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Date Out EFB: 28 FEB 1984

To: Jay Ellenberger
Product Manager 12
Registration Division (TS-767)

From: Samuel M. Creeger, Chief
Review Section No. 1
Exposure Assessment Branch
Hazard Evaluation Division (TS-769)

Attached please find the environmental fate review of:

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

Chemical: Aldicarb

Type Product: Insecticide/nematicide

Product Name: TEMIK

Company Name: Union Carbide

Submission Purpose: Field study - tile-drained corn fields

ZBB Code: other

Date In: 12/20/83

Date Completed: 28 FEB 1984

ACTION CODE: 336

EAB # 4132, 4133

| TAIS (level II) | Days |
|---|---|
| 63 | 2 |

Deferrals To:

_____ Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

## 1. INTRODUCTION

1.1 Union Carbide has recently requested amendment of two of their TEMIK products to include use on corn. EEB became concerned that after application to a tile-drained corn field, toxic levels of aldicarb residues may leave the field via the drainage system and impact adversely on aquatic organisms down stream from the treated field. Therefore, EEB requested Union Carbide to conduct field monitoring studies on tile-drained corn fields.

## 2. DISCUSSION OF DATA

2.1 Tile-Drained Corn 1983 Field Studies Conducted in Michigan and Indiana, Dec. 6, 1983; acc. no. 251946.

Procedure

The study was conducted at two sites. One site was a 12.2 ha field near Blissfield, Michigan (drains were 27.4 m apart and 1.0-1.3 m deep) with drainage into a ditch. The other site was near Bluecast, Indiana and had two drainage systems of 5.0 and 14.2 ha each (drains were 9.1 m apart and 0.2-0.5 m deep) which drained into the Maumee River.

TEMIK 15G was applied to both sites at 1.68 kg ai/ha (1.5 lb ai/A).

See tables I-IX for soil profiles, treatment and sampling dates, soil and water residues, and soil temperatures.

Discussion

Some corn fields require tile drainage systems because the soils are poorly drained. Leaching of aldicarb residues in such soils would, therefore, be minimal. However, runoff of aldicarb residues via the subsurface drainage system could occur.

The data show that use of aldicarb on tile-drained corn fields as described and at rates as described will result in the presence of aldicarb residues in the drainage water as high as 172 ppb. However, rapid decrease in the residue levels in the water will occur when the drainage water enters the drainage ditches due to dilution and degradation. Refer to the 6/28/78 evaluation of aldicarb (oranges), sections 4.1.5-4.1.9 which shows degradation of aldicarb residues in the aquatic sediment/pond environment. Half-lives were estimated to be roughly 5-10 days.

Use of aldicarb on larger tile-drained corn fields of more permeable soil, at higher application rates, with higher levels of rainfall/irrigation, and with lower soil pH would result in higher levels of aldicarb residues leaving the field via the subsurface drainage system. However, these residues would also be subject to rapid dissipation and degradation after leaving the subsurface drainage system.

3. CONCLUSIONS

It cannot be said that the studies as conducted represent a worst case situation showing maximum levels of aldicarb residues leaving the field via the subsurface drainage system. However, assuming the residue levels leaving the field via the subsurface drainage system in a worst case situation to be 10X greater than the highest level (172 ppb) found in the submitted study, or 1.8 ppm, then due to degradation alone, the residues would fall to levels less than 5 ppb in 12-24 weeks after leaving the field. Add to this a minimal dilution factor of 10X-100X; the result is residues would fall to less than 5 ppb in no more than 2-10 weeks after leaving the field. The above would be true for a one-time-only input of pollutant. It must be kept in mind that aldicarb residues will continue to leave the field via the subsurface drainage system for at least as long as 6 months, albeit at decreasing levels. However, the concentration of residues will not build up due to continuous dilution.

Samuel M. Creeger
February 28, 1984
Section #1/EAB
Hazard Evaluation Division

TABLE I

Michigan Pretreatment Analyses
(Sampled 5/19/83)

| | Soil Strata (m) | Mechanical Analysis (Wt %) Sand | Silt | Clay | Organic Matter (wt %) | pH | Moisture Content (wt %) | Aldicarb Residues (ppb) |
|---|---|---|---|---|---|---|---|---|
| Core 1 | 0-0.3 | 51 | 29 | 20 | 3.7 | 8.2 | 17.0 | ND |
| | 0.3-0.6 | 57 | 32 | 11 | 0.52 | 8.3 | 13.8 | ND |
| | 0.6-1.2 | 17 | 72 | 11 | 0.62 | 8.9 | 19.4 | ND |
| | 1.2-1.8 | 37 | 40 | 23 | 1.3 | 8.7 | 18.6 | ND |
| | 1.8-2.1 | 11 | 26 | 63 | 0.60 | 8.8 | 16.7 | ND |
| Core 2 | 0-0.3 | 77 | 22 | 7 | 1.9 | 6.9 | 12.5 | ND |
| | 0.3-0.6 | 53 | 32 | 15 | 0.12 | 6.1 | 12.6 | ND |
| | 0.6-1.2 | 73 | 20 | 7 | 0.26 | 9.1 | 14.4 | ND |
| | 1.2-1.8 | 83 | 10 | 7 | 0.02 | 9.1 | 15.1 | ND |
| Core 3 | 0-0.3 | 69 | 20 | 11 | 3.0 | 8.1 | 13.0 | ND |
| | 0.3-0.6 | 61 | 22 | 17 | 1.7 | 7.7 | 15.9 | ND |
| | 0.6-1.2 | 71 | 18 | 11 | 1.0 | 8.8 | 16.5 | ND |
| Core 4 | 0-0.3 | 71 | 12 | 17 | 1.9 | 7.7 | 12.6 | ND |
| | 0.3-0.6 | 73 | 10 | 17 | 0.52 | 7.4 | 14.0 | ND |
| | 0.6-1.2 | 89 | 2 | 9 | 0.20 | 9.0 | 15.3 | ND |
| Average | 0-0.3 | 65 | 21 | 24 | 2.6 | 7.7 | 13.8 | ND |
| | 0.3-0.6 | 61 | 24 | 15 | 0.72 | 7.4 | 14.0 | ND |
| | 0.6-1.2 | 62 | 28 | 10 | 0.52 | 9.0 | 16.4 | ND |
| | 1.2-1.8 | 60 | 25 | 15 | 0.65 | 8.9 | 16.9 | ND |

ND = None detected at a sensitivity of 5 ppb.

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TABLE II

Indiana Pretreatment Analyses
(Sampled 5/19/83)

| | Soil Strata (m) | Mechanical Analysis (Wt %) Sand | Silt | Clay | Organic Matter (wt %) | pH | Moisture Content (wt %) | Aldicarb Residues (ppb) |
|---|---|---|---|---|---|---|---|---|
| Core 1 | 0-0.3 | 8 | 53 | 39 | 4.5 | 7.5 | 22.6 | ND |
| | 0.3-0.6 | 12 | 37 | 51 | 1.3 | 7.6 | 21.2 | ND |
| | 0.6-1.2 | 9 | 42 | 49 | 0.96 | 7.6 | 16.9 | ND |
| | 1.2-1.8 | 10 | 37 | 53 | 0.98 | 8.7 | 21.7 | ND |
| Core 2 | 0-0.3 | 11 | 47 | 42 | 2.4 | 5.9 | 20.5 | ND |
| | 0.3-0.6 | 0 | 33 | 59 | 0.82 | 5.7 | 22.4 | ND |
| | 0.6-1.2 | 22 | 36 | 53 | 0.78 | 8.4 | 19.5 | ND |
| | 1.2-1.8 | 15 | 38 | 47 | 0.92 | 8.2 | 25.3 | ND |
| Core 3 | 0-0.3 | 19 | 44 | 37 | 2.5 | 5.8 | 22.1 | ND |
| | 0.3-0.6 | 13 | 34 | 53 | 0.66 | 5.7 | 22.6 | ND |
| | 0.6-1.2 | 11 | 42 | 47 | 0.86 | 8.8 | 17.4 | ND |
| | 1.2-1.8 | 11 | 40 | 49 | 0.86 | 8.9 | 18.7 | ND |
| Core 4 | 0-0.3 | 17 | 40 | 43 | 2.3 | 7.1 | 19.3 | ND |
| | 0.3-0.6 | 11 | 36 | 53 | 0.78 | 6.4 | 22.4 | ND |
| | 0.6-1.2 | 13 | 40 | 47 | 0.86 | 8.7 | 15.9 | ND |
| | 1.2-1.8 | 0 | 55 | 45 | 0.88 | 8.8 | 15.9 | ND |
| Average | 0-0.3 | 14 | 46 | 40 | 2.9 | 6.6 | 21.1 | ND |
| | 0.3-0.6 | 11 | 35 | 54 | 0.89 | 6.4 | 21.1 | ND |
| | 0.6-1.2 | 11 | 40 | 49 | 0.87 | 8.4 | 17.4 | ND |
| | 1.2-1.8 | 9 | 43 | 48 | 0.91 | 8.7 | 20.4 | ND |

ND = None detected at a sensitivity of 5 ppb.

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TABLE III

Michigan Post Treatment Soil Results

TENIK Aldicarb, 1.68 Kg ai/ha at Planting (5/30/83)

| | Soil Strata (m) | Moisture Content (wt %) Replicate 1 June 16 | Replicate 1 July 26 | Replicate 1 Oct 7 | Replicate 4 June 16 | Replicate 4 July 26 | Replicate 4 Oct 7 | pH of Composite June 16 | pH of Composite July 26 | pH of Composite Oct 7 | Aldicarb Residues in Composite (ppb) June 16 | Aldicarb Residues in Composite (ppb) July 26 | Aldicarb Residues in Composite (ppb) Oct 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site 1 | 0-0.3 | 11.8 | 7.2 | 10.2 | 12.9 | 8.2 | 9.2 | 7.2 | 7.5 | 7.5 | 30 | 37 | ND |
| | 0.3-0.6 | 11.4 | 7.7 | 7.3 | 12.2 | 7.9 | 5.5 | 6.7 | 7.5 | 7.9 | ND | ND | ND |
| | 0.6-1.2 | 16.6 | 17.3 | 8.7 | 13.7 | 16.1 | 11.6 | 9.2 | 9.3 | 9.0 | ND | ND | ND |
| | 1.2-1.8 | | 17.0 | 17.5 | | 15.4 | 14.8 | | 9.2 | -- | | ND | -- |
| Site 2 | 0-0.3 | 13.0 | 9.7 | 9.0 | 13.3 | 6.9 | 9.8 | -- | -- | -- | 274 | 51 | ND |
| | 0.3-0.6 | 11.0 | 7.0 | 4.6 | 11.3 | 7.5 | 5.6 | -- | -- | -- | ND | 25 | ND |
| | 0.6-1.2 | 14.6 | 15.4 | 9.7 | 13.6 | 14.8 | 10.7 | -- | -- | -- | ND | ND | ND |
| | 1.2-1.8 | | 16.1 | 18.4 | | 22.0 | 14.1 | | -- | -- | | ND | -- |
| Site 3 | 0-0.3 | 14.2 | 8.9 | 10.1 | 12.8 | 9.1 | 8.9 | -- | -- | -- | 265 | 41 | ND |
| | 0.3-0.6 | 13.6 | 14.1 | 5.8 | 15.9 | 8.2 | 4.5 | -- | -- | -- | ND | 23 | ND |
| | 0.6-1.2 | 14.3 | 13.3 | 14.2 | 15.8 | 15.8 | 7.0 | -- | -- | -- | ND | ND | ND |
| | 1.2-1.8 | | | 15.1 | | | 15.3 | | | -- | | | ND |
| Site 4 | 0-0.3 | 13.3 | 10.6 | 9.7 | 12.9 | 10.0 | 11.1 | 6.7 | 6.7 | 7.3 | 458 | 86 | ND |
| | 0.3-0.6 | 14.7 | 8.4 | 4.5 | 11.5 | 8.9 | 8.9 | 6.4 | 7.0 | 7.4 | ND | 10 | 14 |
| | 0.6-1.2 | 16.2 | 15.2 | 8.2 | 16.5 | 15.2 | 8.3 | 8.3 | 9.0 | 8.8 | ND | ND | ND |
| | 1.2-1.8 | | | 15.6 | | | 15.0 | | | 9.2 | | | ND |
| Average | 0-0.3 | 13.1 | 9.1 | 9.8 | 13.0 | 8.6 | 9.8 | 7.0 | 7.1 | 7.4 | 257 | 54 | ND |
| | 0.3-0.6 | 12.7 | 9.3 | 5.6 | 12.7 | 8.1 | 6.1 | 6.6 | 7.3 | 7.7 | ND | 15 | 4 |
| | 0.6-1.2 | 15.4 | 15.3 | 10.2 | 15.1 | 15.5 | 9.4 | 8.8 | 9.2 | 8.9 | ND | ND | ND |
| | 1.2-1.8 | | 16.6 | 14.8 | | 18.7 | 14.8 | | 9.2 | 9.2 | | ND | ND |

ND = None detected at a sensitivity of 5 ppb.

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TABLE IV

Indiana Post Treatment Soil Results

TEMIK Aldicarb, 1.68 Kg ai/ha at Planting (6/10/83)

| | Soil Strata (feet) | Moisture Content (wt %) Replicate 1 June 15 | July 27 | Oct 7 | Replicate 4 June 15 | July 27 | Oct 7 | pH of Composite June 15 | July 27 | Oct 7 | Aldicarb Residues in Composite (ppb) June 15 | July 27 | Oct 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site 1 | 0-0.3 | 18.0 | 13.5 | 15.5 | 20.4 | 15.8 | 15.1 | 7.6 | 7.0 | 6.5 | 320 | 268 | 36 |
| | 0.3-0.6 | 21.5 | 16.6 | 15.4 | 20.1 | 16.6 | 16.8 | 7.2 | 6.7 | 6.2 | ND | 15 | ND |
| | 0.6-1.2 | 16.4 | 17.1 | 14.8 | 17.3 | 17.9 | 16.3 | 8.9 | 9.0 | 8.3 | ND | ND | ND |
| | 1.2-1.8 | 16.5 | 16.7 | 16.5 | 15.6 | 15.7 | 17.1 | 9.0 | 9.0 | 8.3 | ND | ND | ND |
| Site 2 | 0-0.3 | 15.9 | 12.3 | 14.6 | 20.9 | 15.4 | 17.4 | -- | -- | -- | 55 | 160 | 19 |
| | 0.3-0.6 | 15.9 | 17.2 | 17.5 | 21.6 | 16.9 | 16.1 | -- | -- | -- | ND | 9 | ND |
| | 0.6-1.2 | 16.4 | 17.4 | 16.4 | 21.6 | 19.6 | 15.3 | -- | -- | -- | ND | 6 | ND |
| | 1.2-1.8 | 15.2 | 16.3 | 18.3 | 19.5 | 18.7 | 16.0 | -- | -- | -- | ND | ND | ND |
| Site 3 | 0-0.3 | 19.8 | 15.6 | 15.0 | 19.3 | 17.7 | 15.9 | -- | -- | -- | 1432 | 374 | 22 |
| | 0.3-0.6 | 19.1 | 17.0 | 20.8 | 21.2 | 17.3 | 15.9 | -- | -- | -- | 8 | 5 | ND |
| | 0.6-1.2 | 17.9 | 18.2 | 16.4 | 19.0 | 17.8 | 14.7 | -- | -- | -- | ND | 5 | ND |
| | 1.2-1.8 | 17.9 | 15.7 | 14.8 | 17.4 | 15.6 | 19.3 | -- | -- | -- | ND | ND | ND |
| Site 4 | 0-0.3 | 18.1 | 13.7 | 14.5 | 17.1 | 13.8 | 14.0 | 8.0 | 7.7 | 7.0 | 243 | 161 | 19 |
| | 0.3-0.6 | 20.9 | 15.6 | 16.3 | 22.1 | 18.2 | 15.8 | 6.1 | 6.1 | 6.5 | ND | 5 | ND |
| | 0.6-1.2 | 16.4 | 15.5 | 15.0 | 19.7 | 17.8 | 15.7 | 8.9 | 8.8 | 8.5 | ND | ND | ND |
| | 1.2-1.8 | 16.3 | 15.1 | 17.7 | 16.6 | 16.5 | 16.0 | 8.9 | 8.6 | 8.5 | ND | ND | ND |
| Average | 0-0.3 | 18.0 | 13.8 | 14.9 | 19.4 | 15.7 | 15.6 | 7.8 | 7.4 | 6.8 | 513 | 241 | 24 |
| | 0.3-0.6 | 19.4 | 16.6 | 17.5 | 21.3 | 17.3 | 16.2 | 6.7 | 6.4 | 6.4 | 2 | 9 | ND |
| | 0.6-1.2 | 16.8 | 16.9 | 15.7 | 19.4 | 18.3 | 15.5 | 8.9 | 8.8 | 8.4 | ND | 3 | ND |
| | 1.2-1.8 | 16.5 | 16.0 | 16.8 | 17.3 | 16.6 | 17.1 | 9.0 | 8.8 | 8.4 | ND | ND | ND |

ND = None detected at a sensitivity of 5 ppb.

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TABLE V

ALDICARB RESIDUES IN SDIL AFTER APPLICATION

TD TILE DRAINED CORN FIELDS 1983

BLISSFIELD, MICHIGAN

| Strata (m) | Mean Aldicarb Residues | | | | | |
|---|---|---|---|---|---|---|
| | 17 Days[a] | | 57 Days | | 13D Days | |
| | ppb[b] | Fraction[c] | ppb | Fraction | ppb | Fraction |
| 0-0.3 | 257 | 0.685 | 54 | 0.144 | ND | 0.0 |
| 0.3-0.6 | ND | 0.0 | 15 | 0.040 | 4 | 0.009 |
| 0.6-1.2 | ND | 0.0 | ND | 0.0 | ND | 0.0 |
| 1.2-1.8 | | | ND | 0.0 | ND | 0.0 |
| Total | | 0.685 | | 0.184 | | 0.009 |

[a]The number of days after TEMIK® 15G application.

[b]Each number represents the mean residue on 16 samples (arithmetic mean of four analyses of four composite samples).

[c]Amount remaining as a fraction of the total aldicarb applied calculated assuming an even distribution (375 ppb) in the top 0.3 m of soil.

TABLE VI

ALDICARB RESIDUES IN SOIL AFTER APPLICATION

TO TILE DRAINED CORN FIELDS 1983

BLUECAST, INDIANA

| Strata (m) | Mean Aldicarb Residues 5 Days[a] ppb[b] | 5 Days[a] Fraction[c] | 47 Days ppb | 47 Days Fraction | 119 Days ppb | 119 Days Fraction |
|---|---|---|---|---|---|---|
| 0-0.3 | 513 | 1.368 | 241 | 0.643 | 24 | 0.064 |
| 0.3-0.6 | 2 | 0.005 | 9 | 0.024 | ND | 0.0 |
| 0.6-1.2 | ND | 0.0 | 3 | 0.008 | ND | 0.0 |
| 1.2-1.8 | ND | 0.0 | ND | 0.0 | ND | 0.0 |
| Total | | 1.373 | | 0.675 | | 0.064 |

[a]The number of days after TEMIK® 15G application.

[b]Each number represents the mean residue on 16 samples (arithmetic mean of four analyses of four composite samples).

[c]Amount remaining as a fraction of the total aldicarb applied calculated assuming an even distribution (375 ppb) in the top 0.3 m of soil.

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TABLE VII

Water Analyses

Blissfield, Michigan

Tile Drained Corn

| Date | ph | Aldicarb Residues (ppb) |
|---|---|---|
| Tile Drain Composite | | |
| 6/13/83 | 7.6 | ND |
| 6/20/83 | 7.3 | ND |
| 6/27/83 | 8.0 | ND |
| 7/5/83 | 7.1 | 7 |
| 7/11/83 | 7.1 | 10 |
| 7/18/83 | 7.1 | ND |
| 7/25/83 | 7.1 | ND |
| 11/14/83 | 7.3 | 2 |
| 11/23/83 | 7.4 | 2 |
| Creek | | |
| 7/25/83 | 7.1 | ND |
| 8/1/83 | 7.3 | ND |
| 8/8/83 | 7.2 | ND |
| Ditch | | |
| 8/16/83 | 7.1 | ND |
| 11/8/83 | 7.4 | 2 |
| 11/14/83 | 7.3 | 1 |
| 11/23/83 | 7.4 | 2 |

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TABLE VIII

Water Analyses

Bluecast, Indiana

Tile Drained Corn

| Date | pH | Aldicarb Residues (ppb) |
|---|---|---|
| Tile Drain Composite | | |
| 6/16/83 | 7.9 | 2,2 |
| 6/24/83 | 7.9 | ND,ND |
| 6/29/83 | 7.0 | 172 |
| 7/6/83 | 7.8 | 66 |
| 7/15/83 | 7.1 | 52 |
| 7/22/83 | 7.6 | 43 |
| 11/25/83 | 6.6 | 5 |
| 12/2/83 | 6.6 | 1 |
| Maumee River | | |
| 7/27/83 | 7.5 | ND |
| 8/2/83 | 7.5 | ND |
| 8/7/83 | 7.9 | ND |
| 8/10/83 | 7.8 | ND |
| 11/25/83 | 6.7 | ND |
| 12/2/83 | 6.7 | ND |

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TABLE IX

Soil Temperatures

Tile Drained Corn

Blissfield, Michigan

| Strata (m) | Date/Time 6/20 (9 a.m.) | 7/26 (8 a.m.) | 10/5 (12:30 p.m.) |
|---|---|---|---|
| 0.0-0.3 | 21°C | 21°C | 18°C |
| 0.3-0.6 | 29°C | 24°C | 18°C |
| 0.6-1.2 | 17°C | 22°C | 20°C |
| 1.2-1.8 | | 20°C | 17°C |

Bluecast, Indiana

| Strata (m) | Date/Time 6/20 (2 p.m.) | 7/27 (7 a.m.) |
|---|---|---|
| 0.0-0.3 | 24°C | 22°C |
| 0.3-0.6 | 23°C | 24°C |
| 0.6-1.2 | 19°C | 23°C |
| 1.2-1.8 | 21°C | 20°C |