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EEE BRANCH REVIEW

DATE: IN 10/5/76 OUT 4/9/77 IN ____ OUT ____ IN ____ OUT ____

FISH & WILDLIFE ENVIRONMENTAL CHEMISTRY EFFICACY

FILE OR REG. NO. 1016-(78)(69)

PETITION OR EXP. PERMIT NO. 5F1849

DATE DIV. RECEIVED

DATE OF SUBMISSION

DATE SUBMISSION ACCEPTED

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

PRODUCT MGR. NO. Sanders (12)

PRODUCT NAME(S) TEMIK 15% Granular & Temik 10% Granular

COMPANY NAME Union Carbide Corp.

SUBMISSION PURPOSE Amended Registration for use on Soybeans & Dry Beans

CHEMICAL & FORMULATION 2-methyl-2-(methylthio) propionaldehyde
O-(Methylcarbamoyl) oxime (Aldicarb)
10% & 15% Granular

100.0 Pesticidal Use

For control of certain insects, mites and nematodes in dry beans and soybeans.

100.1,.2 Methods/Directions/Rates

A. Dry Beans

1. Amount

Dosages required for aphid control varies from 5 to 7 pounds of TEMIK 15% granular aldicarb pesticide (TEMIK 15G) per acre or 7.5 to 10 pounds of TEMIK 10% Granular aldicarb pesticide (TEMIK 10G) per acre. Based on a 36-inch row spacing, these dosages are equivalent to about 5.5 to 7.5 ounces of TEMIK 15G or 8 to 11 ounces of TEMIK 10G per 1000 linear feet of row.

For control of leafhoppers, Mexican bean beetles, spider mites and nematodes the rates vary from 7 to 14 pounds TEMIK 15G or 10 to 20 pounds TEMIK 10G per acre. Based on the same row spacing these rates are equivalent to 7.5 to 15 ounces TEMIK 15G or 11 to 22 ounces TEMIK 10G per 1000 linear feet of row.

Granules are either drilled in the seed furrow 2 to 3 inches below the seed line or 2 to 3 inches to the side of the row for insect and mite control, or applied in an 8 to 12 inch band over the row and incorporated in soil 2 to 4 inches deep for nematode control.

2. Frequency and Time of Application

Only <u>one</u> application, at-planting per crop is recommended.

3. Labels

Complete label drafts of the 30 pound net weight bag of TEMIK 15% Granular Aldicarb Pesticide accepted under EPA Reg. No. 1016-78 as amended February 4, 1976 and the TEMIK 10% Granular Aldicarb Pesticide 50 pound carton accepted under EPA Reg. No. 1016-69 as amended, October 30, 1975 are included in the "Application for Amended Registration of TEMIK 15% Granular Aldicarb Pesticide (EPA Reg. No. 1016-78) and TEMIK 10% Granular Aldicarb Pesticide

(EPA Reg. No. 1016-78) and TEMIK 10% Granular Aldicarb Pesticide (EPA Reg. No. 1016-69) for Use on Dry Beans and Soybeans. Union Carbide Corporation, August 1976", which is being submitted concurrently with this petition.

B. Soybeans

1. Amount

Dosage required for insect control (Mexican bean beetle) ranges from 5 to 10 pounds of TEMIK 15G per acre or 7.5 to 15 pounds of TEMIK 10G per acre. Based on a 36-inch row spacing, these dosages are equivalent to 5.5 to 11 ounces TEMIK 15G or 8 to 16.5 ounces of TEMIK 10G per 1000 linear feet of row. Placement of the granules for insect control is in the seed furrow 2 to 3 inches below the seed line or 2 to 3 inches to the side of the row. Care should be taken not to apply the granules in direct contact with the seeds.

For nematode control (except soybean cyst nematode) the rates vary from 10 to 14 pounds of TEMIK 15G or 15 to 20 pounds of TEMIK 10G per acre. Soybean cyst nematode requires dosages of 14 to 20 pounds of TEMIK 15G or 20 to 30 pounds of TEMIK 10G per acre. Using a 36-inch row spacing as a base, the dosages for control of nematodes (except soybean cyst nematode) are equivalent to about 11 to 15 ounces of TEMIK 15G or 16.5 to 22 ounces of TEMIK 10G per 1000 linear feet of row. For control of the soybean cyst nematode the proposed rates are equivalent to about 15 to 22 ounches of TEMIK 15G or 22 to 33 ounces of TEMIK 10G per 1000 linear feet of row. Recommended placement of the granules is in an 8-12 inch band and worked into the soil or covered with soil to a depth of 2 to 4 inches with the seeds planted in the treated zone.

2. Frequency and Time of Application

Only <u>one</u> application, at-planting per crop is recommended.

3. Labels

Label drafts as explained in A(3) above, also includes proposed claims for use of TEMIK 15G and TEMIK 10G on soybeans.

101.0 Chemical and Physical Properties

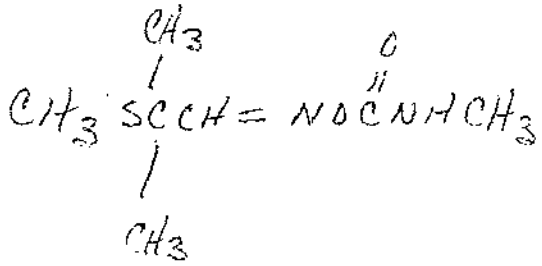
101.1 Chemical Name

2-methyl-2-(methylthio) propionaldehyde O-(methylcarbamoyl) oxime

101.2 Common Name

Temik, Aldicarb, UC 21149

101.3 Structural Formula



Empirical Formula: C H N O S
7 14 2 2

101.4 Molecular Weight

190.3

101.5 Physical State, Color, Odor

White Crystalline Solid, Slightly Sulfurous

101.6 Solubility

Solvent	Percent Solubility at 10°	30°	50°C
Acetone	28	43	67
Benzene	9	24	49
Carbon tetrachloride	2	5	25
Chloroform	38	44	53
Methyl isobutyl ketone	13	24	42
Toluene	10	12	33
Water	0.4	0.9	1.4

101.7 Stability

Aldicarb is a heat-sensitive, inherently unstable chemical and must be stabilized if a practical shelf-life is to be expected. [redacted]

Specific Gravity: 1.195 at 25°C

101.8 Formulations

The formulations to be sold are TEMIK 10G and 15G Aldicarb Pesticide, 10 and 15 percent active, granular products. [redacted]

[redacted] INERT INGREDIENT INFORMATION IS NOT INCLUDED

a. Composition of the formulations (not including moisture):

TEMIK 10G

[redacted]

TEMIK 15G

[redacted]

b. Description of components

[redacted]

102.0 BEHAVIOR IN THE ENVIRONMENT

No data available in our files. A review of Environmental Chemistry's Review indicates that no data were submitted or referenced with this submission.

103.0 Toxicological Properties

103.1 Acute Toxicity

103.1,.1 Mammal

See review by J. Edmondson, 8/7/74.

103.1,.3 Fish

1. Test: LC_{50} Bioassay

Species: Rainbow Trout and Bluegill Sunfish

	Rainbow Trout	Bluegill Sunfish
Results:	24-hr. LC_{50} = 1.0 ppm	24-hr. LC_{50} = .11 ppm
	48-hr. LC_{50} = .56 ppm	48-hr. LC_{50} = .065 ppm
	96-hr. LC_{50} = .56 ppm	96-hr. LC_{50} = .050 ppm

Chemical: UC-21149-TEMIK

Accession No.: 091373

Study Date: October 30, 1964

Researcher: Oliver B. Cope
Fish-Pesticide Res. Lab. U.S.D.I., Denver

Submission: Petition No. 9F079B-Reference No. 47

Test Acceptability: Inadequate for the following:

a. The data submitted was nothing more than a letter from Oliver Cope to Mr. Robert Haines of Union Carbide. Only the results of the tests were submitted (no particulars were provided on how the tests were conducted).

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2. Test: 48-hr LC_{50}

Species: Goldfish (Carassius Ouratus)

Results: 48-hr. LC_{50} = 8.3 ppm

Chemical: UC-21149 (Temik Tech. 98%?)

Accession No.: 091373

Study Date: February 27, 1965

Researcher: A. J. Borash + H. M. Bryant, Jr. Union Carbide

Title: "Test Report On Union Carbide Agricultural Products"

Submission: Petition No. 9F0798-Ref. No. 49

Test Acceptability: Not acceptable to support registration for the following reasons:

1. The species used is not a good representative of a native fish.
2. The bioassay was conducted under continuous aeration.
3. It was stated that the chemical used was UC-21149. It is not known whether this is formulated or tech. grade product. (Report seems to suggest the LC_{50} values are for formulation, however, it is listed as tech. 98%).

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3. Test: LC_{50} bioassay

Species: Bluegill sunfish (Lepomis Macrochirus)

Duration Hours	LC_{50} (95% Confidence Limits) (Formulation) UC-21149 10% (ppm)	DDT (ppm)
48	1.75 (1.59 - 1.92)	0.0060 (0.0045 = 0.0080)
96	1.45 (1.24 - 1.69)	0.0056 (0.0035 - 0.0087)

In terms of active ingredient when calculated from the above figures:

Duration Hours	LC_{50} (95% Confidence Limits) (Active Ingredient) UC-21149 (ppm)	p-p'DDT (ppm)
48	0.175 (0.159 - 0.192)	0.0046 (0.0037 - 0.0061)
96	0.145 (0.124 - 0.169)	0.0043 (0.0027 - 0.0067)

Chemical: "UC-21149 10% Granular"

Title: "UC-21149-Acute Toxicity In sunfish"

Accession No.: 091373

Study Date: 1/19/66

Researcher: R.P. Beliles
Woodard Research Corp.
Herndon, Va. 22070

Submission: Petition No. 9F0798 Ref. No.: 50

Test Acceptability: The test was considered inadequate (see comments) as a basic data requirement for registration. It could, however, be used as supplemental data.

Summary:

Within one hour after the start of the exposure, signs of intoxiciation were seen at levels of 32, 18, 10, 5.6, and 3.2 ppm of UC-21149 10%. Toxic signs consisted of loss of equilibrium followed by death. All dead fish floated to the surface of the containers. It was noted that the granules of UC-21149 10% settled to the bottom of each aquaria. DDT exposure at 0.0122 and 0.0069 ppm resulted in loss of equilibrium.

Mortality Table:

Compound	Concentration ppm	Cumulative Mortality 24 hours	48 hours	72 hours	96 hours
Control	-	0/10	0/10	0/10	0/10
Control	(Acetone-5 ppt)	0/10	0/10	0/10	0/10
UC-21149 10%	32	10/10	10/10	10/10	10/10
UC-21149 10%	18	10/10	10/10	10/10	10/10
UC-21149 10%	10	10/10	10/10	10/10	10/10
UC-21149 10%	5.6	10/10	10/10	10/10	10/10
UC-21149 10%	3.2	10/10	10/10	10/10	10/10
UC-21149 10%	1.8	3/10	6/10	6/10	7/10
UC-21149 10%	1.0	0/10	0/10	0/10	1/10
UC-21149 10%	0.56	0/10	0/10	0/10	0/10

Note: This test also considered unacceptable because 10% granular material used instead of technical grade.

Comments:

1. The main reason why the test was considered inadequate was that granules of UC-21149 10% settled to the bottom of each tank. This suggests that the granuies did not completely dissolve and as such the concentrations reported may be in error. It was never stated whether or not the granules eventually dissolved.

Other:

Although the following discrepancies in the testing procedure were noted they were not considered serious enough to invalidate the study.

1. No probit analysis or mortality curve was submitted in the final report (a mortality table was included).

2. Only 10 fish/concentration were used.

3. Data were not examined by Litchfield-Wilcoxon method.

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4. Test: LC_{50} bioassay

Species: Rainbow Trout (Salmo gairdneri)

Results:

Duration Hours	LLC50 (95% Confidence Limits) UC-21149 10% (ppm)	DDT (ppm)
48	11.2 (7.8 - 16.0)	0.0050 (0.0032 - 0.0079)
96	8.8 (6.2 - 12.5)	0.0020 (0.0014 - 0.0028)

In terms of active ingredient when calculated from the above figures:

48	1.12 (0.78 - 1.60)	0.0038 (0.0024 - 0.0061)
96	0.88 (0.62 - 1.25)	0.0015 (0.0010 - 0.0021)

See note, p.5.

ID

Chemical: UC-21149 10% Granular

Title: "UC-21149-Acute Toxicity In Rainbow Trout"

Accession No.: 091373

Study Date: 3/28/66

Researcher: Woodard Research Corp.

Submission: Petition No. 9F0798 Ref. No.: 51

Test Acceptability: The Test was considered inadequate (see comments) as a basic study required for registration. It could, however, be used as supplemental data.

Summary:

Within six hours after the start of the exposure, signs of intoxication were seen at levels of 18.0 and 10.0 ppm of UC-21149 10%. This was limited to loss of equilibrium. It was noted that the granules of UC-21149 10% settled to the bottom of each aquaria. DDT exposure at 0.0069, 0.0039, and 0.0022 ppm resulted in loss of equilibrium.

Motality Table:

Compound	Concentration ppm	Cumulative Mortality 24-hours	48-hours	72-hours	96-hours
Control	-	0/10	0/10	0/10	0/10
Control	(acetone-5 ppt)	0/10	0/10	0/10	1/10
UC-21149 10%	18.0	6/10	10/10	10/10	10/10
UC-21149 10%	10.0	1/10	3/10	6/10	6/10
UC-21149 10%	5.6	0/10	1/10	3/10	3/10
UC-21149 10%	3.2	0/10	1/10	1/10	1/10
UC-21149 10%	1.8	0/10	0/10	0/10	0/10
UC-21149 10%	1.0	0/10	0/10	0/10	0/10
UC-21149 10%	0.56	0/10	0/10	0/10	0/10
DDT (77.2%)	0.0069	10/10	10/10	10/10	10/10
DDT (77.2%)	0.0039	0/10	3/10	6/10	7/10
DDT (77.2%)	0.0022	0/10	2/10	2/10	6/10
DDT (77.2%)	0.0012	0/10	0/10	0/10	0/10

Comments:

1. The main reason why the test was considered inadequate was that granules of UC-21149 10% settled to the bottom of each tank. This suggests that the granules did not completely dissolve and as such the concentrations reported may be in error. It was never stated whether or not the granules eventually dissolved.

Other:

Although the following discrepancies in the testing procedure were noted they were not considered serious enough to invalidate the study.

1. No probit analysis or mortality curve was submitted in the final report (a mortality table was included).

2. Only 10 fish/concentration were used.

3. Data were not examined by Litchfield-Wilcoxon method.

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5. Test: LC_{50}

Species: Bluegill Sunfish (Lepomis macrochirus)

Results: Temik, 0.1 ppm, Temik Sulfone >64 ppm.

Chemical: See Results

Title: Toxicity, of Temik, Temik Sulfoxide & Temik Sulfone to Bluegill Sunfish

Study Date: November 15, 1968

Researcher: Union Carbide

Submission: Petition 9F0798
Reference No. 52

Test Acceptability: Not acceptable under Section 3 Regulation by the following reasons:

1. Prohibit analysis was not submitted.
2. Test conducted under constant aeration of aquarium.
3. The LC_{50} values given did not specify time (24, 48 or 72 hrs.)
4. A 96-hr. LC_{50} was not determined (not shown in mortality TABLE either)
5. The fish used were too large.

Mortality Table:

Compound[3]	Concentration ppm	Mortality 24-hr.	48-hr.	72-hr.	% Kill 72-hr.
TEMIK	1	20/20	20/20	20/20	100
	0.5	7/7	7/7	7/7[1]	100
	0.25	4/4	4/4	4/4[1]	100
	0.125	5/20	9/20	10/20	50
	0.063	0/20	1/20	1/20	5
	0.031	0/20	0/20	0/20	0
Control	---	0/20	0/20	0/20	0
TEMIK sulfoxide[4]	16	20/20	20/20	20/20	100
	8	20/20	20/20	20/20	100
	6	17/20	17/20	17/20	85
	4	12/20	13/20	13/20	65
	2	1/20	1/20	1/20	5
	1	0/20	0/20	0/20	0
Control	---	0/20	0/20	0/20	0
TEMIK sulfone[5]	64	1/20	---[2]	4/20	20
	48	0/20	---	2/20	10
	32	0/20	---	1/20	5
	16	0/20	---	0/20	0
	8	0/20	---	0/20	0
Control	---	0/20	---	0/20	0

1. From separate range-finding study.
2. No determinations were made.
3. TEMIK--purified grade, 414RD67.
4. Sulfoxide--95.4% purified grade, kept refrigerated.
5. Sulfone--purified grade.

103.2 Subacute Toxicity

103.2.1 Mammal

Test: 15-day, 6-hr./day dermal application

Species: Rabbit

Results: Some depression of weight gain at 100 mg/kg. resulted from wet skin tests. However, 200 mg/kg on dry skin was without effect.

Chemical: TEMIK 10G

Title: 15-day dermal application to rabbits

Accession No.: 091373

Study date: 9/13/66

Test Acceptability: Cannot comment as to acceptability

Test: 28-day sensitivity test

Species: Rat

Results: No effect

Chemical: TEMIK 10G

Title: Response of Rats Living 28-days on Topsoil Treated with TEMIK 10G

Accession No: 091373

Study Date: 1/3/66

Test Acceptability: Cannot Comment as to acceptability

Summary:

All the rats survived this study with no observable adverse effects. These results suggest that soils treated to a depth of not more than 6 cm at rates as high as 500 lbs./acre or 5 times maximum recommended use level should not be hazardous to animals.

Test: Inhalation

Species: Rats

Results: No effect

Chemical: TEMIK 10G

Title: "Response of Rats to Saturated Vapors Generated Under Simulated Greenhouse Conditions."

Accession No.: 091373

Study Date: 12/20/68

Test Acceptability: Cannot Comment as to adequacy

Summary

Groups of six rats survived five consecutive daily exposures, eight hours each, to the vapors of TEMIK 10G with no observable adverse effects. The criteria of toxic stress used in this study included symptomatology, body weight gains, and cholinesterase level. The amount of TEMIK formulations used were five times greater than the anticipated maximum application rate of 100 lbs. formulation/acre.

Note: This study was reviewed 1/9/75 and found unacceptable as a core study because the technical grade was not used. [illegible]

103.2.2 Bird

Test: 10-day dietary feeding study

Species: Bobwhite quail

Results:

Compound	LC_{50} (ppm in diet)	Confidence Limits (ppm in diet)
UC-21149 10%	2,400	(1,860 - 3,096)
DOT (77.2%)	376	(298 - 474

In terms of active ingredient when calculated from the above figures:

UC-21149	240	(186.0 - 309.6)
p-p'DOT	290	(230 - 366)

Chemical: UC-21149 10% granular (TEMIK)

Title: Safety Evaluation on Fish and Wildlife (Bobwhite Quail and Rainbow Trout)

Accession No.: 091373

Study Date: 3/28/66

Researcher: Woodard Research

Submission: Petition No. 9F 0798 Ref. No.: 51

Test Acceptability: Test was considered adequate as basic data requirement for registration

Summary:

1. Birds were 8 weeks old.

2. Fed treated feed for 7-days.

3. 10 birds/concentration.

4. Data examined by Litchfield - Wilcoxon Method (1949).

Mortality Table:

Compound	Level (ppm in diet)	Mortality (Days) 1 2 3 4 5 6 7 8 9 10	Total Mortality
Control	-		0/20
UC-21149 10%	5,600	2 1 4 2 1	10/10
UC-21149 10%	3,200	3 1 1 1	6/10
UC-21149 10%	1,800	1 1	2/10
UC-21149 10%	1,000	1	1/10
UC-21149 10%	560		0/10

The following table summarizes the effects on body weight and food consumption:

Compound	Level (ppm in diet)	Mean Body Weight (g) Day 0	Day 7	Day 10	Mean Food Consumption (g/bird/day) Days 1-7	Days 1-10
Control	-	112.5	115.2	117.0	17.4	16.6
UC-21149 10%	5,600	138.8	160.6	-	14.4	-
UC-21149 10%	3,200	127.9	152.7	158.7	19.7	15.5
UC-21149 10%	1,800	128.0	133.6	136.3	12.9	12.1
UC-21149 10%	1,000	105.8	103.1	122.1	15.6	22.7
UC-21149 10%	560	152.8	141.1	148.8	14.7	20.6
DDT (77.2%)	1,800	102.7	-	-	-	-
DDT (77.2%)	1,000	109.7	-	-	-	-
DDT (77.2%)	560	101.7	102.0	104.2	25.2	9.3
DDT (77.2%)	320	90.4	99.5	114.0	19.0	21.2
DDT (77.2%)	180	132.3	147.4	146.0	19.5	11.7
DDT (77.2%)	100	134.3	135.2	141.5	17.6	16.6

During the first 7 days of study there appeared to be no significant decrease in food consumption or body weight in survivors of both UC-21149 and DDT groups. However, during the recovery period (days 8-10), birds receiving 560 ppm of DDT did show a decrease in mean food consumption (g/bird/day).

Toxic signs consisted of tremors and ataxia in birds receiving 5,600, 3,200, and 1,800 ppm of UC-21149 10 per cent and 1,800, 1,000, and 560 ppm of DDT. No such abnormalities were seen in the birds treated with 1,000 ppm UC-21149 10% or 320 and 180 ppm DDT:

Necropsy of surviving quail receiving UC-21149 10% at 3,200 ppm revealed pale livers but no visible lesions at lower doses.

103.4 Field Toxicity

Test: Field Study

Location: Clayton, North Carolina

Species: Bobwhite Quail

Outline of Study: The test birds used in this study were young adults (19 week old). They were pen-reared, unmated stock obtained from a commercial quail producer.

Birds (mated pairs) were housed in open-bottomed wooden cages, covered with half-inch hardware cloth, that measured 3'X7'X1'. A shelter and shader roof section were also provided. Each cage contained a chick fount waterer. Three ounces of supplemental untreated feed was provided daily for each cage. All pens were moved daily. Pens were positioned on recently seeded cotton land (for the most part bare ground). Tests were conducted during July and August.

Applications were made with a Noble granular applicator. Planting furrows were made with a Noble granular Applicator. Planting furrows were closed by disc and roller; side dressings were by chisel and closure was by gravity only.

Cotton variety - Carolina Queen
Row spacing 42"
3-4 plants per row-foot
1.15 acres per plot

Treatments:

1. 10 lbs. TEMIK 10G/acre applied in-furrow at planting (7-3-68) plus 30 lbs. TEMIK 10G/acre applied sidedress at squaring on 8-14-68.

2) 10 lbs. TEMIK 10G/acre applied in-furrow at planting (8-14-68).

Results: No mortalities or illnesses were noted in 69 of the 72 birds in the test. The death of one of the two birds was accidental. The other bird died 1 day after treatment. There was no direct evidence that death was caused from treatment, however, there was a good possibility that this bird could have ingested granules that were on the soil surface.

In addition, a female exhibited illness 5 days after placement on the treated area. At this time, view seedlings were emerging, and the foliage may have contained TEMIK residues. Symptoms included the inability to stand, rapid heart beat, huddling, and ataxia.

Chemical: The TEMIK 10G formulation used in this study was from a standard production run made in late 1967.

[redacted]

Title: "Field Evaluation of Potentital Hazard to Bobwhite Quail."

Accession No.: 091373

Study Date: July - August, 1968

Researcher: This is a report on the study that was conducted at the Union Carbide Agricultural Research Station, Clayton, North Carolina, during July and August, 1968. The work was done by Mr. V. A. Clarkson, Mr. B. K. Rowe, and Mr. W. H. Hensley, Union Carbide Corporation. It

fulfills the requirements of the test protocol prepared by PRD and modified in some respects by Mr. Clayton Bushong and Mr. Paul Ochs, USDA, and Dr. Richard Back, Union Carbide, on June 25, and by Dr. Thomas Shellenberger, Gulf Coast Research Laboratories, who consulted with the authors at Clayton, North Carolina, prior to initiation of the test.

Submission: Petition No. 9F0798 Ref No. 53

Test Acceptability: Adequate as supplemental data only. (See Comment Section for further clarification)

Summary:

Results of this test indicate there is some hazard to non-target avian species from the use of a granulated formulation of TEMIK to control nematodes in cotton. It would appear that birds ingesting either granules or sprouting seeds may expose themselves to lethal dosages. This study also indicates that soil incorporation of TEMIK 10G greatly reduces hazards to non-target avian species.

Comments:

Although this was a well conducted study, there are serious flaws with the experimental design. My concerns with the design include; supplementing the birds diet with untreated feed and water, pen size, and pen placement. In the past these practices and procedures have been accepted, however, recent concerns by staff members questioning the scientific validity of these methods have been challenged (see memo to J. Touhey - attached).

Test: This is a continuation of the previous small pen simulated field study conducted in Clayton, N.C.

Location: Clayton, North Carolina

Species: Bobwhite Quail

Experimental Design:

Two field studies were conducted in cotton plantings treated with TEMIK 10G at 50% above the maximum rate which is suggested for use on nematodes. Tests were conducted in May and June, 1970.

Mature bobwhite were released in single plots (75 X 100 ft.), newly planted to cotton and treated with two formulations of TEMIK 10G at the rate of 60 lbs./acre, banded-in-row and rototilled in the soil 4 to 6 inches deep. Birds were provided untreated feed and water. Test 1 lasted 20 days (May 8-28) while test 2 lasted 16 days (June 24 - July 9). (A total of 24 birds were used in each test.)

Results: Test 1 - Two female birds died during this test. At the time of death, the cotton was in the "Knuckle" stage (cotyledon leaves not exposed). Subsequent observations failed to detect any signs of birds feeding on young cotton seedlings. Weight losses occurred with practically all birds during the test period (both treated and control). Residue analysis of livers were performed on the dead birds. One bird contained 0.34 ppm TEMIK while the other contained 2.21 ppm (4th day of test).

Test 2 - One female bobwhite was found dead 2-days posttreatment. No mention was made as to whether or not a necropsy was performed. Observations revealed, that eventhough the chemical was disced into the soil, thinly scattered granules could be found in the banded zone on the soil surface. Bird weights were not recorded in this test due to the loss of many birds by other forms of wildlife.

Chemical: UC-21149 10% granular

Title: "Continued Field Evaluations on the Potential Hazards of TEMIK 10G Aldicarb Pesticide to Bobwhite Quail in Cotton Plantings"

Accession No.: 091373

Study Date: May-June, 1970

Researcher: Union Carbide Corporation

Submission: EUP - 1016 - 69

Test Acceptability: Adequate as supplemental data only. (See Comment Section for further classification)

Summary:

Again, results of these field studies indicate TEMIK 10% granular poses some hazard to non-target avian species even when soil incorporated. Because TEMIK is a systemic, birds consuming sprouting cotton seeds could ingest quantities of the chemical. However, a more likely route of exposure is ingestion of the granules themselves.

Comment:

Although this was a well conducted study, there are serious flaws with the experimental design. My concerns with the design include; supplementing the birds diet with untreated feed and water, pen size, and pen placement. In the past these practices and procedures have been accepted, however, recent concerns by staff members questioning the scientific validity of these methods have been challenged (See memo to J. Touhey - attached).

Test: Wildlife Survey

Location: Suffolk, England

Experimental Design:

Sites

Site A. Was a rectangular field of 19 acres of sugar beet. TEMIK was applied at 10 lb. per acre to 5 acres on the southern side of the field on 9th April. In addition, a small area was treated at 5 lb. and 7 1/2 lb. per acre as part of a trial. The soil was a loamy sand. The field was completely surrounded by woodland and windbreaks. To the south there was an area of mixed woodland 100 yards wide with dense undergrowth. On the west there was a 20 yard wide mature coniferous windbreak. A mainly deciduous strip of woodland, 25 yards wide, with light undergrowth occurred on the northern border and to the east mainly deciduous woodland which after 30 yards became coniferous woodland. There was dense undergrowth in this block.

Site B. Was a rectangular field of 45 acres of sugar beet. TEMIK was applied at 10 lb. per acre to 5 acres on the northern side of the field on 23rd April. The soil here was slightly heavier than on Site A. The site was less enclosed by woodland than was Site A. The deciduous windbreak to the south of the field was the same windbreak that lay to the north of Site A. To the west there was a single thin hedge

and to the north and east a double hedgegrow with a centre roadway. A large 30 acre wood was situated immediately to the north west of the edge of which was within 25 yards of the TEMIK treated section of the field. The wood consisted mainly of deciduous trees with variable undergrowth. At the south east corner there was a similar wood but much further from the treated area.

Method of Assessment

Two separate assessments were made. The Monks Wood Experimental Station carried out a trapping programme on the southern and western sides of Site A to study the effect in the small mammal population. Longworth live traps were used baited with crushed oats. Two species were studied: The Wood Mouse, Apodemus sylvaticus and the Bank Vole, Clethrionomys glareolus. Previous work has shown that the Wood Mouse is more likely to be at risk from agricultural chemicals since it moves about more in the open. The work was carried out in three phases:

(1) Preliminary - on the nights of 25th, 26th, & 27th March, 1970 using 100 traps.

(2) Pre-drilling - on the nights of 1st, 2nd, & 7th April, 1970 using 130 traps.

(3) Post-drilling - on the nights of 10th, 11th, & 12th April, 1970 using 130 traps.

In the preliminary survey sixty traps on the southern side of the field in three lines of twenty were used. The first line was 1 yard inside the woodland, the second line on the grassy headland and the third line 8 yards into the field. On the western side of the field forty traps in two lines were used. One line was at the edge of the trees and the other 10 yards into the field. In the pre and post-drilling surveys an extra thirty traps were used on the southern edge of the field to almost link it with the western grid.

The second assessment was mainly concerned with the effect on birds, but some mammals and insects were also observed. The observations were carried out by M. Coe, a competent bird watcher, and a member of the Mi-dox trials staff assisted by the author and other members of the Mi-dox staff, particularly for the searches organized at each site. In addition Peter Clarke of the Holme Bird Observatory was able to visit the sites on four occassions and provide invaluable assistance.

Three periods of observation were spent on Site A prior to application and two periods at Site B. Post application observations were carried out at 1 and 4 days at both Site A and B. Further post application observations were carried out at Site A after 19 and 32 days and Site B after 28 and 43 days. A total of 111 hours was spent on Site A and 66 hours on Site B. The additional time spent on Site A was mainly due to the dense undergrowth which made the search for dead birds difficult.

After application each site was searched on four occassions. As well as the field the following areas were searched:

Site A. The whole area of woodland to the south west and north of the field together with a strip of woodland 30-40 yards wide to the east. On the final visit on the 11th May the southern woodland could not be searched as thoroughly as previously as the Gamekeeper felt this would disturb the many sitting Pheasants.

Site B. The hedgerows to the east and west of the site, the area of search being extended about 200 yards south of the southern boundary of the TEMIK treated area and also for between 30 and 50 yards beyond the field boundary to the east and west. The northern hedge area was also searched and again the area was extended for up to 70 yards into the neighbouring field. The wood to the north west was also searched particular attention being paid to the area nearest the site and to parts of the wood where pigeons had been seen to congregate.

Results:

(a) Small Mammal Trapping

Trapping in the preliminary phase indicated that the number of small mammals present was not very great. Seven Bank Vole were captured and three of these recaptured subsequently. In the case of the Wood Mouse, the figures were 11 and 15. Only the Wood Mouse was trapped out in the field. In the pre-drilling study there were more captives due to the extra traps. Twelve Bank Voles were identified and six recaptured and twenty-one Wood Mice captured and fourteen recaptured. Of the 33 animals captured 17 were already marked from the preliminary survey.

In the post drilling results a total of 14 Bank Voles were captured and recaptured and 48 Wood Mice. Out of this total only 11 were animals that had not been captured in the previous phases.

(b) Birds

Site A. On this site a total of 57 species were identified on, over or around the 19 acres of sugar beet. Of these 57 species 44 were seen before the field was treated, 41 species after treatment and 38 species both before and after treatment. Only six species whose status could be classified as resident were not seen both before and after treatment and of these six species three were only seen after application. During the 7 weeks the site was under observation estimates of bird numbers were obtained wherever possible. Certain birds can be regarded as test species in that their habits make them most likely to be affected by a chemical such as "TEMIK(R)".

A note was made of nests found on Site A. No nests were found before the application of TEMIK(R) but after application the following were recorded:

Woodcock	4 eggs which subsequently hatched
Pheasant 1	3 eggs (removed by Gamekeeper)
Pheasant 2	6 eggs (increasing to 15 eggs)
Pheasant 3	16 eggs (removed by Gamekeeper)
Song Thrush	Bird on nest
Blackbird 1	0 eggs
Blackbird 2	4 eggs
Mistle Thrush	2 fledgelings
Dunnock	4 eggs

Site B. On this site a total of 51 species were identified and of those 31 species were seen before the field was treated, 44 species after treatment and 24 species both before and after treatment. On this site we were not as efficient as on Site A at seeing resident species both prior to and after application. Four resident species were only seen before but not after application (Partridge, Lapwing, Tawny Owl, and Green Woodpecker) and eleven resident species were only seen post application.

The following nests were noted post application almost all of them in the hedgerows which surrounded the site on three sides:

Pheasant	20 eggs
Song Thrush	4 eggs later 3 young
Blackbird 1	4 eggs later 2 young
Blackbird 2	4 eggs later 3 young
Blackbird 3	5 eggs later nest empty
Blackbird 4	4 eggs later 1 young

Blackbird 5	0 eggs later nest empty
Blackbird 6	Nestlings and 1 egg later nest empty
Chaffinch	Nest partly built
Dunnock 1 & 2	Several eggs in each
Longtail tit	0 eggs
Wood Pigeon	4 nests

A total of 14 dead birds; five pheasants, eight pigeons and one yellow hammer were found during the searches. Thin layer Chromatographic analysis of various organs (crop, lungs, gizzard, and gut) revealed residues of TEMIK and TEMIK sulphoxide that ranged from 0.5-5.0 ppm (no detectable residues were found in four of the dead birds). In addition, colorimetric results of crop extracts from pheasants #2 and #3 revealed residues of 258 and 288 ppm, respectively (8.5 and 3.9 mg/kg, respectively).

Results of the mammal surveys indicated there were no significant changes in population sizes as a result of the treatment. Approximately 80% of both species (Wood Mice and Bank Voles) marked prior to treatment were recaptured posttreatment. However, the sample populations were really too small to provide any statistical significance. In addition, it must be remembered that behavior patterns for these particular species may have precluded their use of treated areas whereas the behavior patterns of other mammalian species might not.

Test: Field Toxicity

Species: Valley quail (Lophortyx californicus) and Ring-necked pheasants (Phasianus colchicus)

Location: Greenfield, California

Experimental Design: Sugar beets previously treated at planting time (February 5, 1970) with TEMIK 10G or TEMIK 10GC at 20 lbs./acre were side-dressed twice in the post-emergence period. The first application of each TEMIK formulation was shanked in 2-inches to the side and 2-inches below bed surface when the plants had reached the 6 to 8 true leaf stage (March 10). Ten days after thinning (April 24) the last treatment was made (May 4). Again, 20 lbs./acre were side-dressed 4-inches to the side and 3-1/2-inches deep into the moisture lateral root zone. The beets had attained a growth of 12 to 14 inches and were about one-half mature. Weed growth was checked by hand weeding. All plots received supplemental fertilizer (March 14) and water (1-acre inch on March 18).

One day after the last treatment, pheasants and quail were caged and placed over the treated zones according to the plot diagram (Figure 1). According to expert opinion valley quail do not feed on large sugar beet plants whereas pheasants occasionally do. Therefore, more pheasants were evaluated than quail. Cages containing the latter were placed only in the non-irrigated plots to simulate a dryland beet culture condition. All birds were weighed just before and after the 7-day exposure period.

Because of mating problems, only female pheasants were used. Two birds were placed in each 4x4x16 foot cage which had been set parallel to and over one furrow and two beet beds. A total of six cages of pheasants were placed over each TEMIK formulation--three in the furrow irrigation zone and three each in the dryland area. After the birds were placed, the furrows (in the designated area) were irrigated with sufficient water to soak the beds beyond the beet plant line. Only one "untreated" cage was used and that one was placed in the irrigated section. Cracked grains (Purina Turkey Pellets) and water founts were placed in each pheasant cage. None of the cages were moved during the test period which was terminated after one week of exposure.

Sixteen valley quail were obtained from the California Fish and Game Department, Sacramento. They were transported in game bird boxes and transfereed to the large holding pen one day prior to the exposure period (Figure 2). All birds were used as follows: Plot A (TEMIK 10G) contained 4 males, 2 females; Plot B (untreated) and Plot C (TEMIK 10G) received 2 males, 3 females each. Purina Bird Chow and water founts were placed in each quail cage. The cages were not removed from the original placement during the trial.

After removing the birds from the test site all were weighed and replaced in the holding pen for a ten-day observation period. No rainfall occurred during the trial period and the temperatures were normal (50°F. night, 85°F. day low-high).

Title: "Field Evaluations of Potential Hazard of TEMIK 10G Aldicarb Pesticide to Valley Quail and Ring-necked Pheasants in Sugar Beet Plantings"

Results: Pheasants fed heavily on sprouting sugar beet stalks. Within 5 days most of the vegatative matter in the cage was consumed. None of the birds showed any toxicological symptoms during or at the end of the study. According to Fish and Game representatives, weight losses in birds were due to handling and caging.

Feeding by Valley quail on sugar beet tops was minimal. However, within 8 hours of caging, one male bird was found dead. In addition, two other birds in the same cage manifested extreme ataxia and long plumes of spittle developed from their beaks. One of these birds eventually died. Residue analysis revealed that the first bird that died contained 1.04 ppm total toxic residues of TEMIK in its liver while the other bird had 0.32 ppm. Leaf samples taken randomly showed an average of 18.5 ppm. Birds were exposed to the toxicant through ingestion of granules at row end.

Summary:

This study demonstrates that in all probability, hazards to pheasants and quail ingesting tops of TEMIK treated sugar beets are minimal. However, there does appear to be a hazard to birds ingesting exposed granules. Although granules are soil incorporated both at planting and for side-dressing, a certain amount remain on the soil surface. In addition, spills or poor application methods may also result in exposed granules. Such was the case in this study when it was reported that "a few granules on the soil surface of one row were round near the end of the cage area, undoubetdly resulting from a spillage or leak in the applicator drop tube."

Chemical: TEMIK 10G

Accession No.: This information was taken from a report entitled, "TEMIK 10G Aldicarb Pesticide EPA Registration No. 1016-69 New Information on Wildlife. This report was submitted by R. C. Back to Mr. H. G. Alford on July 6, 1971.

Study Date: September 15, 1970

Researcher: R. G. Haines
Union Carbide Corporation

Test Acceptability: Although there were numerous shortcomings with the experimental design (per size, food and water supplements, etc.) this study is adequate to support registration. more specifically, the pheasant part of the study is considered aequate. The reasons why this part of the study was considered adequate include:

1. It was documented that pheasants actually consumed treated vegetation.

2. Residue analysis of the treated vegetation were conducted and results reported.

3. Methods of application, dosage rates, etc., used in the test were comparable to those specified on label.

Comments:

Spilled groups of granules in the field, if found by birds are hazardous, if ingested prior to becoming soaked by rain or irrigation. Quail are much more apt to take up the product apparently as grit than are pheasants.

No mortalities of either species occurred where [redacted] granules [redacted] were used. However, this may be happenstance since there were no indications of spillage in any of the plots treated with this TEMIK 10G prototype.

Test: Field Toxicity

Location: Black River Wildlife Mgt. Area Chester, New Jersey

Species: Ring-necked Pheasant

Title: "Potential Hazard of TEMIK 10G Aldicarb Pesticide to Ring-necked Pheasant from Simulated Spills."

Experimental Design:

Period of Testing

1. Period of acclimatization--March 16, 1970 to May 4, 1970 (50 days)

2. Period of exposure to simualted spills--May 5, 1970 to July 5, 1970 (63 days)

3. Period of exposure to TEMIK in feed hoppers--July 6-20, 1970 (15 days)

Description of Test Birds

1. Species--Ring-necked pheasant - Phasianus colchicus terquatus

2. Age--approximately 12 months

3. Sex--2 males, 8 females

4. Weight--3-5 pounds

5. Source--Rockport Game Farm, Rockport, N.J. (N.J. Div. of Fish, Game, and Shell Fisheries)

Test Enclosure - 40' x 60' x X6

Simulated Spills

1. Six-8 oz. spills were distributed within the enclosure on the same pattern used in the cottontail tests.

2. Following the small spill tests, 24 ozs. of TEMIK [redacted] was placed in the food hopper with the food.

3. Finally, all food was removed from the hopper, and replaced with 48 ozs. of TEMIK.

4. All spills were marked with plastic flags so that the activity of the birds in relation to the spills could be observed from outside the enclosure without disturbing them.

Results:

Behavior of Birds

The birds did not show any interest in the TEMIK spills when first placed in the enclosure on May 5, 1970. This lack of interest held true throughout the entire simulated spill test period. There is no evidence that any of the granules were consumed.

From the first day the birds were placed in the enclosure, one male dominated the others and attacked it frequently. On May 12, 1970, it was found dead. Mortality is attributed to the numerous pick wounds it received from the other birds.

The females began laying eggs in late April, and at least 200 eggs were removed from the enclosure by the end of the study period. Only one hen succeeded in hatching a chick, though it soon died. All eggs appeared fertile, except for approximately a dozen collected during the last two weeks of the test period which exhibited thin-leathery shells. However, eggs of this type are not unusual toward the end of the laying period.

The failure of the birds to incubate successfully is not unusual either. Pen-raised birds are noted for their lack of maternal instincts. However, several attempts at incubation were recorded.

Mortality-possibly due to the ingestion of TEMIK [redacted]

Only one case of mortality occurred that could possibly be the result of TEMIK poisoning. A hen was found prostrate at 12:10 p.m. on July 16, 1970. It died at 1:05 p.m. while being examined by this investigator. This death occurred 6 days after all feed was removed from the hopper and replaced the TEMIK 9[redacted] The remaining 8 birds were exposed to the TEMIK filled hopper for an additional 5 days before release, but no other mortalities occurred. The remaining birds (1 male and 7 females) were released 7/21/70.

Accession No.: This information was taken from a report entitled "TEMIK 10G Aldicarb Pesticide EPA Reg. No. 1016-69 New Information on Wildlife."

Study Oate: 9/17/70

Researcher: R. C. Lund, Wild, Biologist
Div. Fish and Game
New Jersey

Test Acceptability: Adequate to support registration

Comments:

This study points out that hazard to pheasants from spills or accidents is minimal. (Tends to confirm other previous studies) However, mortality may occur in marginal pheasant range where natural foods are at a minimum.

MATERIALS AND METHODS

[redacted] One corner of a 40-acre cotton field was selected for treatment. A solid block of 32 rows with 38-inch centers by 150 feet were side-dressed with TEMIK 10G at 30 lbs./acre by a two-row Clampco granular applicator mounted on a tractor. Placement of the granules was 6 to 8-inches to both sides of the row and 2 to 4-inches deep. The cotton had reached the 6-node (10 to 12 leaf stage) but had not begun squaring. Cool weather had prevailed in the northern end of the San Joaquin Valley during

the spring and cotton plantings generally were slow in growing. Soil was dry and the cotton showed signs of stress for water. Treatment was made on June 16, 1970.

Both the treated area and an adjoining smaller untreated block (15 rows x 140 feet) were completely surrounded with 1-inch mesh fencing, five feet high.

Immediately following treatment and fencing, valley quail and ring-necked pheasants were introduced into the enclosures as follows:

	TEMIK Treated	Untreated
Adult quail	21	10
Immature pheasants	10	5
Adult pheasants	12	5

All birds except the immature pheasants were transferred from the holding pen in Greenfield, California and had been previously used in TEMIK 10G trials on sugar beets (see Reports on Trials I, II, III). Immature pheasants were supplied by the California Department of Fish and Game. The adult pheasants were in a weakened condition, and the quail were highly nervous. All birds were freshly wing-clipped and leg-banded. No weights were recorded in this trial.

In addition, 5 adult and 5 immature pheasants were individually equipped with battery-operated, radio transmitters attached by means of a harness around the neck and over the back (Figure 3). The transmitters emitted signals each on different frequencies which were picked up by a special receiving device equippped with rhomboid antenna (Figure 4). The technique of locating test animals by radio-telemetry has been investigated by the California Department of Fish and Game for several years, under the direction of Mr. Herbert Hagen, Wildlife Biologist. By triangulation procedures, birds could easily be located, no matter what their dispositon. Transmitter fitted birds were released in the treated zone only. Water and feeding founts were placed in each area at the outset of the Trial.

Observations on all bird or animal life in or around the target area were made twice daily for four days and then once per day thereafter. The test was terminated 13 days after initiation.

Title: "Continued Field Evaluations on the Potential Hazard of TEMIK 10G Aldicarb Pesticide to Valley Quail and Ring-necked Pheasants in a Cotton Planting."

Results: Three days after treatment a total of 11 birds had died (7 quail, 4 immature pheasants) in the treated area. Analysis of five quail, found dead one day after exposure, showed 3 birds to have detectable aldicarb carbamate residues in the liver (0.46-0.85 ppm) and two birds had none. Pheasant livers were not analyzed due to a loss in transit. Cotton leaves taken at random from the treated area had a combined residue of 19.5 ppm one day after treatment.

(Reviewers Note)

As a result of a single observation of feeding wild quail it was reported that these birds show no preference for spilled TEMIK granules. A similar statement was made for pheasants. As such, the researchers purposed that wildgame birds are not attracted to the granules. Based on this single observation the researchers question the validity of comparing what happened during these field trials with natural conditions and situations. To this scientist, such an assumption is grossly inappropriate. In order to determine whether or not wild birds will feed on granules adequate testing must be conducted. A determination, based on single observations, is not only amateruish but extremely poor science.

Accession No.: This information was taken from a report entitled "TEMIK 10G Aldicarb Pesticide EPA Reg. No. 1016-69 New Information on Wildlife."

Study Date: May, 1971

Researcher: R. G. Haines
Union Carbide

Test Acceptability: Adequate to support registration.

Summary:

1. Dead quail had residues in liver ranging from 0.46-0.85 ppm.

2. Cotton leaves had 19.5 ppm residues 1 day posttreatment.

3. Mortality of birds reached nearly 50 percent due to exposed granules at row ends.

4. Mortality of quail was due solely to spilled granules at row ends.

5. Debilitation caused by exposure to TEMIK could have contributed to high predation.

6. Effects on mourining doves feeding on TEMIK granules difficult to access because flight activity prevented observation.

7. It, as previous studies suggest, pheasants avoid ingesting granules, exposure to TEMIK poisoning must have been indirect, that is, through the consumption of treated vegetation. Although the sugar beet study found no mortality, as a result of birds eating foliage, it must be remembered those birds were adults. Pheasants used in this study were immatures. This suggests differential mortality due to age (probably due to body weight as immatures weigh less than adults) is a distinct (and I might add not uncommon) possibility. Support for the body weight theory can be found in the quail tests where mortality as a result of exposure to TEMIK granules is well documented.

Additional Oata:

Mortality Table

Area	Species	Count of Birds					
		Start	End	Dead	Predator	Escape	Unknown
TEMIK	Quail	21	9	9	0	3*	--
	Pheasants(I)	10	0	4	3	0	3
	Pheasants(A)	12	9	0	2	0	1
Untreated	Quail	10	6	0	0	2*	2
	Pheasants(I)	5	2	0	0	0	3
	Pheasants(A)	5	4	0	0	0	1

*Found in the other enclosure.

Comments:

1. A large single enclosure appears to be better for evaluating the effects of TEMIK pesticide on wildlife and their habits than do small cages. Susceptibility to predation is a chief disadvantage.

2. Spilled TEMIK granules at row ends present a hazard to quail and pheasants.

3. Radio telemetry was successful in this trial. However, equipping and handling a project of this nature by telemetry presents many cost problems.

4. Weeder geese were not affected by maximum side-dress treatment of TEMIK 10G to cotton.

104.0 Hazard Assessment

104.1 Discussion

The proposed registration calls for the use of TEMIK 10G and 15G to control certain insects, mites, and nematodes in dry beans and soybeans. Label directions specify a maximum rate of 2.1 lbs. a.i./acre to be used on dry beans while a maximum rate of 3.0 lbs. a.i./acre is recommended to control cyst nematodes in soybeans. Only one application, at planting, is recommended. Granules are soil incorporated 2-4 inches deep.

The carbamate insecticides, like organophosphorous insecticides, are very active inhibitors of the enzyme, cholinesterase, a vital component of the neuromuscular system of insects. However, the carbamates differ from the phosphates in that they are competitive rather than irreversible inhibitors of this enzyme. One of the surprising features is the synergistic action of carbamates which results from their combination with piperonyl butoxide, sesamex, sulfoxide, MGK 264, and other materials that are used as pyrethrin synegists.

The carbamates act by contact or stomach poisoning and are not fumigants or vapor toxicants.

TEMIK is a relatively new systemic carbamate that is currently registered for use on at least cotton and potatoes. It is effective as an insecticide, acarcide and as a nematicide. The product is extremely hazardous and must be handled with great care. Atropine sulfate is effective as an antidote.

TEMIK or Aldicarb, as it is sometimes called, is the most highly toxic carbamate on the market today. Its acute oral LD_{50} to laboratory mice is 1.0 mg/kg while its acute dermal LD_{50} to mice is 5.0 mg/kg. The LC_{50} to bobwhite quail was found to be 240 (186-309) ppm. The acute oral LD_{50} test for an avian species has not been conducted.

TEMIK is an extremely active inhibitor of the neuromuscular system of insects. Its toxicity comes from the rapidity with which it out competes the enzyme for position on the substrate acethylcholine. TEMIK can be synergized by piperonyl butoxide, sesamex, sulfoxide, MGK 264, and other materials that are used as pyrethrin synergists.

As previously mentioned, the carbamates are competitive rather than irreversible inhibitors of the enzyme cholinesterase. Subsequently, cholinesterase inhibition is spontaneously reversible and recovery from a sub-lethal dose should be rapid. This suggests that there will be no cumulative effect, such as occurs with most organo-phosphate pesticides, from TEMIK poisoning.

Under natural conditions, TEMIK undergoes oxidation to become TEMIK sulfoxide which undergoes further oxidation to become TEMIK sulfone (sulfocarb). Although there is a paucity of environmental fate information for TEMIK and TEMIK sulfoxide there are some data available on TEMIK sulfone.

When applied into moist soil at planting, or within one week of planting, TEMIK sulfone is rapidly absorbed by roots and translocated throughout all parts of the plant. TEMIK sulfone provides residual protection against most piercing and sucking insect pests upwards to 6 weeks, depending on growing conditions, application rates and pest species. Tests indicate that systematic activity diminishes as the plants mature.

Although the absorption coefficient (ratio of the pesticide concentration in the soil colloids to its concentration in soil water is quite low (Q=2) indicating high mobility in the soil) studies suggest little or no leaching of sulfocarb is expected, below the top layer of soil, under field conditions. As such, translocation is upward into the vegetative tissues with very little, if any, downward movement.

TEMIK sulfone is a systemic carbamate that is effective as both an insecticide and nematicide. This product is considerably less toxic than its parent compound TEMIK. The mallard duck oral LD_{50} is 33 mg/kg while the 96-hour LC_{50} for bluegill sunfish is >64 ppm.

104.1.1 Adequacy of Data

Refer to each study

104.1.2 Additional Data Required

See 105.0 Conclusions

104.1.3 Likelihood of Exposure to Non-target Organisms

Soybeans are a major agricultural crop and as such the likelihood of pesticidal exposure to non-target organisms is great. However, due to a lack of Environmental Chemistry data on TEMIK's fate in the environment certain areas of non-target contamination cannot be addressed. The following discussion reflects this situation.

Field tests repeatedly demonstrate that the granulated formulation of TEMIK causes non-target mortality especially to avian species. Although some mortality has resulted from birds feeding on treated vegetation most deaths are due to birds ingesting granules. Birds probably consume these granules as grit. It ~~is, rather than a food source,~~ interesting to note that although great care is taken to soil incorporate these granules (as per lable directions) a certain number invariably remain on the soil surface. This problem is compounded when applicators fail to disc under spills or areas at row ends. Misapplication due to faulty equipment also contributes to the problem. Obviously, misapplication or failure to follow label directions could result in large quantities of granules being exposed on the soil surface.

The data suggests that hazard from ingestion of TEMIK granules is correlated to a bird's body size. Tests repeatedly showed that smaller birds, such as quail and dove, were more susceptible than pheasants. Therefore, although adults of these larger bird (pheasant) species do not appear that susceptible, immatures for these (pheasants) species may well be.

In conclusion, it would appear that the toxicological properties and hazards of TEMIK are very similar to those of carbofuran. Both are extremely toxic quick knock-down agents with little or no chance of accumulating within an organism. In addition, granulated formulations of the products greatly reduces hazard (but does not eliminate) to non-target organisms. However, if TEMIK is formulated as a wettable powder or emulsifiable concentrate serious adverse environmental effects may occur. (Carbofuran when sprayed on alfalfa has killed large numbers of geese and other waterfowl grazing on this crop).

104.1.4 Classification

Will not be determined until such time as all basic and conditional studies have been completed.

105.0 Conclusions

A. The Environmental Safety Section objects to the proposed Registration of TEMIK for use on dry beans and soybeans for the following reasons:

Prior to consideration of registration the following basic studies must be either referenced or submitted:

1. A 48-hour LC_{50} for one species of aquatic invertebrate (preferably daphnia)

2. An 8-day dietary LC_{50} for one species of wild waterfowl (preferably the mallard duck)

3. An acute oral LD_{50} for either one species of wild waterfowl (preferably the mallard) or one species of upland game bird (preferably the bobwhite quail).

(Note: The species used in the acute oral study should be the same as one of the species used in dietary study.)

4. A 96-hr. LC_{50} for one species of cold water and one species of warm water fish.

(Note: The registrant has submitted numerous fish bioassay's, however, for various reasons these studies have been found inadequate to support registration.)

B. The following lable precautions/modifications must be made prior to any registration:

1. Modify label to read under "USE DIRECTIONS" - "Granules must be worked into the soil to a depth of at least 2 inches to provide maximum performance and to minimize hazards to birds. Oeep disc any spills of granules at row ends immediately after application to prevent birds from feeding on exposed granules."

2. Modify label to read under "ENVIRONMENTAL HAZARDS" - "This product is toxic to fish, birds, and other wildlife. Birds feeding on treated areas may be killed. Keep out of lakes, streams, and ponds. Do not contaminate water by cleaning of equipment or disposal of wastes. Apply this product only as specified on this label."

C. Results of field studies suggest ingestion of IEMIK may adversely affect food consumption and body weight gains in avian species. As such, the following conditional study will be required prior to registration.

A laboratory feeding study using bobwhite quail

We suggest the registrant contact this section regarding proposed protocol for this study.

D. Pending results of basic and conditional studies additional tests and/or label modifications/precautions may be required.

HFTC

R. W. Felthousen
Environmental Safety
EEEB

4/9/77

Protocol for small pen simulated field test to evaluate pesticidal hazards to birds.

Richard W. Felthousen, Assistant Specialist
Environmental Safety Section

J. Touhey, Chief
EEEB

THRU: J. Akerman, Section Head
Environmental Safety

The purpose of this paper is to call your attention to some of the concerns Environmental Safety has with the protocol for the small pen simulated field test to evaluate pesticidal hazards to birds. The paper was drafted in view of recent comments by staff members who feel the current protocol is grossly inadequate. Specifically, the section believes the protocol has too many built-in biases that reduce hazards far below that which birds would normally encounter under free-ranging conditions. Our primary concerns with the protocol include the following:

Pen Size

The protocol states that each pen shall contain approximately 20 sq. ft. of inside area or approximately 10 sq. ft/bird. Obviously, confinement in such a small area greatly reduces a birds exposure to the contaminated environment. To off-set this limitation the protocol recommends that pens be moved daily or as required ("or as required" has never been defined). Supposedly, this practice would increase hazard as well as maintain adequate vegetative cover within the pen. Unfortunately, there are numerous reasons why this approach has proven unsuccessful. First, many of the testing facilities simply do not move the pens once they are positioned. One of the reasons for this is, if the pen has been constructed according to protocol (i.e., the bottom has not been covered) the birds would have to be handcaptured and removed before the pens could be moved. Although it sounds easy, handcapturing birds from a 20 sq. ft. pen without harming them or letting them escape can be difficult and time consuming. In addition, many testing facilities claim that continued relocation puts undue stress on the birds. Secondly, to avoid this inconvenience many test labs simply cover the bottom of the pen with hardware cloth. This not only eliminates the handcapturing problems and facilitates pen handling but also eliminates having to stake the pens to the ground to prevent predation. Unfortunately, however, this practice also flattens down most of the vegetative cover inside the pen and thus prevents the birds from feeding on much of their natural diet. Although this reduces hazard for all formulation types it is especially bias against granulated formulations. Thirdly, and perhaps most importantly, studies have shown that no amount of pen movement would expose the birds to the same hazards that a free-ranging bird would encounter.

THRU:

Test Conditions

The protocol calls for the pen to be placed in an area representative of the proposed use pattern. The example given was a cotton field. The fallacy with this procedure is that most bird species, especially [illegible] quail, prefer "edge" areas and as such spend only a relatively small percentage of their time occupying monocultures such as cotton or [illegible]. The latter approach, from an exposure stand-point, would be to locate the pens along field borders in the seasonal vegetation [illegible] by the bird at time of application.

Test Procedures

Our greatest concern with the current protocol involves the supplementing of the birds diet with untreated food and water. Numerous studies have shown the primary route of pesticidal exposure in most animals, especially birds, is ingestion of contaminated food. Supplementing the birds diet with "clean" food and water eliminates this source of contamination. Based on my experience with quail, I would say that most of the birds would restrict their diet to the untreated feed and water, especially if the pesticide acted as a repellent.

Any system used to evaluate hazard, from pesticidal use, must be multidiscipline in scope and predicated on valid scientific data. In addition, the system should be structured enough to provide a logical step-by-step decision making approach and yet be flexible enough to allow for scientific judgment. A cookbook approach to hazard evaluation simply doesn't work. Environmental Safety is currently using a flow-chart approach, based on an in-house working paper entitled, "Criteria Upon Which to Trigger Exercise of Conditional and Special Tests for Avian Wildlife", to evaluate avian hazards. This paper was developed, at our request, by R. K. Tucker of the C & E Division. The small pen simulated field test is an intermediate step between laboratory and full field monitoring studies and as such is an integral part of the flow-chart scheme. Obviously, this Section's lack of confidence in this test greatly jeopardizes the entire flow-chart approach to hazard evaluation.

Therefore, the Environmental Safety Section suggests that the protocol for the small pen simulated field test be reviewed as to its adequacy, especially in those areas previously mentioned. This review can best be done by Richard Tucker, C & E Division. We suggest that a member from this section participate in these discussions.

Please indicate whether or not you concur with our concerns and recommendations.

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