

## Benomyl; CASRN 17804-35-2

Human health assessment information on a chemical substance is included in the IRIS database only after a comprehensive review of toxicity data, as outlined in the [IRIS assessment development process](#). Sections I (Health Hazard Assessments for Noncarcinogenic Effects) and II (Carcinogenicity Assessment for Lifetime Exposure) present the conclusions that were reached during the assessment development process. Supporting information and explanations of the methods used to derive the values given in IRIS are provided in the [guidance documents located on the IRIS website](#).

### STATUS OF DATA FOR Benomyl

**File First On-Line 01/31/1987**

Category (section)	Assessment Available?	Last Revised
<b>Oral RfD (I.A.)</b>	yes	01/31/1987
<b>Inhalation RfC(I.B.)</b>	not evaluated	
<b>Carcinogenicity Assessment (II.)</b>	not evaluated	

## I. Chronic Health Hazard Assessments for Noncarcinogenic Effects

### I.A. Reference Dose for Chronic Oral Exposure (RfD)

Substance Name — Benomyl  
CASRN — 17804-35-2  
Last Revised — 01/31/1987

The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis. It is expressed in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Please refer to the Background Document for an elaboration of these concepts. RfDs can also be derived for the noncarcinogenic health effects of

substances that are also carcinogens. Therefore, it is essential to refer to other sources of information concerning the carcinogenicity of this substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file.

### I.A.1. Oral RfD Summary

Critical Effect	Experimental Doses*	UF	MF	RfD
Decreased pup weanling weights	NOEL: 100 ppm diet (5 mg/kg/day)	100	1	5E-2 mg/kg/day
3-Generation Reproduction Rat Study  du Pont, 1968a	LEL: 500 ppm (25 mg/kg/day)			

\*Conversion Factors: 1 ppm = 0.05 mg/kg/day (assumed rat food consumption)

### I.A.2. Principal and Supporting Studies (Oral RfD)

E.I. duPont de Nemours and Co. 1968a. MRID No. 00066773. Available from EPA. Write to FOI, EPA, Washington DC. 20460.

Benomyl, 50 or 70% wettable powder (dose based on % active ingredient), was administered in the diet at 0, 100, 500, and 2500 ppm (0, 5, 25, and 125 mg/kg/day) to male and female ChR-CD rats for 3 generations (7 litters). Six males and females were mated for the first generation, 12 males and females for the second generation, and 20 males and females for the third generation. Histology was performed on F3bn weanlings. F3c pups were used for a post weaning growth curve study. No treatment-related effects were seen with the exception of pup weanling weights in F2b, F3b, and F3c litters at 500 and 2500 ppm as compared with control values. The NOEL was 100 ppm (5 mg/kg/day) and the LEL, based on decreased pup weanling weights, was 500 ppm (25 mg/kg/day).

### **I.A.3. Uncertainty and Modifying Factors (Oral RfD)**

UF — A UF of 100 includes uncertainties in extrapolation from laboratory animals to humans. The extrapolation from the teratology data was considered to be sufficiently covered by this UF, since the NOEL for teratogenic effects is 30 mg/kg/day, that is, 6 times higher than the NOEL of 5 mg/kg/day used to establish the RfD. Thus, there is an overall 600-fold margin between the teratogenic NOEL and the RfD.

MF — None

### **I.A.4. Additional Studies/Comments (Oral RfD)**

Data Considered for Establishing the RfD

- 1) 3-Generation Reproduction - rat: Principal study - see previous description; core grade minimum
- 2) 2-Year Feeding (oncogenic) - rat: Systemic NOEL=2500 ppm (125 mg/kg/day) (HDT); core grade minimum (E.I. du Pont de Nemours and Co., 1969)
- 3) 2-Year Feeding - dog: NOEL=500 ppm (12.5 mg/kg/day); LEL=2500 ppm (62.5 mg/kg/day) (biochemical alterations, hepatic cirrhosis, decreased weight gain and lower food consumption); core grade minimum (E.I. du Pont de Nemours and Co., 1970)
- 4) Teratology - rat: NOEL=30 mg/kg/day; LEL=62.5 mg/kg/day (microphthalmia); core grade minimum (E.I. du Pont de Nemours and Co., 1982)
- 5) Teratology - rat: Fetotoxic NOEL=30 mg/kg/day; Fetotoxic LEL=62.5 mg/kg/day (decreased fetal weight); Maternal NOEL=125 mg/kg/day (HDT); core grade minimum (E.I. du Pont de Nemours and Co., 1980a)
- 6) Teratology - mouse: Teratogenic NOEL=50 mg/kg/day; Teratogenic LEL=100 mg/kg/day (supra occipital scars, subnormal vertebral centrum, supernumary ribs, cleft palate); core grade minimum (Kavlock et al., 1982)

Other Data Reviewed:

- 1) Ocogenic - mice: CD-1 mice were given 0, 500, 1500, and 7500 (reduced to 5000 ppm after 37 weeks) ppm (0, 75, 225, 1125/750 mg/kg/day). High dose males had microscopic evidence of

hepatocellular and testicular (and epididymal) degeneration; core grade minimum (E.I. du Pont de Nemours and Co., 1980b)

2) 90-Day Feeding - rat: NOEL=500 ppm (25 mg/kg/day); LEL=2500 ppm (125 mg/kg/day) (increased relative and absolute liver weight in females and increased SGPT values in males); core grade minimum (E.I. du Pont de Nemours and Co., 1967)

3) 90-Day Feeding - dog: NOEL=500 ppm (12.5 mg/kg/day); LEL=2500 ppm (62.5 mg/kg/day) (depressed albumon/globulin, A/G ratio, and increased SGPT in males); core grade minimum (E.I. du Pont de Nemours and Co., 1968b)

Data Gap(s): None

#### **I.A.5. Confidence in the Oral RfD**

Study — Medium

Database — High

RfD — High

The principal study is of adequate quality and is therefore given medium confidence. Since additional studies are of adequate quality, the database is given high confidence. High confidence in the RfD follows.

#### **I.A.6. EPA Documentation and Review of the Oral RfD**

Other EPA Documentation — Pesticide Registration Standard April, 1986; Special Review Position Document; Pesticide Registration Files

Agency Work Group Review — 03/26/1986

Verification Date — 03/26/1986

Screening-Level Literature Review Findings — A screening-level review conducted by an EPA contractor of the more recent toxicology literature pertinent to the RfD for Benomyl conducted in September 2002 identified one or more significant new studies. IRIS users may request the references for those studies from the IRIS Hotline at [hotline.iris@epa.gov](mailto:hotline.iris@epa.gov) or (202)566-1676.

### **I.A.7. EPA Contacts (Oral RfD)**

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (202)566-1676 (phone), (202)566-1749 (FAX) or [hotline.iris@epa.gov](mailto:hotline.iris@epa.gov) (internet address).

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### **I.B. Reference Concentration for Chronic Inhalation Exposure (RfC)**

Substance Name — Benomyl  
CASRN — 17804-35-2

Not available at this time.

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## **II. Carcinogenicity Assessment for Lifetime Exposure**

Substance Name — Benomyl  
CASRN — 17804-35-2

Not available at this time.

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**III. [reserved]**

**IV. [reserved]**

**V. [reserved]**

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## **VI. Bibliography**

Substance Name — Benomyl  
CASRN — 17804-35-2

## **VI.A. Oral RfD References**

E.I. du Pont de Nemours & Company. 1967. MRID No. 00066771. Available from EPA. Write to FOI, EPA, Washington D.C. 20460.

E.I. du Pont de Nemours & Company. 1968a. MRID No. 00066773. Available from EPA. Write to FOI, EPA, Washington D.C. 20460.

E.I. du Pont de Nemours & Company. 1968b. MRID No. 00066785. Available from EPA. Write to FOI, EPA, Washington D.C. 20460.

E.I. du Pont de Nemours & Company. 1969. MRID No. 00097284. Available from EPA. Write to FOI, EPA, Washington D.C. 20460.

E.I. du Pont de Nemours & Company. 1970. MRID No. 00097305, 00097318, 00097326. Available from EPA. Write to FOI, EPA, Washington D.C. 20460.

E.I. du Pont de Nemours & Company. 1980a. EPA Accession No. 256575. Available from EPA. Write to FOI, EPA, Washington D.C. 20460.

E.I. du Pont de Nemours & Company. 1980b. MRID No. 00096514. Available from EPA. Write to FOI, EPA, Washington D.C. 20460.

E.I. du Pont de Nemours & Company. 1982. MRID No. 00115674. Available from EPA. Write to FOI, EPA, Washington D.C. 20460.

Kavlock, R.J., N. Chernoff, L.E. Gray, Jr., J.A. Gray and D. Whitehouse. 1982. Teratogenic effects of benomyl in the Wistar rat and CD-1 mouse, with emphasis on the route of administration. *Toxicol. Appl. Pharmacol.* 62: 44-54.

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## **VI.B. Inhalation RfC References**

None

## VI.C. Carcinogenicity Assessment References

None

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## VII. Revision History

Substance Name — Benomyl

CASRN — 17804-35-2

Date	Section	Description
12/03/2002	I.A.6.	Screening-Level Literature Review Findings message has been added.

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## VIII. Synonyms

Substance Name — Benomyl

CASRN — 17804-35-2

Last Revised — 01/31/1987

- 17804-35-2
- ARILATE
- BBC
- BENLAT
- BENLATE
- BENLATE 50
- BENLATE 50 W
- Benomyl
- BENOMYL 50W
- 2-BENZIMIDAZOLECARBAMIC ACID, 1-(BUTYLCARBAMOYL)-, METHYL ESTER BNM
- 1-(BUTYLCARBAMOYL)-2-BENZIMIDAZOLECARBAMIC ACID, METHYL ESTER
- 1-(BUTYLCARBAMOYL)-2-BENZIMIDAZOL-METHYLCARBAMAT

- CARBAMIC ACID, METHYL-, 1-(BUTYLCARBAMOYL)-2-BENZIMIDAZOLE  
ESTER
- D 1991
- DU PONT 1991
- F1991
- FUNDASOL
- FUNDAZOL
- FUNGICIDE 1991
- MBC
- METHYL 1-(BUTYLCARBAMOYL)-2-BENZIMIDAZOLYL CARBAMATE
- 1-(N-BUTYLCARBAMOYL)-2-(METHOXY-CARBOXAMIDO)-BENZIMIDAZOL
- TERSAN 1991