

US EPA ARCHIVE DOCUMENT

H W L

CASE GS0109 TERBUFOS PM 04/15/82

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

BRANCH EE8 DISC 40 TOPIC 05103043

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00037483 CONTENT CAT 01

Sleight, B.H., III (1972) The Acute Toxicity of Cycocel<sup>®</sup>(R) and Experimental Insecticide AC 92,100 to Bluegill ("Lepomis mac<sup>®</sup>chirus") and Rainbow Trout ("Salmo gairdneri"). (Unpublished study received Apr 9, 1973 under 3G1340; prepared by Bio-nomics, Inc., submitted by American Cyanamid Co., Princeton, N.J.; CDL1093584-U)

SUBST. CLASS = S.

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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SIGNATURE: *James D. Felkel* DATE: 12/8/82

APPROVED BY:  
TITLE:  
ORG:  
LOC/TEL:

SIGNATURE: DATE:

DATA EVALUATION RECORD

1. CHEMICAL: (1) Terbufos (Shaughnessy No. 105001)  
(2) Cycocel (Shaughnessy No. 018101)
2. Formulation: (1) AC 92,100 #1947-144 (purity 86.3%)  
(2) Cycocel Technical No. 21-0317 (purity 98%)
3. Citation: Sleight, B. 1972. The acute toxicity of Cycocel™ and experimental insecticide AC 92,100 to bluegill (Lepomis macrochirus) and rainbow trout (Salmo gairdneri); (MRID #00037483)
4. Reviewed By: James D. Felkel, Wildlife Biologist  
Ecological Effects Branch  
Hazard Evaluation Division (TS-769)
5. Date Reviewed: November 28, 1982
6. Test Type: Freshwater fish acute LC<sub>50</sub>
  - A. Test Species: Bluegill (Lepomis macrochirus)  
Rainbow trout (Salmo gairdneri)
7. Reported Results: The terbufos 96-hour LC<sub>50</sub> is 0.004 (0.003-0.005) mg/l for the bluegill and 0.010 (0.008-0.013) mg/l for the rainbow trout. No mortality or adverse effects were seen with either test species at Cycocel™ concentrations up to 1000 mg/l.
8. Reviwer's Conclusions:

These test are scientifically sound and indicate that terbufos is very highly toxic to both the bluegill [LC<sub>50</sub> = 3.8(2.8-4.9)ppb] and rainbow trout [LC<sub>50</sub> = 9.4(7.7-11.4)ppb]. With an LC<sub>50</sub> > 1000 ppm for both test species, Cycocel™ is practically non-toxic to the bluegill and rainbow trout. These studies meet the intent of proposed guidelines (7/10/78).

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## METHODS

Bluegills were obtained from a commercial hatchery in Nebraska and had a mean weight of 1.2 g and a mean length of 43 mm. The Rainbow trout were acquired from a commercial hatchery in Massachusetts and had a mean weight and length of 1.5 g and 55 mm respectively. The test fish were observed in the laboratory hatchery facilities for at least 30 days prior to testing. During that period, mortality in the test population was less than 2% and the fish were judged to be in excellent physical condition. Bioassays were conducted in 5-gallon glass vessels held in constant temperature water baths (18°C for bluegill and 13°C for rainbow trout) (+ 0.5). The test diluent consisted of 15 liters of deionized water of at least 1 million ohms resistivity which was reconstituted by adding 3 mg potassium chloride, 30 mg calcium sulfate, 30 mg magnesium sulfate, and 48 mg sodium bicarbonate per liter. The pH of the diluent was 7.1, methyl orange alkalinity was 35 ppm. Bioassays were conducted under static conditions, without aeration, and with a single introduction of toxicant. Fish were approximately the same weight and length (+ 20%). Fish were conditioned to the test water for at least 24 hours prior to testing and were not fed for 2 days before the test commenced. The test solutions of Cycocel® were prepared by adding appropriate amounts of chemical dissolved in water to 15 liters of diluent. AC92,100 was dissolved in acetone before introduction to the test diluent. Ten fish were tested at each concentration, the mass/volume ration never exceeded 1.0 gram of fish per liter of water. Concentrations of the chemical formulations were prepared in series and used to evaluate the susceptibility of the fish to the compounds. Dissolved oxygen levels ranged from a high of 9.0 mg/l at the beginning, to a low of 5.0 mg/l after 96 hours.

## RESULTS

The TL<sub>50</sub> values for 24 and 96 hours are presented in Table 1. The data for p,p' - DDT are the results of our own standard static reference used to provide an indication of the susceptibility of the population to a known toxicant. These results indicate that the test population in question represents what might be considered an "average population". Table 2 presents the concentrations tested and corresponding observed percent mortalities after 24 and 96 hours exposure. The behavior of the test animals that succumbed to the compound was similar to a syndrome characteristic of chemically poisoned fish. Moribund fish first were observed to become dark, swim about erratically, lose equilibrium and drop to the bottom of the test vessel where they eventually expired.

## REVIEWER'S EVALUATION

Methods reported are generally consistent with proposed guidelines (7/10/78). EPA computer analysis (attached) indicates an approximate LC<sub>50</sub> of 3.8(2.8-4.9) ppb for terbufos with the bluegill, using the binomial test. The moving average and probit methods of analysis could not be used since there was only one concentration at which the percent mortality was

between 0 and 100. An approximate LC<sub>50</sub> for terbufos with the rainbow trout is 9.4(7.7-11.4) ppb, using the probit method (attached). These results indicate that terbufos is very highly toxic to both the bluegill and rainbow trout. The complete lack of mortality in both test species to concentrations of Cycocel™ up to 1000 ppm indicates that this material is practically non-toxic to the bluegill and rainbow trout.

CONCLUSIONS

1. Category: Core
2. Rationale: These tests meet the intent of proposed guidelines (7/10/78).
3. Repairability: N/A

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(6)

Table 1.- Acute toxicity of Cycocel<sup>®</sup> and Experimental Insecticide AC92,100 to Bluegill<sup>a</sup> (Lepomis macrochirus) and Rainbow trout<sup>b</sup> (Salmo gairdner). The data are based on the results of static bioassays conducted at the aquatic toxicology laboratory of Economics, Inc. in Wareham, Massachusetts.

Compound/Species	TL <sub>50</sub> milligram active ingredient/liter		No Effect Level (mg/l)
	24 hour	96 hour	
Cycocel <sup>®</sup> /Bluegill	>1000.0	>1000.0	1000.0
Cycocel <sup>®</sup> /Rainbow trout	>1000.0	>1000.0	1000.0
AC92,100/Bluegill	0.006(0.005-0.009) <sup>c</sup>	0.004(0.003-0.005)	0.002
AC92,100/Rainbow trout	0.034(0.030-0.039)	0.010(0.008-0.013)	0.005
AC92,100/Bluegill		0.006(0.003-0.008)	
AC92,100/Rainbow trout		0.008(0.005-0.010)	

<sup>a</sup> Bioassay conducted at 18°C (± 0.5), mean weight of Bluegill 1.2 g.

<sup>b</sup> Bioassay conducted at 13°C (± 0.5), mean weight of Rainbow trout 1.5 g.

<sup>c</sup> 95% confidence interval.

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Table 2 - Concentrations tested and corresponding observed percent mortalities for Bluegill and Rainbow trout after 24 and 96 hours exposure to Cycoce<sup>®</sup> and Experimental Insecticide AC92,100.

Compound/species	Concentration (mg/l)	Mortality Observed (pH)	
		24 hour	96 hour
Cycoce <sup>®</sup> /Bluegill	1000.0	0 (6.8)	0 (6.6)
	500.0	0	0
	100.0	0	0
	50.0	0	0
	10.0	0	0
	1.0	0 (7.1)	0 (7.1)
	Control	0 (7.1)	0 (7.1)
Cycoce <sup>®</sup> /Rainbow trout	1000.0	0 (6.9)	0 (6.8)
	500.0	0	0
	100.0	0	0
	50.0	0	0
	10.0	0	0
	1.0	0 (7.1)	0 (7.0)
	Control	0 (7.1)	0 (7.1)
AC92,100/Bluegill	0.0087	100 (6.9)	100 (6.9)
	0.0065	60	100
	0.0049	0	100
	0.0037	0	40
	0.0028	0 (6.8)	0 (6.9)
	0.0021	0	0
	0.0016	0	0
	0.0012	0 (7.1)	0 (6.9)
	Control	0 (7.1)	0 (7.0)

Table 2 continued.....

Compound/species	Concentration (mg/l)	% Mortality Observed (pH)	
		24 hour	96 hour
AC92,100/Rainbow trout	0.049	100 (6.8)	100 (6.8)
	0.042	90	100
	0.037	50	100
	0.028	20	100
	0.024	0 (6.9)	100 (6.6)
	0.016	0	90
	0.010	0 (6.8)	50 (6.8)
	0.0075	0	40
	0.0049	0	0
	Control	0 (6.9)	0 (6.9)



FELKEL TERBUFOS BMEGILL LC50 (00037483)

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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
8.7	10	10	100	0.09765625
6.5	10	10	100	0.09765625
4.9	10	10	100	0.09765625
3.7	10	4	40	37.69531
2.8	10	0	0	0.09765625
2.1	10	0	0	0.09765625
1.6	10	0	0	0.09765625
1.2	10	0	0	0.09765625

THE BINOMIAL TEST SHOWS THAT 2.8 AND 4.9 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 3.834167

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

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FELKEL TERBUFOS RAINBOW TROUT LC50 (00037483)

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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB. (PERCENT)
49	10	10	100	0.09765625
42	10	10	100	0.09765625
37	10	10	100	0.09765625
28	10	10	100	0.09765625
24	10	10	100	0.09765625
16	10	9	90	1.074219
10	10	5	50	62.30469
7.5	10	4	40	37.69531
4.9	10	0	0	0.09765625

THE BINOMIAL TEST SHOWS THAT 4.9 AND 16 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 10

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
4	0.1006994	9.699372	8.012973	11.56775

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
7	0.2021697	1	0.9792681

SLOPE = 6.193253  
 95 PERCENT CONFIDENCE LIMITS = 3.408563 AND 8.977943

LC50 = 9.412165  
 95 PERCENT CONFIDENCE LIMITS = 7.728582 AND 11.43086

LC10 = 5.869859  
 95 PERCENT CONFIDENCE LIMITS = 3.728554 AND 7.254201

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