

US EPA ARCHIVE DOCUMENT

16 FEB 1983

MEMORANDUM:

TO: Judy Beckman, Registration Standards Coordinator, OD/HED  
THRU: Clayton Bushong, Chief, EEB/HED  
SUBJECT: Registration Standard for fonofos - nontarget insect studies

EEB has completed review of the nontarget insect studies received under the Registration Standard for fonofos. The completed DER's for these studies, along with topical summary, disciplinary review, and data table, were submitted to Spencer Duffy on February 16, 1983.

Allen W. Vaughan, Entomologist  
Ecological Effects Branch ✓

cc: H. Craven (EEB/HED)  
S. Duffy (SPRD)  
J. Tice (SIS/HED)

Allen W. Vaughan/CDW/CM#2/Rm.1128/2/16/83/557-9307/TS-769

Fonofos Registration Standard - Nontarget Insects

Effects on Beneficial Insects

The following studies received full review under this topic:

| <u>Author</u>   | <u>ID</u> |
|-----------------|-----------|
| Atkins et al.   | 00043714  |
| Johansen et al. | 00056152  |
| Stevenson       | 05001991  |

Studies are outlined in Table 1.

Table 1. Toxicity studies on beneficial insects with fonofos.

| <u>Species</u>                         | <u>Formulation</u> | <u>Results</u>  | <u>Author</u>      | <u>Date</u> | <u>MRID#</u> |
|--|--------------------|---|--------------------|-------------|--------------|
| Honey bee<br>( <u>Apis mellifera</u> ) | Technical          | Contact LD <sub>50</sub> =3.3<br>micrograms per bee.<br>Oral LD <sub>50</sub> =8.4<br>micrograms per bee.<br>(moderately toxic) | Stevenson          | 1978        | 05001991     |
| Honey bee                              | Technical          | Contact LD <sub>50</sub> =8.68<br>micrograms per bee.   | Atkins<br>et al.   | 1975        | 00043714     |
| Honey bee                              | 4 lb. EC           | Low to moderate<br>residual toxicity<br>after 3 hr  | Johansen<br>et al. | 1973        | 00056152     |

There is sufficient information to characterize fonofos as moderate in toxicity to honey bees.

Registration Standard - Nontarget Insects

Reasons for Disciplinary Review

Effects of fonofos on beneficial insects

In acute contact and acute oral LD50 studies, fonofos was shown to be highly toxic to honey bees (Stevenson 1978, Atkins et al. 1975.) In a residual toxicity study, weathered residues of fonofos were low relative to toxicity to honey bees three hours after application (Stevenson et al. 1973.)

References (for Disciplinary Review)

Stevenson, D.; Neuman, K.J.; et al. (1975) Effect of Pesticides on Honey Bees. Project No. 1499. (Unpublished study received Dec 2, 1976 under Ex-3; prepared by Univ. of California--Riverside, Citrus Research and Agricultural Experiment Station, Dept. of Entomology, submitted by Chemagro Corporation, Wilmington, Del.; CDL:095996-D) FICHE/MASTER ID 00043714

Stevenson, D.; Baird, C. (1973) Bee Research Investigations, 1973. Unpublished study received Apr 5, 1974 under 148-1170; prepared by Washington State Univ., Dept. of Entomology and Alfalfa Seed Management Project, submitted by Thompson-Hayward Chemical Co., Kansas City, Mo.; CDL: 224671-S) FICHE/MASTER ID 00056152

Stevenson, D.H. (1978) The acute toxicity of unformulated pesticides to worker honey bees (Apis mellifera L.) Plant Pathology 27(1): 38-40. FICHE/MASTER ID 001991.

TABLE A

GENERIC DATA REQUIREMENTS FOR PONOFOFOS

| Data Requirement   | Composition | 1/ Use 2/ Pattern | Does EPA Have Data To Satisfy This Requirement? (Yes, No or Partially) | Bibliographic Citation | Must Additional Data Be Submitted Under FIFRA Section 3(c)(2)(B)? <sup>3/</sup> |
|--|-------------|-------------------|--|------------------------|---|
| <u>\$158.155 Nontarget Insect</u>  |             |                   |  |                        |   |
| <u>NONTARGET INSECT TESTING - POLLINATORS:</u>                                       |             |                   |  |                        |   |
| 141-1 - Honey bee acute contact LD <sub>50</sub>                                     | TGAI        | A, B              | Yes  | 00043714<br>05001991   | No  |
| 141-2 - Honey bee - toxicity of residues on foliage                                  | TEP         | A, B              | Yes  | 00056152               | No  |
| 141-3 - Wild bees important in alfalfa pollination - toxicity of residues on foliage | TEP         | No                |  |                        |   |
| 141-4 - Honey bee subacute feeding study   | [Reserved]  |                   |  |                        |   |
| 141-5 - Field testing for pollinators  | TEP         | No                |  |                        |   |

1/ Composition: TGAI = Technical grade of the active ingredient; TEP = Typical end-use product.  
 2/ The use patterns are coded as follows: A=Terrestrial, Food Crop; B=Terrestrial, Non-Food; C=Aquatic, Food Crop; D=Aquatic, Non-Food; E=Greenhouse, Food Crop; F=Greenhouse, Non-Food; G=Forestry; H=Domestic Outdoor; I=Indoor.  
 3/ Data must be submitted no later than \_\_\_\_\_.

TABLE A

GENERIC DATA REQUIREMENTS FOR FONOFOS

| Data Requirement   | Composition | Use | Does EPA Have Data To Satisfy This Requirement? (Yes, No or Partially) | Bibliographic Citation | Must Additional Data Be Submitted Under FIFRA Section 3(c)(2)(B)? |
|--|-------------|-----|--|------------------------|---|
| <u>§158.155 Nontarget Insect (continued)</u>                                       |             |     |  |                        |   |
| <u>NONTARGET INSECT TESTING - AQUATIC INSECTS:</u>                                 |             |     |  |                        |   |
| 142-1 - Acute toxicity to aquatic insects  | [Reserved]  |     |  |                        |   |
| 142-2 - Aquatic insect life-cycle study  | [Reserved]  |     |  |                        |   |
| 142-3 - Simulated or actual field testing for aquatic insects                      | [Reserved]  |     |  |                        |   |
| 143-1 - <u>NONTARGET INSECT TESTING - PREDATORS AND PARASITES</u><br>thru<br>143-3 | [Reserved]  |     |  |                        |   |

DATA EVALUATION RECORD

CHEMICAL: FONOFOS

BRANCH: EEB

FICHE/MASTER ID NUMBER: 05001991

CITATION: Stevenson, J.H. 1978. The acute toxicity of unformulated pesticides to worker honey bees (Apis mellifera. L.) Plant Pathology 27(1): 38-40.

DIRECT RWV TIME=

START DATE 2/2/83

END DATE 2/2/83

REVIEWED BY: Allen W. Vaughan

TITLE: Entomologist

ORG: EEB/HED

LOC/TEL: Crystal Mall 2/79307

SIGNATURE:

*Allen W. Vaughan*

DATE:

*2/2/83*

-----  
APPROVED BY:

TITLE:

ORG:

LOC/TEL:

SIGNATURE:

DATE:

1. CHEMICAL: Multiple chemicals. See Table.

2. FORMULATION: Technicals

3. CITATION:

Stevenson, J.H. 1978. The acute toxicity of unformulated pesticides to worker honey bees (*Apis mellifera* L.). *Plant Pathol.* 27(1): 38-40 FICHE/MASTER ID 05001991

4. REVIEWER: Allen W. Vaughan  
Entomologist  
EEB/HED

5. DATE REVIEWED: February 2, 1983

6. TEST TYPE: Bee toxicity

A. Test Species: Honey bee (*Apis mellifera*)

7. REPORTED RESULTS: Fonofos was determined to be moderately toxic to honey bees in laboratory tests (Acute contact LD<sub>50</sub> = 3.3 ug per bee; acute oral LD<sub>50</sub> = 8.4 ug per bee.) For data on other pesticides, see table.

8. REVIEWER'S CONCLUSIONS: This study is scientifically sound, and shows fonofos to be moderately toxic to honey bees.

TABLE

Acute contact and oral toxicities to worker honey bees (*Apis mellifera*) of technical samples of pesticide. n = number of determinations on which estimate is based

| Pesticide                 | Contact                       |   | Oral                          |   |
|---------------------------|-------------------------------|---|-------------------------------|---|
|                           | LD <sub>50</sub> (ug per bee) | n | LD <sub>50</sub> (ug per bee) | n |
|                           |                               |   | 9.1                           | 2 |
| Allethrin                 | 3.4                           | 4 | 4.6                           | 3 |
| Azinphos-methyl           | 0.063                         | 2 | 0-15                          | 3 |
| Bencnyl                   | >10                           |   | >10                           |   |
| Bioresmethrin             | 0.0057                        | 3 | 0.055                         | 1 |
| Captan                    | >10                           |   | --                            |   |
| Carbaryl                  | 1.3                           | 2 | 0.14                          | 2 |
| Carbophenothion           | 1.4                           | 2 | 5.2                           | 2 |
| Chlordane                 | 1.4                           | 3 | --                            |   |
| Chlorfenethol             | >50                           |   | >100                          |   |
| Chlorfenvinphos           | 4.1                           | 1 | 0.55                          | 1 |
| Chlorpyrifos              | 0.059                         | 1 | 0.25                          | 3 |
| Dazomet                   | >50                           |   | >10                           |   |
| DDT                       | 3.9                           | 3 | 3.7                           | 5 |
|                           | 38                            |   |                               |   |
| Decamethrin               | 0.051                         | 3 | 0.079                         | 1 |
| Demephion                 | 0.36                          | 2 | 0.22                          | 2 |
| Demeton-S-methyl          | 0.26                          | 3 | 0.21                          | 4 |
| Demeton-S-methyl sulphone | 0.20                          | 2 | 0.19                          | 1 |
|                           | { 9.5                         | 1 |                               |   |
| Dialifos                  | { 28.6                        | 1 | 29.2                          | 2 |
| Diazinon                  | 0.22                          | 2 | 0.20                          | 2 |
| Dicamba                   | >100                          |   | >10                           |   |
| Dichlofluanid             | --                            |   | >70                           |   |
| Dicofol                   | >50                           |   | >10                           |   |
| Dicrotophos               | 0.076                         | 1 | 0.068                         | 3 |
| Dieldrin                  | 0.16                          | 8 | 0.32                          | 6 |
| Diflubenzuron             | >30                           |   | >30                           |   |
| Dimethoate                | 0.12                          | 3 | 0.15                          | 8 |
|                           |                               |   | { 16                          | 2 |
| Disulfoton                | 4.3                           | 4 | { 39                          | 1 |
| Endosulfan                | 7.1                           | 4 | 6.9                           | 3 |
|                           | { 1.2                         | 3 | { 1.4                         | 2 |
| Endrin                    | { 0.65                        | 2 | { 0.46                        | 2 |
| Ethiofencarb              | 2.3                           | 2 | 1.5                           | 1 |
| Ethylmercury chloride     | 22                            | 2 | 13                            | 1 |
| Fenazaflor                | 12.2                          | 2 | 2.9                           | 1 |
| Fenitrothion              | 0.018                         | 3 | 0.019                         | 3 |
| Fonofos                   | 3.3                           | 3 | 8.4                           | 1 |

|                       |        |   |        |   |
|-----------------------|--------|---|--------|---|
| Gamma HCH (BHC)       | { 0.46 | 3 | { 0.45 |   |
| Malathion             | 0.20   | 6 | 0.76   | 1 |
| MCPA                  | 0.27   | 2 | 0.38   | 3 |
| Mecoprop              | >100   |   | >10    |   |
| Menazon               | >100   |   | >10    |   |
| Mevinphos             | 4.3    | 3 | 0.46   | 2 |
| Omethoate             | 0.070  | 6 | 0.027  | 3 |
| Oxamyl                | 0.083  | 1 | 0.048  | 2 |
| Oxydemeton-methyl     | 0.31   | 2 | 0.094  | 2 |
| Paraquat dichloride   | 0.54   | 5 | 0.31   | 3 |
| Permethrin            | >48    |   | >25    |   |
| Phenylmercury acetate | 0.11   | 2 | 0.28   | 3 |
| Phorate               | -      |   | 10     | 2 |
| Pirimicarb            | 0.32   | 3 | 0.44   | 4 |
| Pirimiphos-ethyl      | >54    |   | 3.2    | 1 |
| Pirimiphos-methyl     | <0.5   |   | 0.39   | 2 |
| Pyrethrins            | 0.39   | 2 | 0.36   | 1 |
| Quinomethionate       | { 0.29 | 4 | 0.15   | 2 |
| Resmethrin            | 0.13   | 4 |        |   |
| Rotenone              | -      |   | >80    |   |
| Thiofanox             | 0.015  | 3 | 0.069  | 1 |
| Thiometon             | >60    |   | >30    |   |
| Tolylfluanid          | 0.058  | 1 | 0.062  | 1 |
| Triadimefon           | 0.55   | 2 | 0.56   | 2 |
| Triazophos            | >100   |   | 43     | 1 |
| Trifluralin           | >25    |   | >25    |   |
|                       | 0.055  | 3 | 0.074  | 2 |
|                       | >100   |   | >50    |   |

## Materials and Methods

### Test Procedures

Median lethal doses ( $LD_{50}$ ) were obtained by the probit method. For the contact tests a one microlitre drop of the unformulated pesticide dissolved in the appropriate quantity of acetone was applied to each anaesthetised bee. For oral tests, acetone solutions were mixed with 20 per cent sucrose in water and fed (0.2 ml) to groups of 10 bees. In both tests at least two groups of 10 bees were used for each concentration. The pesticides used were generally at least 95 per cent pure, but with three exceptions: natural pyrethrum extract (20 percent pyrethrins), demephion (70 per cent active ingredient) and triazophos (60 per cent active ingredient).

### Statistical Analysis

(Author's statements)

Standard errors within individual tests are small but variation between individual tests is larger and it seems realistic to take this into account. In the three years 1964-66 standard deviations for all tests were respectively 27, 21 and 20 per cent (mean 23 per cent) for contact tests, and 35, 22 and 43 per cent (mean 33 per cent) for oral tests; we have no reason to think this level of accuracy has changed subsequently. The larger error in the feeding tests is to be expected because doses are presented to 10 bees as a competing group, rather than as individuals. After a series of preliminary experiments, each estimate is based on a small number of probit regressions indicated in the Table under "n". A good measure of the percentage standard error for an  $LD_{50}$  can be obtained by dividing the above mean standard deviation by  $\sqrt{n}$ . Thus for allethrin by contact the value would be  $\frac{23}{\sqrt{4}} = 11.5$  per cent.

### Discussion/Results

Lab tests indicated a great degree of variation in toxicities of different pesticides to honey bees, as expected. See Table for data on individual pesticides.

### Reviewer's Evaluation

#### A. Test Procedure

Procedures were scientifically sound.

#### B. Statistical Analysis

Analysis as discussed by the author (above) was assumed to be valid. No validation was performed by EEB.

#### C. Discussion/Results

This study is scientifically sound. See table for results.

CASE GS0105

FONOFOS

PN 300 07/15/82

CHEM 041701

O-Ethyl S-phenyl ethylphosphonodithioate

BRANCH EEB DISC 40 TOPIC 05050045

FORMULATION 90 - FORMULATION NOT IDENTIFIED

FICHE/MASTER ID 00043714

CONTENT CAT 11

Arkins, E.L.; Kellum, D.; Neuman, K.J.; et al. (1975) Effect of Pesticides on Apiculture: Project No. 1499. (Unpublished study received Dec 2, 1976 under 10182-EX-3; prepared by Univ. of California--Riverside, Citrus Research Center and Agricultural Experiment Station, Dept. of Entomology, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:095996-D)

SUBST. CLASS = S.

OTHER SUBJECT DESCRIPTORS

SEC: EEB -40-05103545

DIRECT RVW TIME =

(MH)

START-DATE 18 JAN 1983

END DATE 18 JAN 1983

REVIEWED BY: Allen W. Vaughan

TITLE: Entomologist

ORG: EEB/HED

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*Allen W. Vaughan*

DATE: 2/2/83

APPROVED BY:

TITLE:

ORG:

LOC/TEL:

SIGNATURE:

DATE:

1. CHEMICAL: Fonofos (Dyfonate)
2. FORMULATION: Technical
3. CITATION: Atkins, E.L.; Kellum, D.; Neuman, K.J.; et al. (1975) Effect of Pesticides on Apiculture: Project No. 1499. (Unpublished study received Dec 2, 1976 under 10182-EX-3; prepared by Univ. of California--Riverside, Citrus Research Center and Agricultural Experiment Station, Dept. of Entomology, submitted by ICI Americas, Inc., Wilmington, Del.; CDL: 095996-D)

FICHE/MASTER ID 00043714

4. REVIEWER: Allen W. Vaughan  
Entomologist  
EEB/HED
5. DATE REVIEWED: January 13, 1983
6. TEST TYPE: Bee toxicity
  - A. Test species: Honey bee (Apis mellifera)
7. REPORTED RESULTS: Fonofos (Dyfonate) was determined to be moderately toxic to honey bees in a laboratory acute contact toxicity test (LD50 = 8.68 micrograms per bee.)
8. REVIEWER'S CONCLUSIONS: This study is scientifically sound, and shows fonofos to be moderately toxic to honey bees.

## Materials and Methods

### Test Procedures

A bell-jar vacuum duster is used to apply the pesticide, mixed with a pyrolite dust diluent, to the test bees. Dosages of dust are weighed, bees are aspirated into dusting cages and treated, and bees are then transferred into holding cages. Observations are recorded at 12, 24, 48, 72, and 96 hours.

### Statistical Analysis

Analysis of the data was performed to enable the authors to determine LD50 values of pesticides from either dosage-mortality curves or from LC50 values. The slope value was also obtained from the dosage-mortality curve.

## Discussion/Results

See "Reported Results," above.

## Reviewer's Evaluation

### A. Test Procedure

Procedures were sound.

### B. Statistical Analysis

Analysis as performed by the authors was assumed to be valid. No validation was performed by EEB.

### C. Discussion/Results

This study is scientifically sound.

CASE G80105

FONOFOS

PM 300 07/15/82

CHEM 041701

O-Ethyl S-phenyl ethylphosphonodithioate

BRANCH EEB DISC 40 TOPIC 05103545

FORMULATION 12 - EMULSIFIABLE CONCENTRATE (EC OR E)

FICHE/MASTER ID 00056152

CONTENT CAT 02

Johansen, C.; Mayer, D.; Baird, C. (1973) Bee Research Investigations, 1973. (Incomplete; unpublished study received Apr 5, 1974 under 148-1170; prepared by Washington State Univ., Dept. of Entomology and Alfalfa Seed Pest Management Project, submitted by Thompson-Hayward Chemical Co., Kansas City, Kans.; CDL: 224671-S)

SUBST, CLASS = S.

DIRECT RVW TIME = (MH) START-DATE 13 JAN 1983 END DATE 13 JAN 1983

REVIEWED BY: Allen W. Vaughan  
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DATE:

1. CHEMICAL: Fonofos (Dyfonate)
2. FORMULATION: 4 lb EC
3. CITATION: Johansen, C., D. Mayer, C. Baird. 1973. Bee research investigations, 1973. (Incomplete; unpubl. study rec'd. Apr 5, 1974 under 148-1170; prepared by Wash. St. Univ., Dept. of Entomol. and Alfalfa Seed Pest Mgmt. Project; subm. by Thompson-Hayward Chem. Co., Kansas City, Kans.; C DL: 224761-S) FICHE/MASTER ID 00056152
4. REVIEWER: Allen W. Vaughan  
Entomologist  
EEB/HED

5. DATE REVIEWED: January 13, 1983

6. TEST TYPE: Bee toxicity

A. Test species: Honey bee (*Apis mellifera*)

7. REPORTED RESULTS: 24-hr. % mortality of bees caged with treated foliage, age of residues

| Material         | lb a.i./A | 3 hr | 8hr |
|------------------|-----------|------|-----|
| Dyfonate 4 lb EC | 1.0       | 9    | 2   |
| Dyfonate 4 lb EC | 2.0       | 59   | 9   |

8. REVIEWER'S CONCLUSIONS: This study is scientifically sound, and shows fonofos to be low to moderate in hazard to honey bees.

Materials and MethodsTest Procedure

Bees were exposed to dried residues on treated foliage, at 3 and 8 hours after treatment. Mortality was recorded after 24 hours of exposure.

Statistical Analysis

None reported.

Discussion/Results

Dyfonate tested low to moderate in hazard to honey bees.

Reviewer's EvaluationA. Test Procedures

Procedures were sound.

B. Statistical Analysis

None reported.

C. Discussion/Results

This study is scientifically sound.