241188
RECORD NO.

SHAUGHNESSEY NO. REVIEW NO.

EEB REVIEW

DATE: IN 3-8-89 OUT 3-15/89

FILE OR REG. NO 89-CA-14

PETITION OR EXP. NO.

DATE OF SUBMISSION 2-27-89

DATE RECEIVED BY HED 3-11-89

RD REQUESTED COMPLETION DATE 3-18-89

EEB ESTIMATED COMPLETION DATE 3-18-89

RD ACTION CODE/TYPE OF REVIEW 510

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

DATA ACCESSION NO(S).

PRODUCT MANAGER NO. D. Stubbs (41)

PRODUCT NAME(S) Namacur 3

COMPANY NAME California Department of Food and Agriculture

SUBMISSION PURPOSE Proposed Section 18 for use on walnuts

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

15 pages

EEB REVIEW

100.0 Submission Purpose

The California Department of Food and Agriculture (CDFA) requests a specific exemption to use Nemacur 3 on walnuts to control nematodes.

100.1 Label Directions and Application Rates

Dosage Apply 3.33 to 6.66 gallons of product per treated acres (9.99 - 19.98 lbs ai). A maximum of 6.66 gallons of product per acre may be applied per growing season.

Application Methods

Band Application:

Apply specified dosage in 20-40 gallons of water per treated acre as a spray to the soil surface with equipment properly calibrated to apply the product in a band covering the feeder root system of the trees. Incorporate immediately with mechanical equipment 2 to 4 inches deep or 1 to 2 inches with sprinkler irrigation. Flood irrigation shall not be use to incorporate soil surface treatment.

Chisel Application (Band):

Apply specified dosage per treated acre with 20-40 gallons of water, 2 or more inches below the soil surface with ground injection equipment. For banded applications, center the treated band on the row using a minimum band width equal to 50% of the row spacing.

Incorporation of this product may be accomplished by mechanical incorporation 2-4" deep, or by sprinkler irrigation applied immediately following application (1-2" of water). Flood irrigation shall not be used to incorporate soil surface treatments. Reduction of nematode populations is best obtained when there is adequate rainfall or irrigation after application to move the product into the root zone.

Aerial application of the product is prohibited.

Low Volume Irrigation (Drip, Micromist, Minijet, Etc.):

Apply one-half to 1 gallon of Nemacur 3 per treated acre per application. Do not make successive applications less than 1 week apart. Do not make more than 6 applications. Do not exceed 18 pound active ingredient (6 gallons of Nemacur 3) per treated acre before the 1989 harvest. A treated acre is defined as the area wetted by the irrigation system. When this product is being applied through a Low Volume Irrigation system, at the entry point to the field, or if there are not obvious entry points, at every 600 feet there shall be signs posted that are readable at 25 feet that state: "Danger! Pesticides are being applied in the water through the Low Volume Irrigation system. Do not drink water or walk on wet soil."

Frequency/Timing of Application

Treat when nematode levels are expected to lead to the development of bacterial canker disease.

Amount of product to be used/acres to be treated

A maximum of 5,000 acres of walnuts may be treated.

Location:

Butte, Sutter, Tehama, and Yuba counties.

101.0 Toxicity of Fenamiphos to Non-target Organisms

Nemacur (fenamiphos) is an organophosphorus nematicide/ insecticide, that is classified as being highly toxic to mammals (rat LD50 ranges from 10 to 61 mg/kg), and very highly toxic to fish (96-hour LC50 of 9.5 ppb - bluegill sunfish) and birds (acute oral LD50 1.6 mg/kg - bobwhite quail; dietary LC50 of 38 ppm - bobwhite quail). In addition, the sulfoxide metabolite of fenamiphos has been found to be more toxic to mammals (rat LD50 ranges from 3.7 to 4.1 mg/kg) than the parent compound. No data are available on the subacute toxicity of the sulfoxide/sulfone metabolite to avian species; however, they are moderatly toxic to fish. Data indicate that fenamiphos causes reproductive impairment in both waterfowl and upland game birds at levels as low as 8 and 2 ppm, respectively.

Results of simulated/actual field studies showed that fenamiphos caused some avian and mammalian mortality when used according to label directions. Results of these studies also indicated that soil incorporation, immediately after applicatin, can somewhat reduce hazards to non-target organisms (see attached).

For additional information on the toxicity of fenamiphos to non-target organisms see the Fenamiphos Registration Standard prepared by R. Felthousen dated 2-12-87.

101.1 Enviornmental Fate of Fenamiphos

There is a paucity of acceptable environmental fate data available for fenamiphos. As such, there are numerous data gaps and unsatisfied Guideline requirements (S. Simko, EAB/HED personal communication).

The following information was obtained from the Exposure Assessment Branch's one-liner file on fenamiphos.

Hydrolysis data suggest that at pH 3 the half-life of fenamiphos in water is 8 to 10 days. At pH 7 the material was found to be stable during the course of test while at pH 9, the half-life was estimated to be between 220 and 230 days. These data suggest that fenamiphos is relatively stable in neutral and alkaline waters.

The field half-life of fenamiphos in soil was calculated to be 30 days. Under anaerobic conditions, the laboratory half-life was greater than 60 days.

Soil adsorption coefficients are 3.05, 5.78, and 4.59 for sandy loam, silt loam, and silty clay soil types, respectively.

Fenamiphos adsorbs to soil particles but can leach in soils which have alow adsorption coefficient. Fenamiphos converts to sulfoxide and sulfone phenols 3 in three weeks, but residues of fenamiphos and its metabolites have been found in soil samples 2 years post-application. Hydrolysis does not appear to be a major mode of degradation in the soil. Fenamiphos and its metabolites are picked up systemically by plants. The metabolites are more persistent than the parent material.

102.0 Hazard Assessment

102.1 Avian Species

The following hazard assessment for avian species for the fenamiphos 3EC formulation was based on exposure from the maximum application rate of 20 lb ai/A and dietary toxicity data from the most sensitive organisms tested (bobwhite quail LC50 = 38 ppm). Because label directions call for band applications to be soil incorporated immediately following application, the application rate has been adjusted to 1 lb ai/A. This assumes a 95% reduction in exposure from soil incorporation.

Toxicity Data

Fenamiphos (88% ai) is very highly toxic to the bobwhite quail (LC50 = 38 ppm) and highly toxic to the mallard duck (LC50 = 316 ppm). No observed effect levels (NOEL's) have been determined for both the mallard duck (14-week NOEL = 8 ppm) and bobwhite quail (25-week NOEL = 2 ppm). Result of reproduction studies show that dietary exposure of 8 ppm reduced quail chick survival by 31% where as dietary exposure of 16 ppm reduced feed consumption and egg production in mallard ducks.

Exposure Analysis

Results of simulated and actual field studies suggest that spray formulations, even when soil incorporated, cause mortality to avian species. The evidence suggests that soil incorporation does reduce hazard to some extent.

The extent to which avian species may be exposed and the degree of hazard from such exposure is shown in Tables 5 and 6 (see attached). Exposure estimates have been based upon one application at the maximum lable rate of 20 lb ai/A which has been adjusted to 1 lb ai/A to account for a 95% soil incorporation factor (Erbach and Tollerfson, 1981). Table 5 presents the food factor calculations and the correlation of total adjusted residues with calculated LC50 values for various species. Table 6 shows estimated dietary concentrations and the total estimated residues for eight species of non-target birds. Comparisons between expected dietary concentrations and LC50 values for eight species of non-target birds suggest the following:

1. Small insectivorous birds and birds that feed on grubs and worms are likely to be exposed to the highest residues of fenamiphos and as such are the most susceptible to hazard.

2. Seed-eating birds are likely to be exposed to the lowest residues of fenamiphos.

3. Residues of fenamiphos exceed NOEL's for tested avian species and suggested that reproductive impairment may occur under field conditions.

4. Mortality and/or other adverse effects may occur to certain species regardless of size.

5. Failure to adequately soil incorporate broadcast or band applications will greatly increase exposure and potential for adverse effects.

6. Total fenamiphos residues exceed 1/5th the calculated LC50 for all eight species [sections 102.11(c)(2)(iii)(B) criterion of section 3 regulations].

102.2 Mammalian Species

Possible routes of exposure to mammals from spray formulations are from feeding on contaminated vegetation/invertebrates, drinking contaminated water, and dermoal contact. Based on bioassay data showing the rat acute oral LC50 to be 10 mg/kg, fenamiphos is classified as very highly toxic to mammalian species. In addition, the sulfoxide metabolites of fenamiphos has been found to be more toxic to mammals (rat LD50s range from 3.7 to 4.1 mg/kg) than the parent compound.

Laboratory studies have shown that the sulfoxide metabolite is more toxic than the parent material. Environmental fate data show that fenamiphos and its metabolites are picked up systemically by plants and that sulfoxide residue may be present in certain soils for up to 2 years after application. These data suggest that small mammals feeding on contaminated vegetation are likely to be exposed to fenamiphos and or its metabolites.

Results of simulated/actual field studies show that fenamiphos causes some mammalian mortality when used according to label directions. Results of these studies also indicate that soil incorporation, immediately after application can reduce but not eliminate hazard to non-target mammalian species. The use of sprinkler irrigation to soil incorporate the pesticide, may result in high levels of fenamiphos being concentrated in small puddles or wet spots which may also pose hazard from oral and dermal exposure.

102.3 Aquatic Assessment

Based upon laboratory data, EEB has characterized fenamiphos as very highly toxic to both cold and warm water fish species. As such, EEB is particularly concerned about the direct and indirect hazard that this material may pose to aquatic environments.

Obviously, the greatest potential for hazard to fish would occur if, during treatment, fenamiphos was directly applied to aquatic environments. Such a circumstance couls easily occur if fenamiphos is aerially applied as a broadcast soil treatment to fields where interconnected waterways such as ditches, canals, creeks, streams, and ponds are used for irrigational purposes. Ground application would, for the most part, preclude any direct application to wetland areas. However, contamination can still occur from runoff.

Table 7 shows the estimated concentrations of fenamiphos that could occur from direct application to water. The application rates listed are the maximum single application that could be applied for the particular crop. The concentration values shown are based upon a nomograph developed by DeWitt at the Patuxent Wildlife Research Center at Patuxent, Maryland.

Table 7

Estimated concentrations of fenamiphos in water contaminated by direct application. Estimates are based upon the maximum label rate of product application.

Crop	Application Rate (lb ai/A)*	Water Depth (in)	Conc. (ppm)
Fruit trees	20.0	0.5	14.7
Fruit trees	20.0	1.0	7.4
Fruit trees	20.0	6.0	1.2

* Aerially applied as a broadcast, preplant soil treatment.

Comparing the 96-hour bluegill sunfish LC50 of 9.6 ppb, with estmiated exposures suggests the following:

a. Direct application of fenamiphos to lentic bodies of water (worse case situation) will result in residues that exceed LC50 values and will most likely cause significant adverse effects.

b. Direct application of fenamiphos to lentic bodies of water (worse case situation) will result in residues that exceed (1/10th LC50) by 1,250 times in 6" of water (1.2 ppm ÷ 96 ppb) and will most likely cause significant advers effects.

Estimated Environmental Concentration (EEC's) for fenamiphos from runoff have also been determined for both lentic and lotic environments using the EXAMS II (Exposure Analysis Modeling System). To determine these EEC's, tne amount of runoff from a 10 hectare tabacco field (i.e., unit of runoff/acre from SWRRB x 10) was loaded into a Georgia pond (lentic) stream (lotic) scenario to simulate the fate of fenamiphos in a Georgia aquatic system.

The Georgia pond-stream scenario consists of a one hectare farm pond, 2 meters-deep, that is surrounded by 10 hectare drainage basin and drains into two streams, one is short (100 meters-long, 3 meters-wide and .05 meters-deep) and one is long (300 meters-long, 3 meters-wide, and .05 meters-deep). EEC's of fenamiphos, applied at 20 lbs ai/A, soil incorporated (2-4") and/or watered-in are shown in Table 8.

Table 8

Estimated Environmental Concentrations (ppb) of fenamiphos in lentic and lotic scenarios from runoff. Estimates are based on the maximum label rate of product.

Soil Incorporation (2-4 inches)	Pond	Stream I	Stream II
a) 1% runoff	14.55	10.45	7.25
b) 5% runoff	72.8	52.27	36.25
Watered-In			
a) 1% runoff	112	80.42	55.78
b) 5% runoff	560	402.0	279

Comparison of fish toxicity data and these EEC's suggest the following:

> Non-target fish indigenous to small ponds and streams will be exposed to fenamiphos residues (worse case situation) that are above the LC50 values.

102.4 Invertebrates

The acute contact LD50 of fenamiphos to the honey bee was found to be 1.87 micrograms per bee. There is sufficient information to characterize fenamiphos as highly toxic to honey bees.

102.5 Endangered Species

The EEB does not have a biological opinion, either case by case or cluster, for walnuts. As such, because fenamiphos is classified as very highly toxic to birds, mammals and fish species the EEB and because estimated environmental concentrations exceed triggers, the EEB has determined that the proposed use of fenamiphos to control nematodes on walnuts "may affect" those endangerd species listed in Table 9.

The EEB has contacted the USFWS-OES in Sacramento, California for an informal opinion on the impact of this pesticide to these species (NOTE: The EEB has contacted Mr. Ted Rado, in order to coordinate this effort, Telephone FTS-460-4866).

Table 9 lists those California counties (including the amount of acreage planted in walnuts), where the use of fenamiphos will jeopordize the continued existence of endangered species.

Table 9

California counties where walnuts are grown and where endangered species are found (Census of Agriculture, 1982)[1/]

County	Acres of Trees	Endangered Species [2/]
Sutter	15,738	Valley Elderberry Longhorn Ground Beetle (K) Bald Eagle (K) Aleutian Canada Goose (K)
Butte	16,888	Bald Eagle (K) Valley Elderberry Longhorn Ground Beetle (K) Peregrine Falcon (P)

Tehama	11,160	Valley Elderberry Longhorn Ground Beetle (K) Bald Eagle (K) Peregrine Falcon (K)
Yuba	6,683	Bald Eagle

1/ U.S. Department of Commerce. 1982. Census of Agriculture Vol. 1. Part 5, California state and county data.

2/ EEB endangered species files (Bill Gill). (K)= known to occur (P)= possible occurrance.

103.0 Conclusions

Based upon available toxicity and environmental fate data, estimated exposure levels and results of simulated/ actual field studies, EEB concludes that the proposed use of fenamiphos on walnuts will result in adverse impacts to various non-target terrestrial and aquatic organisms.

Specifically, EEB believes that the issuance of the Section 18 exemption could adversely impact resident and migratory birds, warm water fish, numerous small mammals, beneficial insects, and "may affect" certain endangered species. As such, the EEB recommends initiation of Section 7 formal consultation with the USFWS Office of Endangered Species, as well as appropriate USFWS personnel responsible for administering the Migratory Bird Treaty Act, to insure Agency compliance with these two acts.

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Table 5. Calculated LC50 Values for Seven Species of Non-target Birds [1/]

Species[2/]	Body Weight (gm)	Food Consumed (gm)	Food Consumed/ Body Weight Percentage	Calculated LC50 (ppm)[3/]
Bobwhite quail (Young)	30.0	6.0	20.0	38.0
Bobwhite quail (Adult)	170.00	15.20	8.94	85.0
Robin	81.10	8.11	10.00	75.9
Mourning dove	100.00	11.20	11.20	67.9
Eastern cowbird	50.00	7.00	14.00	54.3
Field sparrow	13.90	4.60	33.10	23.0
Grasshopper sparrow	13.90	4.60	33.10	23.0
Carolina wren	19.00	6.50[4/]	32.40[4/]	22.2

1/ All of the calculations for calculated LC50 (ppm), except for 38 ppm which is the reference LC50, are based upon the assumption that each species has the same sensitivity to fenamiphos as bobwhite quail.

2/ All species considered are adult organisms, and the body weight and food consumption values are from Kenaga (1973), Nice (1938), and USDI, USFWS, Cicular 199, 1964.

3/ These are the theoretical dietary levels which should cause 50% mortality (LC50) using the assumption stated in (1) above [see Kenaga (1972 and 1973). The procedure used is:

$$\frac{\text{Food Consumption (\%)}}{\text{Body Weight}} \times \text{Toxicant Residue Level (ppm)} = \text{Toxicant (mg/kg) Body Weight/Day}$$

4/ The food consumption value and, consequently, the food consumption/body weight (as %) values were developed from Kenaga (1973). In this article, the food consumption values for a 19.0 gm three sparrow (Spizella arborea) are given as 7.11 and 5.95 gm, the mean equaling 6.53 gm. This value is considered suitable for use with the Carolina wren's body weight of 19.0 gm (from Nice 1938).

Table 6: Dietary Contamination and total estimated fenamiphos residues for eight species of non-target birds

Species	Calculated LC50 (ppm)[1]	1/5 Calculated LC50 (ppm)[2]	Food Consumed		Maximum Expected Residues (ppm)[4]		Maximum Expected Residues (ppm)[4]		Total Residue Both Plant and Animal
			Animal (%)	Plant	Animal	Plant	Animal	Plant	
Bobwhite quail 14-day)	38.0	7.6	80% Beetles Weevils Grasshoppers etc.	20% Seeds: Ragweed Lespedeza Corn etc.	58.0 ppm (k)[7]	12.0 ppm (k)	46.4 ~~23.2~~ ppm[8]	2.4ppm[9]	48.8 ppm
Bowhite quail (adult)	85.0	17.0	27% Beetles Weevils Grasshoppers etc.	73% Seeds Ragweed Lespedeza Corn etc.	58.0 ppm (k)	12.0 ppm (k)	15.7 ppm	8.8 ppm	24.5 ppm
Robin	75.9	15.2	40% Caterpillars Beetles Weevils Earthworms etc.	60% Seeds/ Furits: Cherry Dogwood Holly	58.0 ppm (k)	12.0 ppm (k)	23.2 ppm	7.2ppm	30.4 ppm
Mourning Dove	67.9	13.6	0%	100% Seeds: Corn Pigweed etc.	58.0 ppm (k)	12.0 ppm (k)	0.0 ppm	12.0 ppm	12.0 ppm
Eastern cowbird (adult)	54.3	10.9	52% Grasshoppers Beetles Caterpillars	48% Seeds: Bristlegrass Oats	58.0 ppm (k)	12.0 ppm (k)	30.1 ppm	5.8 ppm	35.9 ppm
Field sparrow (adult)	23.0	4.6	51% Beetles Grasshoppers Caterpillars etc.	49% Seeds: Crabgrass Bristlegrass Panicgrass	58.0 ppm (k)	12.0 ppm (k)	29.6 ppm	5.9 ppm	35.5 ppm
Grasshopper sparrow (adult)	23.0	4.6	61% Grasshoppers Caterpillars Ants etc.	39% Seeds: Bristlegrass Ragweed Knotweed etc.	58.0 ppm (k)	12.0 ppm (k)	35.3 ppm	4.7 ppm	40.0 ppm

Table 6: Dietary Contamination and total estimated fenamiphos residues for eight species of non-target birds (Continued)

Species	Calculated LC50 (ppm)[1]	1/5 Calculated LC50 (ppm)[2]	Food Consumed Amimal (%)	Food Consumed Plant	Maximum Expected Residues (ppm)[4] Animal	Maximum Expected Residues (ppm)[4] Plant	Maximum Expected Residues (ppm)[4] Animal	Maximum Expected Residues (ppm)[4] Plant	Total Residue Both Plant and Animal
Carolina wren (adult)	22.2	4.4	99%	1%	58.0 ppm (k)	12.0 ppm (k)	57.4 ppm	.1 ppm	57.5 ppm

FOOTNOTES:

1/ Refer to Table 5 (footnote 6) for an explaination of how the "calculated LC50's" were obtained.

2/ Application of section 102.11(c)(2)(iii)(B) criterion of section 3 regulations.

3/ This information is taken from Martin, Alexander C., et al., American Wildlife and Plants: A Guide Inc., NY 1951.

4/ Based upon a 1.0 lb ai/A (after soil incorporation) application to expected food times using the following references:

a. Hoerger, F.D.; Kenaga, E.E. Pesticide Residues on Plants. Correlation of Representative Data in the Environment. Environmental Quality, Academic Press, New York, I: 9-28, 1972.

b. Kenaga, E.E. Factors to be Considered in the Evaluation of the Toxicity of Pesticides to Bird and Safety, Academic Press, NY, II: 166-181, 1973.

5/ Residue valsues adjusted to reflect percentage of animal/plant matter consumed. Examples:

a. Bobwhite Quail, Adults:

58.0 ppm x 0.27 (27%) = 15.7 ppm
12.0 ppm x 0.73 (73%) = 8.8 ppm

b. Robin, Adult:

58.0 ppm x 0.40 (40%) = 23.2 ppm
12.0 ppm x 0.60 (60%) = 7.2 ppm

6/ Reflects total residues expected in the diet: animal ir plant alone or a total of animal and plant food times. Examples:

a. Robin, Adult:
23.2 + 7.2 = 30.4 ppm total for animal and plant foods

b. Mourning Dove, Adult:
12.0 ppm total expected in food items consumed (i.e., 1.00 (100%) x 12.0 ppm = 12 ppm).

7/ (k) refers to maximum expected residues as per (4)(a), and (b) above.

8/ This is the maximum expected residue value for daily pesticide burden occurring from animal items.

9/ Daily pesticide burden occurring from ingested plant items.

Attachment

Summary of conditions/results/deficiencies of
fenamiphos conducted simulated/actual field studies

Test Study	Species	Author	Date	MRID #	Conditions/Results	Deficiencies	Fulfills Requirement
Simulated Field	Pheasants Rice Birds	Lamb	1971	00114008	Small pen study with pheasant and rice birds in pinapples. Nemacur 3 lb/gal. SC at 5 lb ai/A. Two of eight rice bird died from exposure (≅ 25%)	Supplemental feeding with untreated feed. Penned birds should have been in place when pesticide was applied.	No*
Simulated Field	Pheasants Rice Birds	Lamb	1971	00082115	Small pen study with pheasant and rice birds in pineapples. Nemaucur 15G at 40 lb ai/A. Six inch soil incorporation. Mortalities occurred at both pheasants (≅ 20%) and rice birds (≅ 10%).	Plastic mulch strips may have reduced exposure.	No*
Simulated Field	English sparrows Bobwhite quail New Zealand rabbits	Lamb	1972	00114013	Small pen sutdy with quail, English sparrows and New Zealand rabbits. Nemacur 15 G at 134 lbs ai/A to turf and without 1/2 irrigation following application - 14 day exposure. 70% of sparrows and 18% of quail died on non-irrigated plots. 50% of sparrows on irrigated plots died. No deaths to rabbits. Weight loss in quail.	Heavy rains during the study probably reduced hazard and baised test results.	No*
Simulated Field	Bobwhite quail & Natural bird Populations	Lamb	1974	109584	Simulated and actual field study in avian species using a peach orchard. Nemacur 15G at a rate of 133 lbs formulation/A. (20 lbs ai/A) with soil incorporation. No effects on natural bird populations were noted. One quail died. Average decrease of 10 grams in weight for all quail.	Cages were not moved daily. Poor census techniques. Recommended protocol for a simulated field study not followed.	No*

Summary of conditions/results/deficiencies of fenamiphos conducted simulated/actual field studies. (Continued)

Test Study	Species	Author	Date	MRID #	Conditions/Results	Deficiencies	Fulfills Requirement
Simulated Field	Bobwhite quail Ring-necked Pheasants	Lamb	1975	00025957	Small pen study. Nemacur 15 G band treatment (incorporated and unicomrporated) and broadcast (incorporated) at 27 ug. formlulation/100 ft. or row and 40 lb formulation la, repectively. Little or no hazard to birds reported.	Age of pheasants (12 weeks) is too young. Diseased condition of quail is unacceptable.	No*
Field Test					Twenty six (26) acres of orchard were sprayed at a rate of 23.8 lbs ai/A. Significant avian and mammalian mortality occurred over the next 5 days. some of the hazard was eliminated by 0.9 inches of rainfall.	Design deficiencies did not allow for statisitical analysis (Control plots were not used; the number of test plots was insufficient). Residues were not reported.	No*
Simulated Field					Small pen study with bobwhite quail. Application rate of 6, 10, and 20 lbs ai/A of Nemacur 3 (35% SC). Soil incoporated 2-3". 10% mortality occurred.	Residues on vegetation, soil and food not oollected. Test location not reported.	No*

* Does not fulfill data requirement. However, information is of supplemental use in a hazard assessment.