EEE BRANCH REVIEW

DATE: IN ______ OUT ______ IN 2/24/77 OUT 9/7/77 IN ______ OUT ______

FISH & WILDLIFE ENVIRONMENTAL CHEMISTRY EFFICACY

FILE OR REG. NO. 1016-69, 78

PETITION OR EXP. PERMIT NO. 6F1829

DATE DIV. RECEIVED 7/13/76

DATE OF SUBMISSION

DATE SUBMISSION ACCEPTED 2/20/76 3CID-yes-2B

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

PRODUCT MGR. NO. 12 Sanders

PRODUCT NAME(S) Temik

COMPANY NAME Union Carbide Corp.

SUBMISSION PURPOSE Added new use on oranges.

CHEMICAL & FORMULATION Aldicarb (2-methyl-2-(methylthio) propionaldehyde O-(methylcarbamoyl) oxime) (Temik)

1.0 Introduction

1.1 Aldicarb, Temik

Both products registered.

10% a.i. - #1016-69
15% a.i. - #1016-78

1.2 Accession # 091372, Vols. 2 of 6, 4 of 6, and 5 of 6.

Accession # 096240, July 1977 - Compilation book of above vols.

1.3 See other reviews.

PP # 6F1829	8/23/76
1016-EUP	11/4/75

1.4 The registrant is proposing a new use on oranges and a tolerance in or on oranges of 0.3 ppm for combined residues of aldicarb and its metabolites Temik-sulfoxide and sulfone. The registrant is also proposing a tolerance of 0.6 ppm in or on the animal feed; dried citrus pulp from oranges for aldicarb and its residues aforementioned.

2.0 Directions for Use.

Dosage TEMIK 15G/Acre	Dosage TEMIK 10G/Acre	Time of Application	Recommended Application
33	50	Just prior to or during spring flush of foliage growth.	Apply granules in a 2 to 4 foot wide continuous band at the outer edge of the dripline on two sides of the tree, incorporate granules 2-3 inches into the soil and follow with irrigation OR, apply granules in a 2 to 4 foof wide band at the outer edge of the dripline around the trees, incorporate granules 2-3 inches into the soil and follow with irrigation.
67	100		

Oranges

- Do not make more than one application per year.

2.1 Disposal

Keep out of any body of water. Do not contaminate water when cleaning of equipment or disposing of wastes.

3.0 Discussion of Data.

3.1 Physico-chemical degradation.

3.1.1 Hydrolysis - data submitted or referenced.

3.1.2 Photodegradation - data not submitted or referenced.

3.2 Metabolism

3.2.1 Aerobic soil - data submitted or referenced.

3.2.2 Effect of pesticides on microbes - data submitted or referenced.

3.2.3 Effect of microbes on pesticides - data not submitted or referenced.

3.3 Mobility

3.3.1 Leaching - data submitted or referenced.

3.3.2 Volatility - data submitted or referenced.

3.4 Field Dissipation

3.4.1 Soil - data submitted or referenced.

3.5 Accumulation

3.5.1 Fish accumulation - data submitted or referenced.

3.6 Environmental Chemistry data submitted ACC #091372, Petition #9F0798, 4/18/68, Vols. 2 of 6, 4 of 6, and 6 of 6.

1. Andrawes, N.R. and W.P. Bagley. Fate of C^{-14} TEMIK in cultivated soil. UCC Project Report 9218. May 24, 1968.

2. Andrawes, N.R. and W.P. Bagley. Degradation and carry-over properties of 2-methyl-2-(methylthio) propionaldehyde O-(methyl=carbamoyl)oxime (TEMIK) in soil. UCC Rpt. 10494. November 19, 1968.

3. Bull, D.L. 1968. Metabolism of UC 21149 [2-methyl-2-(methylthio) propionaldehyde O-(methylcarbamoyl) oxime] in Cotton Plants and Soil in the Field. J. Econ. Entomol. 61:1598-1602.

4. Bull, D.L., J.R. Coppedge and R.L. Ridgway. Fate of TEMIK in soil with special references to chemical changes, movement and volatilization. ARS, USDA, College Station Project Report. 1968.

5. Clarkson, V.A. The persistence of TEMIK in an agricultural soil as indicated by field and laboratory bioassay. UCC Project Report 10490. November 11, 1968.

6. Clarkson, V.A., B.K. Rowe and R.R. Romine. Field evaluation of the persistence and movement of TEMIK and its carbamate metabolites in soil. UCC Project Report 10485. October 28, 1968.

7. Clarkson, V.A., B.K. Rowe and R.R. Romine. Field evaluation of the persistence of TEMIK and its carbamate metabolites in pond water and their effect on pond fuana. UCC Project Report 10491. November 11, 1968.

8. Coppedge, J.R., D.A. Lindquist, D. L. Bull and H.W. Dorough. 1967. Fate of 2-Methyl-2-(methylthio) propionaldehyde O-(methylcarbamoyl) oxime (TEMIK) in Cotton Plants and Soil. J. Agr. Food Chem. 15:902-910.

9. Romine, R.R., C.B. Halstead and C.E. Gibson. Leaching characteristics of TEMIK 10G in soils. UCC Project Report 10902. November 11, 1968.

10. Spurr, Jr. H.W. and E.L. Chancey. Interactions between TEMIK and microorganisms and their importance to ecological relationships in soil. UCC Project Report 9208. April 22, 1968.

We have this data to review.

3.6.1 Environmental Chemistry data submitted ACC. # 096240 July, 1977, Compilation book.

Bull, D.L., Stokes, R.A., Coppedge, J.R. and R.L. Ridgway, 1970. Further Studies of the Fate of Aldicarb in Soil. J. Econ. Entemol. 63:1283-1289.

Lykings, H.F., "TEMIK Insecticide. The Effect of Temperature and pH on the stability of TEMIK Sulfoxide, and TEMIK Sulfone in Water," UCC Informal Report, June 27, 1969.

U.S. Environmental Protection Agency- "Substitute Chemical Program. Initial Scientific and Mini-economic Review of Aldicarb," EPA-540/1-75-013 (1975).

We have this data to review.

3.7 The EC data that we have received is of many mixed studies under one general title. We will index each substudy found under the general title as to the type of data category it falls (i.e. leaching, etc.) We will give the original reference number (1-10), the number the tab that it corresponds to (PP # 9F078, Vol. 2 of 6, Acc. # 091372), and finally, the page number inside the tab that the specific type of study can be located. This information is in tabular form in sect. 3.7.1.

3.7.1 Acc # 091372 Petition # 9F0798 4/18/68, Vol. 2 of 6, 4 of 6, and 6 of 6.

No. of the reference in section 3.6	No. of the TAB corresponding	#Page number, type of study in Tab.
1	10	1-FD
2	12	1-FD
3	4	1598-PM-ANC, FD-ANC
4	9	2-SA,3-FD-ANC,4-VOLA,5-ANC, 7-V,6-V
5	11	1-ANC
6	14	1-FD
7	16	1-FS
8	2	902-PM-ANC, 907-SA
9	15	1-LA
10	13	1-M

# SA	aerobic soil metabolism
FED	field dissipation
PM	plant metabolism
ANC	ancillary
LA	leaching
(V)	microbiological
M	volatility
FS	fish accumulation

4.0 Hydrolysis. The effect of temperature and pH on the stability of Temik, Temik-sulfoxide, and Temik-sulfone in water. ACC # 096240, July 1977, Tab # III-1.

Compound	pH	Half-life 80°C	100°C
TEMIK	6	19.0 hrs.	115 min.
	7	205 min.	54 min.
	8	49 min.	7 min.
TEMIK Sulfoxide	6	80 min.	20 min.
	7	45 min.	8 min.
	8	3.1 min.	0.5 min.
TEMIK SULFONE	6	120 min.	50 min.
	7	15 min.	<1.0 min.
	8	1.5 min.	<0.5 min.

4.1 Methods

Samples were analyzed by a modified thin juice procedure of UC 21149-III-SBF.

4.1.1 Conclusions

The parent compound (Temik) and two of its metabolites (T-sulfoxide, T-sulfone) degraded in water at temperaθ tures of 80° and 100°C. The t 1/2 varied from 19.0 hrs., 80 mins., 120 mins., 115 min, 20 min, and 50 min (pH 6) respectively. This was not a material balance study. The fact that the parent is degrading, shows metabolites forming (possibly oxime moities). The study was not conducted in the dark (we have no data to show that Temik is not susceptible to photolysis). No identification of degradative products was attempted. We do not have enough data to extrapolate the t'2 of parent and metabolites at lower temperatures. We suspect much greater t 1/2 and would need the study at temperature conditions were it is applied to the environment. We agree with the registrant that manufacturing processes may have temperatures of 80° to 100°C, but this is not applicable to EC, were the material is applied to the field. This study provides useful information (Temik metabolites do hydrolyze, but it cannot support any proposed use because of the aforementioned reasons. We could not find the method UC 21149-III-SBF modified (thin juice). If this is to be used for another hydrolysis study, we would need the methodology description.

4.2 Metabolism (soil, aerobic) ACC # 091372, Vol. 2 of 6, Tab #9, pg. 2.

A. Influence of Soil Type, pH and Moisture on the Recovery, Oxidation to Toxic Derivatives, and Decomposition of Temik in the Laboratory.

B. Further Studies of the Fate of Aldicarb in Soil.

NOTE: A and B are identical studies, with B giving more data on soil type characteristics and one more soil Woodward fine sandy loam. We will review both as one study.

4.2.1 ~~Table 3~~ - Fate of aldicarb in Houston clay and in Michigan muck at different conditions of pH and moisture.

% H_2O	pH	Radioactivity	% applied dose at indicated days after treatment: Clay 0	Clay 1	Clay 7	Clay 28	Muck 0	Muck 1	Muck 7	Muck 28
0	6	Aldicarb	91.5	85.9	83.3	68.7	74.7	69.9	66.1	65.0
		Oxidation products	3.4	5.3	6.1	7.8	15.3	18.7	22.9	17.0
		Nontoxic products	0.0	0.4	1.9	1.6	0.0	2.9	1.7	2.8
		Residue	2.1	1.8	2.8	2.2	10.0	2.3	2.6	3.0
		Lost	3.0	6.6	5.9	19.7	.0	6.2	6.7	12.2
0	7	Aldicarb	93.0	85.5	82.0	78.7	72.5	71.1	68.8	68.0
		Oxidation products	3.4	6.4	6.8	6.8	14.3	12.0	15.4	13.7
		Nontoxic products	.0	.9	1.4	1.2	.0	1.7	2.4	2.4
		Residue	2.1	2.1	2.6	7.2	9.1	12.8	2.5	3.7
		Lost	1.5	5.1	7.2	6.1	4.1	2.4	10.9	12.2
0	8	Aldicarb	90.3	91.3	85.7	75.4	76.4	73.8	68.2	61.7
		Oxidation products	3.2	5.6	66.4	7.5	13.0	13.9	18.5	16.5
		Nontoxic products	.0	.7	.7	1.5	.0	1.5	0.9	1.7
		Residue	4.0	2.4	2.4	1.1	10.6	5.3	2.5	2.4
		Lost	2.5	.0	4.8	14.5	.0	4.5	9.9	17.7
50	6	Aldicarb	85.4	63.8	24.9	1.5	72.8	61.8	42.8	10.1
		Oxidation products	6.1	7.7	12.0	2.4	12.6	21.3	25.3	42.5
		Nontoxic products	.0	2.3	24.4	18.5	0.0	2.2	8.1	10.4
		Residue	2.9	6.8	14.3	19.5	11.8	6.8	9.3	21.8
		Lost	5.6	19.4	24.4	58.1	2.8	7.9	14.5	11.9

42.1 ~~Table 3~~ - Continued

% H_2O	pH	Radioactivity	% applied dose at indicated days after treatment: Clay 0	Clay 1	Clay 7	Clay 28	Muck 0	Muck 1	Muck 7	Muck 28
50	7	Aldicarb	85.0	74.1	40.7	1.8	75.3	66.6	42.6	13.6
		Oxidation products	3.4	10.7	25.2	6.7	10.9	16.1	27.0	48.7
		Nontoxic products	.0	2.1	7.6	24.5	.0	1.4	5.0	7.3
		Residue	7.1	3.7	14.2	20.8	6.1	3.1	6.4	19.8
		Lost	4.5	9.4	12.3	46.2	7.7	12.8	19.0	10.4
50	8	Aldicarb	83.2	72.4	31.2	1.1	78.1	62.5	48.2	16.6
		Oxidation products	2.7	7.8	12.9	1.4	10.5	20.3	29.7	50.7
		Nontoxic products	.0	1.3	19.5	23.7	.0	2.4	4.2	8.5
		Residue vv	14.1	5.4	15.8	28.8	9.1	4.7	9.1	17.2
		Lost	.0	13.1	20.6	45.0	2.3	10.1	8.8	7.0
100	6	Aldicarb	85.3	21.1	3.6	0.6	37.9	2.7	2.4	1.2
		Oxidation products	3.3	2.3	4.2	2.0	4.2	3.2	1.6	1.6
		Nontoxic products	.0	22.5	28.0	20.5	.0	16.3	19.0	34.0
		Residue	4.5	3.6	7.3	31.5	4.0	7.8	28.2	44.2
		Lost	6.9	50.5	56.9	45.4	53.9	70.0	48.8	19.0
100	7	Aldicarb	83.2	28.6	5.2	2.2	32.9	4.9	1.3	1.4
		Oxidation products	2.6	3.0	2.9	4.1	4.7	1.4	.8	1.2
		Nontoxic products	.0	13.3	42.1	49.0	.0	11.7	21.6	37.4
		Residue	3.4	4.9	11.4	10.0	10.2	6.5	16.5	23.8
		Lost	10.8	50.2	38.4	34.7	52.2	75.5	50.8	36.2
100	8	Aldicarb	82.1	18.2	1.2	.8	26.8	3.1	2.4	1.6
		Oxidation products	2.4	1.0	1.7	3.5	3.1	2.2	2.0	0.7
		Nontoxic products	.0	20.8	40.7	67.4	.0	16.9	21.3	40.2
		Residue	7.3	5.5	10.2	20.0	6.9	5.9	11.8	22.6
		Lost	9.2	54.5	46.2	8.3	63.2	71.9	62.5	34.9

DATA from 3, 14, and 56 days are submitted in the first title submission.

4.2.7 Fate of aldicarb in pure sand and in Lufkin fine sandy loam at different conditions of pH and mositure.

% H_2O	pH	Nature of Radioactivity	% applied dose at indicated days after treatment*							
			SAND ~~Clay~~				~~Muck~~ loam			
			0	1	7	28	0	1	7	28
0	6	Aldicarb	89.9	87.7	71.8	45.5	87.9	81.6	70.6	58.7
		Oxidation products	4.4	5.2	5.5	5.5	8.3	12.8	14.9	11.3
		Nontoxic products	0.0	1.1	0.7	1.1	0.0	1.5	1.5	1.8
		Residue	.1	0.1	.1	0.1	1.5	0.9	2.8	0.9
		Lost	5.6	5.9	22.7	45.1	2.3	3.2	10.2	27.3
0	7	Aldicarb	90.2	87.0	72.8	53.5	90.1	89.6	79.1	71.2
		Oxidation products	4.9	5.8	4.7	6.1	6.0	5.9	11.0	15.6
		Nontoxic products	.0	1.2	.5	1.0	.0	1.8	1.6	1.7
		Residue	.2	.1	.1	.1	1.8	.7	2.0	1.6
		Lost	4.7	5.9	21.9	39.3	2.1	2.0	6.3	9.9
0	8	Aldicarb	90.9	79.3	39.6	7.8	93.5	88.8	83.9	70.4
		Oxidation products	2.0	3.1	1.7	.9	4.5	5.5	8.7	15.7
		Nontoxic products	.0	1.2	1.4	1.5	.0	1.7	1.3	1.8
		Residue	.2	.1	.1	.2	2.0	1.3	2.4	1.4
		Lost	6.9	26.3	57.2	89.6	.0	2.7	3.7	10.7
50	6	Aldicarb	89.5	86.5	83.6	74.5	85.3	79.9	67.5	45.5
		Oxidation products	4.6	6.1	8.3	6.7	8.2	10.7	17.3	32.4
		Nontoxic products	.0	1.5	1.6	2.5	0.0	1.8	2.4	3.0
		Residue	.1	.1	.1	.1	2.3	1.9	2.9	3.8
		Lost	5.8	5.8	6.4	16.2	4.2	5.7	9.9	15.3
50	7	Aldicarb	96.9	92.7	71.0	45.2	88.0	79.1	72.1	38.5
		Oxidation products	2.5	4.1	4.6	5.1	4.7	7.9	14.0	25.9
		Nontoxic products	.0	1.3	1.1	1.6	.0	.6	3.0	9.3
		Residue	.1	.1	.1	.1	2.5	1.7	3.1	1.6
		Lost	.5	1.8	6.8	16.3	4.8	10.7	7.8	24.7

42.7 Fate of aldicarb in pure sand and in Lufkin fine sandy loam at different conditions of pH and mositure - Continued.

% H2O	pH	Nature of Radioactivity	% applied dose at indicated days after treatment* SAND ~~Clay~~ 0	1	7	28	LOAM ~~Muck~~ 0	1	7	28
50	8	Aldicarb	91.9	87.7	82.4	73.4	91.8	86.9	73.4	40.7
		Oxidation products	2.7	3.3	3366	3.4	3.3	4.8	14.3	30.1
		Nontoxic products	.0	.2	3.5	2.2	.0	1.8	2.6	7.0
		Residue	.1	.1	.2	.1	2.6	2.1	2.8	2.7
		Lost	5.3	8.7	10.3	20.9	2.3	4.4	6.9	19.5
100	6	Aldicarb	94.7	86.1	79.7	74.4	83.7	18.1	2.8	1.4
		Oxidation products	4.7	10.4	10.2	4.6	3.9	4.4	1.0	.9
		Nontoxic products	.0	1.7	1.7	3.7	.0	8.2	16.1	16.8
		Residue	.1	.2	.1	.1	1.5	1.2	1.6	4.7
		Lost	.5	1.6	8.3	17.2	10.9	68.1	78.5	76.2
100	7	Aldicarb	93.5	92.3	85.7	69.9	90.0	7.1	4.8	1.9
		Oxidation products	2.8	5.1	4.0	4.3	2.9	2.1	1.0	1.3
		Nontoxic products	.0	1.1	1.2	8.1	.0	9.8	13.9	15.7
		Residue	.11	.2	.1	.1	2.9	2.8	3.1	2.7
		Lost	3.6	1.3	9.0	17.6	4.2	78.2	77.2	78.4
100	8	Aldicarb	91.4	91.8	83.5	79.1	85.9	12.3	2.2	.4
		Oxidation products	4.4	3.8	3.7	2.6	2.7	2.1	1.3	1.5
		Nontoxic products	.0	1.2	1.4	3.4	.0	13.3	20.1	20.3
		Residue	.0	.1	.2	.1	5.3	4.4	4.1	1.7
		Lost	4.1	3.1	11.2	14.8	6.1	67 .9	72.3	76.1

Data from 3, 14, and 56 days are available in the first title submission.

Properties found in the soils used in testing

Soil	pH	% organic matter	Mechanical analysis % sand	% silt	% clay
Purified sand	7.0	0.0	100.0	0.0	0.0
Construction sand	7.2	.1	97.0	2.0	1.0
Lufkin fine sandy loam	6.8	1.4	58.0	22.0	20.0
Woodward fine sandy loam	6.9	1.0	61.0	26.0	13.0
Houston clay	8.0	8.1	4.4	40.1	55.5
Michigan muck	6.0	78.0			

NOTE: Not all soil types used in the study.

4.2.5 Methods

Methodology consisted of a ^{14}C-labeled procedure using TLC, LCS, and GLC analysis similar to guideline protocol.

4.2.6 Conclusions

It is shown that moisture, type of soil, and pH influence the t 1/2 of Temik from <1day to >56 days. "Oxidative" and "nontoxic" products accumulate with time. The author states that "oxidative products refers to Temik-sulfone and sulfoxide. The author states that "nontoxic" refers to oxime-sulfoxide, oxime-sulfone, nitrile-sulfoxide, nitrile-sulfone, and 4 unknowns. No data submitted to show this claim. A substantial amount of activity is lost, the author states due to volatility, volatility studies in sect. 4.7, 4.8, and 4.9 support this claim. This study combined with a volatility (if required) and other soil metabolism studies could support the proposed use in the submission. Pictures of chromatograms were not submitted. The higher the OM the greater the binding. Greater than 20% in some cases.

4.3 Metabolism (soil). Acc # 091372. Vol. 2 of 6. Tab #2 pg. 907.

Coppedge, J.R., D.A. Lindquist, D.L. Bull and H.W. Dorough. 1967. Fate of 2-Methyl-2-(methylthio) propionaldehyde O-(methylcarbamoyl) oxime (TEMIK) in Cotton Plants and Soil. J. Agr. Food Chem. 15:902-91.

4.3.1 This is a combined plant metabolism and soil study, we will review the soil study only. The plant metabolism will be reviewed later under ancillary studies.

Some Chemical and Physical Properties of Three Soil Types

Soil	% Organic Matter[a]	pH	% H_2O at One Moisture Equivalent[b]	Mechnical Analysis, %[c] Sand	Silt	Clay
Houston clay[d]	4.2	8.0	23.5	4.4	40.1	55.5
Norwood silty clay loam	1.0	8.0	21.4	23.9	53.5	22.6
Lakeland fine sand	0.4	6.3	3.4	92.0	6.0	2.0

a Determined by method of Peach et al. (1947).
b Determined by method of Buouyoucos (1935).
c Determined by method of Buouyoucos (1936) after organic matter was digested with H_2O_2.
d Noncultivated soil.

Fate of 20 P.P.M. S^{35}-Temik in Three Types of Soils[a]

Per Cent of Total Dose at Indicated Weeks after Treatment

Weeks	Houston Clay (Virgin)[b] 1	4	12	Lakeland Fine Sand 1	4	12
Temik	57.3	6.1	0.7	65.1	27.2	3.6
Temik Sulfoxide	31.5	35.3	9.5	27.5	40.7	49.8
Temik Sulfone	4.3	3.8	4.8	3.9	5.7	13.4
Nitrile sulfoxide	0	0.2	0	0	0.2	0
Oxime	0.2	0	0	0.1	0	0
Oxime sulfoxide	3.8	3.4	0.8	1.5	0	0.6
Unknown(s) 2	0.8	0.8	2.3	0.7	0.8	3.3
Unknown 3	1.7	2.1	0.6	1.0	1.7	5.0
Unknown 5	0	0.2	0	0	0.2	0
Unknown 6	0	0.2	0.1	0	0	0.2
Unknown 7	0.4	0	0	0.2	0.1	0.1
Residue[c]	0	47.9	81.2	0	23.4	24.0

Weeks	Norwood Silty Clay Loam 1	4	12
Temik	53.1	0.3	0.4
Temik Sulfoxide	41.5	51.2	25.0
Temik Sulfone	1.2	4.9	6.3
Nitrile sulfoxide	0	0.1	0
Oxime	1.9	2.1	1.0
Oxime sulfoxide	0.8	0.3	0.5
Unknown(s) 2	1.6	5.2	5.1
Unknown 3	0	0.1	0
Unknown 5	0	0.3	0.1
Unknown 6	0	0	0
Unknown 7	0	35.5	61.6
Residue[c]			

a Average of duplicate chromatograms of triplicate samples.
b Noncultivated soil.
c Nitric acid digestion of extracted soil. Essestially 100% recovery of applied radioactivity was obtained from each sample.

Data also at 2, 6 and 9 weeks, but omitted here to shorten charts.

4.3.3 Methodology

A ^{35}S-radiolabeled study with TLC procedures was used. Methods are similar to guideline protocol.

4.3.4 Conclusion

The study shows "bound residues" of ~~535~~ ^{35}S are increasing with time. This contradicts the study from sect. 4.2 that claimed the loss was due to volatily but that study was ^{14}C and this ^{35}S, both are true (results) and thus indicative of different ~~varieties~~ moieties. Sandy soils are important in their reaction with Temik as to persistence, degradate behavior, and bound residues. Characterization of the soils as CEC, bulk density and % moisture at or below 75% of 0.33 bar content were not submitted. Pictures of chromatograms not included. We can forego the CEC, and bulk density in this case, enough other soil characteristics were given for an evaluation. More degradates (11) identified in 5.4.1 then in 4.2(10).

NOTE: % moisture equivalent is defined as:

> The water content expressed as a percentage of the dry weight that a soil can retain against a centrifugal force one thousand times the force of gravity.

4.4 Metabolism (microbical)

Effect of pesticides on microbe. Acc # 091372. Vol. 2 of 6, Tab #13.

UC	Bacteria								Fungi					Soil Mycelial Growth Test			Foliage Disease Control Tests				Metabo-lites			
Number	Sa	Bm	Pa	Cm	Lp	Xm	Ea	Ec	Fg	An	Ped	Pp	Sc	Pd	Rs	Fo	EB	CA	BM	BR	S	P	A	I
21149	1	1	1	1	1				1	1	1	1	1	1	1	1	1		1	1	x	x	x	x
21826	1	1	1	1	1				1	1	1	1	1	11	1	1	1		1	1	x	x	x	x
21865	1	1	1	1	1				1	1	11	1	1	1	1	1	1		1	1	x	x	x	x
21786	1	1	1	1	1				1	1	1	1	1	1	1	1	1		1	1	?	?	x	
31385	1					1	1	1		1				1	1	1	1	1	1	1	x	x	x	x
31386	1					1	1	1		1				1	1	1	1	1	1	1	x	x	x	x
22156	1	3	3	5	3				1	1	1	1	1	1	1	1	1	1	1	1				
31399	1					1	1	1		1				1	1	1	1	1	1	1	x	x	x	x
31398	1					1	1	1		1				1	1	1	1	1	1	1		x	x	x

1 = Complete control
3 = Moderate

S = No control
X = Metabolites

Sa = Staphylococcus aureus
BM = Bacillus mesentericus
Pa = Pseudomenas aeruginosa
Cm = Corynebacterium michiganense
Lp = Lacrobacillus plantarum
Xm = Xanthomonas malvacearum
Ea = Erwinia amylovora
Ec = Escherichia coli

Fg = Fusarium oxysporum
f. fladioli
An = Aspergillus niger
Ped = Penicillium digitatum
Pp = Pellularia pullulans
Sc = Saccharomyces cerevisiae
Pd = Pythium debaryanum
Rs = Rhizontonia solani
Fo = Fusarium oxysporum
f. lycopersici

EB = Tomato early blight
(Alternaria solani)
CA = Cucumber anthracnose
(Colletotrichum lagenarium)
BM = Bean Mildew
(Erysiphe polygoni)
BR = Bean rust
(Uromyces phaseoli)
S = Soil, P = Plant, A = Animal
I = Insect

Growth of Fungi and Bacteria in the Presence of Temik

	R. solani[1]	A. niger[1]	A. solani[1]	A. turnefaciens[2]
Inorganic salts	0	0	0	0.00
TEMIK	2	1	2	0.05
TEMIK + Mannitol	26	2	11	0.10
Mannitol	11	15	12	0.20

1 = mg. dry weight
2 = OD_{650} mu

4.4.1 Methodology

Agar incorporation, optical density (fungal) TLC procedures used. Comparison of mat formation was used in the agar incorporation. Temperature of incubation 30°C. Barteria and 21°C fungi.

4.4.2 Conclusions

We would question the results of the bacteria data. "Eye ball" methods are not scientifically sound in enumerating bacterial numbers. Majority of the organisms used were plant pathogens and/or fecal pollution indicators, which are not indicative of commensal soil populations. The study would not support the proposed use.

4.5 Mobility (leaching). Acc # 091372, Vol. 2 of 6. Tab #9, pg. 4.

Studies of Movement and Volatility of Temik in Small Columns of Soil in the Laboratory.

4.5.1 Methodology. ^{14}C labeled material and TLC used. Similar to guidelines.

4.5.2 Distribution of C^{L4} Temik equivalents in 2.5 x 5.0 in. columns of soil following the addition of 1 in. of water/week for 7 weeks. a/

Soil Type	% of total dose in indicated layer b/					% of total dose				
	0-1	1-2	2-3	3-4	4-5	ex-tracted	in residue	in elution water c/	re-covered	lost
Houston clay	0.44	0.09	0.06	0.04	0.02	0.65	2.47	12.50	15.62	84.38
Lufkin sandy loam	1.16	0.33	0.12	0.07	0.03	1.71	2.95	3.93	8.59	91.41
Sand (coarse)	0.01	T	0.21	0.45	2.04	2.71	0.21	83.97	86.89	13.11
Muck	8.75	5.34	8.47	5.59	4.81	32.96	7.13	3.46	43.55	56.45

a/ (T) = < 0.01 % of total dose.

b/ Number of inches from the surface.

c/ Elution water is water which passed through the columns after the weekly addition of 1 inch of water, or moisture.

4.5.3 The occurrence of C^{14} Temik and certain Temik C^{14} labeled metabolites in water eluted through 2.5 x 5.0 in. columns of soil. a/

Product from indicated soil type. b/	% of total dose at indicated days after treatment								
	3	10	16	23	29	35	41	47	53
Clay									
Temik	-	-	0.51	0.20	-	.01	0	-	-
sulfoxide	-	-	3.21	1.93	-	<0.35	0.15	-	-
sulfone	-	-	0	T	-	.01	0	+	-
other	-	-	0.65	0.64	-	0.29	0.16	-	-
Total	0	3.15	4.37	2.77	0.75	0.65	0.31	0.25	0.25
Accumulative Total	0	3.15	7.52	10.29	11.04	11.69	12.00	12.25	12.50
Sand									
Temik	-	-	7.26	31.47	-	5.02	5.40	2.32	-
sulfoxide	-	-	0.86	2.60	-	1.60	2.02	2.43	-
sulfone	-	-	0	0	-	0	0	0	-
other	-	-	0.20	1.58	+	0.38	0.48	1.05	-
Total	0	3.48	8.32	35.65	9.16	7.00	7.90	5.80	6.67
Accumulative Total	0	3.48	11.80	47.45	56.61	63.61	71.51	77.31	83.98
Loam									
Temik	-	-	.02	.01	-	T	0	-	-
sulfoxide	-	-	0.92	0.25	-	0.29	0.24	-	-
sulfone	-	-	0	0.0	-	T	T	-	-
other	-	-	0.16	0.04	-	0.04	0.06	-	-
Total	0	0.73	1.10	0.03	0.21	0.33	0.30	0.30	0.25
Accumulative Total	0	0.73	1.83	2.13	2.34	2.67	2.97	3.27	3.52

Data from 3, 10, 35, 41, 47 days treatment has been submitted.

4.5.4 The occurrence of C^{14} Temik and certain Temik C^{14} labeled metabolites in water eluted through 2.5 x 5.0 in. columns of soil. a/ - Continued.

Product from indicated soil type b/	% of total dose at indicated days after treatment								
	3	10	16	23	29	35	41	47	53
Muck									
Temik	-	-	-	-	-	T	-	-	-
sulfoxide	-	-	-	-	-	0.1	-	-	-
sulfone	-	-	-	-	-	0	-	-	-
other	-	-	-	-	-	0	-	-	-
Total	0	0.1	.06	.70	.87	0.06	0.10	0.30	1.27
Accumulative Total	0	0.1	.07	.77	1.64	1.80	1.90	2.20	3.47

b/ Clay = Houston clay, Sand = pure quartz sand, Loam = Lufkin sandy loam.

Data from 3, 10, 35, 41, and 47 days has been submitted.

4.5.5 Conclusions

Both parent and degradate were shown to leach through the 5" columns of soil tested. Compounds of quantity that leached in sand are: parent, sulfoxide, and others. In clay: sulfoxide, others, and parent. In loam: others, sulfoxide, and parent. In Muck: sulfoxide. In all cases sulfone did not leach - apparently bound. Soil type relating to OM content seems to indicate the leaching potential, although full classification is needed to fully clarify this such as: pH, CEC, bulk density, percent sand, silt, clay; and one soil not being aged 30 days under aerobic conditions. We need to know why the percent lost is greater in nonmuck soils, except sand. A large amount is lost, volatility data from sect. 4.7, 4.8, and 4.9 would support volatilization!

4.6 Mobility (leaching) Acc # 091372, Tab #15, Vol. 2 of 6 Leaching characteristics of Temik 10G in soils.

4.6.1 Methodology not similar to guidelines.

4.6.2 7 inch column of soil @ 25°C., TEMIK 10G incorporated in top 1 inch, column of soil 6 inches in diameter.

Norfolk sandy loam

days after incorporation	cumulative simulated rainfall, inches	Leachate collected, ml	Total carbarnates in leachate, ug
15	1	370	3.7
22	2	317	30.1
29	3	303	29.0
36	4	271	16.3
64	8	266	10.7
		Total ug leached	122.1
		ug incorporated	88,200
		% leached in 64 days	0.14

Data from 43, 50, and 57 days has been submitted.

4.6.3 Soil cut horizontally into one inch strata after 72 days.

Norfolk Sandy Loam

Column Configuration	Stratum analyzed	dry weight of stratum, gm	Total Carbamates in stratum, ug
Untreated soil	1"	540	6.8
TEMIK 10G incorporated	2"	509	13.5
Untreated soil	3"	574	12.6
	4"	568	13.1
	5"	539	13.2
	8"	289	6.1
		Total ug in soil	87.7
		ug incorporated	88,200
		% left in the soil	0.10

Data from 6, 7" layer of untreated soil has been submitted.

4.6.4 7 inch column of soil @ 25°C., TEMIK 10G incorporated in top 1 inch, column of soil 6 inches in diameter.

Michigan Muck

days after incorporation	cumulative simulated rainfall, inches	Leachate collected, ml	Total carbamates in leachate, ug
20	3	240	2.4
27	4	231	16.8
34	5	234	41.7
41	6	246	86.1
48	7	224	124.3
55	8	221	114.6
		Total ug leached	690.2

ug incorporated 85,280

% leached in 79 days 0.81

Data from 6, 13, 62, 72, and 79 days haves been submitted.

4.6.5 Soil cut horizontally into one inch strata after 87 days.

Michigan Muck

Column configuration	Stratum analyzed	dry weight of stratum, gm	Total Carbamate in stratum, ug
Untreated soil	1"	263	18.4
TEMIK 10G incorporated	2"	277	256.0
Untreated soil	3"	240	398.0
	6"	293	202.0
	7"	249	106.0
	8"	231	176.8
		Total ug in soil	1738.9
		ug incorporated	85,280
		% left in soil	2.0

Data from 4 and 5" layer of untreated soil has been submitted.

4.6.7 Conclusions

The Temik 10G product leached through 7" of soil at about a 1% rate. The percent left in the soil was 1-2%, we need to know what happened to the other 96% of material. Previous study showed that the two soils tested did not leach readily - no soils that were shown to leach previously were used for evaluation. Only two soils were evaluated, the study was not a radioisotopic procedure, characteriaation of the soils were not given: percent sand, silt, clay, OM, pH, CEC, and bulk density. Degradates were not identified and quantitated. One soil was not aged 30 days under aerobic conditions before testing. Soil columns were not 12" in length.

4.6.8 These ~~two~~ Two leaching studies have identified Temik, its two major metabolites (sulfoxide and sulfone), and others (nitrile, oxime degradates) in leaching characteristics. These ~~two~~ Two combined studies combined therefore can satisfy guidelines requirements, since they do show us fate in the environment.

4.7 Mobility (volatility) Acc # 091372, Vol. 2 of 6, Tab #9, pg. 4

Studies of Movement and Volatility of Temik in Small Columns of Soil in the Laboratory.

4.7.1 This is a combined study and the leaching characteristics are described under the leaching heading. We will discuss the results of the volatilization experiment here.

4.7.2 Methodology

Method was radiolabeled and similar to guidelines.

4.7.3 Results

#Days after Treatment	Accumulation (% of Total)
0	N.D.
10	~5%
20	~15%
30	~30%
40	~40%
50	~40%
60	~40%

DATA extrapolated from graph submitted.

4.7.4 Conclusions

Temik volatilized with time and leveled off at day 40. About 50% of the activity is not accounted for. No extraction of the soil, or trapping of the air (identify metabolites) done to support the loss. No data submitted to support the authors claim of the acitvity of "nontoxic" product oxime/nitrile derivatives. The study was not done under actual use conditions. We can draw very few conclusions from this study. It would not support the proposed use.

4.8 Mobility (volatility) Acc # 091372, Vol. 2 of 6, Tab #9.

Influence of Moisture Level on Volatilization of Temik from Soil.

4.8.1 ^{35}S labeled Temik procedure was used. Procedure similar to guidelines.

4.8.1

Moisture (% of field capacity)	H_2O Loss (g. H_2O/g. dry soil)	% of applied dose in indicated soil layer[a/] from beaker						
		Top		Middle		Bottom		
		Extract	Residue	Extract	Residue	Extract	Residue	Total
0	0.0	0.5	0.0	2.9	0.0	81.1	3.7	88.2
25	0.06	1.8	0.1	76.5	0.3	2.3	0.4	81.4
50	0.11	43.6	1.9	31.6	2.1	1.2	0.5	80.9
75	0.15	49.0	2.2	13.9	1.9	1.5	0.2	68.7
100	0.20	40.0	2.0	3.9	0.5	5.6	0.9	52.9

a/ Depth of soil in beaker was 6 cm, each sample layer was 2 cm; treatment was 500 ug Temik-S^{35} on top of bottom layer.

4.8.2 **Conclusions**

The amount of volatilization was inversely proportional to the original moisture level of the soil. What are "Normal outdoor" conditions that were described for the conditions of the experiment. No characterization of the volatiles were evaluated. The study was not done under actual use conditions. Were there any precautions to keep the moisture [redacted] level constant. Did evaporation play any role in the volatility? It could not support its proposed use (if required).

4.9 Mobility (volatility) Acc # 091372, Tab #9, pg. 7, Book 2 of 6.

Influence of Temperature and Moisture on the Volatilization of Temik from Soil.

4.9.1 Influence of temperature and moisture on the volatilization of Temik-S^{35} from sand.

hrs. after treatment	g. H_2O/g. soil (in wet sand)	% of applied dose remaining: Wet Sand	Dry Sand
Samples at 25°C			
0	0.20	100.0	100.0
4	0.20	98.6	98.2
8	0.19	96.6	93.2
24	0.18	91.8	83.3
Samples at 50°C			
0	0.21	100.0	100.0
4	0.16	95.8	81.7
8	0.12	76.0	73.2
24	0.03	43.5	64.9
Samples at 75°C			
0	0.21	100.0	100.0
2	0.11	68.9	--
4	0.03	36.2	70.6
8	0.01	15.9	59.5
24	0.00	11.0	52.1

4.9.2 Methods

Method similar to guidelines.

4.9.3 Conclusions

Temik volatilized at a faster rate under most conditions as the temperature increased from 25° to 50° to 75°C. Temik is temperature dependent to volatility. No attempt was made to characterize the volatility product(s). The study was not done under actual use conditions. It could not support the proposed use (if required).

5.0 Field Dissipation (soil).

Acc # 091372. Tab #10, Vol. 2 of 6.

Fate of ^{14}C-Temik in Cultivated Soil.

5.0.1 Methods were similar to guidelines protocol.

5.0.3 Summary of Daily Temperature and Rainfall Records taken during the 90-Day Growing Season.

Periods [1]	Temperature °F. High	Low	Rainfall Inches
April 25-May 1	67.4	42.7	1.95
May 2-May 8	71.9	47.3	0.70
May 9-May 24	71.9	50.1	2.40
May 25-June 23	82.1	59.1	4.95
June 24-July 23[2]	84.6	65.8	2.95

1. Correspond to various sampling times.
2. Irrigated once during this period.

Concentration of Total Radiolabeled Residues in the Soil After In-Furrow Application of S-Methyl-C^{14} Temik at the Rate of 3 Pounds Per Acre[1]

Days after Treatment	ppm TEMIK Equivalents Sample I	Sample II	Sample III	Average	
0	-	13.23	12.89	13.10	
7	4.97	2.68	2.77	3.47	26.4%
14	4.06	2.46	0.95	2.49	19.0%
30	1.62	3.01	3.33	2.65	20.2%
60	0.12	0.25	0.14	0.17	1.2%
90	0.11	0.05	0.05	0.07	.5%

1. TEMIK applied in the field at the time of planting potatoes.

Moisture content of soil stated as between 65-75% throghout study.

5.0.4

Degradation Products	% of the Recovered Radioactivity at Indicated Days After Treatment[2]						ppb of C^{14}-TEMIK Equivalents at Indicated Days After Treatment				
	0	7	14	30	60	90	0	7	14	30	60
Water solubles	1.2	5.0	9.8	8.2	9.6	23.6	157	174	244	217	18
TEMIK	82.6	34.7	6.5	1.6	ND	ND	$10.82x10^3$	$1.20x10^3$	162	42	ND
TEMIK sulfoxide	12.7	48.6	66.9	54.6	31.1	13.1	$1.66x10^3$	$1.69x10^3$	$1.67x10^3$	$1.45x10^3$	53
TEMIK sulfone	1.4	4.4	11.6	24.7	50.0	41.5	183	153	289	655	85
Oxime sulfoxide	1.2	1.8	0.9	0.8	2.0	2.8	157	62	22	21	3
Nitrile sulfoxide	ND[3]	0.8	1.3	0.6	1.2	0.9	ND	28	32	16	2
Nitrile sulfone	ND	1.2	0.5	1.1	3.0	4.8	ND	42	12	29	5
Unknown I	0.9	3.4	2.5	8.4	3.2	13.3	118	118	62	223	5

1. TEMIK applied at the rate of 3 pounds per acre at planting time.
2. Based on triplicate samples and duplicate anayses for each sample.
3. ND--none detected.

5.0.5 Conclusions

Temik dissipated rapidly in the ~~final~~ first 7 days after application and continued to decline to minute amount at the end of the experimental period. An extrapolated $t_{1/2}$ would be < 1 week. Sample were not taken to a depth of 12" (8"). Tour agricultural use area were not evaluated. Characterization of soils not included: percent sand, salt, clay, OM, pH, CEC, and B.D.

5.1 Field Dissipation (Soil)

Acc #091372 Tab #12, Vol. 2 of 6.

DEGRADATION AND CARRY-OVER PROPERTIES OF 2-METHYL-2-(METHYLTHIO) PROPIONALDEHYDE O-(METHYLCARBAMOYL) OXIME

(TEMIK) IN SOIL

5.1.1 Methodology similar to guidelines.

5.1.2

CONCENTRATION OF TOTAL EXTRATED RADIOLABELED RESIDUES FROM THE SOIL AFTER IN-FURROW APPLICATION OF S-METHYL-C^{14} TEMIK AT THE RATE OF 3 POUNDS PER ACRE

NORFOLK SANDY LOAM

Days after Treatment	Sample I	ppm of C^{14} TEMIK Equivalents Sample II	Sample III	Average
0	12.92	15.44	17.71	15.36
7	13.15	12.37	8.05	11.19>72.8%
14	10.36	10.08	11.94	10.97>70.2%
30	0.45	0.73	0.80	0.66>12%
70	0.19	0.15	0.15	0.16>10%
90	0.03	0.06	0.06	0.05>.3%

3 Samples Submitted For Average

5.0.5 Conclusions

Temik dissipated rapidly in the ~~final~~ first 7 days after application and continued to decline to minute amount at the end of the experimental period. An extrapolated $t_{1/2}$ would be < 1 week. Sample were not taken to a depth of 12" (8"). Tour agricultural use area were not evaluated. Characterization of soils not included: percent sand, salt, clay, OM, pH, CEC, and B.D.

5.1 Field Dissipation (Soil)

Acc #091372 Tab #12, Vol. 2 of 6.

DEGRADATION AND CARRY-OVER PROPERTIES OF 2-METHYL-2-(METHYLTHIO) PROPIONALDEHYDE O-(METHYLCARBAMOYL) OXIME

(TEMIK) IN SOIL

5.1.1 Methodology similar to guidelines.

5.1.2

CONCENTRATION OF TOTAL EXTRATED RADIOLABELED RESIDUES FROM THE SOIL AFTER IN-FURROW APPLICATION OF S-METHYL-C^{14} TEMIK AT THE RATE OF 3 POUNDS PER ACRE

NORFOLK SANDY LOAM

Days after Treatment	ppm of C^{14} TEMIK Equivalents Sample I	Sample II	Sample III	Average
0	12.92	15.44	17.71	15.36
7	13.15	12.37	8.05	11.19>72.8%
14	10.36	10.03	11.94	10.97>70.2%
30	0.45	0.73	0.80	0.66>12%
70	0.19	0.15	0.15	0.16>10%
90	0.03	0.06	0.06	0.05>.3%

3 Samples Submitted For Average

5.1.3

Degradation Products	% of the Recovered Radioactivity at Indicated Days after Treatment[2] 0	7	14	30	70	90	ppm of C^{14} TEMIK Equivalents at Indicated Days after Treatment 0	7	14	30	70	90
TEMIK	81.5	42.1	3.2	ND3	ND	ND	12.52	4.71	0.35	ND	ND	ND
TEMIK sulfoxide	12.9	43.7	76.4	47.2	30.8	38.0	1.98	4.89	8.24	0.31	0.05	0.02
TEMIK sulfone	1.4	2.0	7.4	33.4	10.9	7.3	0.22	0.22	0.80	0.22	0.02	0.01
Oxime sulfoxide	1.2	ND	0.6	3.2	2.0	2.7	0.18	ND	0.06	0.02	<0.01	<0.01
Nitrile Sulfoxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrile sulfone*	ND	ND	ND	6.5	4.2	4.8	ND	ND	ND	0.04	0.01	<0.01
Unknown(s)	1.1	ND	2.3	1.8	13.7	7.7	0.17	ND	0.25	0.01	0.02	<0.01
Water solubles	1.9	12.2	10.1	7.9	38.4	39.5	0.29	1.37	1.09	0.05	0.06	0.02

1. TEMIK applied at the rate of 3 pounds per acre to fallow ground.
2. Based on triplicate samples and duplicate analysis for each.
3. ND--none detected.

*Oxime sulfone and nitrile sulfone were combined.

SUMMARY OF DAILY TEMPERATURE AND RAINFALL RECORDS
TAKEN DURING THE 90-DAY SOIL TEST

Periods[1]	Temperature °F. High	Low	Rainfall Inches
April 29-May 5	76.1	49.9	0.35
May 6-May 12	74.1	48.3	0.75
May 13-May 30	73.7	54.1	3.15
May 31-July 7	83.4	63.5	5.40
July 8-July 28	86.0	67.8	1.50

1. Correspond to various sampling times.

5.1.4 Conclusions

Temik dissipated in Norfolk sandy loan with an extrapolated $t_{1/2}$ of ~2/week. Temik-sulfoxide and sulfone and extrapolated $t_{1/2}$ of ~2 weeks. Discing was stated to reduce the temik residue from (.59 ppm - 0.02 ppm) temik. Tomato and crabgrass were started to have residues of 0.06 ppm and 1.15 ppm Temik at the end of the experiment. Four agricultural use areas were not evaluated, preapplication sample were not taken, characterization of soils not given: percent sand, silt, clay, OM, CEC, a 1 BD. No data for discing a plant residues. Sample was not taken at 12" (8").

5.2.1 Field Dissipation (Soil)

Acc #091372 Vol. 2 of 6. Tab #14.

FIELD EVALUATION OF THE PERSISTENCE AND MOVEMENT
OF TEMIK AND ITS CARBAMATE METABOLITES IN SOIL

5.2.2 Methods similar to guidelines.

5.2.3

Days After Treatment	Sampling Date	Total TEMIK Residue ppm	pH
Treated Area			
0 (pretreatment control)	6/21/68	0.06	6.00
0	6/21	9.4	5.98
3	6/24	7.2	5.90
7	6/28	5.5	5.91
5.0" irrigation water applied 6/28			
8	6/29	0.66	
14	7/5	0.66	
21	7/12	1.1	
28	7/19	0.19	6.01
5 weeks	7/26	0.09	
7 weeks	8/9	0.20	
8 weeks	8/16	0/13	6.08
Runoff Area			
14 - 15' from pond	7/5	< 0.06	
14 - 30' from pond	7/5	0.06	5.89
14 - 45' from pond	7/5	0.06	
21 - 15' from pond	7/12	0.06	
21 - 30' from pond	7/12	< 0.06	5.29
21 - 45' from pond	7/12	0.08	
28 - 15' from pond	7/19	0.07	
28 - 30' from pond	7/19	0.06	5.51
28 - 45' from pond	7/19	0.07	

5.2.3 Conclusions

Temik dissipated in the field with an extrapolated ½ of 1 week. Irrigation accelerated the dissipation. Runoff sample had low levels of residues. Author claims no fish died in adjacent pond. There was .06ppm in pre-application samples; we wonder about the validity of the data. Samples were not taken to a depth of 12" (8"). Four use areas were not sampled, residue were not identified (included as total Temik). Soil characteristic of percent sand, silt, clay, CEC, pH, BD, OM.

5.3 Accumulation (Fish) Acc #091372 Vol. 2 of 6. Tab #6.

FIELD EVALUATION OF THE PERSISTENCE OF TEMIK AND ITS CARBAMATE METABOLITES IN POND WATER AND THEIR EFFECT ON POND FAUNA

5.3.1 Method not similar to guidelines.

5.3.2 Results

RESIDUES OF TEMIK AND ITS CARBAMATE METABOLITIES IN WATER TAKEN FROM POND ADJACENT TO TEMIK TREATED AREA

Days After Treatment	Sampling Date	Total TEMIK Residue ppm	pH
0 (prior to treatment)	6/21/68	0.06	6.12
7 (prior to irrigation)	6/28	< 0.06	
- irrigation water	6/28	< 0.06	4.6
7 (post irrigation)	6/28	0.09	5.92
14, 21, 28 days, 5, 7 and 8 weeks	All	< 0.06	6.05

DATA FROM 21, 28 5 weeks, 7 weeks, 8 weeks have been Submitted

Taken from Buckets in Runoff Area			
8 days (15' from pond)	6/29	0.06	
8 (30' from pond)	6/29	0.08	5.59
8 (45' from pond)	6/29	0.14	
14 (15' from pond)	7/5	< 0.06	
14 (30' from pond)	7/5	0.07	5.50
14 (45' from pond), 17, 21, 24, 27	All	0.06	5.59

DATA FROM 17, 21, 24 and 27 d. submitted.

TEMIK AND ITS CARBAMATE METABOLITES IN POND WATER

Days After Treatment	Sampling Date	ppm	pH
0 (pretreatment	September 9, 1968	0.03	6.5
0 (posttreatment)	September 9	2.8	6.4
1	September 10	2.7	6.5
2	September 11	3.0	6.6
14	September 23	1,1	6.1 (7d)
21	September 30	0.42	
28 (4 weeks)	October 7	0.26	
5 weeks	October 14	0.15	
6 weeks	October 21	0.06	

DATA FROM 3, 4, 5, 6, 7, 10, 14, 21, 28d, 5 weeks, 6 weeks has been submitted.

RESIDUES OF TEMIK AND ITS CARBAMATE METABOLITES IN POND MUD

Days After Treatment	Sampling Date	ppm
0 (pretreatment	September 9, 1968	0.06
0 (posttreatment)	September 9	0.06
1	September 10	<0.06
2	September 11	0.06
28 (4 weeks)	October 7	0.09
5 weeks	October 14	0.08
6 weeks	October 21	0.08

DATA FROM 3, 4, 5, 6, 7, 10, 14d has been submitted.

5.3.3 Conclusions

Temik at 3.0ppm is lethal to bream, large mouth bass, bull frogs and cricket frogs. Legless tad poles survived the treatment. Temik is lettal to fish up to 10 days after treatment.

Preapplication samples were found to contain residues. We would question the validity of this data. Temik appears to influence water pH, although the registrant claims no effect. (no data to support this after day 7.

This study will not support the proposed use and cannot be used for the aforementioned reasons and following:

1) Radioisotopic techniques not used.

2) Only one exposure system used. (STATIC).

3) Catfish not used in static system.

4) Soil not aged properly (2-4 weeks) for initiation of exposure.

5) Determination of residues in whole body, edible tissue, and viscera or carcass were not analyzed.

6) Characteristics of the water were not given

   a. oxygen content
   b. temperatures

5.4 Ancillary Studies

Acc #091372 Vol. 2 of 6. Tab # 4 pg. 1598.

5.4.1 Metabolish of UG-21149' (2-Methyl-2-(methylthio) propionaldehyde)-(methylcarbamoyl) oxime) in Cotton Plants and Soil in the Field

Soil data reviewed under soil metabolism heading - see for methodology.

5.4.2

Relative concentrations of S^{35} labeled UC-21149 sulfone and its metabolites in leaves of field-grown cotton (petiole injection of 120 g/leaf).

Compound	% of applied dose at indicated days after treatment					
	0	1	2	4	8	16
Unknown(s) A	0.2	1.6	3.5	6.4	14.4	26.9
Unknown D		0.8	1.2	1.3	1.0	0.9
Sulfone	99.8	92.7	85.7	74.2	64.7	28.1
Oxime sulfone		1.7	2.3	3.4	2.6	2.1
Nitrile sulfone		9	1.2	1.9	1.4	1.3
Unextractable	.0	2.0	2.2	4.3	4.5	4.8
Lost	.0	.3	3.9	8.5	11.4	35.9

Relative concentrations of S^{35}-labeled UC-21149 and its metabolites recovered from soil that was treated and then exposed to seasonal field conditions.

Compound	% of applied dose at indicated weeks after treatment				
	0	1	2	4	8
Unknown A	0.2	0.7	0.7	0.0	0.1
Unknown B	.0	.1	.2	.1	.1
Unknown C	.1	.2	.1	.0	.0
Unknown D	.0	.0	.9	.3	.0
Sulfoxide	8.0	36.8	14.4	2.2	.8
Oxime sulfoxide	.7	.7	1.2	.5	.1
Sulfone	.0	4.6	3.8	1.8	1.0
Nitrile sulfoxide	.0	1.5	.7	.1	.1
Unknown E	.0	1.3	1.1	.4	.2
UC-21149	76.6	1.6	.2	.2	.1
Unknown F	.0	.2	.4	.1	.1
Unextracted	14.4	13.8	15.9	12.9	11.1
Lost	.0	38.5	60.4	81.4	86.3

5.4.3 Conclusions

Temik was melabolized in 1 week to primarily the sulfoxide melabolite. Lost products increased with time. Activity was uniformerly spread through the plant, adjacent leaves contained more activity than nonadjacent leaves (treated). Unknowns represented one of the largest amounts of residues. This is an ancillary study.

5.4.2 Acc #091377. Vol. 2 of 6. Tab # pg. 5. Movement of Temik in Columns of soil in the Greehouse.

5.4.3 35S Temik used for evaluation.

5.4.4 Results.

Movement of S^{35} Temik through 6 x 8 in. columns of soil following the addition of 1 in. or water/week/column.a/

Product in indicated layer b/	% of total dose at indicated weeks after treatment c/											
	1			2			3			5		
	Sand	Loam	Clay	Sand	Loam	Clay	Sand	Loam	Clay	Sand	Loam	Clay
0-2 in.												
Temik	40.30	7.90	1.40	4.90	0	0	0.37	0	0	0	0	0
sulfoxide	1.96	4.20	3.90	1.40	2.06	4.90	0.17	1.01	0.06	0.09	0.62	0.10
sulfone	0	2.30	0	0	0.15	0.60	0	0.08	1.01	0	0	0
others	4.44	42.40	22.50	3.80	19.49	4.30	1.26	9.81	1.53	0.41	1.38	1.39
Total in layer	46.70	56.60	27.80	9.10	21.70	9.8	1.80	10.10	1.60	0.5	2.00	1.40
4-6 in.												
Temik	2.30	-	-	0.47	0	0	0.67	0	0	0	-	-
sulfoxide	0.45	-	-	0.19	0.03	0.04	0.25	0.03	0.02	0.09	-	-
sulfone	0	-	-	0	0	0	0	0	0	0	-	-
others	1.55	-	-	4.64	0.07	0.16	2.68	0.17	0.18	0.91	-	-
Total in layer	4.30	0.20	0.20	5.30	0.10	0.21	3.60	0.20	0.20	1.0	-	-
6-8 in.												
Temik	0.72	-	-	0.43	-	0	0.29	0	-	0	0	-
sulfoxide	0.20	-	-	0.25	-	0.04	0.18	0.02	-	0.39	0.02	-
sulfone	0	-	-	0	-	0	0	0	-	0	0	-
others	0.58	-	-	6.42	-	0.06	3.43	0.08	-	2.51	0.08	-
Total in layer	1.50	0.10	0.10	7.10	T	0.10	3.90	0.10	T	2.90	0.10	T
Elution water d/	0	0	0	0.10	0	0	2.3	0.3	T	2.1	0.2	T
Total recovery e/	60.4	59.5	29.8	24.70	23.7	10.7	13.9	11.5	2.6	6.8	2.6	1.8

Continued:

Continued:

a/ All columns were treated with 34 mg. (2 lb/acre) or S^{35} Temik applied in a 6 in. band 1.5 in. deep. Results are expressed as the average of triplicate samples.

b/ Layers are indicated in number of inches from the top of the columns.

c/ Sand = coarse builder's sand (10 mesh and smaller) clay = Houston clay (virgin) and loam - Lufkin fine sandy loam.

d/ Eluton water - water which passed through the columsn of soil following the weekly addition of 1 in. of moisture.

e/ Precent of the total applied dose recovered from the whole sample including elution water but excluding residues left in the extracted soil samples.

DATA from 2-4" layer has been submitted.

Movement of C^{14} Temik equivalents through 6 x 30 in columns of soild following the addition of 1 in. of water/column/week for 9 weeks.

Soil type	% of total dose at indicated weeks after treatment						Total eluted (%)
	4	5	6	7	8	9	
Sand (coarse)	0.15	0.33	0.35	0.39	0.28	0.18	1.60
Lakeland fine sand	0	0	0	0	0	0	0
Lufkin sandy loam	0	0	0	0	0	0	0

Dated From 1, 2, 3 weeks has been submitted.

a/ Columns were treated with 34 mg of S^{35} Temik (2 lb/acre) applied in a 6 in. band 3 in. from the top. Results are the average of triplicate samples. Trace amounts (T) - 0.01% of applied dose.

5.2.6 Conclusions

In the Greenhouse Temik is soild dependent for mobility with sand readily mobile. Temick-sulfoxide was the major metabolite, it too was mobile. This is an ancillary study.

5.3 Acc # 091372, Vol. 2 of 6, Tab #11.

<u>The persistence of Temik in an Agricultural Soil as Indicated by Field and Laboratory Bioassay</u>

5.3.1 A field that contained potatoes was planted with treatments of 0, 2, 4, and 6 lb. ai/A of Temik 10G. The field was plowed and in the Spring potatoes plants emerged. They were let grow to observe lethality to insects. Temik is not lethal to insects ~1 year after application.

This is an ancillary study.

5.3.1 ACC # 091372, Vol. 2 of 6, Tab #2, pg. 902.

<u>Fate of 2-Methyl-2-(methylthio)propionaldehyde O-(Methylcarbamoyl) oxime (Temik) in Cotton Plants.</u>

5.3.2 ^{35}S Temik, ^{14}C (S-methyl), and labeled Temik-sulfoxide and sulfone were used for evaluation in cotton plants.

<u>Metabolism of Temik in Intact Cotton Leaves</u>[a]

Product	Per Cent of Total Dose at Indicated Days after Treatment 1	3	7	21	28	35
Temik	24.5	3.5	2.5	0.5	0	0
Temik-sulfoxide	56.4	71.8	52.1	28.9	19.3	5.3
Temik-sulfone	2.7	3.2	6.3	10.4	4.7	2.6
Oxime-sulfoxide	2.5	1.5	0.8	0.7	0	0
Nitrile-sulfoxide	2.0	2.1	4.8	3.4	0.6	1.9
Unknown(s)1	4.5	5.0	3.3	13.9	9.1	13.1
Unknown 3	0	1.6	0.6	0	0	0
Unknown 5	2.0	0	0.2	0.1	0	0
Unknown 6	2.6	0.5	0.2	0.3	0.1	0
Unknown 7	0.6	0.3	1.2	0	0	0
Total in extract	98.0	89.5	72.0	58.2	33.8	22.9
Residue	2.0	6.5	2.6	5.7	1.2	4.9
Lost	0	4.0	25.4	36.1	65.0	72.2

a 200 ug ^{35}S Temik per leaf administered by petiole injection; data based on radioassay and expressed as average of duplicate chromatograms of triplicate samples.

5.3.5 Cotton plants metabolized Temik to Temik-sulfoxide (major metabolite) to unknowns, of which, unknown1, was significant (13%). Volatiles were trapped and identified as Temik-sulfoxide, T-sulfone, and unknown #3. The volatilized materials were lethal to lygus bugs from 8 hrs. (100% lethality) to 48 hrs. (50% lethality). Excised leaves metabolized labeled T-sulfoxide primarily to nitrile-sulfoxide and unknown #1. Excised leaves metabolized labeled T-sulfone, primarily unknown #1. Excised leaves metabolized labeled oxime to primarily nitrile-sulfoxide, unknown #1, and unknown #5. This is an ancillary study.

5.4.0 Acc # 091372, Vol. 2 of 6, Tab #8.

Continuous feeding of Radio labeled Temik to Laying Hens.

5.4.1 Mature laying hens were given doses of Temik and Temik sulfone. The feces were analyzed and found to contain Nitrile sulfoxide, Nitrile sulfone, oxime sulfoxide, oxime sulfone, oxime, nitrile, and 13 unknowns. This is an ancillary study.

5.5.0 Special reviews. Acc # 096240, July 1977. Tab LV. Substitute Chemical Program. Initial Scientific and Microeconomic Review of Aldicarb.

5.5.1 For EF purposes data in subpart ~~support~~ II C.

Fate and Significance in the Environment is Germane.

5.5.2 All the studies submitted are data that has been reviewed in context before, except a report of hydrolysis and oxidation in which it is stated that aldicarb is hydrolyzed in alkali to oxime and then further hydrolyzed by acid to aldehyde. Aldicarb is stated to be oxidized to aldicarb sulfoxide and then to aldicarb sulfone.

6.0 General Conclusions

From the data that was presented, a partial assessment of hazards to the environment can be established, a full assessment (scientifically confident) cannot be made without physico-chemical (photolysis) and metabolism (pesticide effects on microbes) for this use. We will present what can be derived from the data presented.

6.1 Hydrolysis: Temik will hydrolyze at 80° and 100°C with a t 1/2 at pH 6 and 8 of 190 hrs., 49 mins, 115 mins., and 7 mins., respectively. T-sulfoxide and sulfone under the same parameters had t 1/2's of 80 min, 3.1 min, 20 min, 0.5 min, 120 min, 15 min, 50 min, and < 0.5 min. respectively. This study would not support any proposed use because temperatures of 80 and 100° C are not indicative of conditions normally found in the field where Temik is applied. Not enough data (3 points needed) to extrapolate to lower temperature values. The study was not a material balance study (full extent of rate and decline of parent and formation of degradate cannot be made. Not done in the dark (it has not been established that Temik does not photolyze).

6.2 Metabolism (soil, aerobic): Temik will metabolize in clay, fine sand, clay loam, and muck type soils with different pH values (60-80), moisture (3-100%), and organic matter (1-78%) to t 1/2 values from < 1 week to > 56 days. Ten degradates were found with Temik sulfoxide and sulfone being predominant. The compound exhibits volatility and binding in the soil. Organic matter plays a significant role in the fate of Temik in the soil. A total of three aerobic soil metabolites studies were submitted and these three combined give us an acceptable soil (aerobic) metobolism study. We have a good description of Temik and its characteristics in soil. This combined acceptable study will support proposed uses in terrestrial and terrestrial/aquatic (forest) type applications. There is no acceptable aerobic aquatic study and this will not substitute for uses requiring this data (aquatic and aquatic impact uses).

6.3 Metabolism (Microbial): Temik does not exhibit microbiocidal effects to the microorganisms tested. This study would not support any proposed use where required (some terrestrial, aquatic, terrestrial/aquatic (forest) and some aquatic impact uses). "Eye ball" methods are not scientifically sound in enumerating bacterial numbers. Plant pathogens and/or fecal pollution indicators, which are not indicative of commensal soil populations are unacceptable.

6.4 Mobility (leaching)

The ability of Temik and its degradates to leach depends on the soil type, particularily the organic matter. In muck soil the sulfoxide degradate leached through 7" of soil; loamy type soil parent, sulfoxide, and others leached; in clay type soil the same three leached. The sulfone metabolite did not leach and either is bound or volatilized. Since the leaching studies show Temik and its degradates do leach, we can say that the point is proven. Not all soil characteristics such as pH, CEC, bulk density and percent sand, silt, clay; and an aged study were not submitted (not needed, degradates do leach), we can say that in lieu of these deficiencies, the studies can be used to support proposed uses for terrestrial applications. Since the parent compound and its degradates leach (in sandy type soils) a caution should be taken to the contamination of ground water tables and the food web.

6.5 Mobility (volatility)

Temik does volatilize and its rate is dependent upon moisture level of the soil and temperature. The type of soil will play a role on the rate of volatility. These studies were not done under actual use conditions. If Toxicology Branch requires reentry data for Temik, these studies would not support reentry data, for the aforementioned reasons.

6.6 Field Dissipation (soil)

In the sandy loam soils tested Temik had an extrapolated t 1/2 of ~1 week. Temik sulfoxide and sulfone had extrapolated t 1/2's of ~2 weeks. These studies give us a rough idea of field dissipation, however no areas of high organic matter and four agricultural use areas were evaluated, which in soil metabolism showed extremely long half-lives in some cases. Not all characterization of the soils were given including percent sand, silt, clay, organic matter, CEC, and bulk density. These studies would not support any proposed uses for the compound.

6.7 Accumulation (Fish)

Temik at 30 ppm is lethal to bream, large mouth bass, bull frogs and cricket frogs. Temik is lethal to fish up to 10 days after treatment. This study would not support any proposed use because only one exposure system (static) was used. Determinations of residues in whole body, edible tissue and viscera or carcass were not analyzed. Catfish were not used in the static system, radioisotopic techniques, and characteristics of the water were not used for methodology or reported. Pre-application samples were found to contain residues, the validity of the study would be questionable. Temik appears to influence the pH of the water (registrant claims no effect) and pH of water after day 7 was not given. Due to the lethality, rates in water or aging in water may have to be changed to show accumulation.

6.8 Ancillary Studies

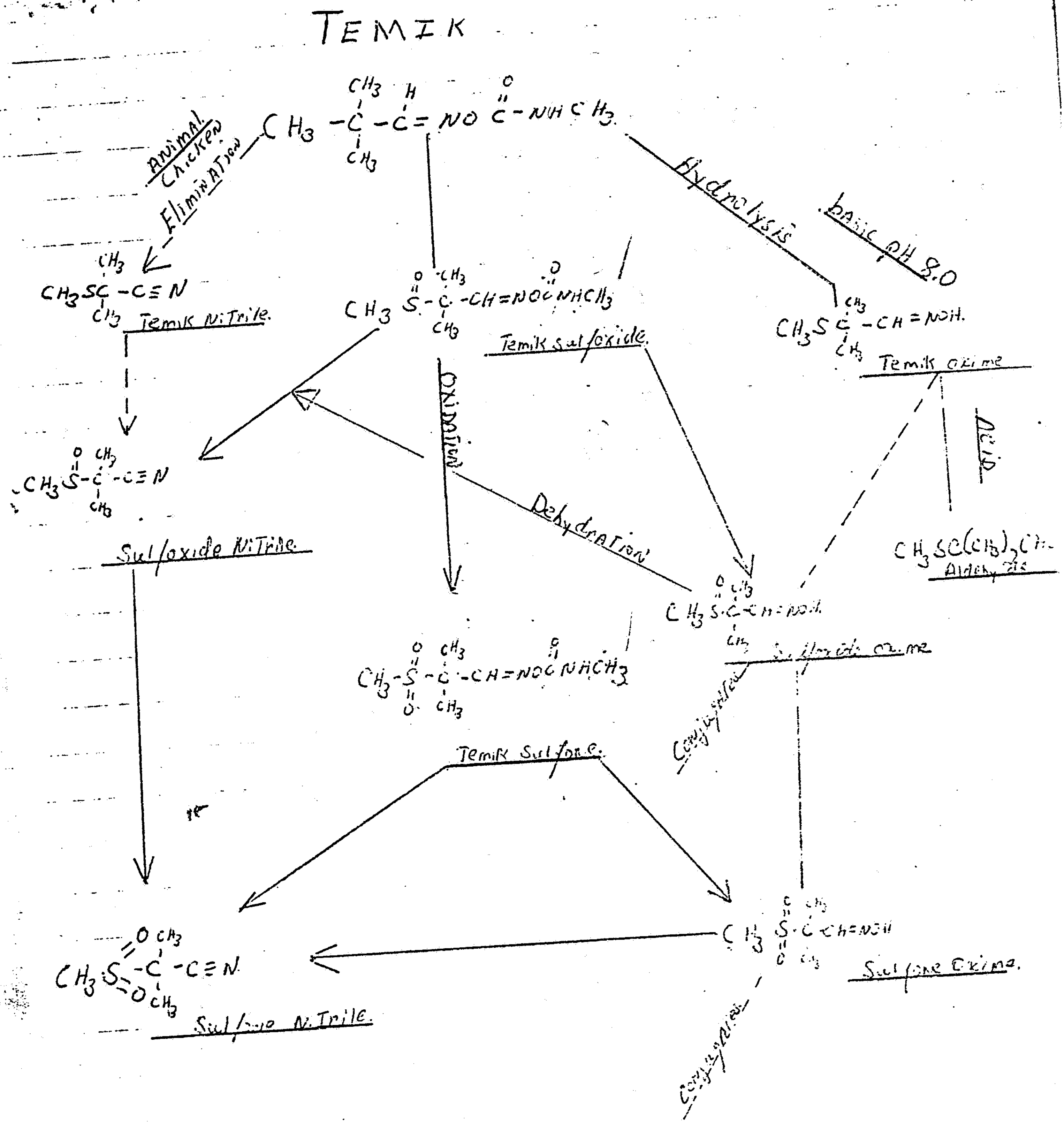
Temik is metabolized in plants to primarily the sulfoxide metabolite and unknown #1. A total of 8-10 metabolites were found in plants and 11 in the soil. Activity was uniformly spread throughout the plant. In the greenhouse Temik is soil dependent for mobility and is readily mobile in sand (coarse). Temik sulfoxide was the major metabolite and found in the 6-8" layer of the column. Temik after ~1 yr. in the soil is not lethal to insects. A large amount of aetivity is lost and is probably due to volatilization. Laying hens were found to have nitrile sulfoxide, oxime sulfone, oxime nitrile, and 13 unknowns in their feces when fed Temik and Temik sulfone. The studies are ancillary. The studies can be used to support any proposed use that is applicable.

6.9 Ancillary Study

Special review - substitute chemical program.

All the studies submitted are data that has been previously reviewed, except a study on hydrolysis and oxidation which stated Temik under alkali conditions is hydrolyzed to oxime, then further by acid to aldehyde. Aldicarb is stated to be oxidized to aldicarb sulfoxide and then to aldicarb sulfone. This is an ancillary data package. It could be useful in some aspects (plant metabolites studies) to give support to appropriate uses.

Metabolism Chart

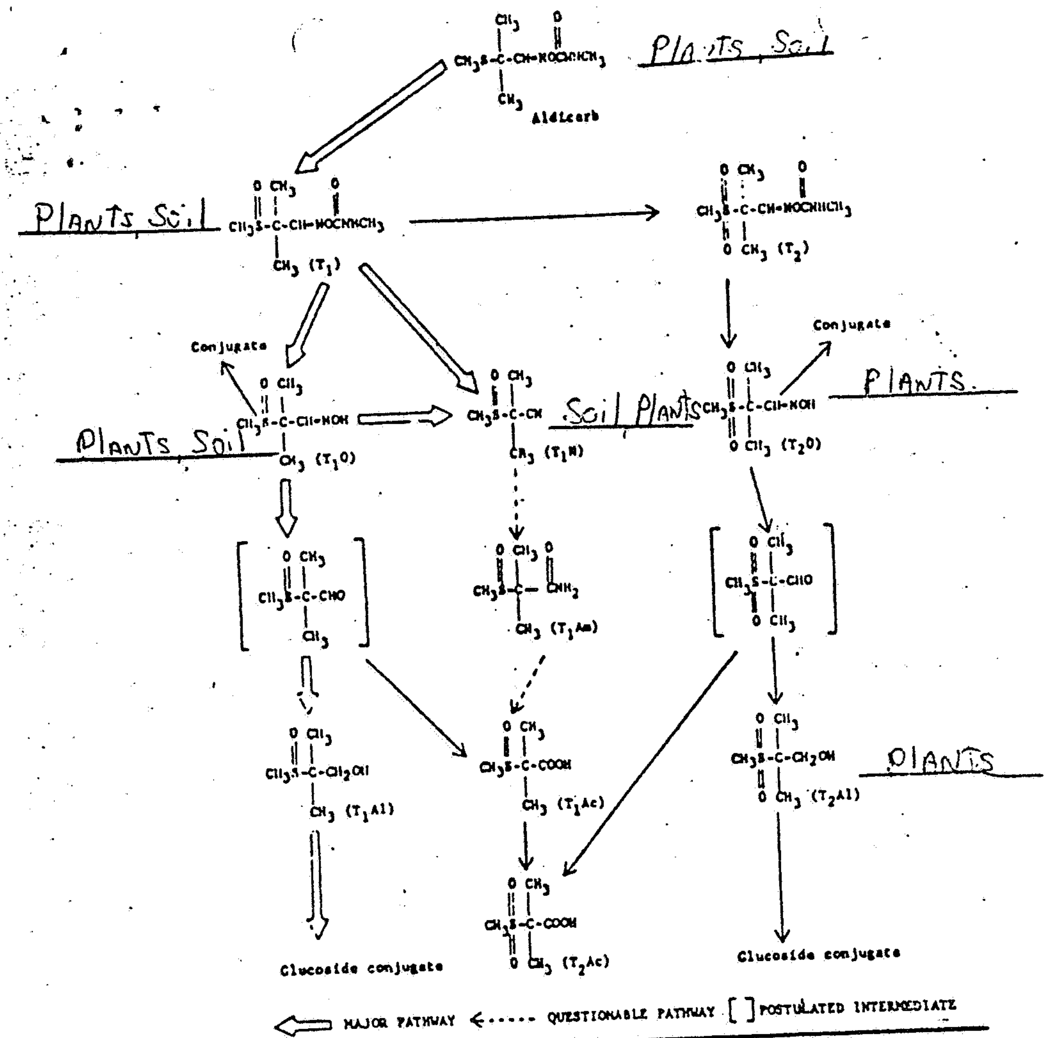


UNKNOWNS NOT included.

- - - - - Probable pathway.

71

52



Compound	Abbreviation
2-Methyl-2(methylsulfinyl)propionaldehyde O-(methylcarbamoyl)oxime (Aldicarb sulfoxide)	T_1
2-Methyl-2-(methylsulfonyl)propionaldehyde O-(methylcarbamoyl)oxime (Aldicarb sulfone)	T_2
2-Methyl-2-(methylsulfinyl)propionaldehyde oxime (Oxime sulfoxide)	T_1O
2-Methyl-2-(methylsulfonyl)propionaldehyde oxime (Oxime sulfone)	T_2O
2-Methyl-2-(methylsulfinyl)propionitrile	T_1N
2-Methyl-2-(methylsulfinyl)propionamide	T_1Am
2-Methyl-2-(methylsulfinyl)propanol	T_1Al
2-Methyl-2-(methylsulfonyl)propanol	T_2Al
2-Methyl-2-(methylsulfinyl)propionic acid	T_1Ac
2-Methyl-2-(methylsulfonyl)propionic acid	T_2Ac

Source: Bariety et al., op. cit. (1970).

7.0 Recommendations

7.1 We cannot concur with the proposed added use on oranges for Temik.

7.2 The following studies were not submitted nor referenced and are required:

(1) Photodegradation in soil.

(2) Photodegradation in water.

(3) Aged leaching study*

(4) Effect of pesticides in microbes.

* Since other studies show Temik and its degradates to leach, we do not need an aged leaching study.

7.2.1 Degradation studies are used to determine rates of loss and identification of pesticides residues which may adversely affect nontarget organisms. Pesticides and their degradates may be available to nontarget organisms as residues in fish and may contaminate the food web. Hydrolysis and photolysis aee two routes of physico-chemical degradation that may effect nontarget organisms or be available in the food web.

Microbial degradation with its biochemical transformations may be of greater importance than phsico-chemical transformations. Microbes are among the most important groups of organisms énvolved in the biochemical transformation of pesticides in soil and sediment. Microbe interactions may affect the availability of pesticides to nontarget organisms and accumulation in the food web.

Pesticide movement (mobility) may cause contamination of the food web, loss of usuable land and water resources to man.

7.3 The following studies are not acceptable; their deficiencies are noted.

7.3.1 Hydrolysis. PP 3F1414, book 1, Sect. D. June 1973, found in Compilation book for Environmental Chemistry, july 1977.

(1) Information is needed concerning the lighting codditions in this study; since pesticides are usually susceptible to both hydrolysis and photolysis.

(2) The temperature evaluated of 80° and 100°C, are not conducive with temperatures found in the environmental conditions of pesticide application to the environment.

(3) A material balance study was not submitted. Both degradates formed and pictures of chromatograms were not submitted.

(4) Methodology of thin juice analytical procedure UC 21149-III-SBF could not be found in the review package.

(5) This study will have to be repeated. Acceptable protocol may be found in sect. 7.95(1). The thin juice analytical procedure UC 21149-III-SBF methodology will have to be submitted.

7.3.3 Microbial Metabolism. Acc # 091372, Vol. 2 of 6, Tab #13.

(1) Animal or plant pathogens and iddications of fecal pollution are unsuitable for microbiocidal or static determinations. They are not commensal organisms found in soil.

(2) ~~Usual~~ Visual enumeration techniques of bacterial growth is unacceptable.

(3) This study will have to be repeated, acceptable protocol can be found in sect. 7.9.5(~~5~~ 3).

7.3.4 Accumulation (Fish)

(1) A flow through system was not evaluated.

(2) Radioisotopic techniques not used.

(3) Catfish not used in the static system.

(4) Soil not aged properly (2-4 weeks - aerobic conditions) prior to initiation of exposure in the static system.

(5) Determinations of residues in whole body, edible tissue, and viscera or carcass were not analyzed.

(6) Characteristics of the water were not given.

(a) O_2 content.

(b) temperature.

(7) This study will have to be repeated. Acceptable protocol may be found in sect. 7.9.5 (7).

7.4 The following studies combined are an acceptable soil metabolism (aerobic study).

(1) Acc # 091372, Vol. 2 of 6, Tab #7, pg. 3.

(2) Compilation EE data book July 77, II-1.

(3) Acc # 091372, Vol. 2 of 6, Tab #2, pg. 907.

7.5 The following studies combined are an acceptable soil leaching study.

(1) Acc # 091372, Vol. 2 of 6, Tab #9, pg. 4

(2) Acc # 091372, Vol. 2 of 6, Tab #15.

7.6 The following studies are scientifically acceptable, but have deficiencies.

7.6.1 Volatility

7.6.2 Acc # 091372, Vol. 2 of 6, Tab #9, pg. 4.

(1) Not evaluated under actual use conditions.

7.6.3 Acc # 091372, Vol. 2 of 6, Tab #9.

(1) Same as above.

7.6.4 Acc # 091372, Vol. 2 of 6, Tab #9, pg. 7

(1) Same as above.

7.7 Field Dissipation

7.7.1 Acc # 091372, Tab # ~~9~~ 10, Vol. 2 of 6.

(1) Four agricultural use areas were not evaluated, the reported data is only for one.

(2) Samples were not taken to a depth of 12".

(3) Characterization of the soils were not included, texture (percent sand, silt, clay), organic matter, pH, cation exchange capacity, and bulk density.

7.7.2 Acc # 091372, Tab #12, Vol. 2 of 6.

(1) Same as above.

(2) Same as above.

(3) Same as above.

(4) No data for discing on residues decline.

(5) No data on plant residue data.

7.7.3 Acc # 091372, Vol. 2 of 6, Tab #14.

(1) Same as above.

(2) Same as above.

(3) Same as above.

7.9.1 The following questions are asked about environmental chemistry data that need clarification.

7.9.2 Why is the percent lost in the leaching study greater in nonmuck soils, except sand, when other soil studies show the opposite to be true (sec. 7.5.1).

7.9.3 In the leaching study with Temik 10G, what happened to the other 96% of the material. Data reported ≈1% was leached and ≈1-2% remained in the soil (sect. 7.5.2).

7.9.4 In volatility studies 50% in study is unaccounted for. A claim is made that they are "nontoxic" oxime and nitrile compounds. Was this analyzed? What are normal outdoor conditions used for the second study (sect. 7.6.1-7.6.3).

7.9.5 The following descriptions are examples of acceptable protocol for either data gaps and/or data with deficiencies.

1. <u>Hydrolysis.</u> Pesticides may enter natural waters via direct application, mobility from treated areas, industrial discharge, and as a result of disposal and cleanup of containers and equipment. Hydrolysis data are required for all pesticides. Studies are to be conducted in darkness using radioisotopic or other comparable detection techniques at different pH values (acidic, neutral, and basic) at two concentrations and two temperatures. Aliquots in duplicate should be taken at four sampling time intervals, with at least one observation made after one-half of the pesticide is hydrolyzed, or thirty days, whichever is shorter.

7.7.3 Acc # 091372, Vol. 2 of 6, Tab #14.

(1) Same as above.

(2) Same as above.

(3) Same as above.

7.9.1 The following questions are asked about environmental chemistry data that need clarification.

7.9.2 Why is the percent lost in the leaching study greater in nonmuck soils, except sand, when other soil studies show the opposite to be true (sec. 7.5.1).

7.9.3 In the leaching study with Temik 10G, what happened to the other 96% of the material. Data reported ≈1% was leached and ≈1-2% remained in the soil (sect. 7.5.2).

7.9.4 In volatility studies 50% in study is unaccounted for. A claim is made that they are "nontoxic" oxime and nitrile compounds. Was this analyzed? What are normal outdoor conditions used for the second study (sect. 7.6.1-7.6.3).

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A material balance (accountability at the completion of an experiment of the pesticide introduced into a defined system including both identified and unidentified products), half-life estimate, and identification of degradation products for the pesticide must be provided (10% or greater). Studies utilizing distilled water provide an upper limit estimate for persistence of pesticides in the aquatic environment. Hydrolysis in natural waters ma- be carried out to supplement studies in distilled water. Concentrations should approximate use rate and 10 X use rate.

2. Photolysis. Sunlight may destroy or chemically alter pesticides in soil, water, and air. Photodegradation studies in water are required for terrestrial, aquatic, terrestrial/aquatic, and aquatic impact uses (except for greenhouse and domestic outdoor uses), and uses where pesticides are discharged into wastewater treatment systems. Studies in soil are required for crop uses and terrestrial/aquatic uses. Studies in vapor phase are required as part of the assessment of reentry hazard. Conduct photodegradation studies using radioisotopic or comparable detection techniques at one concentration (approximately use rate) under natural or simulated [greater than 280 nm wavelength] sunlight. Such studies must provide a material balance, half-life estimate, and the identification of photoproducts, 10% or greater. Rate studies are conducted in distilled or deionized water at pH of maximum stability, and sampling should continue up to twenty percent degradation with sampling for identification of photoproducts to half-life, or thirty days, whichever comes first. Yield of photoproducts may be increased by changing such conditions as wavelengths, concentration, photosensitizers, and solvents other than water. Supplemental rate and photoproduct studies may be carried out in natural water for aquatic uses. Studies performed on the soil used in the soil metabolism studies are preferred but other soiltextures will be acceptable. The

intensity of incident sunlight and time of exposure must be reported if sunlight is used as a source. Information on artificial light sources should contain type of source, intensity, wavelength, and time of exposure.

Photodegradation data must be supported by incident light intensity and percent transmission. Values for intensity in candles per unit area or lambert units are required for artificial light sources. Latitude, time of year, atmospheric cover, and other major variables which affect incident light are to be reported when natural sunlight is used.

Characteristics of water must be reported including pH, temperature, and oxygen content.

3. Effects of microbes on pesticides. Impact of microbes on pesticide transformation is measured by comparisons of metabolic processes under sterile and nonsterile conditions during a thirty day period. Preferred sampling intervals are 1, 3, 7, 14, 20, and 30 days, but other intervals may be appropriate. Acceptable soil sterilization methods are heat or high energy ionizing radiation. Attempts should be made to identify organisms responsible for degradation. For organisms which are difficult to identify, family names will be sufficient. Isolates that cannot be identified to family level must have descriptive characteristics which can be substituted for generic classification. Alternatively, studies utilizing pure or defined and characterized mixed cultures of bacteria, algae, and/or fungi are adequate.

4. Effects of pesticides on microbes. Data on effects of pesticides on microbes aee obtained from studies of effects on microbial functions or microbial populations. Studies of effects on microbial functions constitute a more dieect approach, and are preferred in studies of effects on populations. Some effects cannot be maasured directly and population studies may be the only recourse. When the functional approach

is chosen, data on the effects on nitrogen fixation, nitrification and degradation of cellulose, starch, and protein are required for terrestrial and aquatic uses, and for tresstrial/aquatic uses, an additional pectin degradation study is required. A leaf litter degradation study may be substituted for the cellulose, starch, protein, and pectin degradation studies. When the population approach is chosen, effects on pure or mixed culture populations of representative microorganisms from soiloor water or obtained from culture collections should be recorded for terrestrial/aquatic or aquatic uses. Appropriate organisms include free-living nitrogen-fixing bacteria and blue-green algae such as Azotobacter, Clostridium, and Nostoc, and nitrifiers such as Nitrosomonas and Nitrobacter. For cellulose, starch, pectin, protein, and similar degradation, include at least one each of soil bacteria, actinomycetes, and molds such as Bacillus, Pseudomonas, Arthrobacter, Cellulomonas, Cytophaga, Streptomyces, Penicillium, Flavobacterium, Trichoderma, Aspergillus, Chaetomium, and Fusarium. Animal or plant pathogens and indicators of fecal pollution are unsuitable.

9 5. A field dissipation study under actual use conditions is required. Analyses are continued until a ninety percent loss of the pesticide occurs or until patterns of formation and decline of degradation products are established or to a maximum test duration of eighteen months. Soil samples are taken in increments to a depth of 12 inches from sites in four agricultural use areas. Sampling times include preapplication, day of application, and shortly postapplication. Succeeding samples are dependent upon degradation and metabolism characteristics.

Identification of residues comprising more than ten percent of initial application or 0.01 ppm is needed to construct decline curves of residues in soil.

Characterization of soils must be reported including texture (percent sand, silt, and clay), percent organic matter, pH, cation exchange capacity, and bulk density.

6. Fish residue accumulation data using radioisotopic or comparable technique are required. Two exposure systems are required: flow-through (with constant concentration of aqueous solution of pesticide) and static (with ambient oconcentration of residues). Sunfish are preferred in flow-through system and catfish required in the static system. For the static system treat water overlayering a sandy loam soil at the proposed application rate and allow system to "age" for 2 to 4 weeks prior to initiation of fish exposure.

   Exposure duration is 30 days with suggested sampling times at 0, 1, 3, 7, 10, 14, 22, and 30 days of exposure; while fish and water samples are taken on 0, 1, 3, 7, 10, and 14 days of withdrawal of exposure. Obtain soil and water samples prior to fish exposure intervals. Determine the amount and identify of the residue in water, soil, whole body fish, edible tissue, and viscera or carcass at each sample interval.

   Characteristics of water must be reported including pH, temperature, and oxygen content.

7.9.6 We defer to Environmental Safety the significance of residues in ground water.

I. The use of Temik in orange orchards may result in residues in ground water.

   A. Temik (parent), Temik sulfone and Temik sulfoxide will leach in sandy soils.

      1. Sandy loam

         a. At 16 days after treatment (4 lbs 14 C-Temik /A or 24 ppm ai/A) resulted in 3.93% of total applied in eluted water (water that passed through a 5" soil column). Of this at 16 days .02% was parent (.0032 ppm), .92% T-sulfoxide (.146 ppm), 0% sulfone, and .15% other (.025 ppm).

2. Sand

a. At 23 days after treatment (4 lb ^{14}C Temik /A or 24 ppm ai/A) resulted in 83.97% of total applied in eluted water (water that passed through a 5" column). Of this at 23 days 31.47% (1.03 ppm) was parent, 2.6% (0.08 ppm) was to sulfoxide, 0% sulfone, and .04% (.0013 ppm) others.

3. T. sulfone at 35 days in sandy loam was detected in trace levels.

B. Temik is stable in pH values of 5.0. Temik and Temik sulfone and sulfoxide will degrade in pH of 6, 7, and 8 at 80°C and 100°C with t 1/2's less than 24 hrs. We have no data on more ambient aquatic environmental temperatures. We do not have enough data to extrapolate to these temperatures (although we suspect much longer). We do not have a material balance degradates formed from either parent or t. sulfone and sulfoxide.

C. Temik in pond water at 3.0 ppm (introduced into the water by the registrant) was conducted on bream, large mouth bass, bull frogs, and cricket frogs (static system) and no accumulation (bio) could be made at 3.0 ppm because it was lethal to these species for up to 10 days of treatment (1.6 ppm left). We defer the significance of Temik in pond water also.

7.9.7 We defer to Toxicology Branch regarding the significance of volatile products.

1. Laboratory studies show Temik to volatilyze depending on soil type (sandy type), temperature, and moisture level from 10% to 50%. Another laboratory study showed that volatiles were identified as Temik sulfoxide, Temik sulfone, and unknown #3.

7.9.8 We defer to Toxicology Branch as to the need for r data requirements. If Toxicology Branch determine: that reentry data are needed, then Registration Div will require the following:

a) Soil metabolism.

b) Soil dissipation.

c) Dislodgable residues.

d) Volatility.

e) Photodegradation (vapor phase).

PM Note: We know that other uses are pending for Aldicarb (field/ vegetable crops for one) and other data gaps exist for these uses (anerobic soil metabolism and retational crop data).

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