US EPA ARCHIVE DOCUMENT

FILE
1/9/84

Shaugh. No. 059101

EAB Log Out Date: 09 JAN 1984

Init.: SHL

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

From: Carolyn K. Offutt
Head, Environmental Processes and Guidelines Section
Exposure Assessment Branch, HED (TS-769)

Attached, please find the estimated environmental concentration review of:

Reg./File No.: 464-448

Chemical: Chlorpyrifos

Type Product: Insecticide

Product Name: Lorsban

Company Name: DOW

Submission Purposes: EEC on Wheat

ZBB Code: Other

Action Code: 336

Date In: 11/4/83

EFB#: 4062

Date Completed: 1/9/84

TAIS (Level II)	Days
63	3

Deferrals To:

X Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

Chlorpyrifos

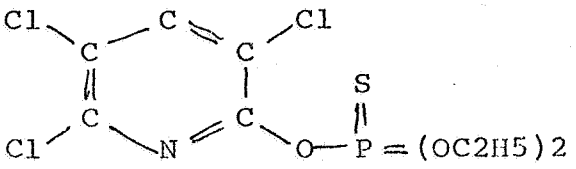
I. Introduction:

Ecological Effects Branch requested on 28 October 1983 that an estimated environmental concentration be calculated for the application of chlorpyrifos to wheat for the control of various insects.

II. Chemical/Physical Properties:

Common Name: Chlorpyrifos
Chemical Name: O,O-diethyl-O-3,5,6-trichloro-2-pyridyl-phosphorothioate

Structure:



Other properties may be found on the attached "one-liner" form.

III. Use Directions:

Lorsban 4E is to used for the control of aphids and grashoppers, armyworms, and cutworms in wheat. The rate of application is to be 1/2 to 2 pints per acre of formulated product or 1/4 to 1 lb. ai/acre of chlorpyrifos. Apply no closer than 28 days before harvest nor more than 1 pint closer than 42 days before harvest. Do not apply more than 3 pints of Lorsban 4E per year.

IV. Discussion:

Runoff, drift, and water quality analyses were performed.

Runoff analysis:

The Coshocton 118 watershed was chosen because it was the only one in which wheat had been grown, and then on a 4 year rotation. The watershed was used to determine the possible quantity of Lorsban in runoff as a function of meteorology and geography. The model river basin is part of the Simulator for Water Resources in Rural Basins (SWRRB). The chemistry and other input data are given in Table 1.

Two applications were made per year at the time when suspected insect damage might occur. This was approximately the end of April and late May.

Very little runoff occurred except for one very large event that occurred with a very large rainfall. Because of this, runoff of chlorpyrifos was not considered to be influential in the

water quality of nearby streams and ponds.

Drift Analysis:

The Holst drift model, based on Akesson and Yates data and the M. von Rumker report of 1975 on spray drift, was used to estimate the possibility of drift from an aerial application of Lorsban. The reason for modeling spray drift is based on actual field studies performed by DOW with chlorpyrifos in Illinois. They found that the principle input of the pesticide into a nearby pond was spray drift. Drift can occur from either aerial or ground application. A conservative application method was used where the volume mean diameter of the droplets was appromimately 275 microns. Smaller VMDs may occur especially with use of fixed-wing aircraft. The quantity of drift was approximately 10% at 100 feet and less than 1% at 200 feet. Using a 1 lb/A input, the quantity of drift would then be 0.1 lb/A at 100 feet and less than 0.01 lb/A at 200 feet.

Water Quality Analysis:

From the drift model, the 0.01 lb/A input was used and the runoff from the field was ignored for the water quality analysis in the Exposure Analysis Modeling System (EXAMS) using the Athens ERL pond scenerio. The chemistry data for chlorpyrifos used in the model is given in Table 2.

The quantites were adjusted for the metric input requirements of EXAMS. Only a one hectare field adjacent to the 1 hectare pond was used because not all of a large field's drifting pesticide will get to the pond.

The maximum quantity found dissolved in the water column was approximately 0.5 ppb. The dissipation half-life from the water was about 1/2 day as the material became adsorbed to the sediments or was carried away. The sorbed quantities in the bottom sediments attained 25 ppb and did not decrease rapidly over the 50 days of the analysis.

An EEC for chlorpyrifos was performed on 13 May 1982 for soybeans. The quantities found in that analysis and the present study are in close agreement. Also it should be noted that DOW, during a field monitoring study (presently not available to the Agency) using chlorpyrifos in corn in Illinois, arrived at similar concentrations in the pond waters as a result of spray drift during a ground application.

Metabolites:

The pyridinol is the principle metabolite. The rate of degradation from chlorpyrifos to the pyridinol is not known, though photo-degradation in quite rapid. The pyridinol has an approximate half-life of 56 days. An analysis of the pyridinol's fate was not made.

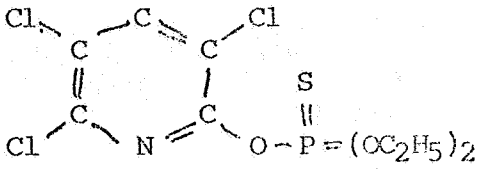
Robert W. Holst, Ph.D.
Plant Physiologist
Exposure Assessment Branch

Shaugh. No. 059101

Common Name: Chlorpyrifos

Chemical Name: O,O-diethyl-O-3,5,6-trichloro-2-pyridyl-phosphorothioate

Structure:



Chemical Properties:

Molecular Weight: 350.6 Solubility (ppm): 2.00 (25 °C)

Partitioning:	$K_d=K_{abs}=K_{ps}$	Soil Type	%OC
K_{ow} 66000	199-1203 (est.)		2%
K_{oc}			

Hydrolysis (halflife hrs.)

(pH 5) 26400 hr (pH 7) 8400 hr (pH 9) 720 hr

K 2.6e-5 K_{ah} 0 K 8E-5 K_{nh} 8E-5 K 9.6E-4 K_{bh} 8.8

Photolysis (halflife hrs.)

Water 6-24 hr K_{dp} 1.44E-2 Soil hr K

Vapor Pressure: 1.87E-5 (25°) Evaporation:

Degradation (halflife hrs.)

Soil (Aerobic)(7 soils 11 to 141 days) 63 days K 4.58E-4 /hr

Soil (Anaerobic)(2 soils 39 to 51 days) 45 days K 6.41E-4 /hr

Water (Type) hr K

Bacteriological

Soil (Type) hr K

Water (Type) hr K

Henry's 4.21E-6

Table 1. Chlorpyrifos inputs for SWRRB (Cosh 118).

Kd = 200.0

Washoff fraction = 10%

Leaf half-life = 2.0 days

Soil decay rate = 0.011 /day

Application Efficiency = 60%

Application times and rates

Year	Day	Lb./A
1956	120	0.5
	140	1.0
1960	122	0.5
	140	1.0
1964	130	1.0
	148	0.5
1968	127	1.0
	150	0.5
1972	120	0.5
	140	1.0

Table. 2. EXAMS --- EXPOSURE ANALYSIS MODELING SYSTEM --- V2.0: MODE 2
ECOSYSTEM: POND, AERL DEVELOPMENT PHASE TEST DEFINITION
CHEMICAL: CHLORPYRIFOS

TABLE 1.1. SH2 (NEUTRAL MOLECULE, SPECIES #1) INPUT DATA.
MWT= 350.6 SOL = 2.000 VAPR= 1.8700E-05 HENRY= 4.2100E-06
KVO= 0.0000E+00 ESOL= 0.0000E+00 EVPR= 0.0000E+00 EHEN = 0.0000E+00
KPS= 100.0 KPB = 0.0000E+00 KOC = 0.0000E+00 KOW = 6.6000E+04
KAH1= 0.0000E+00 EAH1= 0.0000E+00 KNH1= 8.0000E-05 ENH1= 0.0000E+00
KAH2= 0.0000E+00 EAH2= 0.0000E+00 KNH2= 0.0000E+00 ENH2= 0.0000E+00
KAH3= 0.0000E+00 EAH3= 0.0000E+00 KNH3= 0.0000E+00 ENH3= 0.0000E+00
KBH1= 8.800 EBH1= 0.0000E+00 KOX1= 0.0000E+00 EOX1= 0.0000E+00
KBH2= 0.0000E+00 EBH2= 0.0000E+00 KOX2= 0.0000E+00 EOX2= 0.0000E+00
KBH3= 0.0000E+00 EBH3= 0.0000E+00 KOX3= 0.0000E+00 EOX3= 0.0000E+00
KBACW1= 0.0000E+00 QTW1= 0.0000E+00 KBACS1= 0.0000E+00 QTS1= 0.0000E+00
KBACW2= 0.0000E+00 QTW2= 0.0000E+00 KBACS2= 4.5800E-11 QTS2= 0.0000E+00
KBACW3= 0.0000E+00 QTW3= 0.0000E+00 KBACS3= 0.0000E+00 QTS3= 0.0000E+00
KDP= 1.4400E-02 RFLAT= 40.00 LAMAX= 0.00
QUANT1= 1.000 QUANT2= 0.0000E+00 QUANT3= 0.0000E+00
ABSORPTION SPECTRUM (ABS): 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
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Table 3. SWRRB Outputs for Chlorpyrifos Applied to Wheat in Coshocton 118.

Year	Day	lb/A	Rainfall (in)
1956	148	.002	1.750
1960	165	.001	1.570
	166	.019	1.930
1964	134	.001	1.210
1968	148	.001	1.070
	206	.001	2.060
1972	165	.001	1.630
	167	.001	0.880

WELCOME TO HOLST SPRAY DRIFT MODEL.
THIS IS A BALISTIC MODEL WITHOUT DROPLET EVAPORATION.
ENTER DATA USING A DECIMAL SYSTEM.
IS THIS AN AQUATIC (A) OR TERRESTRIAL (T) APPLICATION?
A

1. CRITICAL LEVEL 0.00100 PPM OR LB/ACRE
2. APPL. RATE 1.000 LB AI/ACRE
3. HEIGHT 10.00 FT
4. WIND SPEED 10.00 MPH
5. DROPLET TYPE NUMBER 3.0

1. 86 UM VMD
2. 130 UM VMD SPINNER
3. 278 UM VMD FAN DOWN 40 PSI
4. 460 UM VMD D6-46 BACK 50 P
5. 900 UM VMD D6 BACK 40 PSI

DROPLETS EVAPORATED BEFORE REACHING THE GROUND. DUE TO DROPLET EVAPORATION, A LIKELY MAXIMUM DRIFT DISTANCE OF
244. FEET OR 75. METERS IS POSSIBLE YIELDING A CONCENTRATION OF
0.060000 PPM IN 6 IN. OF WATER OR LB/ACRE - TERRESTRIAL.

1. CRITICAL LEVEL 0.01000 PPM OR LB/ACRE
2. APPL. RATE 1.000 LB AI/ACRE
3. HEIGHT 10.00 FT
4. WIND SPEED 10.00 MPH
5. DROPLET TYPE NUMBER 3.0

DRIFT MAY RESULT IN WATER RESIDUES IN THE TOP SIX INCHES EQUAL TO THE CRIT. LEVEL OF 0.010000 PPM AT A DISTANCE OF 539. FEET OR 164. METERS

IS THIS AN AQUATIC (A) OR TERRESTRIAL (T) APPLICATION?
T

1. CRITICAL LEVEL 0.01000 PPM OR LB/ACRE
2. APPL. RATE 1.000 LB AI/ACRE
3. HEIGHT 10.00 FT
4. WIND SPEED 10.00 MPH
5. DROPLET TYPE NUMBER 3.0

DROPLETS EVAPORATED BEFORE REACHING THE GROUND. DUE TO DROPLET EVAPORATION, A LIKELY MAXIMUM DRIFT DISTANCE OF
244. FEET OR 75. METERS IS POSSIBLE YIELDING A CONCENTRATION OF
0.060000 PPM IN 6 IN. OF WATER OR LB/ACRE - TERRESTRIAL.

1. CRITICAL LEVEL 0.10000 PPM OR LB/ACRE
2. APPL. RATE 1.000 LB AI/ACRE
3. HEIGHT 10.00 FT
4. WIND SPEED 10.00 MPH
5. DROPLET TYPE NUMBER 3.0

DRIFT MAY RESULT IN GROUND RESIDUES EQUAL TO
THE CRIT. LEVEL OF 0.100000 LB/ACRE AT A DISTANCE OF
109. FEET OR 33. METERS.

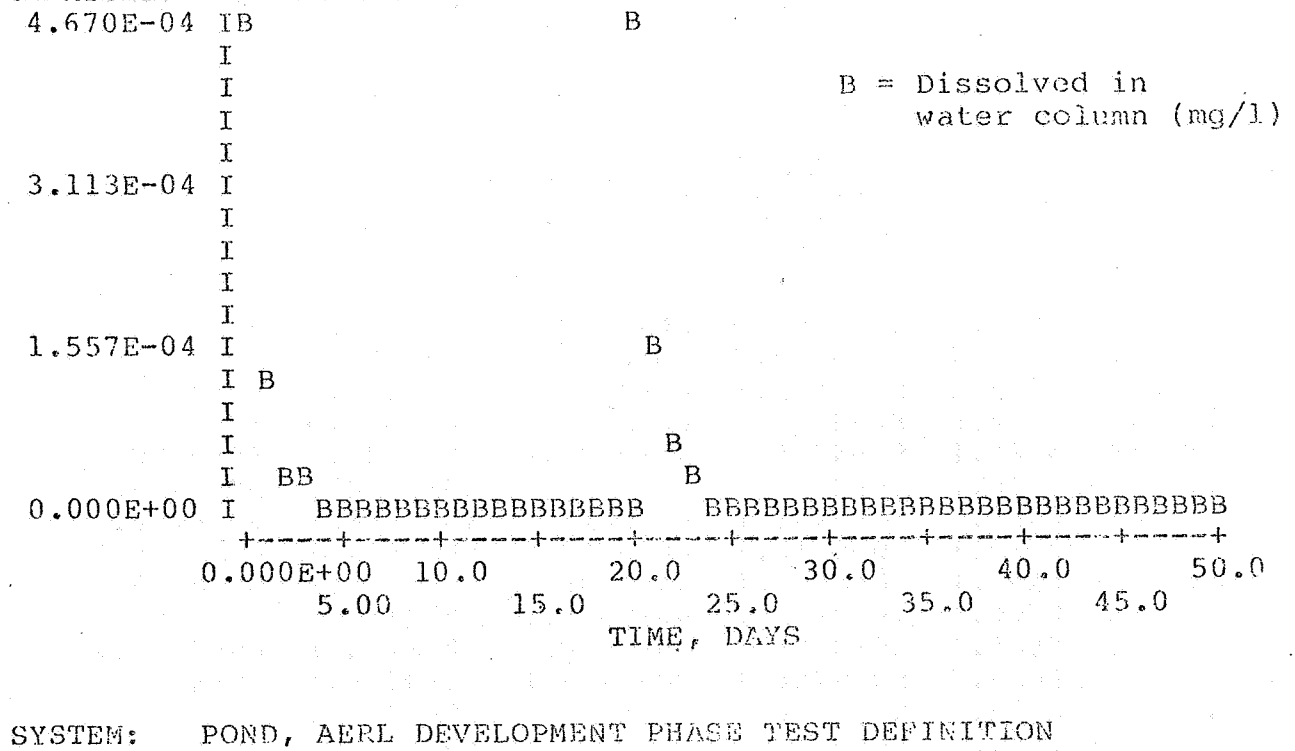
1. CRITICAL LEVEL 0.03000 PPM OR LB/ACRE
2. APPL. RATE 1.000 LB AI/ACRE
3. HEIGHT 10.00 FT
4. WIND SPEED 10.00 MPH
5. DROPLET TYPE NUMBER 3.0
DRIFT MAY RESULT IN GROUND RESIDUES EQUAL TO
THE CRIT. LEVEL OF 0.030000 LB/ACRE AT A DISTANCE OF
278. FEET OR 85. METERS.

1. CRITICAL LEVEL 0.03000 PPM OR LB/ACRE
2. APPL. RATE 1.000 LB AI/ACRE
3. HEIGHT 10.00 FT
4. WIND SPEED 10.00 MPH
5. DROPLET TYPE NUMBER 4.0
DRIFT MAY RESULT IN GROUND RESIDUES EQUAL TO
THE CRIT. LEVEL OF 0.030000 LB/ACRE AT A DISTANCE OF
66. FEET OR 20. METERS.

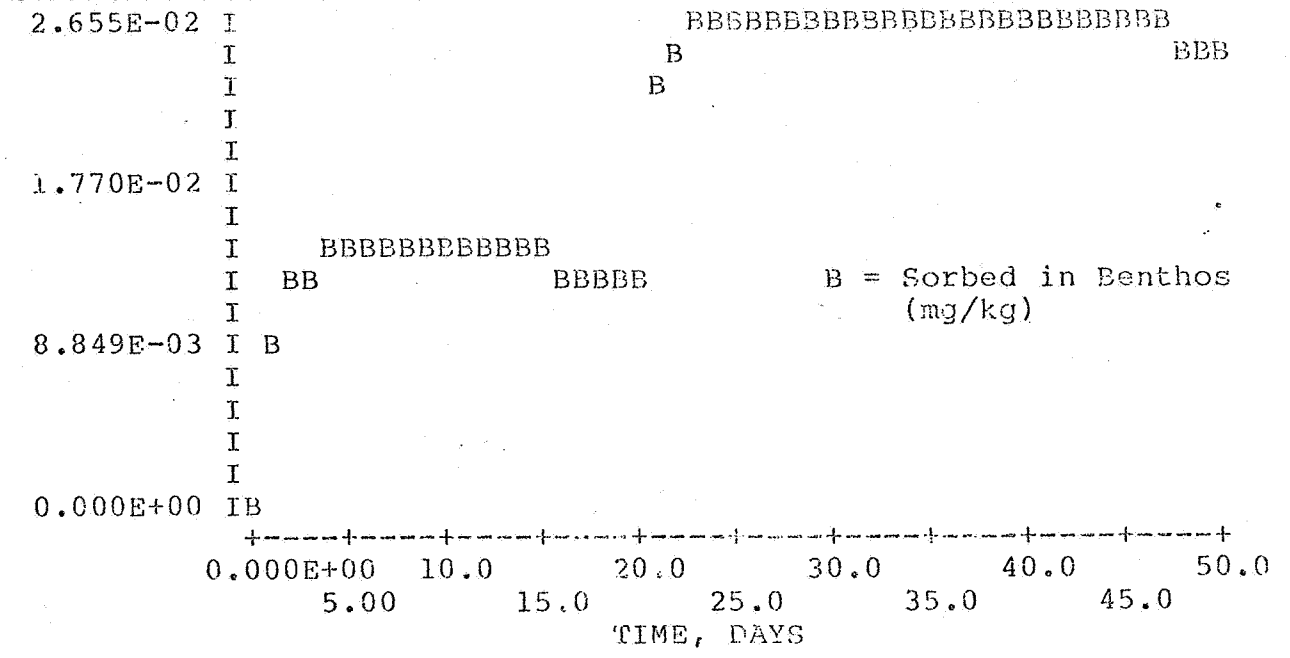
1. CRITICAL LEVEL 0.01000 PPM OR LB/ACRE
2. APPL. RATE 1.000 LB AI/ACRE
3. HEIGHT 10.00 FT
4. WIND SPEED 10.00 MPH
5. DROPLET TYPE NUMBER 4.0
DRIFT MAY RESULT IN GROUND RESIDUES EQUAL TO
THE CRIT. LEVEL OF 0.010000 LB/ACRE AT A DISTANCE OF
108. FEET OR 33. METERS.

1. CRITICAL LEVEL 0.01000 PPM OR LB/ACRE
2. APPL. RATE 0.500 LB AI/ACRE
3. HEIGHT 10.00 FT
4. WIND SPEED 10.00 MPH
5. DROPLET TYPE NUMBER 4.0
DRIFT MAY RESULT IN GROUND RESIDUES EQUAL TO
THE CRIT. LEVEL OF 0.010000 LB/ACRE AT A DISTANCE OF
79. FEET OR 24. METERS.

SYSTEM: POND, AERL DEVELOPMENT PHASE TEST DEFINITION
CHEMICAL: CHLORPYRIFOS



SYSTEM: POND, AERL DEVELOPMENT PHASE TEST DEFINITION
CHEMICAL: CHLORPYRIFOS



EXAMS -- EXPOSURE ANALYSIS MODELING SYSTEM -- V2.0: MODE 2
ECOSYSTEM: POND, AERL DEVELOPMENT PHASE TEST DEFINITION
CHEMICAL: CHLORPYRIFOS

TABLE 16. SIMULATION RESULTS -- TIME-TRACE OF CHEMICAL CONCENTRATIONS.

TIME	AVERAGE CHEMICAL CONCENTRATIONS				MASS OF CHEMICAL	
	WATER COLUMN		BOTTOM SEDIMENTS		WATER COL	SEDIMENTS
DAYS	FREE(MG/L)	SED(MG/KG)	PORE(MG/L)	SED(MG/KG)	TOTAL KG	TOTAL KG
Drift input .01 kg						
0.	4.625E-04	1.25	0.000E+00	0.000E+00	1.0000E-02	0.000E+00
1.	1.387E-04	0.375	3.547E-06	9.598E-03	2.9994E-03	6.481E-03
2.	4.391E-05	0.119	4.580E-06	1.239E-02	9.4939E-04	8.369E-03
3.	1.614E-05	4.368E-02	4.877E-06	1.320E-02	3.4901E-04	8.911E-03
4.	8.005E-06	2.166E-02	4.958E-06	1.342E-02	1.7310E-04	9.060E-03
5.	5.624E-06	1.522E-02	4.976E-06	1.347E-02	1.2162E-04	9.093E-03
6.	4.921E-06	1.332E-02	4.976E-06	1.347E-02	1.0640E-04	9.093E-03
7.	4.705E-06	1.273E-02	4.971E-06	1.345E-02	1.0175E-04	9.083E-03
8.	4.638E-06	1.255E-02	4.964E-06	1.343E-02	1.0028E-04	9.070E-03
9.	4.624E-06	1.251E-02	4.956E-06	1.341E-02	9.9979E-05	9.056E-03
10.	4.608E-06	1.247E-02	4.949E-06	1.339E-02	9.9637E-05	9.042E-03
11.	4.588E-06	1.241E-02	4.941E-06	1.337E-02	9.9204E-05	9.029E-03
12.	4.584E-06	1.240E-02	4.933E-06	1.335E-02	9.9113E-05	9.015E-03
13.	4.578E-06	1.239E-02	4.926E-06	1.333E-02	9.8998E-05	9.000E-03
14.	4.564E-06	1.235E-02	4.918E-06	1.331E-02	9.8698E-05	8.987E-03
15.	4.558E-06	1.233E-02	4.910E-06	1.329E-02	9.8560E-05	8.973E-03
16.	4.547E-06	1.231E-02	4.903E-06	1.327E-02	9.8332E-05	8.959E-03
17.	4.545E-06	1.230E-02	4.895E-06	1.325E-02	9.8271E-05	8.945E-03
18.	4.540E-06	1.228E-02	4.887E-06	1.323E-02	9.8167E-05	8.931E-03
19.	4.539E-06	1.228E-02	4.880E-06	1.320E-02	9.8140E-05	8.917E-03
Drift input .01 kg						
20.	4.670E-04	1.26	4.872E-06	1.318E-02	1.0098E-02	8.903E-03
21.	1.432E-04	0.388	8.411E-06	2.276E-02	3.0971E-03	1.537E-02
22.	4.842E-05	0.131	9.437E-06	2.554E-02	1.0470E-03	1.724E-02
23.	2.065E-05	5.587E-02	9.726E-06	2.632E-02	4.4646E-04	1.777E-02
24.	1.251E-05	3.384E-02	9.800E-06	2.652E-02	2.7041E-04	1.791E-02
25.	1.011E-05	2.737E-02	9.811E-06	2.655E-02	2.1869E-04	1.793E-02
26.	9.403E-06	2.544E-02	9.803E-06	2.653E-02	2.0332E-04	1.791E-02
27.	9.183E-06	2.485E-02	9.790E-06	2.649E-02	1.9858E-04	1.789E-02
28.	9.109E-06	2.465E-02	9.776E-06	2.645E-02	1.9696E-04	1.786E-02
29.	9.076E-06	2.456E-02	9.761E-06	2.641E-02	1.9626E-04	1.784E-02
30.	9.053E-06	2.450E-02	9.746E-06	2.637E-02	1.9576E-04	1.781E-02
35.	8.993E-06	2.433E-02	9.670E-06	2.617E-02	1.9445E-04	1.767E-02
40.	8.910E-06	2.411E-02	9.595E-06	2.596E-02	1.9266E-04	1.753E-02
45.	8.853E-06	2.396E-02	9.520E-06	2.576E-02	1.9143E-04	1.740E-02
50.	8.772E-06	2.374E-02	9.447E-06	2.556E-02	1.8967E-04	1.726E-02

UNITED ST ES ENVIRONMENTAL PROTECTIOI GENCY
WASHINGTON, D.C. 20460

OCT 2 1983

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

TO: Jay Ellenberger, PM-12
Registration Division (TS-767)

THRU: Clayton Bushong, Chief
Ecological Effects Branch
Hazard Evaluation Division (TS-769)

SUBJECT: Request for an Aquatic Estimated Environmental Concentration on Lorsban 4E (464-448).

The Ecological Effects Branch requires an estimated environmental concentration for aquatic exposure from Lorsban 4E use on wheat. An EEC is needed to update our risk assessment for non-target fish and aquatic invertebrates likely to be exposed to Lorsban. An EEC is needed for both lentic and lotic situations.

Please forward a copy of the Lorsban 4E label amendment (wheat) with the request to EAB and also notify EEB of expected turn around for the EEC calculation.

Les Touart
Sec. 4, Fisheries Biologist
Ecological Effects Branch
Hazard Evaluation Division, TS-769

cc. H.T. Craven

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