

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** CARBARYL ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

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 CARBARYL.

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.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

(a) Definitions. (1) "Permissible exposure" means exposure of employees to airborne concentrations of carbaryl (Sevin (R)) 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 carbaryl averaged over an eight-hour work shift.

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

(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 carbaryl;

(ii) Any measurements of carbaryl taken;

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

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

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

(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 and above the action level	$\pm 35\%$
At or below the action level	$\pm 50\%$

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

(2) Employee exposures to airborne concentrations of carbaryl 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 carbaryl.

(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 carbaryl to at or below the permissible exposure; or

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

(v) In emergencies.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

(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 carbaryl 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 CARBARYL (Sevin (R))

CONDITON	PERMISSIBLE RESPIRATORY PROTECTION
Particulate or Vapor Concentration	
50 mg/M3 or less	Any supplied-air respirator. Any self-contained breathing apparatus.
250 mg/M3 or less	Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
600 mg/M3 or less	A Type C supplied-air respirator operated in pressure - demand or other positive pressure or continuous-flow mode.
Greater than 600 mg/M3 or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied - air respirator with a full facepiece operated in pressure - demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus 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.* Any escape self-contained breathing apparatus.

*Including pesticide respirators meeting the requirements of this class.

(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.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

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

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

(2) Carbaryl shall be stored so as not to come in contact with strong oxidizers.

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

(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 carbaryl or liquids containing carbaryl. 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 carbaryl change into uncontaminated clothing before leaving the work premises.

(3) Employers shall ensure that clothing contaminated with carbaryl is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of carbaryl from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the carbaryl, the employer shall inform the person performing the operation of the hazardous properties of carbaryl.

(4) Employers shall ensure that non-impervious clothing which becomes contaminated with carbaryl be removed promptly and not reworn until the carbaryl 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 carbaryl or liquids containing carbaryl may contact the eyes.

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

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

(3) Employers shall ensure that employees who handle carbaryl or liquids containing carbaryl 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 carbaryl 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 carbaryl 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 carbaryl or liquids containing carbaryl, or employees who work where a spill of carbaryl may occur, shall annually:

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

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

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

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

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

(2) Preplacement medical examination. The employer shall make available to each employee who is exposed, or will be exposed, to airborne concentrations of carbaryl 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 carbaryl or liquids containing carbaryl, a preplacement medical examination which must include a medical history and physical examination with emphasis on the lungs, heart, central nervous system and skin.

(3) Periodic medical examination. The employer shall make available to each employee exposed to airborne concentrations of carbaryl 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 carbaryl or liquids containing carbaryl, twelve months from the date of the employee's first exposure, and every twelve months thereafter, a periodic medical examination which must include a medical history and physical examination with emphasis on the lungs, heart, central nervous system and skin.

(4) Interim medical examination. The employer shall provide an interim medical examination for the employee if the employee informs the employer of any of the signs or symptoms of exposure to carbaryl which are listed in Appendix A which the employee suspects are caused by exposure to carbaryl.

(5) 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 carbaryl;
- (ii) A description of the affected employee's duties as they relate to his exposure to carbaryl;
- (iii) A description of any personal protective equipment and respirators required to be used;
- (iv) The results of any measurements which may indicate the affected employee's exposure;
- (v) The affected employee's anticipated exposure level; and
- (vi) Upon request of the physician, any available information from previous medical examinations of the affected employee.

(6) 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.

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

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

(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 carbaryl;

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

(8) No employee shall be exposed to carbaryl 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.

(9) 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.

(10) 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.

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

(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 carbaryl.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to carbaryl 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.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

(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 carbaryl;

(D) A copy of information provided to the physician pursuant to paragraph (j)(5)(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 thirty years after termination of the employment of the affected employee.

(6) Access to records. (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.

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

(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 carbaryl which is conducted pursuant to this section.

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

(iii) Record the results obtained.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

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

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR CARBARYL (SEVIN (R))

- I. SUBSTANCE IDENTIFICATION
 - A. Substance: Carbaryl (Sevin (R))
 - B. Permissible Exposure: 5 milligrams of carbaryl per cubic meter of air (mg/M3) averaged over an eight-hour work shift.
 - C. Appearance and Odor: Colorless solid
- II. HEALTH HAZARD DATA
 - A. Ways in which the chemical affects your body: Carbaryl 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 may enter your body through your skin.
 - B. Effects of Overexposure:
 - 1. Exposure to carbaryl may cause small pupils, watering of the eyes, excessive discharge from the nose, mouth watering, sweating, abdominal cramps, nausea, vomiting, diarrhea, shaking, a blue color of the skin and convulsions. Concentrated solutions on the skin may cause irritation and systemic intoxication. Carbaryl when given to several species of pregnant animals has caused defects in their offspring.
 - 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 carbaryl.
- III. EMERGENCY FIRST AID PROCEDURES
 - A. Eye Exposure: If carbaryl or liquids containing carbaryl get into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention immediately. Contact lenses should not be worn when working with this chemical.
 - B. Skin Exposure: If carbaryl or liquids containing carbaryl get on your skin, promptly wash the contaminated skin using soap or mild detergent and water. If carbaryl or liquids containing carbaryl penetrate through your clothing, remove the clothing promptly and wash the skin using soap or mild detergent and water. Get medical attention immediately.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

- C. Breathing: If you or any other person breathes in large amounts of carbaryl 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 carbaryl or liquids containing carbaryl 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.
- E. Rescue: Move affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the locations of the emergency rescue equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

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

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Carbaryl is a combustible solid.
- B. Carbaryl must be stored in tightly closed containers in a cool, well ventilated area away from strong oxidizers.
- C. Sources of ignition such as smoking and open flames are prohibited wherever carbaryl is handled, used or stored in a manner that could create a potential fire or explosion hazard.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

- D. If your work clothing may have become contaminated with carbaryl, you must change into uncontaminated clothing before leaving the work premises.
- E. You must promptly remove any non-impervious clothing that becomes contaminated with carbaryl and this clothing must not be reworn until the carbaryl is removed from the clothing.
- F. If your skin becomes contaminated with carbaryl, you must promptly wash or shower with soap or mild detergent and water to remove the carbaryl from your skin.
- G. You must not eat or smoke in areas where solid carbaryl is handled, processed or stored.
- H. If you handle carbaryl or liquids containing carbaryl, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.
- I. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
- J. Ask your supervisor where carbaryl 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 carbaryl. In addition, your employer must instruct you in the safe use of carbaryl, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to carbaryl. 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 thirty 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 carbaryl is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligation. To the extent the information supplements this regulation for carbaryl, it is advisory in nature.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR CARBARYL (SEVIN (R))

I. SUBSTANCE IDENTIFICATION

A. Substance Identification

1. Synonyms: 1-naphthyl N-methylcarbamate; alpha-naphthyl N-methylcarbamate
2. Formula: $C_{12}H_{11}NO_2$
3. Molecular weight: 201.2

B. Physical Data

1. Boiling point (760 mm Hg): Decomposes
2. Specific gravity (water = 1): 1.23
3. Vapor density (air = 1 at boiling point of carbaryl): Not applicable
4. Melting point: 142 C (288 F)
5. Vapor pressure at 20 C (68 F): 0.005 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.004
7. Evaporation rate (butyl acetate = 1): Not applicable
8. Appearance: Colorless solid

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: Data not available.
2. Minimum ignition temperature: Data not available
3. Minimum explosive concentration: Data not available
4. Extinguishing media: Water
5. Special fire-fighting procedures: Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Although fire data are not available, carbaryl is believed to be a combustible solid. All ignition sources must be controlled where carbaryl is used, handled or stored in a manner that could create a potential fire or explosion hazard.

B. Reactivity

1. Conditions contributing to instability: None
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen, methylamine, and carbon monoxide) may be released in a fire involving carbaryl.
4. Special precautions: None.

III. SPILL AND DISPOSAL PROCEDURES

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

1. Ventilate area of spill.
2. For small quantities, sweep onto paper or other suitable material, place in an appropriate container and burn in

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

a safe place (such as a fume hood). Large quantities may be reclaimed; however, if this is not practical, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

- B. Persons not wearing protective equipment should be restricted from areas of spills until cleanup has been completed.
- C. Waste disposal methods: Carbaryl may be disposed of:
 - 1. By making packages of carbaryl in paper or other flammable material and burning in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.
 - 2. By dissolving carbaryl in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

IV. MONITORING AND MEASUREMENT PROCEDURES

- A. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the 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 collection of the particulates and vapors using a high efficiency membrane filter followed by an adsorption tube with subsequent chemical analysis of both the filter and adsorption tube. Detector tubes certified by NIOSH under 42 CFR part 84 or other direct-reading devices calibrated to measure carbaryl may be used. The method of measurement must determine the concentration of carbaryl 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 carbaryl 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 S" (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

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

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

VI. COMMON OPERATIONS

Common operations in which exposure to carbaryl is likely to occur are: During its production and its use as an insecticide, pesticide and acaricide.

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

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; skin absorption; ingestion.

II. TOXICOLOGY

Carbaryl (Sevin) dust is a short-acting anticholinesterase agent, with the important characteristic of rapid reversibility of enzyme inhibition. It inactivates cholinesterase, resulting in the accumulation of acetylcholine at synapses in the nervous system, skeletal and smooth muscle, and secretory glands. Signs and symptoms of overexposure may include miosis, blurred vision, lacrimation, excessive nasal discharge or salivation, sweating, abdominal cramps, nausea, vomiting, diarrhea, tremor, cyanosis, and convulsions. The rapid reversibility of cholinesterase inhibition is of significance in monitoring exposure: measurements of this enzyme are likely to give clinically misleading values in the normal range of activity and will not reflect the true magnitude of exposure; carbaryl is also rapidly metabolized which further diminishes the severity of its effect. A single dose of 250 mg (approximately 2.8 mg/kg) ingested by an adult resulted in moderate poisoning; after 20 minutes, there was sudden onset of abdominal pain followed by profuse sweating, lassitude, and vomiting; one hour after ingestion, and following a total of 3 mg atropine sulfate, the person felt better and was completely recovered after another hour. In a study of 59 workers exposed to concentrations ranging from 0.23 to 31 mg/M3 during a 19 month period, there were no signs or symptoms of anticholinesterase activity; in the most heavily exposed workers, relatively large amounts of 1-naphthol (a metabolite of carbaryl) were excreted in the urine and the blood cholinesterase activity was slightly depressed; it was concluded that an excretion level of total (free plus conjugated) 1-naphthol significantly above 400 ug/100 ml of urine indicates absorption and metabolism of carbaryl. On the skin, concentrated solutions may cause irritation and systemic intoxication. Carbaryl administered orally during organogenesis was teratogenic in

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

guinea pigs at a dose of 300 mg/kg and in beagle dogs at a dose of 25 mg/kg. Of 60 mongrel rats of male sex given 30 mg/kg orally twice weekly, 12 were alive after 22 months of treatment; 2 of the 12 had fibrosarcomata, 1 had a polymorphonuclear (sic) sarcoma, and 1 had an osteosarcoma with numerous metastases; of 48 rats receiving 20 mg in a paraffin pill implanted subcutaneously, 10 were alive after 22 months and 2 of the 10 had fibrosarcomata; 46 of 48 control animals were alive in the eleventh month when a fibrosarcoma was discovered in 1 rat; although not stated, there were apparently no further deaths or tumors in control rats during the 22 months of the study."

III. SIGNS AND SYMPTOMS

Miosis, blurred vision, tearing; excessive nasal discharge or salivation; sweating; abdominal cramps, nausea, vomiting, diarrhea; tremor; cyanosis; convulsions; skin irritation from contact with concentrated solutions.

IV. SPECIAL TESTS

Analysis of urine for 1-naphthol; a level of total (free plus conjugated) 1-naphthol significantly above 400 ug/100 ml of urine indicates absorption and metabolism of carbaryl.

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 conscious, induce vomiting. Give artificial resuscitation if indicated. If intoxication is severe, administer atropine sulfate, 2 to 4 mg (1/30 to 1/15 grain) intravenously. Repeat at 5 to 10 minute intervals until signs of atropinization appear (dry, flushed skin and tachycardia as high as 140 per minute). 2-PAM and other oxime reactivators of cholinesterase are not recommended because of their inherent toxicity and the rapidly reversible inhibition of cholinesterase by carbaryl.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of carbaryl are caused by its anticholinesterase properties, which are rapidly reversible. Since it is teratogenic in mammalian animals, the advisability of exposure of women of child bearing age should be considered. Concentrated solutions on the skin may result in systemic intoxication from skin absorption. It is important that the physician become familiar with plant operating conditions in which exposure to carbaryl (Sevin) 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

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

The following medical procedures must be made available to each employee who is exposed to carbaryl (Sevin):

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 respiratory system, cardiovascular system, and central nervous system should be stressed. The skin should be examined for evidence of chronic disorders.

C. PERIODIC EXAMINATIONS

The above medical examinations are to be repeated on an annual basis.

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Carbaryl (Sevin)," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, pp. 37-38.
2. Hayes, W.J., Jr.: Clinical Handbook on Economic Poisons, Emergency Information for Treating Poisoning, U.S. Public Health Service Publication No. 476, U.S. Government Printing Office, Washington, D.C., 1963, pp. 44-46.
3. Best, E.M., Jr. and B.L. Murray: "Observations on Workers Exposed to Sevin Insecticide: A Preliminary Report," Journal of Occupational Medicine, 10:507-517, 1962.
4. Goodman, Louis S. and Alfred Gilman: The Pharmacological Basis of Therapeutics (5d ed.), The Macmillan Publishing Company, New York, 1975, p. 456.
5. Robens, J.F.: "Teratologic Studies of Carbaryl, Diazinon, Norea, Disulfiram, and Thiram in Small Laboratory Animals," Toxicology and Applied Pharmacology, 15:152-163, 1969.
6. Smalley, H.E., et al: "Teratogenic Action of Carbaryl in Beagle Dogs," Toxicology and Applied Pharmacology, 13:392-403, 1968.
7. Andrianova, M.M. and I.V. Alekseev: "On the Problem of Carcinogenous Properties of the Pesticides Sevin, Maneb, Ciram and Cineb, Voprosy Pitaniia, 29:71-74, 1970.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

REFERENCES AND SOURCES

CARBARYL

1910.1000

- (f) Personal Protective Equipment, and, (h) Sanitation
- Eye: Grant, "Toxicology of the Eye;" Deichmann and Gerarde, "Toxicology of Drugs and Chemicals"
- Skin: American Conferences of Governmental Industrial Hygienists, "Documentation of the Threshold Limit Values for Substances in Workroom Air;" Gleason, "Clinical Toxicology of Commercial Products;" Deichmann and Gerarde, "Toxicology of Drugs and Chemicals;" Sax, "Dangerous Properties of Industrial Materials;" Spencer, "Guide to the Chemicals Used in Crop Protection"
- Ingestion: Sax, "Dangerous Properties of Industrial Materials;" American Conference of Governmental Industrial Hygienists, "Documentation of the Threshold Limit Values for Substances in Workroom Air;" Gleason, "Clinical Toxicology of Commercial Products;" International Labour Office, "Encyclopedia of Occupational Safety and Health;" Grant, "Toxicology of the Eye"

COMMENTS

Eye - Classifications: 2 and 6

Output statement numbers: 10 and 12 combined

Exceptions: None

According to Grant, a "splash contact of an insecticide liquid containing both carbaryl and dimethoate in one patient on two different occasions caused transient injury of the corneal epithelium and much swelling of the lids, but recovery was rapid and complete. This suggests that carbaryl is not particularly dangerous to the eye."

Deichmann and Gerarde report "a 25% aqueous suspension of the microfine material instilled in the rabbit eye caused no injury and 50 mg of dust caused only traces of corneal necrosis."

Classifications of 2 and 6 are concluded to be most appropriate for this substance.

Skin - Classifications: 2 and 6

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

Exceptions: None

The ACGIH gives the acute dermal toxic LD50 as being greater than 4,000 mg/kg for both sexes of rats and notes that the substance "inhibits cholinesterase . . . , however, the inhibition is rapidly reversible and the compound itself is quickly metabolized."

Gleason reports minimal absorption via the skin.

Deichmann and Gerarde note that when four rabbits received Sevin 85S, a "microfine wettable powder containing 85% active agent by weight," at 5.0 g/kg of a 50% suspension in dimethylphthalate by 24-hour covered application to the skin, no visible ill effects were observed during a 14-day period.

Sax lists the substance as being an acute local irritant

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

of moderate toxic hazard and a chronic local irritant of slight toxic hazard. He also lists the acute systemic effects by skin absorption as being of moderate toxic hazard.

The ILO considers the compound a "systemic poison which produced moderately severe acute effects by . . . skin absorption." It is also noted that the substance can cause "acute local irritation."

Spencer gives the dermal LD50 for the rabbit as being in excess of .2000 mg/kg.

Carbaryl has a melting point of 288 degrees F, a vapor pressure at 20 degrees C of 0.005 mm of Hg, and a 0.004% solubility in water.

It is concluded that significant local effects and effects by skin absorption can be adequately prevented by specification of classifications 2 and 6.

Ingestion - Classifications: 2 and 6

Output statement numbers: 19, 20a

Exceptions: None

Sax rates the substance as of moderate toxic hazard by ingestion and states that it is a "reversible cholinesterase inhibitor." The ACGIH agrees, and gives the acute oral toxicity as 850 mg/kg for the male rat and 500 mg/kg for the female rat. The ACGIH further states, "moderate doses given orally . . . during a brief period produce illness. Female rats may occasionally be killed by a single oral dose of 100 mg/kg. The highest single oral dose that produced no observable symptoms in rats was 25 mg/kg. A single oral dose of 250 mg (about 2.8 mg/kg) produced moderate illness in a man. On the other hand, only slightly smaller doses are tolerated repeatedly. A dietary level of 200 ppm was tolerated by male and female rats for two years without detectable effect; the average intake for the males was 7.9 mg/kg/day or about the equivalent of 553 mg/man/day."

According to Gleason, the substance "has greater anti-cholinesterase activity in insects than in mammals." He gives the oral LD50 for rats as 0.51 gm/kg.

The ILO reports the compound is a "systemic poison which produces moderately severe acute effects by ingestion . . . As a cholinesterase inhibitor it is much more active in insects than in mammals." Grant also notes the substance as a cholinesterase inhibitor, further adding that it "is rapidly hydrolyzed by warm-blooded animals."

Classifications of 2 and 6 are concluded to be warranted.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

Union Carbide Corp., "Facts on Sevin Carbaryl Insecticide" (UCC)

Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition,

Vol. 11, p. 711 (K-O)

"Merck Index," 8th edition, 1968 (Merck)

Sources of data items used:

- | | | | |
|----|----|----|----------------------|
| I. | A. | 1. | Synonyms: K-O, Merck |
| | | 2. | Formula: Merck |

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

- 3. Molecular weight: Merck
- B. 1. Boiling point: ADL
- 2. Specific gravity: K-0
- 3. Vapor density: Not applicable
- 4. Melting point: K-0
- 5. Vapor pressure: K-0
- 6. Solubility in water: K-0
- 7. Evaporation rate: Not applicable
- 8. Appearance and odor: K-0
- II. A. 1. Flash point: Not applicable
- 2. Autoignition temperature: Data not available
- 3. Flammable limits: Not applicable
- 4. Extinguishing media: ADL
- 5. Special fire fighting procedures: ADL
- 6. Unusual fire and explosion hazards: None
- B. 1. Conditions contributing to instability: ADL
- 2. Incompatibilities: ADL
- 3. Hazardous decomposition products: ADL
- 4. Special precautions: None
- III. A. Steps if released or spilled: ADL
- C. Waste disposal method: ADL
- V. Miscellaneous precautions: ADL

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

- "Carbaryl," Hazard Process Index, Hazard Entry No. 34, NIOSH-HSM-99-73-62 (HPI)
- "Carbaryl - 1," Union Carbide Corp., "List of Recommended Uses for Sevin," July 1969 (Carbide - 1)
- "Carbaryl - 2," Union Carbide Corp., "Facts on Carbaryl Insecticide," December 1970 (Carbide - 2)
- "Carbaryl - 3," Union Carbide Corp., "What You Should Know About Sevin," March 1971 (Carbide - 3)
- "EPA Compendium of Registered Pesticides," Vol. III, U. S. Environ. Protection Agency (EPA)
- Feldman, R. and Mailbach, H. I., "Percutaneous Penetration of Some Pesticides and Herbicides in Man," Tox. and Appl. Pharm., 28(1), p. 126 - 32, 1974 (NIOSH Technical Information Service NIOSH 37566)
- International Labour Office, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)
- Jegier, Z., "Health Hazards in Insecticide Spraying of Crops," Arch. Environ. Health, 8, p. 670 - 4, 1964 (Jegier)
- National Clearinghouse for Poison Control Centers, Public Health Service, U. S. Dept. Health, Education and Welfare, 60th supplement, p. 66 (NIOSH Technical Information Service NIOSH 45376)
- Simpson, G. R., "Exposure to Orchard Pesticides," Arch. Environ. Health, 10, p. 884 - 5, 1965 (Simpson)
- Smith, D. A. and Wiseman, J. S., "Pesticide Poisoning," Texas Medicine, 67(2), p. 56 - 9, 1971 (NIOSH Technical Information Service NIOSH 26111)
- Spencer, E. Y., "Guide to the Chemicals Used in Crop Protection," 6th edition, Publication 1093, Research Branch Agriculture, Canada, 1973 (Spencer)
- Stanford Research Institute, "Chemical Economics Handbook," Menlo Park, California (SRI)

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

References for Specific Use/Exposure

1. EPA, HPI, SRI, Simpson, Smith (NIOSH 26111), Jegier, Carbide - 1
2. EPA, HPI, Simpson, Smith (NIOSH 26111), Jegier, Carbide - 2
3. HPI, Spencer, Carbide - 3

References for Specific Control Methods

EPA, HPI, ILO, Feldman (NIOSH 37566), Nat'l Clearinghouse (NIOSH 45376), Simpson, Carbide - 3 were the references used in all the Specific Control Methods.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Carbaryl (Sevin(R))

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

WARNING PROPERTIES:

Odor Threshold: The American National Standards Institute states that carbaryl is "essentially odorless."

Eye Irritation Level: Grant states that "splash contact of an insecticide liquid containing both carbaryl and dimethoate in one patient on two different occasions caused transient injury of the corneal epithelium and much swelling of the lids, but recovery was rapid and complete. This suggests that carbaryl is not particularly dangerous to the eye."

For the purposes of this standard, half-facepiece respirators are permitted unless eye irritation occurs. If eye irritation occurs, a full facepiece respirator must be worn.

Evaluation of Warning Properties: There are no quantitative data available relating warning properties to air concentrations of carbaryl. The concentration of carbaryl in saturated air at 20 C could present a significant exposure relative to the permissible exposure. Gas sorbent respiratory equipment is not permitted.

IDLH: 600 mg/M3

Basis for IDLH Value: Since there are no useful acute inhalation toxicity data available upon which to base the IDLH for carbaryl, the chosen IDLH has been estimated from oral toxicity data and rounded to 600 mg/M3. The NIOSH Toxic Substances List gives an oral rat LD50 of 89 mg/kg. In the Documentation of TLV's notes that "female rats may occasionally be killed by a single oral dose of 100 mg/kg."

Other Toxicological Information: The Documentation of TLV's states that "the acute oral and dermal toxicity of carbaryl to rats is as follows:

LD50 VALUES (mg/kg)

Oral		Dermal	
Male	Female	Male	Female
850	500	greater than: 4,000	4,000

"Carpenter, et al. reported a similar acute oral toxicity.

"Carbaryl inhibits cholinesterase and this appears to be the basis of its toxic action; however, the inhibition is rapidly reversible and the compound itself is quickly metabolized.

"Moderate doses given orally or inhaled during a brief period produce illness. Female rats may occasionally be killed by a single oral dose of 100 mg/kg. The highest single oral dose that produced no observable symptoms in rats was 25 mg/kg. A single oral dose of

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

250 mg (about 2.8 mg/kg) produced moderate illness in a man. A concentration of approximately 75 mg/M3 of micronized carbaryl dust produced typical poisoning in dogs within five hours . . .

"The range of air concentration of carbaryl in a carefully studied industrial situation was 0.23 to 31 mg/M3. The upper concentration - if sustained - would lead to inhalation of about 310 mg/man/day. Actually, during the month of highest exposure, an average excretion of 18.5 ppm of total 1-naphthol was measured in the urine. This is approximately equal to excretion of carbaryl-equivalent at the rate of 39 mg/man/day.

"Even though concentrations above 31 mg/M3 may be tolerated, a threshold limit of 5 mg/M3 is recommended to provide a safety factor for protection against systemic effects."

Deichmann and Gerarde state that "six guinea pigs gained weight normally following inhalation for 4 hours of a 50% Sevin wettable powder at a concentration of 390 mg/M3. A 25% aqueous suspension of the microfine material instilled in the rabbit eye caused no injury and 50 mg of the dust caused only traces of corneal necrosis."

LFL: Data not available

VAPOR PRESSURE AT 20 C: 0.005 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 6.6 ppm (54 mg/M3)

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CARBARYL

USE/EXPOSURE AND CONTROL DOCUMENT
CARBARYL

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of dust and skin contact with solid during use as pesticide and acaricide - application of dusts and powders by blower spraying, aerial methods, or manual spreading for field crops, fruit, vegetables, ornamentals, livestock, poultry, humans, and pets. Carbaryl is used in agricultural buildings and equipment, forests, non agricultural lands, domestic dwellings, medical facilities, schools, commercial and industrial areas, urban and rural outdoor areas, and sewage treatment plants.	A,D	Personal protective equipment (respiratory protective devices, eye protection, protective clothing); good personal hygiene practice
2.	Inhalation of dust and mist and skin contact with solid or liquid during use as pesticide - application of liquid by blower spraying, aerial methods, or manual spreading	A,D	Personal protective equipment (respiratory protective devices, eye protection, protective clothing); good personal hygiene practice
3.	Inhalation of solid or liquid and skin contact with solid or liquid during manufacture, packaging (pesticide formulation), distribution, and maintenance of equipment and storage containers	A,D	Personal protective equipment (respiratory protective devices, eye protection, protective clothing); good personal hygiene practice; process enclosure; local exhaust ventilation

A -- Inhalation

B -- Skin and eye contact resulting in localized irritation

C -- Ingestion

D -- Skin contact resulting in absorption and subsequent systemic poisoning