8-1-95

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG - 1 1995

MEMORANDUM

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

SUBJECT: Chlorethoxyfos (Fortress) Application for Registration (D212604, D212662)

TO: Dennis Edwards, PM 19
Registration Division (7505C)

FROM: Anthony F. Maciorowski, Chief
Ecological Effects Branch
Environmental Fate and Effects Division (7507C)

Attached is the Ecological Effects portion of the risk assessment for Fortress 2.5G and 5G, E. I. DuPont DeNemours and Co.'s corn insecticide containing the active ingredient chlorethoxyfos. The data packages referenced above also include a response from DuPont to a previous EEB risk assessment, as well as DuPont's own risk assessment for review and comment. These last two items will be addressed and sent under separate cover. Reviews of two chronic studies are also forthcoming.

EEB has strong concerns about terrestrial and aquatic adverse effects from the use of chlorethoxyfos on corn. High-risk LOCs have been exceeded for small mammals for both acute and chronic effects. Additionally, endangered species LOCs have been exceeded for all classes of organisms. In addition to the LOC exceedances, there was significant field mortality observed in a terrestrial field study, and severe impacts to numerous species of aquatic invertebrates were observed in a mesocosm study. Requiring incorporation of the granules might possibly reduce the risks associated with the use of chlorethoxyfos on corn. Additionally, EEB suggests that monitoring for terrestrial and aquatic mortalities and other effects be required as a condition of the registration of this chemical.

The only outstanding data for chlorethoxyfos is a fish early life stage study with the sheepshead minnow. EEB has been informed that this study is currently in progress and will be submitted to the Agency in September, 1995. This data will be of high value in confirming chronic risk to marine/estuarine fish species.

If you have any questions on the above, please contact Kathryn Montague (308-2804).

DP Barcode : D212604
PC Code No : 129006
EEB Out : 08/01/95

To: Dennis Edwards
Product Manager 19
Registration Division (7505C)

From: Anthony F. Maciorowski, Chief
Ecological Effects Branch/EFED (7507C)

Attached, please find the EEB review of...

Reg./File # : 000352-LLG
Chemical Name : Chlorethoxyfos
Type Product : Insecticide
Product Name : Fortress Technical
Company Name : E. I. DuPont DeNemours and Company, Inc.
Purpose : Revisions to application for registration and submission of response to previous EEB review DuPont's assessment and proposed label.
Action Code : 101 Date Due : 08/01/95
Scientist : K. Valente Date In : 06/20/95

EEB Guideline/MRID Summary Table: The review in this package contains an evaluation of the following:

GDLN NO	MRID NO	CAT	GDLN NO	MRID NO	CAT	GDLN NO	MRID NO	CAT
71-1(A)			72-2(A)			72-7(A)		
71-1(B)			72-2(B)			72-7(B)		
71-2(A)			72-3(A)			122-1(A)		
71-2(B)			72-3(B)			122-1(B)		
71-3			72-3(C)			122-2		
71-4(A)			72-3(D)			123-1(A)		
71-4(B)			72-3(E)			123-1(B)		
71-5(A)			72-3(F)			123-2		
71-5(B)			72-4(A)			124-1		
72-1(A)			72-4(B)			124-2		
72-1(B)			72-5			141-1		
72-1(C)			72-6			141-2		
72-1(D)			Assessment	435503-04		141-5		
			Response	435503-05				

Y=Acceptable (Study satisfied Guideline)/Concur
P=Partial (Study partially fulfilled Guideline but additional information is needed
S=Supplemental (Study provided useful information but Guideline was not satisfied)
N=Unacceptable (Study was rejected)/Nonconcur

ECOLOGICAL EFFECTS ASSESSMENT (EFED)

1. Ecological Toxicity Data

EFED has adequate data needed to assess the hazard of chlorethoxyfos to nontarget terrestrial and aquatic organisms; however, some data requirements are outstanding. These data are needed as high-value confirmatory information:
72-4a: Fish early life-stage with Sheepshead minnow

a. Toxicity to Terrestrial Animals

i. Birds, Acute and Subacute

In order to establish the toxicity of chlorethoxyfos to birds, the following tests are required using the technical grade material: one avian single-dose oral (LD_{50}) study on one species (preferably mallard or bobwhite quail); two subacute dietary studies (LC_{50}) on one species of waterfowl (preferably the mallard duck) and one species of upland game bird (preferably bobwhite quail or ring-necked pheasant). Avian single-dose oral (LD_{50}) testing was also performed with each formulated product.

Avian Acute Oral Toxicity Findings

Species	% A.I.	LD_{50}	MRID No. Author/Year	Toxicity Category	Fulfills Guideline Requirement*
Northern Bobwhite	86	28 mg a.i./kg	408837-35 Grimes and Jaber, 1987	Highly toxic	Y
House Sparrow	86	197 mg a.i./kg	417368-39	Moderately toxic	S
Northern Bobwhite	5G	36 mg a.i./kg	412906-36 Grimes and Jaber, 1988	Highly toxic	Y
Northern Bobwhite	2.5G	32.8 mg a.i./kg (NOEL=7.9 mg a.i./kg)	435402-02 Campbell & Beavers, 1994	Highly toxic	Y
Northern Bobwhite	5G	29 mg a.i./kg	412906-37 Grimes & Jaber, 1988	Highly toxic	S
Northern Bobwhite	5G	28 mg a.i./kg	412906-38 Grimes & Jaber, 1988	Highly toxic	Y
Northern Bobwhite	10G	46 mg a.i./kg	408837-36 Grimes & Jaber, 1987	Highly toxic	Y

*Y=Acceptable (Study satisfied Guideline)/Concur P=Partial (Study partially fulfilled Guideline but additional information is needed
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Avian Subacute Dietary Toxicity Findings					
Species	% A.I.	LC_{50} ppm	MRID No. Author/Year	Toxicity Category	Fulfills Guideline Requirement*
Northern Bobwhite	86	181	417368-41 Long et al, 1990	Highly toxic	Y
Northern Bobwhite	86	148	408837-37 Grimes & Jaber, 1987	Highly toxic	S
Mallard Duck	86	203	408837-38 Grimes & Jaber, 1987	Highly toxic	Y

*Y=Acceptable (Study satisfied Guideline)/Concur P=Partial (Study partially fulfilled Guideline but additional information is needed
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These results indicate that chlorethoxyfos is highly toxic to avian species on an acute oral and subacute dietary basis. The guideline requirements are fulfilled.

ii. Birds, Chronic

Avian reproduction studies are required when birds may be exposed repeatedly or continuously through persistence, bioaccumulation, or multiple applications, or if mammalian reproduction tests indicate reproductive hazard. The terrestrial field-dissipation half-lives indicate that it is persistent for greater than 4 days (aerobic soil metabolism half-life is 15 days and volatility half-life is 7 days). Chlorethoxyfos has also been shown to bioaccumulate in earthworms by a factor of 3.

Avian Reproduction Findings						
Species	% A.I.	NOEL ppm	LOEL ppm	Endpoints affected	MRID No. Author/Year	Fulfills guideline requirement*
Northern Bobwhite	86	25	Not determined		408837-39 Beavers et al, 1988	S
Northern Bobwhite	86	30	66	Toxicity symptoms, gross necropsy findings, egg production, body weight, feed consumption, viability, hatchling numbers, hatchling survivors, and hatchling survivor body weight	437177-02 Beavers et al, 1995	Unreviewed data[1]
Mallard Duck	86	5	25	Toxicity symptoms	408837-40 Beavers et al, 1988	Y

*Y=Acceptable (Study satisfied Guideline)/Concur P=Partial (Study partially fulfilled Guideline but additional information is needed
S=Supplemental (Study provided useful information but Guideline was not satisfied) N=Unacceptable (Study was rejected)/Nonconcur
[1]The submitted study has received only a cursory review at the time of this assessment. The status of the data requirement will be determined pending a full review of the submitted study.

The northern bobwhite reproductive study indicates that chlorethoxyfos can cause reductions in egg production, reductions in hatchling numbers, decreased egg viability, decreased hatchability, reduction in number of 14-day hatchling survivors, decreased body weight in hatchling survivors, symptoms of toxicity, and abnormalities revealed during gross necropsy at 90 ppm. Signs of toxicity, abnormal necropsy findings and decreased egg production were also seen at 66 ppm. The mallard duck reproduction study indicates that chlorethoxyfos can cause signs of toxicity at 25 ppm.

The guideline requirements are partially fulfilled; the first northern bobwhite study was unacceptable due to lack of a LOEC, and was repeated. The new study was received at the time of this assessment, and received a cursory review. If a complete review of the study show it to be acceptable, then the guideline requirements will be fulfilled.

iii. Mammals

Wild mammal testing is required on a case-by-case basis, depending on the results of the lower tier studies such as acute and subacute testing, intended use pattern, and pertinent environmental fate characteristics. Two wild mammal tests were performed using chlorethoxyfos. The results of these tests are reported below. Additionally, an acute oral LD_{50} from the Agency's Health Effects Division (HED) for rats is reported below.

Mammalian Acute Oral Toxicity Findings

Species	% a.i.	Toxicity Value (LD_{50})	MRID #	Toxicity Category	Fulfills Requirements?
Deer mouse	98.4	7.7 mg a.i./kg	425592-26 Hooper et al, 1992	Very highly toxic	Y
Deer mouse	5G	5.0 mg a.i./kg	425592-25 Hooper et al, 1992	Very highly toxic	Y
Rat (small mammal surrogate)	86	4.8 mg a.i./kg males 1.8 mg a.i./kg females	408837-11	I (Very highly toxic)	Y

The available mammalian data indicate that chlorethoxyfos is very highly toxic to small mammals on an acute basis.

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iv. Mammals, chronic

Results of mammal chronic testing from the Health Effects Division are used to assess the chronic risk to mammals. The results of a rat reproduction test are generally used for this purpose. The results of this test are reported below.

MAMMALIAN CHRONIC TESTING RESULTS				
SPECIES	**% a.i.**	**NOEL**	**MRID #**	**FULFILLS REQ?**
Rat--reproduction	86	Parental repro: 1 ppm Offspring cholinergic: 0.1 ppm	008330	Supplemental

v. Insects

A honey bee acute contact LD_{50} study is required if the proposed use will result in honey bee exposure. The proposed use of chlorethoxyfos (granular, at-plant corn insecticide) will not result in honey bee exposure; however, honey bee acute contact testing was available for chlorethoxyfos and is summarized below.

Nontarget Insect Acute Contact Toxicity Findings				
Species	**% AI**	**LD_{50}**	**MRID No.**	**Toxicity Category**
Honey Bee	86	0.09 µg/bee	408837-49	Highly toxic

There is sufficient information to characterize chlorethoxyfos as highly toxic to bees. The guideline requirement is fulfilled.

vi. Terrestrial Field Testing

A terrestrial field study was conducted on corn in Iowa in 1991. Fortress 5G was applied as a T-band at-plant, in a single application of 0.33 lb a.i./A. The study received an abbreviated review by EEB. Substantially more bird and mammal carcasses were found on the treated plots than on the control. A total of 178 (112 bird, 63 mammals) were found on 7 treatment plots (average of 25.4 carcasses per plot). A total of 42 carcasses were found on the 5 control plots (8.4 carcasses per plot). Additionally, several of the carcasses found on treated plots had detectable chlorethoxyfos levels in their GI tracts, as well as reduced cholinesterase levels (chlorethoxyfos exposure results in reduction of cholinesterase). Therefore, EEB concluded that Fortress 5G applied as a T-band to corn is likely to cause mortality to birds and mammals (See attached tables).

vii. Earthworm studies

Earthworm toxicity studies are sometimes required when a chemical is suspected of causing severe impact to these beneficial invertebrates, or when there is concern for avian species from chemical exposure via earthworms or other invertebrate food items. Chlorethoxyfos has been shown to bioaccumulate in fish (2100x), and a bioaccumulation study in earthworms (MRID #425529-30) using the 5G formulation showed that it bioaccumulated by a factor of 3. An acute contact laboratory study with the 5G formulation (MRID #425592-31) at the maximum label rate at the time (6 oz product/1000 ft row) resulted in less than 10% mortality, but the worms demonstrated a rubbery-rigid, intoxicated appearance. An acute LD_{50} study with the technical grade of chlorethoxyfos (MRID #435497-01) showed the LD_{50} to be 0.33 mg a.i./mL (330 ppm).

A field evaluation was conducted with 5G at 0.3 oz a.i./1000 ft row at 2 separate sites (corn fields, separated by a ditch and a road)(MRID #435497-02). The study demonstrated a 40% decrease in the number of earthworms in treated areas 3 months after in-furrow application, and a 22% reduction for the T-band application at site A. At 6 months post-application, there were 10% and 15% reductions for the T-band and in-furrow applications, respectively, for this site. At site B, however, there was an 11% increase and no change for the T-band and in-furrow applications, respectively, at 3 months. At 6 months, there was a 35% increase and a 31% reduction for the two methods, respectively. The only statistically significant effects was the 40% reduction 3 months post-application at site A for the in-furrow method. The study was conducted at twice the currently proposed maximum application rate.

b. Toxicity to Aquatic Animals

i. Freshwater Fish, Acute

In order to establish the toxicity of a pesticide to freshwater fish, the minimum data required on the technical grade of the active ingredient are two freshwater fish toxicity studies. One study should use a coldwater species (preferably the rainbow trout), and the other should use a warmwater species (preferably the bluegill sunfish).

Freshwater Fish Acute Toxicity Findings

Species	% A.I.	LC_{50}	MRID No.; Author/Year	Toxicity Category	Fulfills guideline requirement*
Rainbow trout	86	89 ppb a.i.	413341-01; Hutton, 1990	Very highly toxic	Y
Bluegill sunfish	86	2.3 ppb a.i.	413341-02; Hutton, 1990	Very highly toxic	Y

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The results of the 96-hour acute toxicity studies indicate that chlorethoxyfos is very highly toxic to both cold and warm water fish. The guideline requirements are fulfilled.

ii. Freshwater Fish, Chronic

Early life-stage testing is required with freshwater fish when the product is expected to transport to water, either from direct application or runoff, and when any of the following conditions apply: presence in water likely to be continuous or persistent, any aquatic LC_{50} or EC_{50} is less than 1 mg/L (1 ppm), the estimated EEC is equal to or greater than 0.01 of any LC_{50} or EC_{50} and there is any indication from other testing that the chemical may cause chronic effects. Fish early life-stage testing was required for chlorethoxyfos due to its high toxicity to freshwater fish.

Freshwater Fish Chronic Toxicity Findings

Species	% A.I.	NOEC	LOEC	MRID #	Fulfills Guideline Requirements*
Fathead minnow	86	0.84 ppb	1.6 ppb	408837-45 Hutton, 1990	Y

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Based on this data, chlorethoxyfos is very highly toxic to fish on a chronic basis. The guideline requirements for freshwater fish chronic testing are fulfilled.

iii. Freshwater Invertebrates, Acute

The minimum testing required to assess the hazard of a pesticide to freshwater invertebrates is a freshwater aquatic invertebrate toxicity test, preferably using first instar *Daphnia magna* or early instar amphipods, stoneflies, mayflies, or midges.

Freshwater Invertebrate Acute Toxicity Findings

Species	% A.I.	EC_{50}	MRID NO. Author/Year	Toxicity Category	Fulfills guideline requirement*
Daphnia magna	86	0.41 ppb	413341-03	Very highly toxic	N

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The results of this study cannot be used to assess the toxicity of chlorethoxyfos to freshwater invertebrates because the study was invalid due to inconsistencies the measured concentrations. The guideline requirement is not fulfilled; however, no further testing is required because core data is available from testing on marine invertebrates, which are more sensitive to chlorethoxyfos than freshwater invertebrates.

iv. Freshwater Invertebrates, Chronic

Chronic testing is required for freshwater invertebrates when the product is expected to transport to water, either from direct application or runoff, and when any of the following conditions apply: presence in water likely to be continuous or persistent, any aquatic LC_{50} or EC_{50} is less than 1 mg/L (1 ppm), the estimated EEC is equal to or greater than 0.01 of any LC_{50} or EC_{50} and there is any indication from other testing that the chemical may cause chronic effects. Freshwater invertebrate life-cycle testing was required for chlorethoxyfos due to its high toxicity to freshwater invertebrates.

Freshwater Invertebrate Chronic Toxicity Findings

Species	% A.I.	NOEC	LOEC	MRID NO.	Toxicity Category	Fulfills guideline requirement*
Daphnia magna	86	0.032 ppb	0.060 ppb	418083-01 Baer, 1991	Very highly toxic	Y

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The data indicate that chlorethoxyfos is very highly toxic to freshwater invertebrates on a chronic basis. The Guideline requirement (72-4b) is fulfilled.

v. Estuarine and Marine Animals

Acute toxicity testing with estuarine and marine organisms is required when an end-use product is intended for direct application to the marine/estuarine environment or is expected to reach this environment in significant concentrations. The terrestrial food (corn) use of chlorethoxyfos may result in exposure to the estuarine environment.

The requirements under this category include a 96-hour LC_{50} for an estuarine fish, a 96-hour LC_{50} for shrimp, and either a 48-hour embryo-larvae study or a 96-hour shell deposition study with oysters.

Estuarine/Marine Acute Toxicity Findings					
Species	**% A.I.**	**LC_{50}/EC_{50}**	**MRID No. Author/Year**	**Toxicity Category**	**Fulfills guideline requirement***
Eastern oyster (embryo-larvae)	86	0.13 ppb a.i.	417368-48 Ward and Boeri, 1990	Very highly toxic	Y
Mysid	86	0.10 ppb a.i.	417368-46 Ward and Boeri, 1990	Very highly toxic	S
Mysid	86	0.054 ppb a.i. (NOEC=0.019 ppb a.i.)	431422-01 Graves, 1994	Very highly toxic	Y
Sheepshead minnow	86	0.30 ppb a.i.	417368-47 Ward and Boeri, 1990	Very highly toxic	S
Sheepshead minnow	86	1.8 ppb a.i.	425592-23 Graves & Swigert, 1992	Very highly toxic	Y

*Y=Acceptable (Study satisfied Guideline)/Concur P=Partial (Study partially fulfilled Guideline but additional information is needed
S=Supplemental (Study provided useful information but Guideline was not satisfied) N=Unacceptable (Study was rejected)/Nonconcur

There is sufficient information to characterize chlorethoxyfos as very highly toxic to marine/estuarine fish and invertebrates. The guideline requirement is fulfilled.

vi. Marine/estuarine animals, chronic

Due to the greater sensitivity of marine/estuarine animals to chlorethoxyfos, and the results of freshwater chronic testings suggesting that chlorethoxyfos is very highly toxic on a chronic basis, chronic testing is required with marine/estuarine fish and invertebrates. The results of a life-cycle test with the mysid were received at the time this assessment was written, and were given a cursory review. The early life-stage test with Sheepshead minnow is still outstanding at the time of this assessment.

Estuarine/Marine Chronic Toxicity Findings						
Species	**% A.I.**	**ENDPOINTS AFFECTED**	**NOEC LOEC**	**MRID No. Author/Year**	**Toxicity Category**	**Fulfills guideline requirement***
Mysid	86	First-generation survival and wet weight	.0124 ppb a.i. .0258 ppb a.i.	437177-01 Boeri et al , 1995	Very highly toxic	Unreviewed data

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vii. Simulated Aquatic Field (Mesocosm) Testing

A mesocosm study was conducted with chlorethoxyfos at nominal concentrations of 0.073 ppb to 8.770 ppb. Mean measured concentrations ranged from 0.010 ppb to 0.821 ppb,

significantly less than the nominal concentrations. However, significant adverse impacts were observed at all treatment levels. There were significant reductions in numbers for all major taxa of invertebrates (except Gastropoda) and plants (including algae) at 0.470 ppb and higher. Class Insecta, subfamily Tanypodinae, showed significant reductions at 0.036 ppb. Additionally, the diversity of species present was significantly reduced at levels of 0.036 ppb and higher. Some of these effects had reversed themselves 2 to 3 months after application, but abundance of diatoms, flagellated phytoplankton and odonates, as well as richness and abundance of Tanypodinae (dipterans) did not recover.

c. Toxicity to Plants

i. Terrestrial

Terrestrial plant testing (seedling emergence and vegetative vigor) is required for herbicides which have terrestrial or aquatic food or non-food (except residential) use patterns and under any of the following conditions: a) the vapor pressure of the TGAI is equal to or greater than 1.0×10^{-5} mm at 25°C and the TEP is not incorporated immediately after application; b) the TEP is applied aerially, by forced air, air blast or through sprinkler irrigation; c) endangered or threatened plant species are associated with the site of application. Terrestrial plant testing is also required for all pesticides which carry phytotoxicity warnings on their labels. Since none of these conditions apply to chlorethoxyfos, terrestrial plant testing was not required.

ii. Aquatic

Tier II aquatic plant testing is required for an herbicide applied to terrestrial or aquatic food or non-food (except residential), or for any pesticide when the label carries a phytotoxicity warning. The following species should be tested: *Selenastrum capricornutum*, *Lemna gibba*, *Skeletonema costatum*, *Anabaena flos-aquae*, and a freshwater diatom. (For cases of testing based on label phytotoxicity warnings, only *Lemna gibba* and *Selenastrum capricornutum* testing is required). None of these conditions apply to chlorethoxyfos; therefore, aquatic plant testing is not required.

3. Exposure and Risk Characterization

a. Ecological Exposure and Risk Characterization

Explanation of the Risk Quotient (RQ) and the Level of Concern (LOC): The Levels of Concern are criteria used to indicate potential risk to nontarget organisms. The criteria indicate that a chemical, when used as directed, has the potential to cause undesirable effects on nontarget organisms. There are two general categories of LOC (acute and chronic) for each of the four nontarget faunal groups and one category (acute) for each of two nontarget floral groups. In order to determine if an LOC has been exceeded, a risk quotient must be derived and compared to the LOC's. A risk quotient is calculated by dividing an appropriate exposure estimate, e.g. the estimated environmental concentration, (EEC) by an appropriate toxicity test effect level, e.g. the LC_{50}. The acute effect levels typically are:

-EC_{25} (terrestrial plants),
-EC_{50} (aquatic plants and invertebrates),
-LC_{50} (fish and birds), and
-LD_{50} (birds and mammals)

The chronic test results are the:
-NOEC for avian and mammal reproduction studies, and either the NOEC for chronic aquatic studies, or the Maximum Allowable Toxicant Concentration (MATC), the geometric mean of the NOEC and the LOEC for chronic aquatic studies.

When the risk quotient exceeds the LOC ~~for a particular category, risk to~~ that particular category is presumed to exist. Risk presumptions are presented along with the corresponding LOC's.

Levels of Concern (LOC) and associated Risk Presumption

Mammals, Birds

IF THE	LOC	PRESUMPTION
acute RQ>	0.5	High acute risk
acute RQ>	0.2	Risk that may be mitigated through restricted use
acute RQ>	0.1	Endangered species may be affected acutely
chronic RQ>	1	Chronic risk (non- and endangered- species)

Fish, Aquatic invertebrates

IF THE	LOC	PRESUMPTION
acute RQ>	0.5	High acute risk
acute RQ>	0.1	Risk that may be mitigated through restricted use
acute RQ>	0.05	Endangered species may be affected acutely
chronic RQ>	1	Chronic risk (non- and endangered-species)

Plants

IF THE	LOC	PRESUMPTION
RQ>	1	High risk
RQ>	1	Endangered plants may be affected

Currently, no separate criteria for restricted use or chronic effects for plants exist.

i. Exposure and Risk to Nontarget Terrestrial Animals

(a) Acute, Birds and Mammals

Avian and Mammalian Acute Risk Quotients

Use Site **Corn**	**Application rate**	**Avian RQs**	**Mammalian RQs**
T-Band application	3 oz product/1000 row ft (5G), (2.5G 6 oz product/1000 row ft), = 0.162 lb a.i./A With a 7" band, 30" spacing= 0.128 lb a.i./A within the band (assuming 15% exposure)	Bobwhite: 0.3 LD_{50}/ft^2	Deer mouse: 16.9 LD_{50}/ft^2
In-furrow	3 oz product/1000 row ft (5G), (2.5G 6 oz product/1000 row ft)= 0.162 lb a.i./A With a 30" row spacing, assuming 1% left exposed on surface = 0.05 lb a.i./A	Bobwhite: 0.10 LD_{50}/ft^2	Deer mouse: 5.79 LD_{50}/ft^2

Acute adverse effects to birds are not expected from the use of chlorethoxyfos at maximum application rates. However, the LOC for endangered species has been exceeded for birds. The high risk LOC has been exceeded for small mammals from the proposed use; adverse acute effects are expected to occur to small mammal species. The acute risk is 3 times higher for the T-band application method than it is for the in-furrow method. The terrestrial field study showed significant mortality to small mammals and birds from the T-band method at approximately twice the currently proposed application rate.

(b) Chronic, birds and mammals

Chronic exposure was estimated by calculating the amount of residue in the top 1 inch of soil following an application, and then multiplying by the 3x bioaccumulation factor observed in the

earthworm bioaccumulation study. This was done to attempt to predict the chronic risk to birds and mammals which consume earthworms and similar soil-inhabiting invertebrates. For birds and mammals that consume plant materials or insects/invertebrates found above the soil, the Kenaga residue estimate for forage/insects was used as a "worst-case" estimate for chronic exposure.

Avian and Mammalian Chronic Risk Quotients			
Use Site **Corn**	**Application rate and exposure estimate**	**Avian RQ EEC/NOEC**	**Mammalian RQ (EEC/NOEC)**
T-Band application	3 oz product/1000 row ft (5G), (2.5G 6 oz product/1000 row ft), = 0.162 lb a.i./A With a 7" band, 30" spacing= 0.856 lb a.i./A within the band = 1.3 ppm in upper 1" of soil X 3 (BCF) = 3.9 ppm	Bobwhite: 0.13 Mallard: 0.78	Rat (small mammal surrogate): 3.9
Residues on food items	0.162 lb a.i./A x 58 (Kenaga residue for forage/insects) = 9.4 ppm	Bobwhite: 0.31 Mallard: 1.9	Rat (small mammal surrogate): 9.4

The small mammal LOC for chronic effects has been exceeded for both food item calculations from this use of chlorethoxyfos. Additionally, the mallard chronic LOC has been exceeded for forage/insect residues of chlorethoxyfos.

(c) Insects

Chlorethoxyfos is very highly toxic to honeybees; however, since it is a granular and is not taken up by the plant, adverse effects to bees and other pollinating insects are not expected to occur from the proposed use.

ii. Exposure and Risk to Nontarget Aquatic Animals

Expected Aquatic Concentrations: Chlorethoxyfos displays very high toxicity to all aquatic organisms tested to date. Estimated environmental concentrations were modelled using the PRZM2 and EXAMS II programs (see attachment). These programs simulated a corn site in Iowa, with Marshall silty clay loam soil, which provides a reasonable worst-case scenario for the runoff of chlorethoxyfos. The results reported in the table, below, are 1 in 10 year maximum values.

ESTIMATED ENVIRONMENTAL CONCENTRATIONS (EECs) FOR CHLORETHOXYFOS							
Crop	Application Method	Application Rate in lb a.i./A (number of applications)	Initial EEC (ppb)	4-day EEC (ppb)	21-day EEC (ppb)	60-day EEC (ppb)	90-day EEC (ppb)
Corn	T-band	0.162 (1)	0.0261	0.0167	0.0091	0.0060	0.0046
Corn	In-furrow	0.162 (1)	0.0126	0.0081	0.0044	0.0030	0.0022

(a) Freshwater Fish - Acute

Freshwater Fish Acute Risk Quotients		
Application method	Species	Acute RQ (96-hr)
T-band	Bluegill Rainbow trout	0.0073 0.0002
In-furrow	Bluegill Rainbow trout	0.0035 0.00009

None of the acute LOCs for freshwater fish have been exceeded for the proposed use of chlorethoxyfos.

(b) Freshwater Fish - Chronic

Freshwater Fish Chronic Risk Quotients		
Application method	Species	Chronic RQ (60-day)
T-band	Fathead minnow	0.07
In-furrow	Fathead minnow	0.004

The chronic RQs do not exceed the LOC for freshwater fish.

(c) Freshwater Invertebrates - Acute

Acute risk quotients cannot be generated for freshwater invertebrates due to a lack of valid data. Risk to freshwater invertebrates is estimated to be the same or less than that to marine/estuarine invertebrates.

(d) Freshwater Invertebrates - Chronic

Freshwater Invertebrate Acute Risk Quotients		
Application method	Species	Chronic RQ (21-day)
T-band	*Daphnia magna*	0.28
In-furrow	*Daphnia magna*	0.24

(e) Estuarine and Marine Animals - Acute

Marine/Estuarine Organisms Acute Risk Quotients		
Application method	Species	Acute RQ (96-hr)
T-band	Sheepshead minnow Oyster Mysid	0.0093 0.128 0.31
In-furrow	Sheepshead minnow Oyster Mysid	0.0045 0.062 0.15

None of the acute RQs exceeds the high risk LOC. However, the RQ for mysid exceeds the restricted use LOC for the T-band application method. Additionally, the oyster and mysid RQs for the in-furrow application method exceed the endangered species LOC. The U.S. Fish and Wildlife Service (FWS) previously recommended vegetative buffer strips or chemical-free buffer zones of a minimum of 10 feet between the corn field and any waterway when chlorethoxyfos is applied. The FWS also recommended that the applicator "vigilantly ensure that the techniques used to incorporate the granules are consistently effective, and that appropriate actions are taken if misapplied" to help protect endangered and threatened aquatic organisms (see attached memos).

(e) Estuarine and Marine Animals - Chronic

There is no data currently available to assess the risk to marine/estuarine fish species. Marine/estuarine fish species are more sensitive than freshwater species on an acute basis, so it is likely that they are more sensitive chronically as well. For this assessment, freshwater fish chronic RQs will have to be used to predict risk to marine/estuarine fish species. A fish chronic study with sheepshead minnows is required, and is scheduled to be submitted to the Agency in September, 1995. If the results of this study show significantly greater sensitivity of this species than freshwater species to chlorethoxyfos, the risk assessment will have to be updated. The freshwater fish chronic RQ did not exceed the LOC.

A mysid life-cycle study was given a cursory review for use in this assessment. The following RQ is based on the results of that study.

Marine/Estuarine Invertebrate Chronic Risk Quotients		
Application method	Species	Chronic RQ (21-day)
T-band	Mysid	0.73
In-furrow	Mysid	0.35

The LOC was not exceeded for marine/estuarine invertebrates for either application method.

iii. Exposure and Risk to Nontarget Plants

No phytotoxicity data has been required or submitted for chlorethoxyfos because it is a granular insecticide with no indication of phytotoxic effects on the label. Therefore, a risk assessment for non-target plants cannot be completed at this time.

iv. Endangered Species

The endangered species LOCs are exceeded for birds, small mammals, and aquatic invertebrates. FWS recommendations for aquatic organism protection are described above and in the attached memos. Due to the tendency of chlorethoxyfos to bioaccumulate, secondary poisoning to predator species such as Bald eagles and other birds of prey, and mammalian predators, is a possibility. Thorough incorporation of granules should help prevent exposure to birds and mammals, on both a primary and secondary basis. Thorough incorporation of granules also reduces the chance of runoff into aquatic habitats.

The Endangered Species Protection Program is expected to become final in 1995. Limitations in the use of chlorethoxyfos will be required to protect endangered and threatened species, but these limitations have not been defined and may be formulation specific. EPA anticipates that a consultation with the Fish and Wildlife Service will be conducted in accordance with the species-based priority approach described in the Program. After completion of consultation, registrants will be informed if any required label modifications are necessary. Such modifications would most likely consist of the generic label statement referring pesticide users to use limitations contained in county Bulletins.

v. Conclusions

The Agency's acute high-risk LOC for small mammals has been exceeded by the proposed use of chlorethoxyfos. Limiting the application of Fortress to in-furrow or **requiring** incorporation of at least 1 inch would reduce the risk of exposure to mammals (and birds).

The LOC for chronic effects has been exceeded for mammals from various food types, and for birds from forage/above-surface insects. Incorporation would again reduce this risk.

Endangered species LOCs have been exceeded for birds, mammals and aquatic invertebrates. This is discussed in the Endangered Species section above.

Although the acute RQs for birds do not indicate high risk, there was significant mortality observed in the terrestrial field study with Fortress 5G applied as a T-band. While the direct cause of the mortality could not be determined (i.e., was it direct ingestion, ingestion of contaminated food items, or inability to handle stress due to the effects of the chemical?), it is clear that the application of chlorethoxyfos was somehow related to the mortalities. Similarly, the mesocosm study showed significant impacts on aquatic invertebrates at levels comparable to the modeled EECs, although the RQs do not indicate high-risk. EEB has strong concerns about the possibility of field mortality and impacts on aquatic invertebrate species from the use of this chemical. Incorporation of the granules would greatly reduce the likelihood of exposure to birds and mammals, thereby reducing the risk. Incorporation also lessens the chance of runoff into adjacent aquatic habitats, thereby reducing the risk to aquatic organisms. Limiting the application method to in-furrow only, or requiring incorporation to a specified depth of at least 1 inch with the T-band method, would reduce the risk associated with the proposed use of chlorethoxyfos on corn. If registration of chlorethoxyfos is granted, monitoring for both terrestrial and aquatic organism mortalities, and reporting any mortalities to the Agency, would be very helpful in confirming the ability of our RQs to predict acute and chronic risk.

Kathryn V. Montague, M.S. Kathryn V. Montague 8/1/95
Biologist
Ecological Effects Branch (EFED)

Norman Cook Norman Cook 08·01·95
Section Chief
Ecological Effects Branch (EFED)

for Anthony F. Maciorowski, Ph.D 8/1/95
Branch Chief
Ecological Effects Branch (EFED)

Attachment I

Filed

Shaughnessy No: 129006
DP Barcode: D207762
Date: October 11, 1994

TO: Harry Craven
Ecological Effects Branch
Environmental Fate and Effects Division

FROM: Ronald Parker, Ph.D., Environmental Engineer
Surface Water Section
Environmental Fate and Ground Water Branch

THROUGH: Henry Nelson, Ph.D., Head
Surface Water Section
Environmental Fate and Ground Water Branch

Henry Jacoby, Chief
Environmental Fate And Ground Water Branch
Environmental Fate and Effects Division

Attached, please find the EFGWB refined surface water computer modelling report for:

Product Name: Chlorethoxyf

Common Name: Fortress

Type of Product: Organophc

Company Name: DuPont

Chemical #: 129006

DP Barcode: D207762

NOTE:
These EECs were generated at the "old" appl. rate. They were adjusted to the new rate for the assessment.

Purpose: To estimate a range of Expected Environmental Concentrations (EEC's) in a standard pond for Fortress on corn for a medium exposure site in Iowa.

SUMMARY

This report describes the Tier II estimated environmental concentration (EEC) computer modelling for Chlorethoxyfos (Fortress) use on corn. The purpose of this analysis is to generate an aquatic exposure estimates for use in a refined ecological risk assessment for this chemical. This Tier II EEC calculation uses a single site which represents a typical exposure scenario for the use of Fortress. In furrow and T-band applications are simulated. The weather and agricultural practice are simulated at the site over 36 years so that the ten year exceedence probability EEC at that site can be estimated.

The EEC's generated in this analysis were calculated using PRZM 1.0 for simulating runoff from the agricultural field and EXAMS 2.94 for estimating environmental fate and transport in surface water. Input values for both programs are attached to this report in Tables 1 and 2. The scenario chosen was a corn field in Pottawottamie County, Iowa. It was selected as a site on which runoff data had been collected by USDA as a check on runoff values. The modelling predicts an annual total of 4.5 inches of runoff or approximately 12 percent of rainfall. This Marshall silty clay loam soil is a B hydrologic group soil which would be expected to produce moderate runoff and erosion. Sites exist which would represent a worse case for corn (ie Mississippi) which would lead to higher EEC values (possibly by a factor of 2 to 3). Due to the great prevalence of corn in the Mid-West, however, these sites would be outside the 90% worst case sites we normally model and so are not considered here. A copy of the PRZM1 input files is attached.

The EXAMS II receiving water program was used to simulate the fate and transport of Fortress in the standard static pond. Calculations were made for one application on May 14 each year as is typical practice in this area. The Tier 2 upper tenth percentile EEC's are graphed and listed below. The EEC's have been calculated so that in any given year, there is a 10% probability that the maximum of the average concentrations for each duration in that year will equal or exceed the EEC at the site.

Scenarios

The scenario chosen was used to represent a typical to high runoff site for chlorethoxyfos applied on corn. The site represents a 10 hectare corn field draining into a 1 hectare static pond, 2 meters deep with no outlet. It is assumed that evaporation losses and inflow from rainfall and runoff are in balance.

The site is a field in MLRA 107. Data for the Marshall Silty Clay Loam was taken from the PIC database and the 1987 National Resources Inventory. This is hydrologic group B soil and SCS curve numbers were generated based on this grouping. USLE soil loss ratios are based on plant cover and USDA Paper 537 (United States Soil Conservation Service, 1972). Weather data was taken from

weather station W14943 in Sioux City, IA. The weather data file is part of the PIRANHA shell and is used to represent the weather for all of MLRA 107. This site receives about 87 centimeters of precipitation yearly and an average of 12% of this leaving the field as runoff.

Field studies conducted by Dupont on Chlorethoxyfos show a consistent volatility/soil metabolism half-life of approximately seven days. Assuming that volatilization occurs from the top two centimeters of the profile, a two centimeter surface layer was modelled in PRZM using this overall rate. Modelling results with this layer are consistent with field dissipation field results. The remainder of the uppermost horizon was modelled using the 15 day soil metabolism half-life.

Environmental Fate Inputs

Environmental fate inputs to the PRZM and EXAMS programs are listed along with their sources in Tables 1 and 2 attached. All inputs are derived from environmental fate studies sumbitted by the registrant and accepted by EPA.

Results

Modelling results are shown on the attached graphs and spreadsheet tables and are include in the EEC Modelling Summary sheet below.

Limitations of this Analysis

There are several factors which limit the accuracy and precision of this analysis including the selection of the high exposure scenarios, the quality of the input data, the ability of the models to represent the real world, and the number of years that were modeled.

Scenarios that are selected for use in Tier 2 EEC calculations are ones that likely to produce large concentrations in the aquatic environment. Each scenario should represent a real site to which the pesticide in question is likely to be applied. Sites should be extreme enough to provide conservative estimates of the EEC, but not so extreme that the model cannot properly simulate the fate and transport processes at the site. Currently, sites are chosen by best professional judgement to represent sites which generally produce EEC's larger than 90% of all sites use for that crop. The EEC's in this analysis are accurate only to the extent that the site represents this hypothetical high exposure site. The most limiting part of the site selection is the use of the standard pond with no outlet. Obviously, a Georgia pond, even with appropriately modified temperature data is not the most appropriate water body for use in New York or Oregon. It does however provide a level playing field on which most pesticides cn be judged on equal terms.

The models themselves represent a limitation on the analysis quality. While the models are some of the best environmental fate estimation tools available, they have significant limitations in their ability to represent some processes. The most substantial limitation in this analysis is the handling of spray drift, which is estimated as a straight 1% of the application rate reaching the pond for each application. A second major limitation of the models is the lack of validation at the field level for pesticide runoff. While several of the algorithms (volume of runoff water, eroded sediment mass, are well validated and well understood, no adequate validation has yet been made of PRZM2 for the amount of pesticide transported in runoff events for all combinations of sites and pesticide fate characterists. Other limitations of the models include: inability to handle within site variation (spatial variability), lack of crop growth algorithms, and overly simple soil water transport algorithms (ie. the "tipping bucket" method).

A final limitation is that only thirty-six years of weather data was available for the site. Consequently there is approximately 1 chance in 20 that the true 10% exceedence EEC's are larger than the maximum EEC in the calculated in the analysis.

EEC Modelling Summary

CHEMICAL COMMON NAME: CHLORETHOXYFOS **FORMULATION:** FORTRESS
RUNOFF MODEL: PRZM1 **RECEIVING WATER MODEL:** EXAMS 2.94
REGISTRANTS: DUPONT **MODELLER:** RON PARKER **DATE:** 9/15/94

CHEMICAL PARAMETERS:
HYDROLYSIS t½:pH5 72 DAYS pH7 59 D pH9 4.3 D AQU PHOTOL t½ STABLE
KOC 6000 KD 104 AEROBIC SOIL t½ 15 D VOLATILIZATION t½ 7 D
AEROBIC AQUATIC t½ STABLE ANAEROBIC AQUATIC t½ STABLE SOL 2.1
VAPOR PRESSURE 1.7e-3 HENRYS LAW CONSTANT 3.6e-4

CROP SITE 1

LOCATION:
CROP CORN COUNTY POTTAWOTTAMIE STATE IA MLRA 107
SOIL SERIES MARSHALL TEXTURE SILTY CLAY LOAM
JUSTIFICATION This site is representative of corn culture in the midwest and is used as a typical, medium exposure scenario.

MANAGEMENT:
TILLAGE TYPE CONVENTIONAL TILLAGE TIME FALL RESIDUES REMAINING
APPLICATION METHOD IN FURROW INCORPORATION DEPTH (CM) 8.0
CROP DATES: PLANTING 14/5 EMERGENCE 21/5 MATURITY 26/9
HARVEST 11/10 SPRAY DRIFT 0.0 %

PESTICIDE APPLICATION:
RATE(LBS/AC) 0.365 DATES:1 14/5 2 3 4 5 6
7 8 9 10 JUSTIFICATION This is the maximum label rate and maximum number of applications permitted on the label.

RESULTS:
MAXIMUM DISSOLVED CONCENTRATION[1] - TEN YEAR RETURN PERIOD (PPT)
POST LOAD[1] 25.3 96HOUR[2] 16.2 21DAY[3] 8.8 60DAY 5.9
90DAY 4.5 5DAY 14DAY AVE RAIN (INCH/YEAR) 34.2
AVE RUNOFF (IN/YEAR) 4.1 AVE EROSION (TONS/ACRE/YEAR)
LOADING BREAKDOWN[4] 1951:RUNOFF 31.3 % EROSION 68.7 % SP DRIFT 0.0%

COMMENTS: SOIL ADSORPTION VALUES WERE USED TO CALCULATE KOC DUE PROBLEMS WITH THE DESORPTION TEST; NO AQUATIC METABOLISM VALUES

[1] POST LOAD - MAXIMUM OF ALL POND CONCENTRATIONS DURING THE YEAR CALCULATED IMMEDIATELY AFTER A RUNOFF OR SPRAY DRIFT LOADING AND COMPLETE MIXING IN THE POND BUT BEFORE ANY DEGREDATION OF THE LAST LOADING HAS TAKEN PLACE

[2] 96 HOUR - MAXIMUM OF THE RUNNING AVERAGE CONCENTRATIONS OF ANY CONSECUTIVE FOUR DAY PERIOD DURING THE YEAR

[3] 21 DAY - MAXIMUM OF THE RUNNING AVERAGE CONCENTRATIONS OF ANY CONSECUTIVE TWENTY-ONE DAY PERIOD DURING THE YEAR

[4] VALUES REFER TO THE PERCENT OF EACH FORM OF ANNUAL LOADING IN THE YEAR REPRESENTING A ONE IN TEN EXCEEDENCE PROBABILITY

EEC Modelling Summary

CHEMICAL COMMON NAME: CHLORETHOXYFOS **FORMULATION:** FORTRESS
RUNOFF MODEL: PRZM1 **RECEIVING WATER MODEL:** EXAMS 2.94
REGISTRANTS: DUPONT **MODELLER:** RON PARKER **DATE:** 9/15/94

CHEMICAL PARAMETERS:
HYDROLYSIS t½:pH5 72 DAYS pH7 59 D pH9 4.3 D AQU PHOTOL t½ STABLE
KOC 6000 KD 104 AEROBIC SOIL t½ 15 D VOLATILIZATION t½ 7 D
AEROBIC AQUATIC t½ STABLE ANAEROBIC AQUATIC t½ STABLE SOL 2.1
VAPOR PRESSURE 1.7e-3 HENRYS LAW CONSTANT 3.6e-4

CROP SITE 1

LOCATION:
CROP CORN COUNTY POTTAWOTTAMIE STATE IA MLRA 107
SOIL SERIES MARSHALL TEXTURE SILTY CLAY LOAM
JUSTIFICATION This site is representative of corn culture in the midwest and is used as a typical, medium exposure scenario.

MANAGEMENT:
TILLAGE TYPE CONVENTIONAL TILLAGE TIME FALL RESIDUES REMAINING
APPLICATION METHOD T-BAND INCORP DEPTH 1/3 at SURF 2/3 at 8cm
CROP DATES: PLANTING 14/5 EMERGENCE 21/5 MATURITY 26/9
HARVEST 11/10 SPRAY DRIFT 0.0 %

PESTICIDE APPLICATION:
RATE(LBS/AC) 0.365 DATES:1 14/5 2 3 4 5 6
7 8 9 10 JUSTIFICATION This is the maximum label rate and maximum number of applications permitted on the label.

RESULTS:
MAXIMUM DISSOLVED CONCENTRATION[1] - TEN YEAR RETURN PERIOD (PPT)
POST LOAD[1] 52.2 96HOUR[2] 33.4 21DAY[3] 18.2 60DAY 12.1
90DAY 9.3 5DAY 14DAY AVE RAIN (INCH/YEAR) 34.2
AVE RUNOFF (IN/YEAR) 4.1 AVE EROSION (TONS/ACRE/YEAR)
LOADING BREAKDOWN[4] 1951:RUNOFF 31.3 % EROSION 68.7% SP DRIFT 0.0 %

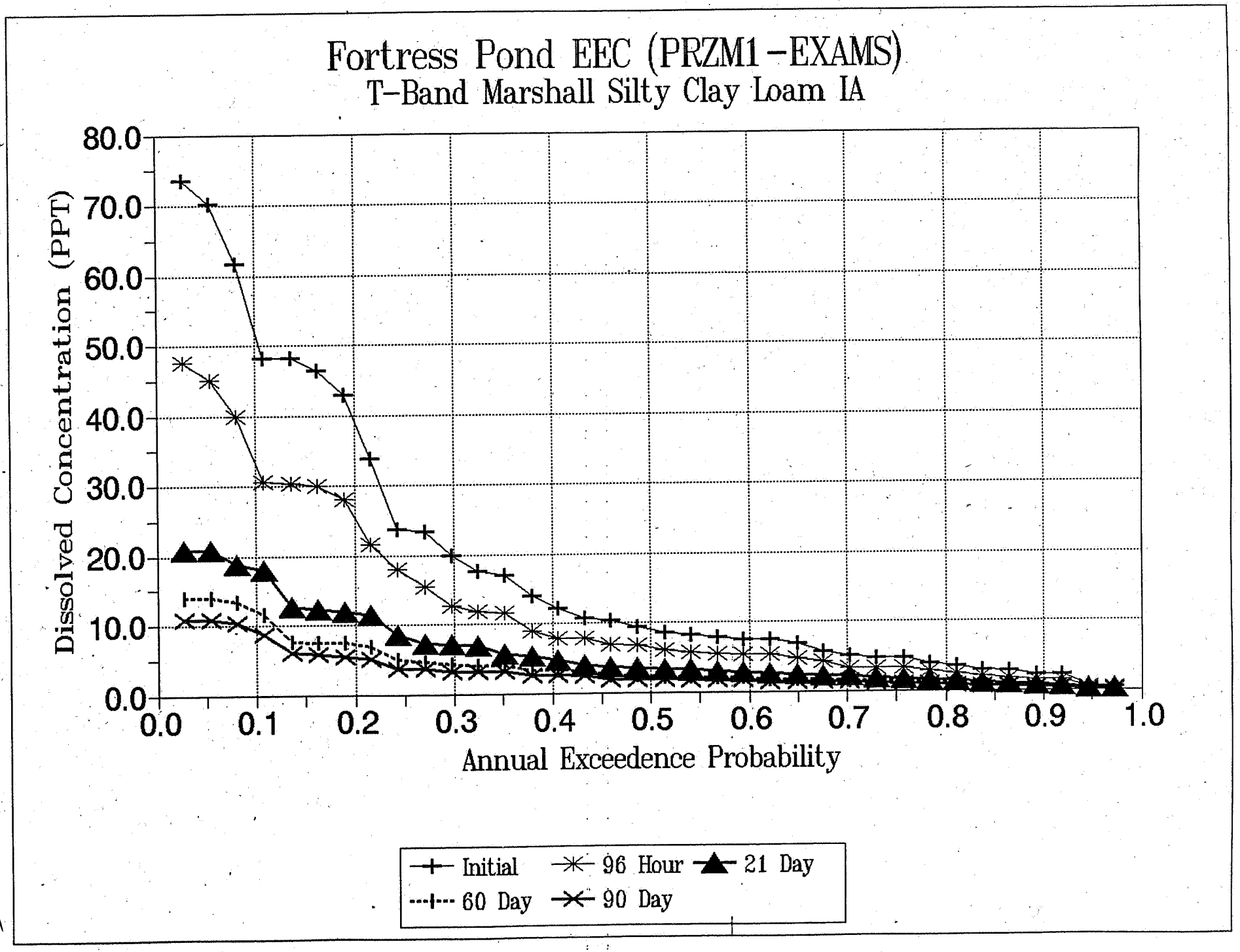
COMMENTS: SOIL ADSORPTION VALUES WERE USED TO CALCULATE KOC DUE PROBLEMS WITH THE DESORPTION TEST; NO AQUATIC METABOLISM VALUES

[1] POST LOAD - MAXIMUM OF ALL POND CONCENTRATIONS DURING THE YEAR CALCULATED IMMEDIATELY AFTER A RUNOFF OR SPRAY DRIFT LOADING AND COMPLETE MIXING IN THE POND BUT BEFORE ANY DEGREDATION OF THE LAST LOADING HAS TAKEN PLACE

[2] 96 HOUR - MAXIMUM OF THE RUNNING AVERAGE CONCENTRATIONS OF ANY CONSECUTIVE FOUR DAY PERIOD DURING THE YEAR

[3] 21 DAY - MAXIMUM OF THE RUNNING AVERAGE CONCENTRATIONS OF ANY CONSECUTIVE TWENTY-ONE DAY PERIOD DURING THE YEAR

[4] VALUES REFER TO THE PERCENT OF EACH FORM OF ANNUAL LOADING IN THE YEAR REPRESENTING A ONE IN TEN EXCEEDENCE PROBABILITY


Fortress Pond EEC (PRZM1-EXAMS)
T-Band Marshall Silty Clay Loam IA
Dissolved Concentration (PPT)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Annual Exceedence Probability
Initial
96 Hour
21 Day
60 Day
90 Day

IA. PRZM INPUTS - CHLORETHOXYFOS

VARIABLE NAME	VARIABLE DESCRIPTION	VALUE	UNITS	SOURCE
PFAC	Pan factor	0.71	dimensionless	PIC
SFAC	Snow factor	0.50	cm melt/C°	PIC
ANETD	Depth evap extracted	15	centimeters	PIC
ISCOND	Postharvest cond	3	residue	PIC
DT	Monthly ave daylight	N/A	hours	PIC
USLEK	Erodibility factor	0.32	dimensionless	NIR
USLELS	Lengthslope factor	3.06	dimensionless	NIR
USLEP	Practice factor	0.50	dimensionless	Contour Plowed
AFIELD	Field area	10.0	hectares	STANDARD
TR	Runoff duration	4.4	hours	PIC
CINTCP	Crop interception	0.25	centimeters	PIC
AMXDR	Active root depth	90	centimeters	PIC
COVMAX	Areal crop cover	100	percent	PIC
ICNAH	Postharvest surface	RESIDU	N/A	PIC
CN1	Curve no fallow	86	dimensionless	PIC
CN2	Curve no crop	78	dimensionless	PIC
CN3	Curve no harvest	82	dimensionless	PIC

IB. PRZM INPUTS - CHLORETHOXYFOS (CONTINUED)

USLEC1	USLE C value fallow	0.50	dimensionless	USDA PAPER 537
USLEC2	USLE C value crop	0.25	dimensionless	"
USLEC3	USLE C value residue	0.30	dimensionless	"
WFMAX	Crop dry weight	0.0	kilo gram/m^2	PIC
HTMAX	Crop max height	0.0	centimeters	PIC
EMD,EMM IYREM	Emergence date (day/month/year)	4/1/1948	N/A	TYPICAL IOWA
MAD,MAM IYRMAT	Maturity date (day/month/year)	5/15/48	N/A	"
HAD,HAM IYRHAR	Harvest date (day/month/year)	12/31/83	N/A	"
APD,APM IAPYR	Pesticide application date (day/month/year)	4/1/each 5/1/each 6/1/each	N/A	"
WINDAY	No. moisture checks	0.0	N/A	PIC
DEPI	Incorporation depth	8.0	centimeters	LABEL
TAPP	Application rate	0.365	kilogram/ha	LABEL
FAM	Foliar appl. flag	1	N/A	LABEL
IPSCND	Postharvest deposit	0.0	N/A	
FILTRA	Filtration parameter	0.0	N/A	N/A
PLVKRT	Plant volatilization	N/A	day^{-1}	N/A
FEXTRA	Foliar extraction	0.1	% / cm rain	PIC
CORED	Depth of soil core	150	centimeters	PIC

IC. PRZM INPUTS - CHLORETHOXYFOS (CONTINUED)

UPTKF	Plant uptake factor	0.0	fract of evap	PIC
HSWZT	Drainage flag	0	N/A	PIC
NHORIZ	Number of horizons	4	N/A	PIC
THKNS1	Thickness horizon 1	2	centimeters	FOR VOLATILIZATION
BD1	Bulk den. horizon 1	1.25	tonnes/m^3	PIC
THETO1	Soil water horiz. 1	0.495	cm^3/cm^3	PIC
AD1	Drainage para hor 1	0.0	liter/day	PIC
DISP1	Solute dispersion 1	0.0	cm^2/day	PIC
THKNS2	Thickness horizon 2	43.0	centimeters	PIC
BD2	Bulk den. horizon 2	1.25	tonnes/m^3	PIC
THETO2	Soil water horiz. 2	0.495	cm^3/cm^3	PIC
AD2	Drainage para hor 2	0.0	liter/day	PIC
DISP2	Solute dispersion 2	0.0	cm^2/day	PIC
THKNS3	Thickness horizon 3	100.0	centimeters	PIC
BD3	Bulk den. horizon 3	1.30	tonnes/m^3	PIC
THETO3	Soil water horiz. 3	0.416	cm^3/cm^3	PIC
AD3	Drainage para hor 3	0.0	liter/day	PIC
DISP3	Solute dispersion 3	0.0	cm^2/day	PIC
DWRATE1	Dissolv hydrol rate1	0.099	day^{-1}	DUPONT/EFED VOLATILIZATION
DSRATE1	Adsorb hydrol rate 1	0.099	day^{-1}	DUPONT/EFED VOLATILIZATION
DGRATE1	Vapor decay rate 1	0.0	day^{-1}	PIC

ID. PRZM INPUTS - CHLORETHOXYFOS (CONTINUED)

DWRATE2	Dissolv hydrol rate2	0.046	day^{-1}	PIC
DSRATE2	Adsorb hydrol rate 2	0.046	day^{-1}	PIC
DGRATE2	Vapor decay rate 2	0.0	day^{-1}	PIC
DWRATE3	Dissolv hydrol rate3	0.046	day^{-1}	PIC
DSRATE3	Adsorb hydrol rate 3	0.046	day^{-1}	PIC
DGRATE3	Vapor decay rate 3	0.0	day^{-1}	PIC
DPN1	Compart. thickness 1	30	centimeters	PIC
THETFC1	Field capacity 1	0.495	cm^3/cm^3	PIC
THETWP1	Wilting point 1	0.265	cm^3/cm^3	PIC
OC1	Organic carbon 1	1.74	Percent	PIC
KD1	Partition coef 1	104.4	cm^3/gram	DUPONT/EFGWB
DPN2	Compart. thickness 2	30	centimeters	PIC
THETFC2	Field capacity 2	.495	cm^3/cm^3	PIC
THETWP2	Wilting point 2	.265	cm^3/cm^3	PIC
OC2	Organic carbon 2	1.74	percent	PIC
KD2	Partition coef 2	104.4	cm^3/gram	DUPONT/EFED
DPN3	Compart. thickness 3	30	centimeters	PIC
THETFC3	Field capacity 3	0.416	cm^3/cm^3	PIC
THETWP3	Wilting point 3	0.216	cm^3/cm^3	PIC
OC3	Organic carbon 3	0.116	percent	PIC
KD3	Partition coef 3	6.96	cm^3/gram	DUPONT/EFED

2A. EXAMS INPUTS - CHLORETHOXYFOS

VARIABLE NAME	VARIABLE DESCRIPTION	VALUE	UNITS	SOURCE
	CHEMICAL VARIABLES			
HENRY	Henry's law rate	3.6E-4	atm-m^3/mole	DUPONT
KAH	Acid hydrol rate	0.0	$hour^{-1}$	DUPONT
KBACS	Benthic bact rate	0.0	$(cfu/mL)^{-1}hr^{-1}$	PUPOND
KBACW	Water col bact rate	0.0	$(cfu/mL)^{-1}hr^{-1}$	DUPONT
KBH	Base hydrol const	6.30E2	$hour^{-1}$	DUPONT
KDP	Direct photol rate	0.0	$hour^{-1}$	DUPONT
KNH	Neutral hydrol rate	4.14E-4	$hour^{-1}$	DUPONT
KOC	Partition coef.	6.0E3	liter/kg	DUPONT
KOW	Octanol water part.	N/A	liter/kg	DUPONT
KPS	Sediment part. coef.	0.0	liter/kg	DUPONT
MWT	Molecular weight	257.44	grams/mole	DUPONT
QTBAS	Sediment bacteria temperature coef.	2	dimensionless	STANDARD
QTBAW	Water bacteria temp coef	2	dimensionless	STANDARD
SOL	Solubility	2.1	mg/liter	DUPONT
VAPR	Vapor pressure	1.7E-3	torr	DUPONT

2B. EXAMS Inputs - CHLORETHOXYFOS (Continued)

	Geometry Variables			
AREA	Segment area	10,000	meter^2	GEORGIA POND
CHARL	Mixing length	1.025	meter	GEORGIA POND
DEPTH	Segment thickness	2	meter	GEORGIA POND
KOUNT	Number of segments	2	N/A	GEORGIA POND
LENG	Segment length	100	meter	GEORGIA POND
VOL	Segment volume	20,000	meter^3	GEORGIA POND
	Flow and loading variables			GEORGIA POND
ADVPR	Part flow advected	0.0	proportion	
DRFLD	Drift loadings	0.0	kg/hour	
EVAP	Evaporation	0.0	mm/month	
IMASS	Pulse load	0.0917	kilogram	
NPSED	Nonpoint sed load	0.0	kg/hour	
NPSFL	Nonpoint flow	0.0	meter^3/hour	
NPSLD	Nonpoint chem load	PRZM2	kg/hour	
PCPLD	Precipitation load	0.0	kg/hour	
SEELD	Chem seepage load	0.0	kg/hour	
SEEPS	Seepage flow	0.0	meter^3/hour	
STFLO	Stream flow	0.0	meter^3/hour	
STRLD	Chem load in flow	0.0	kg/hour	
STSED	Stream-borne sed.	0.0	kg/hour	

2C. EXAMS Inputs - CHLORETHOXYFOS (Continued)

	Environmental Variables			
AEC	Anion exchange cap	1.0e-2	meq/100 gr	GEORGIA POND
ATURB	Atmospheric turb	2.0	kilometer	GEORGIA POND
BACPL	Plankton Population	1.0	cfu/mL	GEORGIA POND
BNBAC	Benthic bacteria	37	cfu/100 gr	GEORGIA POND
BNMAS	Benthic biomass	6.0e-3	gr/m^2	GEORGIA POND
BULKD	Bulk density	1.85	gr/cm^3	GEORGIA POND
CEC	Cation exchange cap	1.0e-2	meq/100 gr	GEORGIA POND
CLOUD	Mean monthly clouds		tenths of sky	GEORGIA POND
DFAC	Distribution factor	1.19	dimensionless	GEORGIA POND
DISO2	Disolved oxygen	5.0	mg/liter	GEORGIA POND
DOC	Dissolved org carb	5.0	mg/liter	GEORGIA POND
DSP	Dispersion coef.	3.0e-5	m^2/hour	GEORGIA POND
FROC	Frac. organic carbon	0.04	dimensionless	GEORGIA POND
OZONE	Mean monthly ozone	0.3	cm NTP	GEORGIA POND
PH	Log hydrogen ion con	7.0	pH units	GEORGIA POND
POH	Log hydroxid ion con	7.0	pOH units	GEORGIA POND
RAIN	Ave monthly rainfall	N/A	mm/month	GEORGIA POND
RHUM	Relative Humidity	N/A	% saturation	GEORGIA POND
SUSED	Suspended sediment	30	mg/liter	GEORGIA POND
TCEL	Temperature celsius	variable	C^o	

```
//Simulation Title    --    Loc: M-107
   1 148          311283
//Hydrology Title     --    HGRP: B     Crop: Corn
   0.710   0.500        0   15.00        1        1
       1
    0.32    3.06     0.50    10.0    4.40
       1
       1    0.25    90.00  100.00        3  86  78  82 .50 .25 .30     0.00
      36
  21 548  26 948  111048    1
  21 549  26 949  111049    1
  21 550  26 950  111050    1
  21 551  26 951  111051    1
  21 552  26 952  111052    1
  21 553  26 953  111053    1
  21 554  26 954  111054    1
  21 555  26 955  111055    1
  21 556  26 956  111056    1
  21 557  26 957  111057    1
  21 558  26 958  111058    1
  21 559  26 959  111059    1
  21 560  26 960  111060    1
  21 561  26 961  111061    1
  21 562  26 962  111062    1
  21 563  26 963  111063    1
  21 564  26 964  111064    1
  21 565  26 965  111065    1
  21 566  26 966  111066    1
  21 567  26 967  111067    1
  21 568  26 968  111068    1
  21 569  26 969  111069    1
  21 570  26 970  111070    1
  21 571  26 971  111071    1
  21 572  26 972  111072    1
  21 573  26 973  111073    1
  21 574  26 974  111074    1
  21 575  26 975  111075    1
  21 576  26 976  111076    1
  21 577  26 977  111077    1
  21 578  26 978  111078    1
  21 579  26 979  111079    1
  21 580  26 980  111080    1
  21 581  26 981  111081    1
  21 582  26 982  111082    1
  21 583  26 983  111083    1
//Pesticide Title COM: CHLORETHOXYFOS          TRD: Fortress
      72
  140548     0.122    0.00
  150548     0.243    8.00
  140549     0.122    0.00
  150549     0.243    8.00
  140550     0.122    0.00
  150550     0.243    8.00
  140551     0.122    0.00
  150551     0.243    8.00
  140552     0.122    0.00
  150552     0.243    8.00
  140553     0.122    0.00
  150553     0.243    8.00
  140554     0.122    0.00
```

150554	0.243	8.00
140555	0.122	0.00
150555	0.243	8.00
140556	0.122	0.00
150556	0.243	8.00
140557	0.122	0.00
150557	0.243	8.00
140558	0.122	0.00
150558	0.243	8.00
140559	0.122	0.00
150559	0.243	8.00
140560	0.122	0.00
150560	0.243	8.00
140561	0.122	0.00
150561	0.243	8.00
140562	0.122	0.00
150562	0.243	8.00
140563	0.122	0.00
150563	0.243	8.00
140564	0.122	0.00
150564	0.243	8.00
140565	0.122	0.00
150565	0.243	8.00
140566	0.122	0.00
150566	0.243	8.00
140567	0.122	0.00
150567	0.243	8.00
140568	0.122	0.00
150568	0.243	8.00
140569	0.122	0.00
150569	0.243	8.00
140570	0.122	0.00
150570	0.243	8.00
140571	0.122	0.00
150571	0.243	8.00
140572	0.122	0.00
150572	0.243	8.00
140573	0.122	0.00
150573	0.243	8.00
140574	0.122	0.00
150574	0.243	8.00
140575	0.122	0.00
150575	0.243	8.00
140576	0.122	0.00
150576	0.243	8.00
140577	0.122	0.00
150577	0.243	8.00
140578	0.122	0.00
150578	0.243	8.00
140579	0.122	0.00
150579	0.243	8.00
140580	0.122	0.00
150580	0.243	8.00
140581	0.122	0.00
150581	0.243	8.00
140582	0.122	0.00
150582	0.243	8.00
140583	0.122	0.00
150583	0.243	8.00

1

```
//Soils Title  --          Series: MARSHALL                    Txt: Silty Clay Loam
 150.00     0.00       30        0        0        0        0
      4
      1     2.00    1.250    0.000    .0990    0.495    0.000
            0.495    0.265    104.4    1.740
      2    43.00    1.250    0.000    .0462    0.495    0.000
            0.495    0.265    104.4    1.740
      3   100.00    1.300    0.000    .0462    0.416    0.000
            0.416    0.216     6.96    0.116
      4     5.00    1.300    0.000    .0462    0.416    0.000
            0.416    0.196     3.48    0.058
      0        0
   WATR     MNTH        5     PEST     MNTH        5     CONC     MNTH        5    1
      2
   RFLX     TSER       -9.100E+06
   EFLX     TSER       -9.100E+06
```

```
//Simulation Title    --    Loc: M-107
   1 148          311283
 //Hydrology Title     --    HGRP: B     Crop: Corn
    0.710    0.500         0    15.00         1         1
         1
      0.32     3.06     0.50     10.0     4.40
         1
         1     0.25    90.00   100.00          3   86   78   82 .50 .25 .30     0.00
        36
   21 548   26 948   111048    1
   21 549   26 949   111049    1
   21 550   26 950   111050    1
   21 551   26 951   111051    1
   21 552   26 952   111052    1
   21 553   26 953   111053    1
   21 554   26 954   111054    1
   21 555   26 955   111055    1
   21 556   26 956   111056    1
   21 557   26 957   111057    1
   21 558   26 958   111058    1
   21 559   26 959   111059    1
   21 560   26 960   111060    1
   21 561   26 961   111061    1
   21 562   26 962   111062    1
   21 563   26 963   111063    1
   21 564   26 964   111064    1
   21 565   26 965   111065    1
   21 566   26 966   111066    1
   21 567   26 967   111067    1
   21 568   26 968   111068    1
   21 569   26 969   111069    1
   21 570   26 970   111070    1
   21 571   26 971   111071    1
   21 572   26 972   111072    1
   21 573   26 973   111073    1
   21 574   26 974   111074    1
   21 575   26 975   111075    1
   21 576   26 976   111076    1
   21 577   26 977   111077    1
   21 578   26 978   111078    1
   21 579   26 979   111079    1
   21 580   26 980   111080    1
   21 581   26 981   111081    1
   21 582   26 982   111082    1
   21 583   26 983   111083    1
//Pesticide Title COM: CHLORETHOXYFOS          TRD: Fortress
        36
   140548     0.365    8.00
   140549     0.365    8.00
   140550     0.365    8.00
   140551     0.365    8.00
   140552     0.365    8.00
   140553     0.365    8.00
   140554     0.365    8.00
   140555     0.365    8.00
   140556     0.365    8.00
   140557     0.365    8.00
   140558     0.365    8.00
   140559     0.365    8.00
   140560     0.365    8.00
```

```
  140561     0.365    8.00
  140562     0.365    8.00
  140563     0.365    8.00
  140564     0.365    8.00
  140565     0.365    8.00
  140566     0.365    8.00
  140567     0.365    8.00
  140568     0.365    8.00
  140569     0.365    8.00
  140570     0.365    8.00
  140571     0.365    8.00
  140572     0.365    8.00
  140573     0.365    8.00
  140574     0.365    8.00
  140575     0.365    8.00
  140576     0.365    8.00
  140577     0.365    8.00
  140578     0.365    8.00
  140579     0.365    8.00
  140580     0.365    8.00
  140581     0.365    8.00
  140582     0.365    8.00
  140583     0.365    8.00
       1
//Soils Title  --          Series: MARSHALL                Txt: Silty Clay Loam
  150.00      0.00        30         0         0         0         0
       4
       1     2.00     1.250     0.000    .0990    0.495    0.000
             0.495    0.265     104.4    1.740
       2    43.00     1.250     0.000    .0462    0.495    0.000
             0.495    0.265     104.4    1.740
       3   100.00     1.300     0.000    .0462    0.416    0.000
             0.416    0.216      6.96    0.116
       4     5.00     1.300     0.000    .0462    0.416    0.000
             0.416    0.196      3.48    0.058
       0        0
    WATR     MNTH         5     PEST     MNTH         5     CONC     MNTH         5    1
       2
    RFLX     TSER        -9.100E+06
    EFLX     TSER        -9.100E+06
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Attachment II - FWS Recommendations for an EUP on Fortress

file

United States Department of the Interior

FISH AND WILDLIFE SERVICE
BLOOMINGTON FIELD OFFICE (ES)
718 North Walnut Street
Bloomington, Indiana 47401
(812)334-4261

IN REPLY REFER TO:

April 24, 1990

cc: Dennis H. Edwards, EPA
Rita Kumar, EPA

Deborah L. Freerksen
Du Pont Agricultural Products
Walker's Mill, Barley Mill Plaza
P.O. Box 80038
Wilmington, DE 19880-0038

Dear Ms. Freerksen:

This is in response to your April 11, 1990 letter regarding an Experimental Use Permit for Du Pont Fortress Insecticide 5G. The U.S. Environmental Protection Agency (EPA) has issued the permit and a temporary tolerance for the period April 6, 1990 to April 6, 1991. The EPA also required that your organization confer with the U.S. Fish and Wildlife Service (Service), and comply with the Service's advice prior to the applications.

The following counties in Indiana are included under this permit: Decatur, DuBois, Jasper, Knox, LaPorte, Madison, Pulaski, Rush, and Shelby.

These counties are within the range of the federally endangered Indiana bat (Myotis sodalis). The Indiana bat uses woodland areas during the summer when maternity colonies utilize trees with loose bark for nesting. These bats forage primarily over wooded stream corridors, although they have been collected in grazed woodlots, mature deciduous forests, and pastures with trees. Ideal foraging habitat consists of a riparian corridor with at least 30 meters of woody vegetation on each bank. Bald eagles (Haliaeetus leucocephalus) are also frequently observed some of the aforementioned counties, most often during winter. The fat pocketbook (Potamilus capax), an endangered freshwater mussel, can still be found in the Wabash River in southwestern Indiana.

The Service has reviewed the information provided to us concerning Fortress 5G, and we recommend the following measures be taken to protect fish and wildlife resources, including threatened and endangered species.

1) There should be a vegetative buffer between waterways and fields where experimental application of Fortress 5G is applied; or, in the absence of the vegetative buffer strip, no insecticide should be applied to the field within a minimum of 10 feet from field/waterway interface.

2) The applicator should vigilantly ensure that the techniques used to incorporate the granular insecticide are consistently effective, and that appropriate actions are taken if misapplied.

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3) As a minimum, the experimental fields should be monitored daily during the first several days after insecticide application to assess any impacts to terrestrial and/or aquatic life (if field is near a watercourse). Any dead or impaired animals should be immediately reported to appropriate natural resource agencies, and the animals should be disposed of in a way so that secondary poisoning of other animals does not occur.

These comments constitute informal consultation only, and are not intended to fulfill the requirements of Section 7 of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). If additional information on listed or proposed species becomes available, or if experimental usage indicates potential impacts to threatened or endangered species, this determination may be reconsidered.

We would appreciate receiving the legal descriptions of the fields where Fortress 5G was applied under this permit in Indiana, and copies of any monitoring reports generated for these fields.

If you have any questions, or require further technical assistance, please contact Dan Sparks of my staff at (812) 334-4265.

Sincerely yours,

David C. Hudak

David C. Hudak
Supervisor

cc: Regional Director, FWS, Twin Cities, MN (AFWE-SE)
FWS, Division of Environmental Contaminants, Washington, D.C. (Andreasen)