

# **E X T O X N E T**

## **Extension Toxicology Network**

A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Michigan State University, Oregon State University, and University of California at Davis. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program.

**P**esticide  
**I**nformation  
**P**rofile

**Carbaryl**

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## **TRADE OR OTHER NAMES**

Product names include Carbamine, Denapon, Dicarbam, Hexavin, Karbaspray, Nac, Ravyon, Septene, Sevin, Tercyl, Tricarnam, and Union Carbide 7744.

## **INTRODUCTION**

Carbaryl is a wide-spectrum carbamate insecticide which controls over 100 species of insects on citrus, fruit, cotton, forests, lawns, nuts, ornamentals, shade trees, and other crops, as well as on poultry, livestock and pets. It is also used as a molluscicide and an acaricide. Carbaryl works whether it is ingested into the stomach of the pest or absorbed through direct contact. The chemical name for carbaryl is 1- naphthol N-methylcarbamate.

Carbaryl is formulated as a solid which varies from colorless to white to gray, depending on the purity of the compound. The crystals are odorless. This chemical is stable to heat, light and acids under storage conditions. It is non-corrosive to metals, packaging materials, or application equipment. It is found in all types of formulations including baits, dusts, wettable powder, granules, oil, molassas, aqueous dispersions and suspensions ([13](#)).

Carbaryl is a general use pesticide.

## **TOXICOLOGICAL EFFECTS**

### **ACUTE TOXICITY**

Carbaryl is moderately to very toxic, and is labeled with a WARNING signal word. It can produce adverse effects in humans by skin contact, inhalation or ingestion. The symptoms of acute toxicity are typical of the other carbamates. Direct contact of the skin or eyes with moderate levels of this pesticide can cause burns. Inhalation or ingestion of very large amounts can be toxic to the nervous and respiratory systems resulting in nausea, stomach cramps, diarrhea and excessive salivation. Other symptoms at high doses include sweating, blurring of vision, incoordination, and convulsions. About fifty cases of occupational or accidental illnesses due to exposure to carbaryl have been reported, but no fatalities have been documented. The only documented fatality from carbaryl was through intentional ingestion.

The oral LD50 of carbaryl ranges from 250 mg/kg to 850 mg/kg for rats, and from 100 mg/kg to 650 mg/kg for mice ([12](#), [13](#)). The inhalation LC50 for rats is 0,005 to 0.023 mg/kg ([13](#)). Low doses can cause minor skin and eye irritation in rabbits, whose dermal LD50 has been measured at greater than 2,000 mg/kg ([12](#)). Technical carbaryl has little potential for skin or eye irritation.

Occupational workers have the greatest potential for exposure through inhalation or through the skin. The general public's highest risk of exposure is through ingestion of contaminated food ([14](#)).

## CHRONIC TOXICITY

Although it may cause minor skin and eye irritation, carbaryl does not appear to be a significant chronic health risk at or below occupational levels. Male volunteers who consumed low doses of carbaryl for six weeks did not show symptoms, but tests indicated slight changes in their body chemistry ([12](#)).

### Reproductive and Teratogenic Effects

No reproductive or fetal effects were observed during a long-term study of rats which were fed high doses of carbaryl ([12](#)). The evidence for teratogenic effects due to chronic exposure are minimal in test animals. Birth defects in rabbit and guinea pig offspring occurred only at dosage levels which were highly toxic to the mother. A 1980 New Jersey epidemiological study found no evidence of excess birth defects in a town sprayed with carbaryl for gypsy moth control. There is only limited evidence that carbaryl causes birth defects in humans. The EPA has concluded that carbaryl does not pose a teratogenic risk to humans if used properly ([16](#)).

### Mutagenic Effects

Numerous studies indicate that carbaryl poses only a slight mutagenic risk ([8](#), [12](#)). However, carbaryl can react with nitrite under certain conditions to give rise to N-nitrosocarbaryl. Nitrosocarbaryl has been shown to be highly mutagenic at low levels in laboratory test systems. This may be a concern to humans because there is a possibility that carbaryl, a pesticide, and nitrite, a substance found in food additives and in human saliva, may react in the human stomach to form nitrosocarbaryl ([2](#), [8](#)). Carbaryl has been shown to affect cell mitosis (cell division) and chromosomes in rats ([13](#)).

### Carcinogenic Effects

Carbaryl has not caused tumors in ten longterm and lifetime studies of mice and rats. Rats were administered high daily doses of the pesticide for two years, and mice for eighteen months, with no signs of carcinogenicity ([3](#)). However, N-nitrosocarbaryl, formed by the reaction of carbaryl and nitrite, has been shown to be carcinogenic in rats at high doses ([7](#)). Also, mice exposed to carbaryl in the product, tricaprylin, for four weeks each, developed lung tumors ([12](#)).

### Organ Toxicity

Ingestion of carbaryl affects the lungs, kidneys and liver. Inhalation will also affect the lungs ([14](#), [17](#)). Nerve damage can occur after administration of high doses for 50 days in rats and pigs ([12](#)). Several studies indicate that carbaryl can affect the immune system in animals and insects. These effects however have not been documented in humans.

## Fate in Humans and Animals

Most animals, including humans, readily break down carbaryl and rapidly excrete it in the urine and feces. Workers occupationally exposed by inhalation to carbaryl dust excreted 74% of the inhaled dose in the urine in the form of a breakdown product ([13](#)). This is consistent with information on other species which excreted nearly three quarters of a dose in their urine within 24 hours of administration ([14](#)). The metabolism of up to 85% of carbaryl occurs within 24 hours after administration ([13](#)).

## ECOLOGICAL EFFECTS

Carbaryl is lethal to many nontarget insects. The pesticide is more active in insects than in mammals. The destruction of honeybee populations in sprayed areas is sometimes a problem. Carbaryl is moderately toxic to aquatic organisms, such as rainbow and lake trout, bluegill, and cutthroat. It is also moderately toxic to wild bird species, with low toxicity to Canada geese ([12](#)).

Accumulation of carbaryl can occur in catfish, crawfish, and snails, as well as in algae and duckweed. Residue levels in fish were 140 fold greater than the concentration of carbaryl in water. In general, due to its rapid metabolism and rapid degradation, carbaryl should not pose a significant bioaccumulation risk in alkaline waters. However, under conditions below neutrality it may be significant ([14](#)).

## ENVIRONMENTAL FATE

Carbaryl has a short residual life on treated crops. The insecticide remains at the application site, where it is slowly taken into the plant and metabolized. Insecticidal properties are retained for 3-10 days. Loss of carbaryl is due to evaporation and uptake into plants. Breakdown by sunlight does not appear to be significant.

Degradation of carbaryl in the soil is mostly due to sunlight and bacterial action. It is bound by organic matter and can be transported in soil runoff. Carbaryl has a half-life of 7 days in aerobic soil and 28 days in anaerobic soil ([9](#)). Degradation of carbaryl in crops occurs by hydrolysis inside the plants. It has a short residual life of less than two weeks. The metabolites of carbaryl have lower toxicity to humans than carbaryl itself. The breakdown of this substance is strongly dependant on acidity and temperature.

In pond water, carbaryl is broken down by bacteria through chemical processes. Evaporation does not occur. Carbaryl has a half-life of from 1 to 32 days in pond water. In a stream, carbaryl that had washed in from forest spraying, decayed to 50% within a 24 hour period. It has been shown to degrade more slowly in the presence of mud in aquatic habitats. Carbaryl has been detected in groundwater in three separate cases in California.

Carbaryl has a half-life in the air of one to four months. Crops, shade trees, shrubs and other vegetation in bloom should not be sprayed with carbaryl as bee kills are possible.

## PHYSICAL PROPERTIES AND GUIDELINES

Carbaryl is a solid which varies from colorless to white or gray, depending on the purity of the compound. The crystals are odorless. Carbaryl is stable to heat, light and acids. It is not stable under alkaline conditions. It is non-corrosive to metals, packaging materials or application equipment.

## Exposure Guidelines:

**NOEL:** 0.06 mg/kg/day

**ADI:** 0.1 mg/kg/day

**STEL:** 10 mg/m<sup>3</sup>

**TLV:** air TWA 5 mg/m<sup>3</sup>

**CL:** 625 mg/m<sup>3</sup>

**Drinking Water** Drinking Water Equivalent Level: (DWEL): 3.5 mg/L ([13](#))

**Health Advisory:**

## Physical Properties

**CAS #:** 63-25-2

**Chemical Name:** 1-naphthyl N-methylcarbamate

**Solubility in water:** 0.005 g/100 g (20 degrees C), 0.004 g/100 g (30 degrees C)

**Solubility in solvents:** Carbaryl is soluble in ethanol, petroleum ether, diethyl ether, and chloroform; moderately soluble in polar solvents such as acetone, dimethyl sulfoxide, mixed cresols, and cyclohexanone.

**Melting point:** 145 degrees C

**Vapor pressure:** <0.0001 torr (20-25 degrees C)

**Log P:** <-3.00

**Kow:** 64.6-229.1 ([1](#), [5](#), [6](#), [10](#))

**Koc:** 205.0-457.1 ([1](#), [4](#), [5](#))

**K(d):** nonionic

**BCF:** 28.2-28.8 ([1](#), [5](#))

**H:** <9.9 x 10 to the minus 5 power torr/M

## BASIC MANUFACTURER

Rhone-Poulenc Ag. Co.  
P.O. Box 12014  
TW Alexander Dr.  
Research Triangle Park, NC 27709  
Telephone: 919-549-2000  
Emergency: 800-334-7577

## Review by Basic Manufacturer:

Comments solicited: October, 1992  
Comments received:

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