight-hour work shift. NIOSH has recommended that the permissible exposure limit be changed to 5 mg/m^3 averaged over a work shift of up to 10 hours per day, 40 hours per week. The NIOSH Criteria Document for Benzoyl Peroxide should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

- Routes of exposure
Benzoyl peroxide can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.
- 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:* A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to benzoyl peroxide.

- Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to benzoyl peroxide at potentially hazardous levels:

1. *Initial Medical Examination:*

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the skin and respiratory system should be stressed.

—Skin disease: Benzoyl peroxide is a primary skin irritant and a skin sensitizer. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—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.

2. *Periodic Medical Examination:* The aforementioned medical examinations should be repeated at least every 3 years. Emphasis should be placed on informing the employee to report any symptoms associated with benzoyl peroxide toxicity.

- Summary of 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 two 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/m^3 experienced pronounced irritation of the nose and throat. When repeatedly applied to the skin of mice, it was not carcinogenic.

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 242
2. Boiling point (760 mm Hg): Not applicable
3. Specific gravity (water = 1): 1.33
4. Vapor density (air = 1 at boiling point of benzoyl peroxide): Not applicable
5. Melting point: 103 C (217 F) (decomposes)
6. Vapor pressure at 20 C (68 F): Much less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Less than 1
8. Evaporation rate (butyl acetate = 1): Not applicable

• 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 fires and explosions. Contact with oxidizable materials such as lithium aluminum hydride may also cause fires and explosions. In the dry state, benzoyl peroxide is highly flammable. At elevated temperatures it 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; fires and explosions may result.

• Flammability

1. Flash point: Not applicable
2. Autoignition temperature: 103 C (217 F) (ignites and/or explodes)
3. Flammable limits in air, % by volume: Not available
4. Extinguishant: Water

• Warning properties

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 93% pure powder or a 50% paste in dimethyl phthalate to rabbit eyes."

MONITORING AND MEASUREMENT PROCEDURES

• General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30

minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• Method

Sampling and analyses may be performed by collection of benzoyl peroxide on a filter, followed by colorimetric analysis. An analytical method for benzoyl peroxide is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 4, 1978, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00317-3).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with benzoyl peroxide or liquids containing benzoyl peroxide.

• Employees using or handling pure benzoyl peroxide should be provided with and required to wear fire-resistant clothing treated with an antistatic agent.

• Non-impervious clothing which becomes contaminated with benzoyl peroxide should be removed promptly and not reworn until the benzoyl peroxide is removed from the clothing.

• If employees' clothing may have become contaminated with solid benzoyl peroxide, employees should change into uncontaminated clothing before leaving the work premises.

• Clothing contaminated with benzoyl peroxide should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of benzoyl peroxide from the clothing. If the clothing is to

be laundered or otherwise cleaned to remove the benzoyl peroxide, the person performing the operation should be informed of benzoyl peroxide's hazardous properties.

- Employees should be provided with and required to use dust- and splash-proof safety goggles where benzoyl peroxide or liquids containing benzoyl peroxide may contact the eyes.

SANITATION

- Skin that becomes contaminated with benzoyl peroxide should be promptly washed or showered with soap or mild detergent and water to remove any benzoyl peroxide.

- Eating and smoking should not be permitted in areas where solid benzoyl peroxide is handled, processed, or stored.

- Employees who handle benzoyl peroxide or liquids containing benzoyl peroxide should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use as free radical initiator for polymerization of many vinyl monomers in manufacture of a variety of plastics; use in manufacture of polyester resins as initiator for polymerization of unsaturated polyesters; room temperature curing agent for polyester resins, for auto-repair kits, optical and dental castings, and other molding applications	Local exhaust ventilation; personal protective equipment
Use in vulcanization of natural and synthetic rubber for rubber cements, silicone rubbers and polyester rubbers; use in textile manufacture as a burn-	Local exhaust ventilation; personal protective equipment

out agent for cellulose acetate in mixed fabrics with viscose, silk, or cotton to produce lace-like appearance; use in printing paste

Use as a bleaching agent for flour, cheese, fats, oils, and waxes; use in manufacture of pharmaceuticals as ingredient of skin creams for burns, dermatitis, poisoning, and external wounds

Use in manufacture of special fast-drying printing inks for printing on plastic surfaces; use as initiator for addition and substitution reactions in organic synthesis

Local exhaust ventilation; personal protective equipment

Local exhaust ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If benzoyl peroxide or liquids containing benzoyl peroxide get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If benzoyl peroxide or liquids containing benzoyl peroxide get on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If benzoyl peroxide or liquids containing benzoyl peroxide penetrate through the clothing, remove the clothing promptly and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

• 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.

SPILL AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and cloth-

ing should be restricted from areas of spills until cleanup has been completed.

• 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 of the slurry at a time with about ten times its weight of 10% sodium hydroxide solution. This slurry can then be disposed in a secured sanitary landfill.
 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.
- Waste disposal method:
See above.

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RESPIRATORY PROTECTION FOR BENZOYL PEROXIDE

Condition	Minimum Respiratory Protection* Required Above 5 mg/m ³
Particulate Concentration	
25 mg/m ³ or less**	Any dust and mist respirator containing non-oxidizable sorbents, except single-use respirators.***
50 mg/m ³ or less**	Any dust and mist respirator containing non-oxidizable sorbents, except single-use or quarter-mask respirator.*** Any fume or high efficiency particulate respirator containing non-oxidizable sorbents.*** Any supplied-air respirator. Any self-contained breathing apparatus.
250 mg/m ³ or less	A high efficiency particulate filter respirator with a full facepiece containing non-oxidizable sorbents.*** Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
1000 mg/m ³ or less	A powered air-purifying respirator with a full facepiece, helmet, or hood and high efficiency particulate filter containing non-oxidizable sorbents.*** 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 1000 mg/m ³ or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any dust and mist respirator containing non-oxidizable sorbents, except single-use respirator.*** Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

**If eye irritation occurs, full-facepiece respiratory protective equipment should be used.

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

