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2-7-94

ENVIRONMENTAL FATE AND GROUND WATER BRANCH

Review Action

To: Dennis Edwards, PM #19
Registration Division (H7505C)

From: Akiva Abramovitch, Section Head
Chemistry Review Section 3
Environmental Fate & Ground Water Branch/EFED (H7507C)

Thru: Henry Jacoby, Chief
Environmental Fate & Ground Water Branch/EFED (H7507C)

Henry Jacoby 2/7/94

Attached, please find the EFGWB review of...

Common Name:	Chlorethoxyphos	Trade name:	Fortress
Company Name:	E.I. du Pont de Nemours and Company Inc.		
ID #:	000352-LLG Technical and 000352-LLE 5G Insecticide		
Purpose:	New Chemical Review		

Type Product:	Action Code:	EFGWB #(s):	Review Time:
Insecticide	100	93-0258-0259	14 days

STATUS OF STUDIES IN THIS PACKAGE:

STATUS OF DATA REQUIREMENTS

ADDRESSED IN THIS PACKAGE:

Guideline #	MRID	Status ¹
161-2	41736821	A
161-3	41736822	A
161-4	41736823	I
162-1	41736824	C
162-2	41736825	U
163-1	41736826	A
163-2	41736827	A
164-1	41290605	C
164-1	41736828	C

Guideline #	Status ²
161-2	S
161-3	S
161-4	N
162-1	S
162-2	N
163-1	S
163-2	N
164-1	S

¹Study Status Codes:

A=Acceptable U=Upgradeable C=Ancillary I=Invalid.

²Data Requirement Status Codes: S=Satisfied P=Partially satisfied N=Not satisfied R=Reserved W=Waived.

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1. CHEMICAL:

Common Name: Chlorethoxyphos

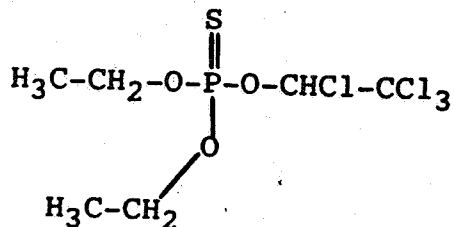
Trade Name: Fortress

(Labeled for T band and in-furrow application only)

Chemical Name: phosphorothioic acid, O,O-diethyl O-(1,2,2,2-tetrachloroethyl) ester]

Type of product: Soil Insecticide

Chemical Structure:



Physical/Chemical Properties

molecular weight: 336

CAS registry No: 54593-83-8

Boiling point: 105 to 115 C at 0.8 mmHg.

aqueous solubility: at 25 C was reported to be 2.1 ppm.

vapor pressure: 1.7×10^{-3} mm Hg at 25 C.

Henry's law constant: 1.5×10^{-2} , 3.5×10^{-4} atm m³ mole⁻¹

Kow = 39,000

Koc = 6100 (average on four soils)

U.V. max. = <290 nm

2. TEST MATERIAL:

See attached DERS.

3. STUDY/ACTION TYPE:

New Chemical review.

4. STUDY IDENTIFICATION:

(1) MRID No:41736821

Hawkins, D.R., B.C. Mayo, M.J. Redrup, and L.M. Haynes. 1989. The photodegradation of ¹⁴C-DPX-43898 in water. Huntingdon Report No. HRC/DPT 174/8949; Du Pont Report No. AMR-931-87. Unpublished study performed by Huntingdon Research Centre Ltd., Huntingdon, Cambridgeshire, England, and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(2) MRID No: 41736822

Bramble, Jr., F.Q., and A.C. Barefoot. 1989. Photodegradation of ¹⁴C-labeled DPX-43898 on soil (conducted in sunlight). Revision No. 1. Report No. AMR-795-87. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(3) MRID No: 41736823

Dykes, J. 1990. Photodegradation of DPX-43898 in air. ABC Report

No. 38363; Du Pont Report No. AMR-1535-89. Unpublished study performed by Analytical Bio-Chemistry Laboratories, Columbia, MO, and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(4) MRID No: 41736824

Woodward, M.D., and C.M. Pukalski. 1990a. Aerobic metabolism of ¹⁴C-DPX-43898 in soil. Report No. AMR-1457-89. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(5) MRID No: 41736825

Woodward, M.D. and C.M. Pukalski. 1990b. Anaerobic metabolism of ¹⁴C-DPX-43898 in soil. Report No. AMR-1456-89. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(6) MRID No: 41736826

Woodward, M.D. 1990b. Batch equilibrium (adsorption/desorption) study of DPX-43898 on soil. Supplement No. 1. Report No. AMR-1085-88. Published report submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(7) MRID No: 41736827

Barefoot, A.C., and M. Troup-Mayforth. 1990. Laboratory volatility of DPX-43898. Report No. AMR-1172-88. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(8) MRID No: 41736829

Slates, R.V., and C.D. Crowe. 1990. Field soil dissipation of Fortress soil insecticide. Du Pont Report No. AMR-1143-88. Unpublished study performed by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE, and Minnesota Valley Testing Laboratories, Inc., New Ulm, MN; and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(9) MRID No: 41290603

Babicki, W.A., Jr., G.F. Barber, and R.V. Slates. 1988. Residue method for determination of Fortress insecticide active ingredient DPX-43898 and its oxon analogue IN-34158 in soil by electron-capture gas chromatography. Report No. AMR-1194-88. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(10) MRID No: 41736828

Woodward, M.D. 1990c. Field soil dissipation of Fortress soil insecticide. Supplement No. 1. Report No. AMR-831-87. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(11) MRID No: 42559238

Babicki, W.A., Jr., and R.V. Slates. 1991. Freezer storage stability of Fortress insecticide active ingredient DPX-43898 and

its oxon analogue IN-34158 in soil. Supplement No. 1. Report No. AMR-1244-88. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(12) MRID No: 41290609

Babicki, W.A., Jr., and R.V. Slates. 1989. Freezer storage stability of Fortress insecticide active ingredient DPX-43898 and its oxon analogue IN-34158 in soil. Report No. AMR-1244-88. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(13) MRID No: 41290603

Babicki, W.A., Jr., G.F. Barber, and R.V. Slates. 1988. Residue method for determination of Fortress insecticide active ingredient DPX-43898 and its oxon analogue IN-34158 in soil by electron-capture gas chromatography. Report No. AMR-1194-88. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(14) MRID No: 42559239

Slates, R.V. 1991. Freezer storage stability of trichloroacetic acid in soil. Supplement No. 1. Report No. AMR-1342-88. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(15) MRID No: 41290612

Barber, G.F. 1989c. Freezer storage stability of trichloroacetic acid in soil. Report No. AMR-1342-88. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

(16) MRID No: 41290605

Barber, G.F. 1989b. Analytical method for the determination of residues of trichloroacetic acid in crops and soil. Report No. AMR-1253-88. Unpublished study performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE.

5. REVIEWED BY:

Kevin L. Poff, Chemist
Environmental Chemistry Review Section #3
Environmental Fate and Groundwater Branch/EFED

K L Poff

Date: 2/7/94

6. APPROVED BY:

Akiva Abramovitch, Ph.D., Chemist
Environmental Chemistry Review Section #3
Environmental Fate and Groundwater Branch/EFED

Akiva Abramovitch

Date:

FEB 7, 1994

7. CONCLUSIONS:

Photodegradation in Water DER 1

1. Study MRID #41736821 is acceptable and completely satisfies

the photodegradation in water (161-2) data requirement for chlorethoxyphos.

2. Chlorethoxyphos (tetrachloroethoxy-labeled [2-¹⁴C]chlorethoxyphos) [DPX-43898; phosphorothioic acid, O,O-diethyl O-(1,2,2,2-tetrachloroethyl) ester] photodegraded with a half-life of 27 days in sterile aqueous buffered solutions (pH 5) that were continuously irradiated with a UV-filtered xenon light source at approximately 25 C. The photolysis component alone for the degradation of chlorethoxyphos corrected for lamp intensity and a 12 hr. photoperiod was approx. 130 days. Chlorethoxyphos degraded with a half-life of 89 days when incubated in darkness under similar conditions. Degradates identified in the irradiated and dark control solutions were trichloroacetaldehyde and dichloroacetic acid.

Photodegradation on Soil DER 2

1. Study MRID #41736822 is acceptable and completely satisfies the photodegradation on soil (161-3) data requirement for chlorethoxyphos.
2. Chlorethoxyphos [DPX-43898; phosphorothioic acid, O,O-diethyl O-(1,2,2,2-tetrachloroethyl) ester] degraded with a half-life of 21 days on sandy loam soil incubated in natural sunlight at 22-28 C for 32 days. It appears degradation took place through processes other than direct phototransformation since in the dark control chlorethoxyphos degraded with a half-life of 26 days. The major nonvolatile degradate identified in both the irradiated and dark control soil was trichloroacetaldehyde; tentatively identified were trichloroacetic acid and dichloroacetic acid. In the irradiated soil at 32 days posttreatment, ¹⁴CO₂ was the major degradate and totaled 27.2% of the applied radioactivity.

Photodegradation in Air DER 3

1. Study MRID #41736823 is unacceptable and does not satisfy the photodegradation in air (161-4) data requirement for chlorethoxyphos for the following reasons:
 - a) material balances were incomplete; up to 40.4% of the applied radioactivity in the irradiated air samples and 37.2% in the dark controls was not accounted for.
 - b) photodegradation of the test substance in the air could not be distinguished from photodegradation of the test substance that had condensed on the sides of the photoreactor vessel or that had not volatilized.
2. Since the material balances were incomplete and the study was not designed to distinguish photodegradation in air from photodegradation on glass surfaces, the problems with this

study cannot be resolved with the submission of additional data. A new photodegradation in air study should not be initiated until the technical issues with the photodegradation in air study are resolved. Thus, the data requirement will be placed in a reserved status.

Aerobic Soil Metabolism DER 4

1. Study MRID #41736824 may be used as ancillary data to the previously reviewed acceptable aerobic soil metabolism study. The aerobic soil metabolism (162-1) data requirement has been satisfied by a previously submitted and reviewed study MRID #40883705 (EFGWB #90-0067, 2/21/90).
 - a) The study authors reported that the organic [¹⁴C]volatiles, which totaled 15.0% of the applied radioactivity (0.075 ppm) at 120 days posttreatment, were shown to consist of "mostly" parent chlorethoxyphos; however, it was not described how the ethylene glycol trapping solutions were analyzed for chlorethoxyphos, and quantitative results were not provided.
2. Chlorethoxyphos [DPX-43898; phosphorothioic acid, O,O-diethyl O-(1,2,2,2-tetrachloroethyl) ester] degraded with a half-life of approximately 23 days in clay soil that was incubated in the dark at 25 C and 75% of field moisture capacity. Only chlorethoxyphos was identified in the soil; carbon dioxide was the major degradate and totaled 63.0% of the applied at 120 days posttreatment.

Anaerobic Soil Metabolism DER 5

1. Study MRID #41736825 may be used as supplemental data until the additional data to upgrade study MRID #41736825 is submitted and reviewed.
2. Chlorethoxyphos [DPX-43898; phosphorothioic acid, O,O-diethyl O-(1,2,2,2-tetrachloroethyl) ester] degraded with half-lives of 41-47 days in clay soil that was incubated anaerobically (flooding plus nitrogen atmosphere) in the dark at 25 C for 62 days following 19 days of aerobic incubation. Only chlorethoxyphos was identified in the soil and floodwater; carbon dioxide was the major degradate and totaled 36.5% of the applied at the termination of the experiment.

Mobility data on degradates of Chlorethoxyphos DER 6

1. MRID #41736826 provides acceptable mobility data on the degradates of chlorethoxyphos (trichloroacetic acid and trichloroacetaldehyde). Acceptable batch equilibrium (163-1) was submitted for parent chlorethoxyphos; studies MRID #41290618, #40883709, reviewed and accepted 2/21/90, EFGWB #90-0067 and #90-186.
2. Based on a partial English translation of a German article

(reference 1) the Freundlich k for chloral hydrate (trichloroacetaldehyde) extrapolated from figure 1 on four soils ranges from 0.1 to 0.3 and overlaps the trichloroacetic acid plot. This data indicate that chloral hydrate is only slightly bound to soil and would be in the same mobility class as trichloroacetic acid. Reference 2 demonstrates that chloral hydrate can be easily leached from any of the four test soils indicating the compounds high mobility potential. Trichloroacetic acid, the major degradate of chloral hydrate in soils, is used as a standard for the highest mobility class in soils (MRID 41736820). The Freundlich adsorption constant k, for trichloroacetic acid extrapolated from the information in Reference 1 and is <1 (0.1 to 0.3).

Laboratory Volatility DER 7

1. Study MRID #41736827 is acceptable and completely satisfies the laboratory volatility 163-2 data requirement for chlorethoxyphos.
2. The mass flux of chlorethoxyphos which was calculated from the total amount of compound which evolved per hour using the area of the soil surface was measured at 45.6 cm². The highest concentration, which was 281 ug/m³, was measured on Day 1 of the experiment where chlorethoxyphos was incorporated 1/4 inch into the sandy loam soil. By day 16 the concentration decreased to 23.1 ug/m³. When incorporated 1 inch into the soil chlorethoxyphos was measured at 183 ug/m³ on Day 1 and decreased to 36.6 ug/m³ by Day 13. Three other soils were tested at 1/4 inch and 1 inch incorporation of chlorethoxyphos 10G at approximately 4X. The volatilization was dependent upon the %OM and the depth of incorporation of chlorethoxyphos into the soil.

Terrestrial Field Dissipation DER 8 (Fortress 10% G, Field Corn)

1. Portions of study MRID #41736829 may be upgradable to acceptable with the submission of additional information but does not currently satisfy the terrestrial field dissipation 164-1 data requirement for chlorethoxyphos for the following reasons:
2. The portions of this study conducted in Iowa and California are scientifically sound and may be made upgradable by rectifying the following deficiencies:
 - field test procedures were not completely described,
 - field test data were incomplete, and
 - field maintenance practices were not adequately reported.

The portion of this study conducted in North Carolina is scientifically sound and may be made upgradable by rectifying

the following deficiencies:

soil samples collected during the initial 2 weeks posttreatment (five sampling intervals) may have been misidentified; therefore, conclusions based on the results of those soil samples are tentative.

The portion of this study conducted in Illinois is unacceptable and may not be upgradable for the following reason:

the data were too variable to accurately assess the dissipation of chlorethoxyphos in the soil.

3. In order for the portions of this study conducted in Iowa and California to be upgraded to acceptable, the registrant must provide complete descriptions of the field test procedures and field maintenance practices; submit additional field test data, such as depth to water table, slope of field, etc.; and specify which soil residue data were used to calculate the dissipation rates and substantiate the methods used for the calculations (see Comment 1). In order for the portion of this study conducted in North Carolina to be upgraded to acceptable, the registrant must provide documentation to illustrate how samples collected at 5 sampling intervals were misidentified.
4. Chlorethoxyphos [DPX-43898; phosphorothioic acid, O,O-diethyl O-(1,2,2,2-tetrachloroethyl) ester] dissipated with observed half-lives of 7-14 days in sandy loam soil in California and 14-35 days in clay loam soil in Iowa after chlorethoxyphos (Fortress, 10% granular) was applied at 0.6 oz ai/1000 row-feet (0.5 lb ai/A) as a preemergence soil-incorporated band over-row application to plots of field corn. Chlorethoxyphos was detected in the 18- to 24-inch soil depth at the Iowa site, contamination is suspected. At the California site chlorethoxyphos did not leach below the 0- to 3-inch depth. In California rainfall totaled 0.01 inches at 7 days posttreatment, 0.03 inches at 14 and 30 days, and 7.22 inches at the end of the study; irrigation added an additional 15.5-31 inches by the end of the study (irrigation water was not accurately measured). In Iowa rainfall totaled 1.50 inches at 14 days posttreatment, 3.55 inches at 35 days, and 31.76 inches at the end of the study. The degradate trichloroacetic acid was detected at both sites, but the oxon analog of chlorethoxyphos, [IN-34158; phosphoric acid, diethyl (1,2,2,2-tetrachloroethyl) ester], was detected at the Iowa (and Illinois) site.

Terrestrial Field Dissipation: DER 9 (Fortress 10% G, Field Corn)

1. Study MRID #41736828 may be used as ancillary information but does not satisfy the terrestrial field dissipation 164-1 data requirement for chlorethoxyphos for the following reason:

- a) Study MRID # 41736828 was previously submitted and reviewed under MRID #41290619 (EFGWB #90-0067; 2/21/90). At that time the study was judged to be supplemental but did not satisfy the 164-1 data requirement primarily because the fate of the potential degradates were not addressed in the field. The registrant will not be able to address this concern due to the soil samples being destroyed in a fire.
2. Chlorethoxyphos was applied as a granular (Fortress 10G) to a Iowa loam soil (pH= 6.8, OM= 3.3%) and a Illinois clay loam soil (pH= 6.2, OM= 4.9%) at rates equivalent to 0.5 to 1.0 lbs ai/acre (2-4 times the maximum label rate) and incorporated to a depth of 3 inches. Almost all of the chlorethoxyphos remained in the top 3 inches of soil at both the Iowa and Illinois sites (although rainfall at both sites during the study were somewhat lower than the historical mean, the almost complete lack of mobility of chlorethoxyphos suggest that supplemental irrigation would have little if any effect). The study authors calculated an initial dissipation half-life of 2.0 days for chlorethoxyphos in the top 3 inches of the Iowa loam soil and reported that 90% had dissipated in 17 days. For chlorethoxyphos in the top 3 inches of the Illinois clay loam soil, the study authors calculated an initial dissipation half-life of 2.6 days and reported that 90% had dissipated in 26 days.

Ancillary Study - Freezer Storage Stability DER 10

1. Freezer storage stability studies are not specifically required by Subdivision N guidelines.
2. Chlorethoxyphos [DPX-43898, phosphorothioic acid, O,O-diethyl O-(1,2,2,2-tetrachloroethyl) ester] was stable in soil stored frozen (-20 C) for 31 months. Phosphoric acid, diethyl (1,2,2,2-tetrachloroethyl) ester (IN-34158), the oxon analog of chlorethoxyphos, was found to degrade rapidly during the period between fortification of the soil samples and when the samples were actually frozen, but did not appear to degrade further during 31 months of frozen storage.
3. This study is scientifically sound. Based on the information provided by this study, soil samples containing chlorethoxyphos and IN-34158 may be stored frozen for up to 31 months prior to analysis.
4. If samples are stored frozen for longer than 31 months prior to analysis, additional storage stability information may be required.

Ancillary Study - Freezer Storage Stability DER 11

1. Freezer storage stability studies are not specifically required by Subdivision N guidelines.

2. Trichloroacetic acid was stable in clay loam soil stored frozen (-20 C) for up to 23 months.
3. This study is scientifically sound. Based on the information provided by this study, soil samples containing trichloroacetic acid may be stored frozen up to 23 months prior to analysis.
4. If samples are stored frozen for longer than 23 months prior to analysis, additional storage stability information may be required.

8. RECOMMENDATIONS:

a. Inform the registrant that studies MRID #41736821, photodegradation in water (161-2); MRID #41736822, photodegradation on soil (161-3); MRID #41736827, laboratory volatility (163-2); and study MRID #41736826 mobility information (163-1) on the degradates (TCA and choral hydrate) of chlorethoxyphos are acceptable and completely satisfy those data requirements.

Study MRID #41736829 provides supplemental terrestrial field dissipation (164-1) data on chlorethoxyphos and its degradates from the California and Iowa sites. Study MRID #41736828 (previously submitted and reviewed under MRID #41290619; EFGWB #90-0067, 2/21/90) provides supplemental terrestrial field dissipation (164-1) data on parent chlorethoxyphos from the Illinois and Iowa sites. Together, the above mentioned four sites from the supplemental studies MRID #41290605 and MRID #41736828 completely satisfy the terrestrial field dissipation (164-1) data requirement for chlorethoxyphos.

b. The aerobic soil metabolism (162-1) study MRID #41736824 may be used as ancillary data to the already reviewed and acceptable studies MRID #40883705, #41290617 (EFGWB #90-186, 1/31/89, EFGWB #90-0067, 2/21/90). There is no need to submit additional data to upgrade study MRID #41736824 to acceptable due to the aerobic soil metabolism (162-1) data requirement being already satisfied.

c. The anaerobic soil metabolism (162-2) study MRID #41736825 may be upgradable to acceptable with the submission of additional data: the actual concentrations of chlorethoxyphos that were detected in the organic volatiles, and specify the concentrations of any other volatilized [¹⁴C]compounds that were present.

d. The photodegradation in air study MRID #41736823 is unacceptable and does not satisfy the photodegradation in air (161-4) data requirement because of: material balances were incomplete, and the photodegradation of the test substance in the air could not be distinguished from photodegradation of the test substance that had condensed on the sides of the photoreactor vessel or that had not volatilized. However, the photodegradation in air (161-4) data requirement will remain in a reserve status until the technical issues are resolved whereupon a new study may then be required.

PRELIMINARY ENVIRONMENTAL FATE AND GROUND WATER ASSESSMENT

Chlorethoxyphos:

In general, chlorethoxyphos' major route of dissipation is through aerobic soil metabolism. The compound was not persistent in the soils tested in the aerobic soil metabolism studies or in the terrestrial field dissipation studies yielding half-lives ranging from 7 to 23 days and 2 to 48 days respectively. The compound has a relatively low aqueous solubility (2.1 mg/L) and appears to be relatively strongly bound even to moderately low organic soils (Freundlich binding coefficients ranging from 40 to 200). Chlorethoxyphos has a relatively high vapor pressure although soil incorporation of the granular will minimize this route of dissipation. Therefore under most conditions Chlorethoxyphos will have a very low potential for movement to groundwater. However, there is a possibility of runoff to surface water through erosion of soil particles to which chlorethoxyphos is adsorbed, but this is only a short term threat due to the rapid dissipation of the compound in the soil. If the compound were to reach surface water it may persist for some time due to the relatively long abiotic hydrolysis half-lives (pH 5 and 7, 72 and 59 days respectively) as well as the low inclination to photodegrade. If the compound were to reach surface water it would also have a very high potential to bioaccumulate (maximum BCF's of 1000-4000), however the chemical would dissipate rapidly from the exposed tissues due to rapid depuration. In addition, if the compound were to reach surface waters volatilization would greatly decrease the persistence (Henry's law constant: 1.5×10^{-2} , 3.5×10^{-4} atm m³ mole⁻¹).

The degradates of chlorethoxyphos vary according to soil pH and include dichloroacetic acid, generated under neutral to alkaline pH's and trichloroacetaldehyde (chloral) generated under acidic to neutral pH's. Trichloroacetaldehyde is sometimes oxidized to trichloroacetic acid (TCA) depending upon soil microbial populations, and/or soil physical/chemical characteristics as was noted in the soil photolysis, adsorption/desorption, confined rotational crop study, and the terrestrial field dissipation studies. In the field it appears degradation of chloral alone is primarily microbial, however chloral degrades under sterile conditions as well due to the instability of the aldehyde. In addition, due to the high reactivity of TCA (strong acid) and rapid mineralization in the field TCA would not pose a threat to ground water under normal use conditions.

The phosphoryl portion of the molecule was not labeled and therefore its fate was not addressed in the laboratory studies. However, the EFGWB will not require environmental fate data on the phosphoryl portion of the molecule because EEB and HED do not believe that the phosphoryl portion by itself is of any toxicological or ecological significance at levels expected in the environment due to the low application rate of chlorethoxyphos

(maximum of 0.25 lbs ai/acre).

Moreover, the phosphoryl portion of the test substance is common to many organophosphorus pesticides and for reference the registrant has provided a literature review (summary; not actual studies) on the environmental fate and toxicity of diethylthiophosphate (DETP) and diethylphosphate (DEP) in lieu of conducting studies using chlorethoxyphos labeled in the phosphoryl moiety.

Based upon the literature data DETP and DEP are the primary phosphoryl degradates of chlorethoxyphos. DETP is the primary hydrolysis product of diethylthiophosphate and diethyldithiophosphate and is stable to further hydrolysis in the environmentally significant pH ranges. DETP and DEP are polar anions in the environment which are physically mobile in soil and could contaminate both ground and surface water under some conditions. Both DETP and DEP are expected to degrade to CO₂ with the possibility of monoethyl compounds being formed. DETP has reported degradative half-lives of <2 weeks to <8 weeks in various soils under aerobic conditions.

Environmental Fate Data Review:

Hydrolysis data demonstrated that chlorethoxyphos degraded with half-lives of 72, 59 and 4.3 days at pH 5, 7, and 9 respectively at 25C. At pH 5 and 7 chloral hydrate (trichloroacetaldehyde) was the major degradate, at pH 9 dichloroacetic acid. The concentration of both degradates continually increased during the duration of the study giving an indication that the degradates were hydrolytically stable under the test conditions.

Chlorethoxyphos in water at pH 5 under a Xenon lamp gave an irradiated half-life of 27 days (uncorrected for lamp intensity or continuous radiation) and 89 days when incubated in darkness under similar conditions. Chloral hydrate (major degradate) and dichloroacetic acid were the degradation products. The u.v. max of chlorethoxyphos is <290nm indicating that direct phototransformation is not possible. Photodegradation on soil by natural sunlight showed that chlorethoxyphos degraded with a calculated half-life of 21 days for the irradiated and 26 days for the dark control. It appears this degradation was through other means rather than direct photolysis. Non-irradiated samples produced chloral hydrate (43%), polar compounds (11%) and volatiles. The exposed samples produced chloral hydrate (17%), polar compounds (7%, primarily di- and trichloroacetic acid) and carbon dioxide (27%) and volatiles (1%).

An aerobic soil metabolism study conducted in a static system showed that the half-life of the parent was 20 days. Major degradates were chloral hydrate at a maximum of 21.9% of applied at day 5 then decreased to less than 5.1% at day 7. CO₂ increased throughout incubation time to greater than 47% of applied. Based

upon data from a flow through system the half-life of the parent was 7 days. Although degradation to chloral hydrate and CO₂ contributed to the dissipation, the volatilization of the parent contributed much more to dissipation than the metabolic degradation. In another aerobic soil study reviewed in this submission the parent degraded with a half-life of approximately 23 days. Only chlorethoxyphos was identified in the soil; carbon dioxide was the major degradate and totaled 63.0% of the applied at 120 days posttreatment. Anaerobic soil degradation was slower than aerobic with a half-lives of 41-47 days in clay soil that was incubated anaerobically in the dark at 25 C for 62 days following 19 days of aerobic incubation. Only chlorethoxyphos was identified in the soil and floodwater; carbon dioxide was the major degradate and totaled 36.5% of the applied at the termination of the experiment.

The adsorption/desorption results indicate that parent chlorethoxyphos is strongly bound to even low organic matter soils. The Freundlich binding coefficients for the adsorption of parent on 4 soils ranged from K= 40 to K= 200. Trichloroacetic acid was observed in all four soils during the adsorption phase as a degradation product.

In previously reviewed terrestrial field dissipation studies (MRID # 41736828, MRID #41290619) almost all chlorethoxyphos remained in the top 3 inches of the test plots. The study authors calculated an initial dissipation half-life of 2.0 days for chlorethoxyphos in the top 3 inches of the Iowa loam soil and reported that 90% had dissipated in 17 days. For chlorethoxyphos in the top 3 inches of the Illinois clay loam soil, the study authors calculated an initial dissipation half-life of 2.6 days and reported that 90% had dissipated in 26 days. In the terrestrial field dissipation (164-1) studies reviewed in this document (MRID #41736829) containing six sites, Chlorethoxyphos dissipated with observed half-lives of 7-14 days in sandy loam soil in California and 14-35 days in clay loam soil in Iowa. In North Carolina, chlorethoxyphos dissipated with an observed half-life of 14-48 days from the upper 3 inches of a sandy loam soil and parent was detected into the 12- to 18-inch depth (0.04 ppm at day 0). Chlorethoxyphos was detected in the 18- to 24-inch soil depth (0.01 ppm) at the Iowa site (contamination is suspected), but did not leach below the 0- to 3-inch depth at the California site. The rainfall plus irrigation may have been greater in Iowa than California due to the inaccurate measurement of irrigation in California. However, generally a large portion parent chlorethoxyphos seems to remain in the 3 inch soil layer and is degraded there to trichloroacetic acid. The degradate trichloroacetic acid was detected at all sites, but the oxon analog of chlorethoxyphos, [IN-34158; phosphoric acid, diethyl (1,2,2,2-tetrachloroethyl) ester], was detected at the Iowa and Illinois site and did not leach below the 0- to 3-inch soil depth. The oxon analog would exhibit physical/chemical properties similar to that of the parent and would be microbially degraded.

The submission of data required for full registration of chlorethoxyphos on terrestrial food use sites is summarized below:

Satisfied:

-Hydrolysis (161-1); MRID #40883705, EFGWB #90-186, 1/31/89, EFGWB #90-0067, 2/21/90. Half-life of 72, 59 and 4.3 days at pH 5, 7, and 9 respectively at 25C. At pH 5 and 7 chloral hydrate was the major degradate, at pH 9 dichloroacetic acid.

-Photodegradation in Water (161-2); MRID #41736821, EFGWB #93-0258, -0259. Photodegraded with a half-life of 27 days (uncorrected for lamp intensity or continuous radiation) in sterile aqueous buffered solutions (pH 5) irradiated with a UV-filtered xenon light source at approximately 25 C. The dark control showed a half-life of 89 days when incubated in darkness under similar conditions. Degradates identified in the irradiated and dark control solutions were trichloroacetaldehyde (major degradate) and dichloroacetic acid.

-Photodegradation on Soil (161-3); MRID #41736822, EFGWB #93-0258, -0259. The calculated half-life was 21 days for the irradiated (natural sunlight) and 26 days for the dark control. Non-irradiated samples produced chloral hydrate (43%), polar compounds (11%) and volatiles. The exposed samples produced chloral hydrate (17%), polar compounds (7%) and carbon dioxide (27%) and volatiles (1%).

-Aerobic Soil Metabolism (162-2); MRID #40883706, #41290617, EFGWB #90-186, 1/31/89, EFGWB #90-0067, 2/21/90. - Based upon data from a static system the half-life of the parent was 20 days. Major degradates were chloral hydrate at a maximum of 21.9% of applied at day 5 then decreased to less than 5.1% at day 7. CO₂ increased throughout incubation time to greater than 47% of applied. Based upon data from a flow through system the half-life of the parent was 7 days. Although degradation to chloral hydrate and CO₂ contributed to the dissipation the volatilization of the parent contributed much more than the dissipation.

Ancillary data reviewed above: MRID #41736824, EFGWB #93-0258, -0259. The parent degraded with a half-life of approximately 23 days. Only chlorethoxyphos was identified in the soil; carbon dioxide was the major degradate and totaled 63.0% of the applied at 120 days posttreatment.

- Leaching/Adsorption/Desorption (163-1); MRID #40883709, #41290618, EFGWB #90-186, 1/31/89, EFGWB #90-0067, 2/21/90. The Freundlich binding coefficients and the exponential constants for the adsorption of parent on a Hanford sandy loam (pH= 6.4, OM= 1.0%), North Carolina loamy sand (pH= 5.4, OM= 2.0%), Fargo silt loam (pH= 7.2, OM= 4.3%) and La Hogue (incorrectly identified as Flanagan) loam (pH= 7.4, OM= 5.0%) were K= 40, 1/n=1.1; K= 53, 1/n=1.1; K= 150, 1/n= 1.1; and K= 200, 1/n= 1.1. These results indicate that parent chlorethoxyphos is strongly bound to even low organic matter soils. The Freundlich binding coefficients and

exponential constants for desorption of parent in the above soils are; $K= 7.5$, $1/n= 0.38$; $K= 8.2$, $1/n= 0.39$; $K= 5.3$, $1/n= 0.14$; and $K=5.2$, $1/n= 0.12$. These results indicate that parent chlorethoxyphos will not be easily desorbed after adsorption takes place. Degradation was observed during the adsorption phase of the experiment with TCA being observed.

-Adsorption/Desorption (Batch Equilibrium on degradates); The Freundlich constants for the chloral hydrate and trichloroacetic acid were obtained from the literature and are less than 1 indicating that both have a high mobility potential.

-Leaching (soil column on chloral hydrate) A soil column leaching study from the literature also indicate that chloral hydrate is easily leached from the four test soils used indicating the high mobility of the compound.

-Laboratory Volatility (163-2); MRID #41736827, EFGWB #93-0258,-0259. The mass flux of chlorethoxyphos was measured at 45.6 cm^2 .

-Terrestrial Field Dissipation (164-1); MRID # 41736828, MRID #41290619 (EFGWB #90-0067; 2/21/90). All 164-1 studies used Fortress 10G and exaggerated use rates. Almost all chlorethoxyphos remained in the top 3 inches of soil. The study authors calculated an initial dissipation half-life of 2.0 days for chlorethoxyphos in the top 3 inches of the Iowa loam soil and reported that 90% had dissipated in 17 days. For chlorethoxyphos in the top 3 inches of the Illinois clay loam soil, the study authors calculated an initial dissipation half-life of 2.6 days and reported that 90% had dissipated in 26 days. The fate of the degradates was not addressed.

MRID #41290605, (EFGWB #93-0258,-0259). Chlorethoxyphos dissipated with observed half-lives of 7-14 days in sandy loam soil in California and 14-35 days in clay loam soil in Iowa. In North Carolina, chlorethoxyphos dissipated with an observed half-life of 14-48 days from the upper 3 inches of a sandy loam soil and parent was detected into the 12- to 18-inch depth. Chlorethoxyphos leached into the 18- to 24-inch soil depth at the Iowa site, but did not leach below the 0- to 3-inch depth at the California site. The degradate trichloroacetic acid was detected at all sites, but the oxon analog of chlorethoxyphos, [IN-34158; phosphoric acid, diethyl (1,2,2,2-tetrachloroethyl) ester], was detected at the Iowa site (and Illinois) and did not leach below the 0- to 3-inch soil depth.

-Bioaccumulation in Fish (165-4); MRID #40883710, #41290621, EFGWB #90-186, 1/31/89, EFGWB #90-0067, 2/21/90. Channel catfish exposed to 0.0047 mg/L parent 1100 (muscle after 21 days), 4000 (viscera after 7 days), and 2100 (whole fish after 21 days exposure). BCF's after 28 days were 500 (muscle), 2000 (viscera), and 1100 (whole fish). After 14 days depuration, BCF's were greatly reduced 31 (muscle), 86 (viscera), and 46 (whole fish). Most of radioactivity (92-99%) in fish tissue and water was parent chlorethoxyphos.

Upgradable:

(studies will be considered ancillary until acceptable data is

submitted)

-Anaerobic Soil Metabolism (162-2); MRID #41736825, EFGWB #93-0258,-0259. [¹⁴C]organic volatiles that comprised up to 58.3% of the applied (0.29 ppm) radioactivity were not adequately identified. Parent degraded with half-lives of 41-47 days in clay soil that was incubated anaerobically (flooding plus nitrogen atmosphere) in the dark at 25 C for 62 days following 19 days of aerobic incubation. Only chlorethoxyphos was identified in the soil and floodwater; carbon dioxide was the major degradate and totaled 36.5% of the applied at the termination of the experiment

Reserved:

-Photodegradation in Air (161-4); MRID #41736823, EFGWB #93-0258,-0259. Material balances were incomplete, and photodegradation on the glass surface could not be distinguished from the air, a new study is not currently required.

9. BACKGROUND :

Chlorethoxyphos (DPX-43898) is an organophosphorus insecticide currently being developed by du Pont for use in the control of corn root worms and other soil insects on corn. The proposed use rate is 0.3 oz ai/1000 feet of row (0.25 lb ai/A assuming 40-inch row spacing). Single active ingredient formulations include granular. Chlorethoxyphos is highly toxic to birds and fish.

10. DISCUSSION:

See attached DERS.

11. COMPLETION OF ONE-LINER:

Attached.

12. CBI INDEX:

Not Applicable.