4-12-82
Duplicate

DATA EVALUATION

1. CHEMICAL: Cypermethrin

2. FORMULATION: 98.1 % active ingredient (Technical, WL 43467)

3. CITATION: Stephenson, R.R., and D.F. Kane (1980) the acute toxicity of cypermethrin (WL 43467) to the freshwater shrimp (Gammerus pulex) and larvae of the mayfly, (Cleon dipterum), in continuous-flow tests. Unpublished report from Shell Research Ltd, submitted 12/28/81 by ICI Americas, Wilmington, Delaware

EPA Accession No. 070562

4. REVIEWED BY: Thomas B. Johnston
Biologist, EEB/HED

5. REVIEW DATE: April 12, 1982

6. TEST TYPE: Acute toxicity in flow-through system (96-hr EC_{50} and LC_{50})

7. REPORTED RESULTS: The reported 96-hr EC_{50} and LC_{50} values of cypermethrin for Cleon dipterum are 4 and 20 pptr. The 96-hr EC_{50} and LC_{50} values for Gammarus pulex are 5 and 9 pptr.

8. REVIEWER'S CONCLUSIONS: This study is scientifically sound, and fulfills USEPA guideline requirements for an acute toxicity test using an aquatic invertebrate. With 96-hr EC_{50}s and LC_{50}s of $\leq$ 20 pptr, cypermethrin is very highly toxic to mayfly larvae and freshwater shrimp (isopods).

MATERIALS/METHODS

Methods used generally followed USEPA guidelines. Concentrations used in the EC_{50} and LC_{50} calculations were mean measured values, rather than nominal ones. The EC_{50} test criterion was inability to make normal escape movements in response to repeated tacitle stimulation. Concentrations below detection limits were estimated by linear extrapolation. After the 96-hr period, the organisms still alive were transfered to clean water and observed for 24 hours.

STATISTICAL ANALYSES

Data were analyzed according to the probit method.

RESULTS

Gammarus pulex

Concentrations (pptr)	No. Affected	No. Dead	No. Exposed
24	10	10	10
10	10	7	10
7	5	1	10
2	3	0	10
0.7	0	0	10
Control	0	0	10

EC_{50} 4 pptr. (95% confidence limits 2-7 pptr.)
LC_{50} 9 pptr. (95% confidence limits 7-10 pptr.)

Cleon dipterum

Concentrations (pptr)	No. Affected	No. Dead	No. Exposed
83	15	13	15
47	15	7	15
24	15	5	15
(6)	10	7	15
(2)	4	2	15
Control	1	1	15

EC_{50} = 4 pptr (2-6 pptr)
LC_{50} = 20 pptr (10-70 pptr)

The relatively small changes in the EC_{50} values from 24 hrs to 96 hrs indicate that the 96 hr values were close to the threshold values for the two species. Therefore, longer exposure periods would be unlikely to produce lower EC_{50} values. Both species showed some decline in LC_{50} from 24 hrs to 96 hrs, which indicates that for lethal effects a threshold night not have been reached by 96 hrs.

G. pulex were shown to recover the ability to make escape responses when returned to uncontaminated water. The ability of C. dipterum to do so was not assessed because of high control mortalities.

CONCLUSIONS:

Validation Category: Core

Category Rationale: N/A

Category Repairability: N/A

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH EC50 GAMMMARUS PULEX

****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB (PERCENT)
24	10	10	100	.0976563
10	10	10	100	.0976563
7	10	5	50	62.3047
2	10	3	30	17.1875
.7	10	0	0	0976563

THE BINOMIAL TEST SHOWS THAT .7 AND 10 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.

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
3	.115454	3.82181	2.68263	5.61214

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
6	.199139	1	.116917

SLOPE = 2.81819
95 PERCENT CONFIDENCE LIMITS = 1.56058 AND 4.07581

LC50 = 4.02374
95 PERCENT CONFIDENCE LIMITS = 2.42798 AND 6.06021

LC10 = 1.42556
95 PERCENT CONFIDENCE LIMITS = .463857 AND 2.37658

****

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH LC50 GAMMARUS PULEX

****

CONC	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB (PERCENT)
24	10	10	100	.0976563
10	10	7	70	17.1875
7	10	1	10	1.07422
2	10	0	0	.0976563
7	10	0	0	.0976563

THE BINOMIAL TEST SHOWS THAT 7 AND 24 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 8.94619

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
3	.227759	9.99477	6.46001	16.4731

NO CONVERGENCE IN 25 ITERATIONS. THE PROBIT METHOD
PROBABLY CANNOT BE USED WITH THIS SET OF DATA

****

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH EC50 GAMMMARUS PULEX

****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB (PERCENT)
24	10	10	100	.0976563
10	10	10	100	.0976563
7	10	5	50	62.3047
2	10	3	30	17.1875
.7	10	0	0	0976563

THE BINOMIAL TEST SHOWS THAT .7 AND 10 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.

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
3	.115454	3.82181	2.68263	5.61214

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
6	.199139	1	.116917

SLOPE = 2.81819
95 PERCENT CONFIDENCE LIMITS = 1.56058 AND 4.07581

LC50 = 4.02374
95 PERCENT CONFIDENCE LIMITS = 2.42798 AND 6.06021

LC10 = 1.42556
95 PERCENT CONFIDENCE LIMITS = .463857 AND 2.37658

****

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH LC50 GAMMARUS PULEX

****

CONC	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB (PERCENT)
24	10	10	100	.0976563
10	10	7	70	17.1875
7	10	1	10	1.07422
2	10	0	0	.0976563
7	10	0	0	.0976563

THE BINOMIAL TEST SHOWS THAT 7 AND 24 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 8.94619

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
3	.227759	9.99477	6.46001	16.4731

NO CONVERGENCE IN 25 ITERATIONS. THE PROBIT METHOD
PROBABLY CANNOT BE USED WITH THIS SET OF DATA

****

5

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH EC50 CLEON DIPTERUM

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB (PERCENT)
83	14	14	100	6.10351E-03
47	14	14	100	6.10351E-03
24	14	14	100	6.10351E-03
6	14	9	64.2857	21.1975
2	14	3	21.4286	2.86865

THE BINOMIAL TEST SHOWS THAT 0 AND 24 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 4.20292

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
2	.150857	4.20932	2.38183	6.39319

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
6	.26052	1	.937913

SLOPE = 2.91082
95 PERCENT CONFIDENCE LIMITS = 1.42511 AND 4.39655

LC50 = 4.03064
95 PERCENT CONFIDENCE LIMITS = 2.50845 AND 6.18719

LC10 = 1.47595
95 PERCENT CONFIDENCE LIMITS = .426733 AND 2.4028

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH LC50 CLEON DIPTERUM

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB (PERCENT)
83	14	12	85.7143	.646972
47	14	6	42.8571	39.5263
24	14	4	28.5714	8.97827
6	14	6	42.8571	39.5263
2	14	1	7.1429	.0915527

THE BINOMIAL TEST SHOWS THAT 2 AND 83 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 51.3172

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
4	.224782	30.5791	18.7859	54.7832

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
5	2.32764	2.72414	.0425795

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

SLOPE = 1.00482
95 PERCENT CONFIDENCE LIMITS =-.528195 AND 2.53783

LC50 = 29.6523
95 PERCENT CONFIDENCE LIMITS = 0 AND +INFINITY

LC10 = 1.61491
95 PERCENT CONFIDENCE LIMITS = 0 AND 12.6258

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH EC50 CLEON DIPTERUM

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB (PERCENT)
83	14	14	100	6.10351E-03
47	14	14	100	6.10351E-03
24	14	14	100	6.10351E-03
6	14	9	64.2857	21.1975
2	14	3	21.4286	2.86865

THE BINOMIAL TEST SHOWS THAT 0 AND 24 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 4.20292

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
2	.150857	4.20932	2.38183	6.39319

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
6	.26052	1	.937913

SLOPE = 2.91082
95 PERCENT CONFIDENCE LIMITS = 1.42511 AND 4.39655

LC50 = 4.03064
95 PERCENT CONFIDENCE LIMITS = 2.50845 AND 6.18719

LC10 = 1.47595
95 PERCENT CONFIDENCE LIMITS = .426733 AND 2.4028

JOHNSTON CYPERMETHRIN 96HR FLOW-THROUGH LC50 CLEON DIPTERUM

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB (PERCENT)
83	14	12	85.7143	.646972
47	14	6	42.8571	39.5263
24	14	4	28.5714	8.97827
6	14	6	42.8571	39.5263
2	14	1	7.1429	.0915527

THE BINOMIAL TEST SHOWS THAT 2 AND 83 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 51.3172

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
4	.224782	30.5791	18.7859	54.7832

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
5	2.32764	2.72414	.0425795

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

SLOPE = 1.00482
95 PERCENT CONFIDENCE LIMITS =-.528195 AND 2.53783

LC50 = 29.6523
95 PERCENT CONFIDENCE LIMITS = 0 AND +INFINITY

LC10 = 1.61491
95 PERCENT CONFIDENCE LIMITS = 0 AND 12.6258