

100601
SHAUGHNESSEY NO.

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23
REVIEW NO.

EEB BRANCH REVIEW

DATE: IN 7/16/82 OUT 9/28/82

FILE OR REG. NO. 3125 - 236, - 238

PETITION OR EXP. PERMIT NO. _____

DATE OF SUBMISSION 6/21/82

DATE RECEIVED BY HED 7/16/82

RD REQUESTED COMPLETION DATE 10/ 1/82

EEB ESTIMATED COMPLETION DATE 9/24/82

RD ACTION CODE/TYPE OF REVIEW 335 / Amendment -- New Food/Feed Use

TYPE PRODUCT(S): I, D, H, F, N, R, S Insecticide

DATA ACCESSION NO(S). None

PRODUCT MANAGER NO. H. Jacoby (21)

PRODUCT NAME(S) Nemacur 15G and Nemacur 3 (E)

COMPANY NAME Dow Chemical Company

SUBMISSION PURPOSE Proposed Conditional Registration of Grape Use

SHAUGHNESSEY NO. CHEMICAL, & FORMULATION % A.I.

100601 Fenamiphos [Ethyl 3-methyl-4-(methylthio)phenyl

(methylethyl) phosphoramidate] or

[Ethyl 4-(methylthio)-m-tolyl isopropyl

phosphoramidate]

Nemacur 3 (E) 35.0

Nemacur 15 G 15.0

100 Pesticide Label Information

100.1 Pesticide Use

Nemacur 3 and Nemacur 15G are proposed as an insecticide for control of nematodes in grapes.

100.2 Formulation Information

Nemacur 3 -- 35 % ai (3 lb ai per gallon)
Nemacur 15G -- 15 % ai

100.3 Application Methods, Directions, Rates

Use Nemacur 3 and 15G formulations at a rate of 18 lb a.i./A for broadcast applications and 9 lb a.i./A (18 lb a.i. per treated acre) for band treatments with a minimum width of 50% of the row spacing. For Nemacur 3 use 6 gallons product in 20 to 40 gallons of solution per acre.

Broadcast: With ground injection equipment (west of Rockies) and with suitable ground equipment (east of Rockies), apply 120 pounds (18 lb a.i. per acre 2 or more inches below soil surface.

Band: Use proportionally less Nemacur per acre. Treated band should center on the vine row with a minimum width of 50% of row spacing. West of the Rocky Mountains, apply with ground injection equipment. East of the Rocky Mountains, incorporate immediately.

NOTE: For use on grapes (west of the Rocky Mountains) Control of nematodes is best obtained when there is adequate rainfall or irrigation after application to move the product into the root zone.

100.4 Target Organism(s)

Control of nematodes in grapes.

100.5 Precautionary Labeling

No new precautionary labeling was submitted. Available labels approved in April 1982 read:

Nemacur 3:

This product is toxic to fish, birds, and other wildlife. Keep out of lakes, streams, or ponds. Birds feeding on treated areas may be killed. In cleaning of equipment or disposal of wastes, do not contaminate water.

Nemacur 15G:

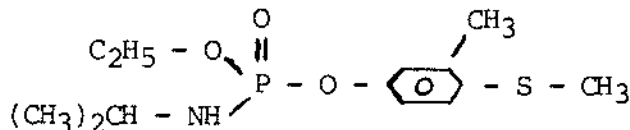
This product is toxic to fish and wildlife. Keep out of lakes, streams, or ponds. Birds feeding on treated areas may be killed.

101 Physical and Chemical Properties (See EEB Review by Mary Gessner,
dated 12/3/80)

101.1 Chemical Name

Ethyl 4-(methylthio)-m-tolyl isopropyl phosphoramidate

101.2 Structural Formula



101.3 Common Name --- Fenamiphos

101.4	Trade Name	---	Nemacur
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101.5 Molecular Weight — 303

101.6 Physical State

Form and color: Tan, waxy solid

Odor:

pH:

Melting Point:

Boiling Point:

Vapor Pressure:

101.7	Solubility	Soluble in most organic solvents
		Water: ca. 400 ppm

102 Behavior in the Environment (See EEB Review by Mary Gessner, dated
12/3/80 for extraction of EFB Review by R. W. Cook, dated 10/3/73)

Some leaching in soils with low adsorption coefficient (low in organic matter and fine clay particles). Some runoff.

Half-life in water (pH 7) is about 5 days.

Nemacur and its soil metabolites, sulfoxide and sulfone, are absorbed by plants.

103 Toxicological Properties (See EEB Reviews by O'Brien, dated 11/25/77, and Turner, dated 9/27/78, and Tox Review by Coberly, dated 9/15/69)

Test	Species	Material	LD/LC50	Validation Status
Oral LD50	Rat (M)	Tech.	8.1	mg/kg
	Rat (F)	Tech.	4.75	mg/kg
	Rat	Tech.	10 - 19	mg/kg
	Mouse (F)	Tech.	8.3	mg/kg
	Guinea Pig	Tech.	75 - 100	mg/kg
	Cat	Tech.	2.5 - 10	mg/kg
	Dog	Tech.	> 2.5	mg/kg
	Rat (F)	35 % ai	10.6	mg/kg
	Rat (F)	35 % ai	25 (97-188)	mg/kg
	Rat (F)	10 % ai	56.5	mg/kg
Rat (F)	5 % ai	134.5	mg/kg	
Dermal LD50	Rat	% a.i.	80.1	mg/kg
	Rabbit (M)	Tech.	225	mg/kg
	Rabbit (F)	Tech.	178.8	mg/kg

103.2 Minimum Requirements (Compilation of EEB Reviews and Data Validations, O'Brien, 11/25/77; and Gessner, 12/3/80)

	Test	Species	Material	LD/LC50	Validation Status	Data Source
103.2.1	Acute Oral LD50	Bobwhite (M)	88 % ai	0.7 (0.5-0.8) mg/kg	Invalid	Lamb & Jones
		Bobwhite (F)	88 % ai	0.9 (0.7-1.1) mg/kg	Invalid	(1978)
		Mallard (M)	88 % ai	1.1 (0.9-1.3) mg/kg	Invalid	"
		Mallard (F)	88 % ai	1.2 (0.9-1.6) mg/kg	Invalid	Nelson & Burke (1977a)
		Mallard (M)	88 % ai	1.0 (0.9-1.2) mg/kg	Invalid	
		Mallard (F)	88 % ai	0.9 (0.8-1.1) mg/kg	Invalid	
		Canary	81.6 % ai	1 - 2 mg/kg	Suppl.	Herman (unk)
		Pigeon	81.6 % ai	0.5 - 1 mg/kg	Suppl.	Herman (unk)
		R-n. Pheasant	81 % ai	0.5 - 1 mg/kg	Suppl.	Hudson (1972)
		Mallard	81 % ai	1.68 mg/kg	Suppl.	Hudson (1972)
		Canary	Tech.	0.5 - 1 mg/kg	Suppl.	Farbenfabriker Bayer AG (1968)
		Bobwhite (M)	35 % ai	2.2 (1.9-2.5) mg/kg	Sup/Core	Keichline & Bradburn (1969)
		Bobwhite (F)	35 % ai	2.5 (1.9-2.8) mg/kg	Sup/Core	Crawford & Nelson (unk.)
		Mallard	35? % ai	2.5 - 3 (ca. 0.87 % ai) mg/kg	Sup/Core	
		Bobwhite (M)	% ai	0.8 (0.7-0.9) mg/kg	Suppl.	Keichline & Bradburn (1969)
		Bobwhite (F)	% ai	1.8 (1.4-2.3) mg/kg	Suppl.	
		Nemacur Sulfoxide				
		Bobwhite (M)	% ai	1.8 (1.4-2.3) mg/kg	Invalid	Lamb & Jones
		Bobwhite (F)	% ai	1.8 (1.4-2.3) mg/kg	Invalid	(1978)
		Mallard (M)	% ai	1.5 (0.9-2.4) mg/kg	Invalid	"
		Mallard (F)	% ai	1.5 (1.2-1.8) mg/kg	Invalid	
		Nemacur Sulfone				
		Bobwhite (M)	% ai	1.9 (1.2-3.1) mg/kg	Suppl.	"
		Bobwhite (F)	% ai	4.3 (3.2-5.8) mg/kg	Suppl.	"
		Mallard (M)	% ai	1.1 (0.8-1.5) mg/kg	Suppl.	"
		Mallard (F)	% ai	1.3 (1.0-1.8) mg/kg	Suppl.	"
103.2.2	8-Day Dietary LC50	Bobwhite(13d)	88 % ai	36 (31 - 45) ppm	Core	Nelson & Burke (1977b)
		Mallard (14d)	88 % ai	316 (221 -457) ppm	Core	Fink (1977)
		Coturnix(14d)	81.0 % ai	59 (49 - 71) ppm	Suppl.	Hill et al (1975)
103.2.3	96-Hour Fish LC50	Bluegill	88 % ai	9.5 (6.8-15) ppb	Core	Lamb & Roney (1977)
		Bluegill	81 % ai	17.7 (14.4-21.6) ppb	Core	Lamb & Roney (1972a)
		Rainbow Trout	81 % ai	72.1 (61.2-84.7) ppb	Core	Lamb & Roney (1972b)

Mosquitofish	74.1 % ai	< 100 ppb	Suppl.	Metcalf & Rowehl (1971)
Blk Bullhead	Tech	10	ppm Suppl.	Marking (1970)
Mosquitofish	Tech	24-hr LC100 < 200 ppb	Suppl.	Rowehl
Sailfin Molly	Tech	no separation of species	Suppl.	(1969)
Mosquitofish	40	% ai 24-hr LC100 < 100 ppb	Suppl.	Rowehl
Sailfin Molly	40	% ai no separation of species	Suppl.	(1969)
Catfish sp.?	35	% ai 10.5 (9.7 - 11.4) ppm	Sup/Core	Keichline & Bradburn (1969b)
Rainbow Trout	35	% ai 310 (250- 360) ppb	Sup/Core	Keichline & Bradburn (1969a)
Bluegill	15	% ai 151 (114- 201) ppb	Sup/Core	Lamb & Roney (1972a)
Rainbow Trout	15	% ai 563 (454- 698) ppb	Sup/Core	Lamb & Roney (1972b)
Goldfish		% ai 500 - 10,000	ppb Invalid	Cichoruis
Goldorfs		% ai 100 - 1,000	ppb Invalid	(1970)
Rainbow Trout		% ai 111 (90 - 130) ppb	Sup/Core	Keichline & Bradburn (1969a)

Nemacur Sulfoxide

Bluegill	99	% ai 2000 (1800-2300) ppb	Suppl.	Lamb & Roney (1972)
Bluegill		% ai 2653 (1000-4600) ppb	Core	Lamb & Roney (1977)

Nemacur Sulfone

Bluegill		% ai 1173 (1000-1500) ppb	Core	Lamb & Roney (1977)
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103.2.4	Aquatic Invertebrate magna 48-Hour EC50	Daphnia	88	% ai	1.6 (1.3-1.9) ppb	Suppl.	Nelson & Burke (1977)
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103.4 Additional Aquatic Laboratory Tests

103.4.1	Estuarine 96-Hour LC/EC50	Sheepshead	35	% ai	0.32 (48 hr)	ppm Suppl.	Lowe (1970)
		Pink Shrimp	35	% ai	0.15 (48 hr)	ppm Suppl.	Lowe (1970)
		Eastern Oyster larvae	35	% ai	no effect at 0.1 ppm (48 hr)	Suppl.	Lowe (1970)

103 Field Tests

103.5.2	Simulated Field Test - Small Pen Study	Rice Bird	35	% ai 5 lb ai/A - some died	Suppl.	Lamb &
		R-n. Pheasant	35	% ai 5 lb ai/A - no deaths	Suppl.	Nelson (197)
		Wild Bird Pop.	35	% ai 10 lb ai/A - no deaths	Suppl.	Fisher (197)
		Bobwhite	15	% ai 6 lb ai/A - reported	Invalid	Lamb &
		R-n. Pheasant	15	% ai little or no hazard	Invalid	Jones (1975)
		Bobwhite	15	% ai 20 lb ai/A - 1 died	Invalid	Lamb et al.
		Wild Bird Pop.		reported little or no hazard	Invalid	(1974)
		Eng. Sparrow	15	% ai 20 lb ai/A - ?/12 deaths	Suppl.	Lamb &
		Bobwhite	15	% ai 2/12 deaths	Suppl.	Jones
		N. Z. Rabbit	15	% ai 0/12 deaths	Suppl.	(1972)
		Rice Bird	15	% ai 40 lb ai/A incorporated	Suppl.	Lamb &
		R-n. Pheasant	15	% ai some deaths in both	Suppl.	Nelson (197)

104 Hazard Assessment

104.1 Discussion

Fenamiphos is an organophosphate compound which is used as a nematocide. It degrades into its sulfoxide and sulfone metabolites which also afford additional pest protection because these products are systemically absorbed by the plants. The sulfoxide and sulfone metabolites are persistent and bind readily to soil particles.

Acutely fenamiphos and its two degradates (its sulfoxide and sulfone metabolites) are very highly toxic to mammals and most bird species. Dietary tests indicate fenamiphos to be very highly toxic to quail and highly toxic to mallard ducks. In the aquatic environment fenamiphos is very highly toxic to bluegill sunfish, rainbow trout, and daphnids, while the two metabolites were found to be practically non-toxic to bluegill sunfish.

Nemacur 3 (E) and Nemacur 15G were proposed for use on grapes to control nematodes at a rate of 18 lb ai per acre. Broadcast and band applications are recommended for both products using ground injection equipment or suitable ground equipment followed immediately by soil incorporation 2 to 4 inches deep.

104.2 Likelihood of Adverse Effects on Non-target Organisms

According to Gusey and Maturgo (1973) grape vineyards are used extensively for feeding, nesting, and cover by many wildlife species including 24 songbird species, 5 upland gamebirds, wood ducks, 12 fur and game mammals and white-tailed deer. Application of Nemacur 3 (an emulsifiable systemic insecticide) at proposed rates and soil incorporation to a depth of 2 or more inches would result in residues in soil of less than 20 ppm, which is less than

the subacute dietary LC50 values for birds. Assuming 10 percent transport to adjacent aquatic habitats and 100 percent solubility (conditions reflecting worst case), fenamiphos residues in the water would be less than 96-hour LC50 for the most sensitive fish species and about equal to the available (invalid study) 48-hour EC50 for daphnids. Spray drift to aquatic areas is not likely, since the application is by ground equipment and the nozzles would be close to and directed toward the ground. Based on the above reasoning, use of Nemacur 3 at the proposed rates followed by immediate soil incorporation would appear to present little hazard to nontarget fish and wildlife.

As in the case of Nemacur 3 (E), the proposed application rates and immediate incorporation of Nemacur 15G granules into the ground would eliminate most hazard to aquatic organisms. However, fenamiphos formulated as a granular pesticide would appear to present a slightly more hazardous situation for terrestrial species which may accidentally or intentionally ingest sufficient granules to cause mortality.

At the proposed application rate of 18 lb ai per acre and an average of 0.0135 mg ai per granule, each treated square foot would contain 187 mg ai or over 13,000 granules of fenamiphos. Assuming that 2 to 3 percent of the granules will remain uncovered following soil incorporation as reported in granular field studies at Iowa State University (D. Erbach and J. Tollefson, unpublished), over 260 granules would remain exposed after treatment. During soil injection granules may be expected to be spilled and remain exposed when the injection machinery is inserted and withdrawn from the ground at the ends of the rows. Incorporation of broadcasted granules by discing may be expected to leave an even greater percentage of granules exposed.

Although the following avian results were obtained from oral LD50 studies which tested insufficient numbers of birds for too short an observation period, for lack of available data the results can be used to estimate the potential acute hazard on representative species:

Test Species $LD50 \times \text{Body Weight} = LD50 \text{ Dose/Animal} = \# \text{ Granules/Animal}$

Bobwhite (M)	0.7 x 0.17 kg	0.12 mg ai/bird	8.9
Bobwhite (F)	0.9 x 0.17 kg	0.15 mg ai/bird	11.1
Mallard (M)	1.1 x 1.1 kg	1.21 mg ai/bird	89.6
Mallard (F)	1.2 x 1.1 kg	1.32 mg ai/bird	97.8
Mouse	8.3 x 0.02 kg	0.17 mg ai/mouse	12.6

Preliminary tests by EER on house sparrows and red-wing blackbirds also indicate that only a few granules are necessary to cause mortality:

	Number of Granules Fed		
	1	5	10
House Sparrow	0/5 dead	2/5 dead	3/5 dead
Red-wing Blackbird	1/5 dead	2/5 dead	3/5 dead

Both sets of data indicate that a single treated square foot contains a sufficient number of granules to exceed the acute oral LD50 for all of these representative species. While it is unlikely that mammals would intentionally ingest granules, some mammals could ingest

granules attached to mucous membranes of some invertebrates. On the whole, mammals are not likely to be adversely effected by this use.

On the other hand, birds may ingest granules either accidentally with grit which aids digestion or attached to the mucous membranes of prey such as slugs, earthworms, etc. Based on exposure and toxicity, some avian mortality may be expected from this proposed use. Indeed, at least one PIMS report indicates avian mortality resulting from the use of Nemacur granules. In Florida, six ducks were reported killed following consumption of fenamiphos granules applied to turf.

104.3 Endangered Species Considerations

With grape vineyards are present in almost all of the 48 contiguous states and in many of the counties within each state, almost every endangered species has the potential of being exposed to fenamiphos from use on grapes to control nematodes. While the number of species with the potential for exposure is great, the potential for any impact on them is remote since the acreage in grape vineyards are small in most areas. Over 85 percent of the 712,804 acres are grown in California and only Michigan, New York, Pennsylvania, and Washington reported more than 10,000 acres in 1978.

In previous OES biological opinions on pesticide use on grapes for Carbofuran (10G, 15G, and 4F) dated May 1, 1981 and for Endosulfan (3G, 34EC, 50WP, etc.) dated July 30, 1982, OES did not identify any endangered species as being in jeopardy. Since OES concluded that no jeopardy existed for either carbofuran which is similar to fenamiphos in formulation and toxicity to birds or endosulfan which has similar aquatic toxicity, EEB concludes that fenamiphos use on grapes as proposed will not jeopardize any endangered species.

104.4 Adequacy of Toxicity Data

Of the minimum six basic studies, only the two avian dietary LC50 and the two fish 96-hour LC50 studies are adequate to support this registration. The avian acute oral tests used too few birds and the observation period was too short. The daphnia study did not use the first instar life stage as required.

104.5 Additional Data Required

See Section 107.5

107 Conclusions

EEB cannot conduct a complete hazard assessment for the proposed use of Nemacur 15G and 3 (E) on grapes, because some essential studies are missing. From the existing data base, EEB expects little or no impact on wildlife from the use of Nemacur 3. Use of Nemacur 15G is expected to result in the exposure of sufficient granules to have some adverse effects on birds and possibly mammals, despite directions to incorporate granules into the soil. Additional testing are necessary to estimate the extent of the hazard to these wildlife.

107.1 Environmental Fate and Toxicological Acknowledgemnet

No additional information was received to support this proposed use on grapes from EFB or Tox branches.

107.2 Classification Labeling

If not already classified as such, EEB suggests a Restricted Use classification for protection of nontarget wildlife.

107.3 Environmental Hazards Labeling

Based on the available data, the existing labeling is appropriate.

107.4 Data Adequacy Conclusions

Two of the six basic studies are missing and from existing data the need for a small-pen simulated field study is indicated to support the registration of the Nemacur 15G formulation.

107.5 Data Requests

Additional studies required to support the proposed conditional registration of Nemacur for use on grapes are:

- 1 - Avian acute oral LD50 test on either bobwhite or mallard duck;
- 1 - 48-Hour or 96-hour EC50 on an aquatic invertebrate, preferably Daphnia magna; and
- 1 - Small-pen simulated field study.

Given the available data on the toxicity of fenamiphos and its potential exposure to birds, a small-pen simulated field study is required using Nemacur 15G at the maximum recommended rate of application.

107.6 Special Notes

The above additional tests have been requested to support previous action, but no data was been received.

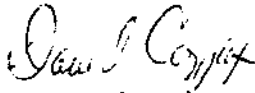
107.7 Recommendations

EEB has reviewed the proposed conditional registration of fenamiphos (Nemacur 15G and 3 (E)) for use on grapes. Insufficient data has been submitted to complete a full hazard assessment. See Section 107.5 for additional data needs. Based on the available data and use information EEB concludes that the proposed uses will result in mortality of some birds and possibly some mammals caused by the ingestion of Nemacur 15G granules. Additional data from the simulated field study are needed before the extent of the granular hazard can be assessed.

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Date: 9/28/82



David Coppage, Section Head
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