(TDR038) DATA EVALUATION RECORD PAGE 1 OF

CASE GS0109 TERBUFOS PM 04/15/82

CHEM 105001 Terbufos (S-(((1,1-dimethylethyl)thio)

BRANCH EEB DISC 40 TOPIC 05054543

FORMULATION 01 - TECHNICAL CHEMICAL

FICHF/MASTER ID 00085176 CONTENT CAT 01

Bentley, R.E. (1973) Acute Toxicity of Counter¬(TM)¤ to Bluegill (‡"Lepomis macrochirus"‡), Channel Catfish (‡"Ictalurus punc"‡-‡"tatus"‡) and Crayfish (‡"Procambarus clarkii"‡). (Unpublished study received May 1, 1974 under 4F1496; prepared by Bionomics, Inc., submitted by American Cyanamid Co., Princeton, N.J.; COL:090808-G)

SUBST. CLASS = S.

OTHER SUBJECT DESCRIPTORS
SEC: EEB -40-05054547

DIRECT RVW TIME = 5 hrs. (MH) START-DATE 10/4/82 END DATE 10/29/82

REVIEWED BY: James D. Felkel
TITLE: Wildlife Biologist
ORG: Ecological Effects Branch, Hazard Evaluation Division (TS-769)
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APPROVED BY:
TITLE:
ORG:
LOC/TEL:

SIGNATURE: DATE:

10 pages

DATA EVALUATION RECORD

1. Chemical: Terbufos (Shaughnessy No. 105001)

2. Formulation: Technical, Lot No. W302060-000-A, 88.6% a.i.

3. Citation: Bentley, R. 1973. Acute toxicity of COUNTER™ to Bluegill (Lepomis macrochirus), Channel catfish (Ictaluras punctatus) and crayfish (Procambarus clarkii). Report prepared by Bionomics, Inc. for American Cyanamid Co. (MRID#00085176)

4. Reviewed By: James D. Felkel, Wildlife Biologist
Ecological Effects Branch
Hazard Evaluation Division (TS-769)

5. Date Reviewed: October 29, 1982

6. Test Type: Fish and aquatic invertebrate LC_{50} (dynamic bioassay)

A. Test Species: Bluegill (Lepomis macrochirus)
Channel catfish (Ictaluras punctatus)
Crayfish (Procambarus clarkii)

7. Reported Results: 96-hour LC_{50} values are as follows:

Bluegill 0.8 (0.5-1.4) ppb
Channel catfish 10.5 (6.5-16.8) ppb
Crayfish 7.7 (4.2-14.0) ppb

8. Reviewer's Conclusions:

These studies are scientifically sound and indicate that terbufos is very highly toxic to all three test species with LC_{50} values as follows: bluegill, 0.87 (0.77-1.0) ppb; channel catfish, 9.6 (8.5-11.1) ppb; and crayfish, 8.0 (6.9-10.2) ppb. These studies do not fully meet the intent of proposed guidelines (7/10/78) for these test types since actual toxicant concentrations were not measured in this flow-through study.

2

METHODS AND MATERIALS

These investigations were preformed at the aquatic toxicology laboratory of Bionomics, Inc., Wareham, Massachusetts. The susceptibility of bluegill (Lepomis macrochirus), channel catfish (Ictalurs punctatus), and crayfish (Procambarus clarkii) to technical Counter™ (Lot number W30206-000-A, 88.6% A.I.), tested under dynamic conditions was reported as the incipient median tolerance limit (TL_{50}), the concentration of the test compound in water causing 50 percent mortality with no additional significant response (>10%) during the final 48 hours of exposure. The predicted TL_{50} value and its 95% confidence intervals were arrived at by converting the concentrations tested and the corresponding observed percent mortalities to logs and probits, respectively. These values were then used to calculate a linear regression equation.

Except for those conditions described below, test procedures for the dynamic bioassay are those described for fish Bioassay Procedures in the 1970 edition of Standard Methods (APHA). The bluegill used in these tests were acquired form a fish farmer in Nebraska and had a mean weight of 2.5 g and a mean length of 55 mm. The channel catfish used in these tests were obtained form a commercial fish farmer in Arkansas, and had a mean weight of 2.0 g and mean length of 80 mm.

The crayfish used in these tests were acquired form a commercial fish farmer in Louisiana, and had a mean weight and length of 40 g and 90 mm, respectively. The dynamic bioassays were conducted using a continuous flow proportional dilution apparatus (Mount and Brungs, 1967)[1]. The apparatus provides for intermittent introduction of seven concentrations of the test compound into test vessels and diluent water to a vessel serving as a control unit. Flow rate to each of the 30-liter test vessels was 5 liters/hr. throughout the test period.

The test diluent consisted of aerated well water of pH 7.1, total hardness 38 mg/l as $CaCO_3$, and a constant temperature of 21°C (+ 1.0). Dissolved oxygen levels for the test ranged from 9.1 to 9.3 mg/l. Thirty specimens were introduced 48 hours prior to the start of the assays into each test unit. The desired concentrations of the test compound were established after the 48 hour acclimation period in the test vessels by adding sufficient amounts of stock solution containing the compound dissolved in acetone to each test vessel. The proportional dilution apparatus was then used to maintain the desired conentrations of the compound in each test vessel.

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[1] Mount, D.I. and W.A. Brungs. 1967. A simplified dosing apparatus for fish toxicology studies. Water Research. 1:21.

RESULTS

The predicted TL_{50} values and 95% confidence intervals are presented in Table 1. Table 2 presents a summary of observed mortality for the test after 24, and 96 hours of exposure and end of test. Moribund test animals generally became dark and lethargic, lost equlibrium, and expired.

REVIEWER'S EVALUATION

Test methods reported for these flow-through aquatic bioassays are gennerally consistent with proposed guidelines (7/10/78). However, acceptable protocols (Stephen, 1975) specify that toxicant concentrations in the test chambers must be measured as this is the only way to check the accuracy of the diluters. EPA computer analyses (attached) indicate LC_{50} values of 0.87 (0.77-1.0) ppb for the bluegill (probit method), 9.6 (8.5-11.1) ppb for the channel catfish (moving average method), and 8.0 (6.9-10.2) ppb for the crayfish (probit method). These data indicte that terbufos is very highly toxic to all three of these aquatic species.

CONCLUSIONS

1. Category: Supplemental

2. Rationale: Actual toxicant concentrations in the test vessels were not measured/reported.

3. Repairability: No

Table 1 -- Acute toxicity of technical Counter® to bluegill[a] (Lepomis macrochirus), channel catfish[b] (Ictalurus punctatus), and crayfish[c] (Procambarus clarkii). These data are based on dynamic bioassays conducted at the aquatic toxicology laboratory of Bionomics Inc., Wareham, Massachusetts.

species	TL_{50} - milligram/liter 24 hour	96 hour	Incipient[d]	No Effect Level (mg/l)
bluegill	>0.0010	0.0008 (0.0005-0.0014)[e]	0.0004 (0.0003-0.0006)	0.00018
channel/ catfish	0.0119 (0.0050-0.0219)	0.0105 (0.0065-0.0168)	0.0081 (0.0063-0.0103)	0.0040
crayfish	>0.0100	0.0077 (0.0042-0.0140)	0.0069 (0.0042-0.0111)	0.0024

[a]Assay conducted at 21C (± 1.0), mean weight of bluegill 2.5 g.

[b]Assay conducted at 21C (± 1.0), mean weight of channel catfish 2.0 g.

[c]Assay conducted at 21C (± 1.0), mean weight of crayfish 40 g.

[d]Incipient TL_{50} estimated over 168 hours for bluegill, 144 hours for the channel catfish, and over 120 hours for the crayfish.

[e]95% confidence interval.

Table 2 -- Concentrations of technical Counter® tested and corresponding observed percent mortalities for bluegill (Lepomis macrochirus), channel catfish (Ictalurus punctatus), and crayfish (Procambarus clarkii) after 24 and 96 hours of exposure and end of test.

Species	Concentration (mg/l)	% mortality observed 24 hour	96 hour	Incipient
				168 hour
bluegill	0.00100	0	67	97
	0.00075	0	30	91
	0.00056	0	15	75
	0.00042	0	7	37
	0.00032	0	0	15
	0.00024	0	0	10
	0.00018	0	0	0
	control	0	0	0
				144 hour
channel catfish	0.017	53	75	100
	0.013	53	53	57
	0.009	57	67	70
	0.007	27	27	27
	0.005	20	23	23
	0.004	0	0	0
	0.003	0	0	0
	control	0	0	0

Table 2 -- Continued

Species	Concentration (mg/l)	% mortality observed		
		24 hour	96 hour	Incipient 120 hour
crayfish	0.0100	0	60	70
	0.0075	0	47	57
	0.0056	0	20	27
	0.0042	0	33	40
	0.0032	0	10	10
	0.0024	0	0	0
	0.0018	0	0	0
	control	0	0	0

NOTE TO REVIEWER: THIS DATA SET DOES NOT MEET
THE CRITERIA ESTABLISHED BY THE COMMITTEE ON
METHODS FOR TOXICITY TESTS WITH AQUATIC ORGANISMS
BECAUSE NO PERCENT DEAD IS GREATER THAN 65 PERCENT.

FELKEL TERBUFOS CRAYFISH LC50 (00085176)

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
10	30	18	60	18.07973
7.5	30	14	46.66667	42.77678
5.6	30	6	20	0.07154532
4.2	30	10	33.33333	4.936857
3.2	30	3	10	0.0004215166
2.4	30	0	0	9.313226E-08
1.8	30	0	0	9.313226E-08

THE BINOMIAL TEST SHOWS THAT 3.2 AND +INFINITY CAN BE
USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT
CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL
ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 8.056817

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
2	0.3792832	8.268027	7.05232	10.93469

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
6	0.09170354	1	0.1203535

SLOPE = 3.365062
95 PERCENT CONFIDENCE LIMITS = 2.346034 AND 4.38409

LC50 = 8.048931
95 PERCENT CONFIDENCE LIMITS = 6.869246 AND 10.17273

LC10 = 3.375442
95 PERCENT CONFIDENCE LIMITS = 2.567309 AND 4.016479

FELKEL TERBUFOS CHANNEL CATFISH LC50 (00085176)

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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
17	30	23	76.66667	0.261144
13	30	16	53.33333	42.77678
9	30	20	66.66667	4.936857
7	30	8	26.66667	0.8062401
5	30	7	23.33333	0.261144
4	30	0	0	9.313226E-08
3	30	0	0	9.313226E-08

THE BINOMIAL TEST SHOWS THAT 7 AND 17 CAN BE
USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT
CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL
ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 8.114595

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
5	0.05662886	9.611449	8.53048	11.07291

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
6	0.316099	2.893588	0.01289492

SINCE THE PROBABILITY IS LESS THAN 0.05, RESULTS CALCULATED
USING THE PROBIT METHOD PROBABLY SHOULD NOT BE USED.

SLOPE = 3.606201
95 PERCENT CONFIDENCE LIMITS = 1.578698 AND 5.633704

LC50 = 9.94277
95 PERCENT CONFIDENCE LIMITS = 7.415633 AND 15.81246

LC10 = 4.419124
95 PERCENT CONFIDENCE LIMITS = 1.778425 AND 6.154927

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9

FELKEL TERBUFOS BLUEGILL LC50 (00085176)

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
1	30	20	66.66667	4.936857
0.75	30	9	30	2.138697
0.56	30	5	16.66667	0.01624571
0.42	30	2	6.666667	4.339963E-05
0.32	30	0	0	9.313226E-08
0.24	30	0	0	9.313226E-08
0.18	30	0	0	9.313226E-08

THE BINOMIAL TEST SHOWS THAT 0.75 AND +INFINITY CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 0.8779544

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
1	0.4774214	0.8779544	0.7738842	1.02123

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
5	0.1067055	1	0.9121484

SLOPE = 5.488131
95 PERCENT CONFIDENCE LIMITS = 3.695389 AND 7.280873

LC50 = 0.8653255
95 PERCENT CONFIDENCE LIMITS = 0.7727665 AND 1.019936

LC10 = 0.5078916
95 PERCENT CONFIDENCE LIMITS = 0.4153091 AND 0.575637