

US EPA ARCHIVE DOCUMENT

5/10/81 ✓

Date Out EFB: NOV 3 1981

To: Product Manager 12 Ellenberger
TS-767

From Dr. Willa Garner *ll*
Chief, Review Section No. 1
Environmental Fate Branch

Attached please find the environmental fate review of:

Reg./File No.: 264-330, 264-331

Chemical: Aldicarb

Type Product: Insecticide

Product Name: Temik

Company Name: Union Carbide

Submission Purpose: Use on citrus including ground water contamination
considerations

ZBB Code: 3(c)(7)

ACTION CODE: 335

Date in: 10/21/81

EFB # 20, 21

Date Completed: NOV 3 1981

TAIS (level II)

Days

Deferrals To:

60

2

Ecological Effects Branch

Residue Chemistry Branch

Toxicology Branch

1.0 INTRODUCTION

This is to address the question raised by Product Manager team-12, c/o Mr. Ellenberger, as to whether or not aldicarb would contaminate ground water when used to citrus (PM Nos. 36593, 36596; EFB Nos. 82-20, 82-21). Expanded use to citrus is proposed by Union carbide under Section 3(c)(7) of FIFRA as amended on September 30, 1978.

2.0 BACKGROUND

Aldicarb[2-methyl-2-(methylthio)propionaldehyde O-(methyl-carbamoyl)oxime] is a registered insecticide/nematocide that is currently used on several crops, mainly oranges peanut, potatoes, cotton, sugarcane, dry beans, sugar beets, and sweet potatoes at rates of up to 10 lbs ai/A/year (Reg. Nos. 264-330 and 331 for aldicarb 15G and 10G respectively). The chemical in its granular formulation can be applied and incorporated 2-3 inches below the surface. Aldicarb is stable to hydrolysis at pH 5-7 and temperature of 15-25% °C, however, the reaction at pH>8 is much faster with a half-life of 8 days. On the other hand, the biodegradation half-lives for aldicarb and its two major metabolites, aldicarb sulfoxide and aldicarb sulfone are 14.5 days, 60-90 days and >90 days respectively.

aldicarb has high water solubility (7800 pm), and very low partition coefficient ($K_d < 4$). It leaches into the soil and contaminates ground water. The 1980 ground water monitoring data showed aldicarb contamination to the ground water in New York, Maine, Wisconsin, and Missouri, Possible leaching in Florida, Virginia, and Georgia has not been confirmed by Union Carbide. For these reasons, decisions on aldicarb uses should be handled on a case-by-case basis.

3.0 PROPOSED USE

Citrus (Grapefruit, Lemons and Limes):

For citrus nematode control, apply in band along dripline on both sides of tree row just prior to or during spring flush of foliage growth. Incorporate in the top 2 to 3 inches of soil and irrigate promptly after treatment. For aphids control, apply as above, or, apply in irrigation furrows. Use the following dosages:

For citrus nematode control: Aldicarb 10G OR 15G at 10 lbs ai/A.

For aphids control: Aldicarb 10G or 15G at 5-10 lbs ai/A.

- ° Do not make more than one application per crop.
- ° Do not harvest within 30 days of application.
- ° Do not allow livestock to graze in treated areas.

4.0 DISCUSSION OF DATA

4.1 No environmental chemistry or ground water monitoring data were submitted.

4.2 PESTAN LEACHING MODEL

A simulated PESTAN leaching model was carried out for a typical citrus grove in St. Lucie County, Florida. Soil characteristics and composition in the top 0-6 inches of soil profile, as well as in the 85-115 inches, were obtained from USDA soil survey #22, 1969, page 162. The simulation was for a single application at 11.21 Kg/ha for a depth of 500 cm and projected time of 1000 days. The recharge rate was calculated from the actual 1980 rainfall records and the evapotranspiration rates, previously reported to us by Union Carbide along with the 1980 national monitoring data. The degradation rate coefficient was the same value reported by Smelt *et. al.* 1978. In addition, a calculated degradation rate coefficient where considerations were given to hydrolysis, was also used in the simulation. The latter rate coefficient was adapted after the 1980 INTERA report to the EPA "Mathematical Modeling of Aldicarb in Long Island" in which best agreement between predicted and actual field data were obtained when aldicarb $t_{1/2}$ was 5 $\frac{1}{2}$ years. The K_d was calculated using the average oc in the top ten feet and K_{oc} relationships. Finally, soil porosity, characteristic curve coefficient, and air entry value were taken from Clapp and Hornberger typical of the Troup series of St. Lucie County, Florida.

4.3 PESTAN PREDICTIONS

Input and output parameters are filed in the EFB.

Using the degradation rate coefficient reported in the literature, peak concentration of aldicarb residues predicted in the saturated zone, 250 cm below the soil surface, was 5 ppt 580 days after application. Note that the water table in some of these locations varies from 10 inches for a period of 2-4 months and not more than 40 inches below the surface the rest of the year. Using the INTERA degradation rate coefficient and a dilution factor of 10X, peak concentrations in the ~~same~~ same zone, 250 cm below the surface, was 178 ppb 700 days after application.

This predicted peak was comparable to the peak residues of 122 ppb contaminating the same profile in the same location which was reported to us along with the 1980 national monitoring data for aldicarb. Accurate predictions of pollutant concentrations could be possible if all modes of chemical metabolism are considered in calculating the degradation rate coefficient.

5.0 CONCLUSIONS

The Environmental Fate Branch believes that when aldicarb is used on citrus grown in Florida, it would leach into the saturated zone and contaminate ground water at predictable maximum residues of 178 ppb. The 1980 field monitoring data showed aldicarb contamination to the saturated zone, 250 cm below the soil surface, at a peak concentration of 122 ppb.

Sami Malak

Sami Malak, Chemist
Review Section #1
Environmental Fate Branch/HED

User's Name Sami Malak

Date 11/3/81

PESTAN Leaching Model Worksheet

Chemical : Aldicarb
Use Site (Crop) : Citrus
Location (State) : St. Lucie County, Florida
Rainfall + Irrigation : 60
Evapotranspiration (%) : 45"
Recharge (inches/year) : 15

Soil Characteristics : Texture Loamy sand pH 5.3 (5.2)* CEC 5.2 (1.3)*
Soil Composition (%) : OM 0.86 (0.08)* Sand 86 (87)* Silt 9 (5)* Clay 5 (8)*

*In the 0-6" and 85-115" respectively. Source: USDA Soil Survey Report #22,1969, Page 162.

PESTAN Input Parameters

Solubility (ppm) 7800
Estimated Recharge Rate (cm/hr). . . . 0.00435
Sorption Constant (k_d) 0.0844
Degradation Rate Coefficient (/hr) . . 0.00019^a (0.0000158)^b
Bulk Density (gm/cc) 1.5
Soil Porosity (cm^3/cm^3). 0.41
Characteristic Curve Coefficient . . . 4.38
Air Entry Value (cm) 9.0
Dispersion Coefficient (cm^2/hr). . . 0.06
Minimum Depth (cm) 0
Maximum Depth (cm) 500
Minimum Projected Time (day) 400
Maximum Projected Time (day) 1000
Number of Applications 1
Application Rate (kg a.i./Ha). 11.21
Days Before Beginning of Recharge. . . 12

^a/Smelt, et. al. 1978. Pestic. Sci. 9:279-292.

TITLE: ALDICARB/CITRUS/FLORIDA/SIM

MODEL USED: PESTVAN
 DATE: 10/30/81
 SOLUBILITY= 7800 ppm
 RECHARGE RATE= .00435 cm/hr
 SORPTION CONSTANT= .0844
 DEGRADATION RATE COEFFICIENT= .00019 /hr
 BULK DENSITY= 1.5 gms/cc
 SOIL POROSITY= .41 cc/hr

CHARACTERISTIC CURVE COEFFICIENT= 4.38
 AIR ENTRY VALUE= 9 cm
 DISPERSION COEFFICIENT= .06 cm²/hr
 LOADING= 11.0872
 PROJECTED WATER CONTENT= .183839
 PORE WATER VELOCITY= .023662 cm/hr
 POLLUTANT VELOCITY= .0140124 cm/hr
 LENGTH OF POLLUTANT SLUG= .0773195 cm

NUMBER OF APPLICATIONS= 1 APPLICATION RATE= 11.21 kg a.i./Ha

DAYS BEFORE RECHARGE= 12

DEPTH	0.0 cm	50.0 cm	100.0 cm	150.0 cm	200.0 cm	250.0 cm	300.0 cm	350.0 cm	400.0 cm	450.0 cm	500.0 cm
AT 400 DAYS	0.00E+00	7.33E-06	5.73E-04	1.15E-03	5.89E-05	1.04E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AT 460 DAYS	0.00E+00	3.13E-07	5.07E-05	3.36E-04	9.19E-05	1.04E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AT 520 DAYS	0.00E+00	1.23E-08	3.63E-06	6.03E-05	5.98E-05	3.53E-06	1.23E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AT 580 DAYS	0.00E+00	6.55E-10	2.25E-07	7.74E-06	2.13E-05	4.68E-06	8.26E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AT 640 DAYS	0.00E+00	0.00E+00	1.26E-08	7.81E-07	4.92E-06	3.14E-06	2.03E-07	1.40E-09	0.00E+00	0.00E+00	0.00E+00
AT 700 DAYS	0.00E+00	0.00E+00	6.52E-10	6.59E-08	8.26E-07	1.28E-06	2.43E-07	5.68E-09	0.00E+00	0.00E+00	0.00E+00
AT 760 DAYS	0.00E+00	0.00E+00	3.72E-11	4.85E-09	1.09E-07	3.53E-07	1.67E-07	1.14E-08	1.12E-10	0.00E+00	0.00E+00
AT 820 DAYS	0.00E+00	0.00E+00	0.00E+00	3.21E-10	1.18E-08	7.23E-08	7.42E-08	1.27E-08	3.64E-10	0.00E+00	0.00E+00
AT 880 DAYS	0.00E+00	0.00E+00	0.00E+00	1.94E-11	1.10E-09	1.17E-08	2.34E-08	8.89E-09	6.37E-10	8.82E-12	0.00E+00
AT 940 DAYS	0.00E+00	0.00E+00	0.00E+00	1.18E-12	9.10E-11	1.56E-09	5.61E-09	4.25E-09	6.76E-10	2.26E-11	2.35E-13
AT 1000 DAYS	0.00E+00	0.00E+00	0.00E+00	6.27E-14	6.77E-12	1.77E-10	1.07E-09	1.49E-09	4.78E-10	3.54E-11	5.64E-13

MODEL USED: PESTAN
 DATE: 10/30/81
 SOLUBILITY= 7800 ppm
 RECHARGE RATE= .00435 cm/hr
 SORPTION CONSTANT= .0844
 DEGRADATION RATE COEFFICIENT= .0000158 /hr
 BULK DENSITY= 1.5 gms/cc
 SOIL POROSITY= .41 cc/hr

TITLE: ALDICARB/CITRUS/FLORIDA/SM

CHARACTERISTIC CURVE COEFFICIENT= 4.38
 AIR ENTRY VALUE= 9 cm
 DISPERSION COEFFICIENT= .06 cm²/hr
 LOADING= 11.1997
 PROJECTED WATER CONTENT= .183839
 PORE WATER VELOCITY= .023662 cm/hr
 POLLUTANT VELOCITY= .0140124 cm/hr
 LENGTH OF POLLUTANT SLUG= .0781044 cm

NUMBER OF APPLICATIONS= 1 APPLICATION RATE= 11.21 kg a.i./ha DAYS BEFORE RECHARGE= 12

SOLUTION CONCENTRATIONS (ppm)

DEPTH	0.0 cm	50.0 cm	100.0 cm	150.0 cm	200.0 cm	250.0 cm	300.0 cm	350.0 cm	400.0 cm	450.0 cm	500.0 cm
AP 400 DAYS	0.00E+00	2.39E-02	1.87E+00	3.75E+00	1.92E-01	3.35E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AP 460 DAYS	0.00E+00	3.50E-03	5.56E-01	3.68E+00	1.01E+00	1.14E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AP 520 DAYS	0.00E+00	4.48E-04	1.34E-01	2.22E+00	2.20E+00	1.30E-01	4.48E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AP 580 DAYS	0.00E+00	8.03E-05	2.78E-02	9.59E-01	2.64E+00	5.79E-01	1.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AP 640 DAYS	0.00E+00	0.00E+00	5.25E-03	3.25E-01	2.05E+00	1.31E+00	8.44E-02	5.76E-04	0.00E+00	0.00E+00	0.00E+00
AP 700 DAYS	0.00E+00	0.00E+00	9.03E-04	9.21E-02	1.16E+00	1.78E+00	3.39E-01	7.93E-03	0.00E+00	0.00E+00	0.00E+00
AP 760 DAYS	0.00E+00	0.00E+00	1.73E-04	2.28E-02	5.10E-01	1.66E+00	7.83E-01	5.37E-02	5.20E-04	0.00E+00	0.00E+00
AP 820 DAYS	0.00E+00	0.00E+00	0.00E+00	5.07E-03	1.86E-01	1.14E+00	1.17E+00	2.01E-01	5.80E-03	0.00E+00	0.00E+00
AP 880 DAYS	0.00E+00	0.00E+00	0.00E+00	1.07E-03	5.84E-02	6.20E-01	1.24E+00	4.72E-01	3.38E-02	4.64E-04	0.00E+00
AP 940 DAYS	0.00E+00	0.00E+00	0.00E+00	2.08E-04	1.62E-02	2.78E-01	1.00E+00	7.58E-01	1.21E-01	4.07E-03	4.15E-05
AP 1000 DAYS	0.00E+00	0.00E+00	0.00E+00	3.72E-05	4.06E-03	1.06E-01	6.41E-01	8.91E-01	2.86E-01	2.12E-02	3.35E-04