(TDR03P) 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 05100542

FORMULATION 00 = ACTIVE INGREDIENT

FICHE/MASTER ID 00087717 CONTENT CAT 01

Roberts, S.; Wineholt, R.L. (1976) 8-day Dietary LC50 Study of Terbufos in Bobwhite Quail and Mallard Duck: Laboratory No. 6E-3165. (Unpublished study received Nov 24, 1976 under 2749-427; prepared by Cannon Laboratories, Inc., submitted by Aceto Chemical Co., Inc., Flushing, N.Y.; CDL:226950-A)

SUBST. CLASS = S.

DIRECT RVW TIME = 8 hrs.(MH) START-DATE 10/4/82 END DATE 11/10/82

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: 12/10/82

APPROVED BY:
TITLE:
ORG:
LOC/TEL:

SIGNATURE: DATE:

13 pages

DATA EVALUATION RECORD

1. Chemical: Terbufos (Shaughnessy #105001)

2. Formulation: Technical 86% a.i. (F. Betz review)

3. Citation: Roberts, S. and Wineholt, R. 1976. 8-day dietary LC_{50} study of terbufos in bobwhite quail and mallard ducks. Report prepared by Cannon Laboratories, Inc. for Aceto Agricultural Chemicals Corp. (MRID#00087717)

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

5. Date Reviewed: November 3, 1982

6. Test Type: Avian dietary LC_{50}

A. Test Species: Bobwhite quail (Colinus virginianus)

Mallard duck (Anas platyrhynchos)

7. Reported Results: 8-day dietary LC_{50} for the bobwhite quail is 140(107-183) ppm and for the mallard, 160(131-195) ppm.

8. Reviewer's Conclusions:

The bobwhite quail study is considered scientifically sound and with an LC_{50} of 143(103-214) ppm (moving average method), indicates that terbufos is highly toxic to this species; the intent of proposed guidelines (7/10/78) is met for an avian dietary test with this species. The mallard study is invalid due to low body weights in treatment and control and very low food consumption in treatment groups, relative to controls.

METHODS REPORTED

Preliminary toxicity studies were initiated to establish the dietary levels to be utilized during the 8-day feeding study.

The birds for the 8-day dietary phase were randomly selected and placed in groups as follows:

Groups	Species	Birds/Pen	Test Material	Dietary Concentration Range
6	Mallard duck	10	Terbufos	100-1000 ppm
6	Bobwhite quail	10	Terbufos	25-350 ppm
6	Mallard duck	10	Dieldrin	25-100 ppm
6	Bobwhite quail	10	Dieldrin	5-50 ppm
4	Mallard duck	10	Normal Control	-
4	Bobwhite quail	10	Normal Control	-

A total of 160 Bobwhite quail and 160 Mallard ducks were used in this study. Birds of between 10 and 15 days of age, randomly selected, were housed in thermostatically controlled quarters for the acclimatization period and for the duration of this study.

Dosage Preparation:

The test material "Terbufos" and dieldrin (the positive control) were dissolved in edible grade corn oil and incorporated into the ration such that the concentration of the corn oil containing test material represented 2 parts (by weight) of the diet while the standard bird ration (Anthony's Game Bird Chow) represented 98 parts (by weight).

Normal control ration was prepared using edible grade corn oil minus test material and standard bird ration as described above.

Treatment:

During the pre-treatment acclimatization period, all of the birds received normal control ration as indicated above.

During the 8-day procedure, the test birds received diets containing their respective dosage level of the test material for the first 5 days, then standard bird ration was substituted and fed for an additional 3 days. Feed and water were available at all times.

Observations:

Birds were observed during the acclimatization period, during the 5-day test material feeding period and during the 3-day observation period for the following: (1) body weight at day 0 by group, (2) food consumption based upon the total consumption per group, (3) time of death (day) of each bird, (4) symptoms of toxicity, and (5) percent mortality of each group including the controls.

Calculations:

Eight day LC_{50} determination have been calculated in accordance with the method of Litchfield, J.T., Jr. and Wilcoxon, F., "A Simplified Method of Evaluating Dose-Effect Experiments", J. Pharm. and Exp. Therap. 96, 99-113 (1949).

Results:

Mallard ducks, when administered "Terbufos" in concentrations between 100 ppm and 1,000 ppm, exhibited signs of abnormal behavioral or mortality. Bobwhite quail, when administered "Terbufos" in concentrations between 25 ppm and 350 ppm, exhibited signs of abnormal behavior or mortality. Note signs of abnormal behavior were decreased locomotor activity, feather erection and loss of righting reflex.

Dieldrin, when administered to Mallard ducks, caused decreased locomotor activity at 25 ppm, but no fatalities. Decreased locomotor activity, feather erection and loss of righting reflex were observed at all of these levels. In Bobwhite quail, 5 ppm of dieldrin caused decreased locomotor activity, but no fatalities. Decreased locomotor activity, loss of righting reflex, feather erection and varying rates of death were observed at 10, 20, 30, 40 and 50 ppm.

All control groups of Mallard ducks and Bobwhite quail exhibited no signs of abnormal behavior or mortality. See Tables 3 and 13 for mallard and bobwhite quail body weight, food consumption, and dose-mortality data.

Summary:

Effects of "Terbufos" were observed in all dose levels for both Mallard ducks and Bobwhite quail. In each species, only one death occurred at the low dose while high dose showed no survivors.

Varying rates of death occurred in Mallard ducks exposed to dieldrin at concentrations of between 35 and 100 ppm and in Bobwhite quail exposed to feed concentrations between 10 ppm and 50 ppm. Rates of death were directly proportional to toxicant (dieldrin and "Terbufos") in both cases.

The 8-day dietary LC_{50} for dieldrin in Mallard ducks is 52 ppm (upper limit = 63, lower limit = 43) and 20 ppm (upper limit = 29, lower limit = 14) in Bobwhite quail. "Terbufos" is less toxic then dieldrin in both Mallard ducks, LC_{50} = 160 ppm (upper limit = 195 ppm, lower limit = 131 ppm) and Bobwhite quail, LC_{50} = 140 ppm (upper limit = 183 ppm, lower limit = 107 ppm).

Reviewer's Evaluation

Methods reported were generally consistent with proposed subpart E guidelines (7/10/78). However, problems with low mallard body weights in treatment and control groups and low food consumption is treatment groups, relative to controls, caused this test to be invalidated by F. Betz. High apparent food consumption in the bobwhite quail study was considered most likely due to spillage (see appended reviews by F. Betz). EEB computer analysis indicates an LC_{50} of 143(103-214) ppm using the moving average method and 137(75-250) ppm using the binomial test, for the bobwhite quail.

Conclusions

1. Category: Mallard study: invalid
   Bobwhite quail study: core

2. Rationale: Mallard study: see above evaluation
   Bobwhite quail study: Study meets intent of proposed guidelines (7/10/78).

3. Repairability: Mallard study: No
   Bobwhite quail study: N/A

Cannon Laboratories, Inc.

TABLE 3
SUMMARY: 8-DAY DIETARY FEEDING STUDY OF "TERBUFOS"

SPECIES: MALLARD DUCK

GROUP	DIETARY LEVEL (PPM)	BODY WEIGHT* DAY 0 (GMS)	FOOD** CONSUMPTION (GMS)	DEATH RATE/DAY 1	2	3	4	5	6	7	8	% MORTALITY
1	100	355	811	0	0	1	0	1	0	0	0	20
2	150	350	759	0	1	0	1	2	0	0	0	40
3	250	371	302	1	2	1	3	2	0	0	0	90
4	500	370	100	4	3	1	1	1	-	-	-	100
5	750	355	40	4	2	2	1	1	-	-	-	100
6	1000	340	35	5	2	3	-	-	-	-	-	100

SPECIES: BOBWHITE QUAIL

GROUP	DIETARY LEVEL (PPM)	BODY WEIGHT* DAY 0 (GMS)	FOOD** CONSUMPTION (GMS)	DEATH RATE/DAY 1	2	3	4	5	6	7	8	% MORTALITY
1	25	145	367	0	0	0	0	1	0	0	0	10
2	75	140	351	0	0	0	0	0	0	0	1	10
3	125	164	349	0	0	1	2	1	2	0	0	60
4	200	195	356	0	0	0	0	1	3	0	0	40
5	250	157	100	0	0	1	1	5	2	0	0	90
6	350	141	176	0	1	1	3	2	2	-	-	100

*Body weight/cage group

**Food consumption based upon total consumption per pen

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TABLE 13

SUMMARY: 8-DAY DIETARY FEEDING STUDY OF NORMAL CONTROL

SPECIES: MALLARD DUCK

GROUP	DIETARY LEVEL (PPM)	BODY WEIGHT* DAY 0 (GMS)	FOOD** CONSUMPTION (GMS)	DEATH RATE/DAY 1	2	3	4	5	6	7	8	% MORTALITY
1	-	363	2,400	0	0	0	0	0	0	0	0	0
2	-	365	2,405	0	0	0	0	0	0	0	0	0
3	-	375	2,385	0	0	0	0	0	0	0	0	0
4	-	360	2,420	0	0	0	0	0	0	0	0	0

SPECIES: BOBWHITE QUAIL

GROUP	DIETARY LEVEL (PPM)	BODY WEIGHT* DAY 0 (GMS)	FOOD** CONSUMPTION (GMS)	DEATH RATE/DAY 1	2	3	4	5	6	7	8	% MORTALITY
1	-	155	1,075	0	0	0	0	0	0	0	0	0
2	-	160	1,100	0	0	0	0	0	0	0	0	0
3	-	165	1,050	0	0	0	0	0	0	0	0	0
4	-	170	1,055	0	0	0	0	0	0	0	0	0

*Body weight/cage group

**Food consumption based upon total consumption per pen

TEST: Avian Subacute Dietary LC_{50}

SPECIES: Mallard

RESULTS: LC_{50} = 160 (131-195) ppm.

Dose levels ranged from 100 to 1000 ppm. Twenty percent mortality occurred at 100 ppm and 100% mortality at 500 ppm and above. All deaths occurred within the first 3-5 days.

CHEMICAL: Terbufos (86% a.i.)

TITLE: Report 8-Day Dietary LC_{50} Study of Terbufos in Bobwhite Quail and Mallard Ducks.

AUTHOR: Cannon Labs. Inc.

STUDY DATE: October 21, 1976

ACCESSION NO.: 226950

REGISTRANT: Aceto Agricultural Chemicals Corp.

VALIDATION CATEGORY: Invalid

Some of the body weight and food consumption data are clearly in error. Average body weight of test and control birds was 34-38 grams (10-15 days old), whereas expected body weight would be 100-200 grams. Also, average food consumption was 30 gms/bird/day for controls compared to 3.1 to 12.7 gms/bird/day for test animals, whereas the expected value for birds of this age is 20-40 gms/bird/day). I spoke with Mr. Sam Charles on November 7, 1978 (Cannon Labs.) concerning these discrepancies. He agreed that there was a problem and indicated they would re-run the test.

Mallard

A) Test Birds (10-15 days old)

Avg. Body Wgt. @ Day 0 = 34-37 grams

Avg. Food Consump. = 3.1-12.7 gms/bird/day 10-30%

B) Controls

Avg. Body Wgt. @ Day 0 = 36-38 grams

Avg. Food Consump. = 30 gms/bird/day 83%

C) Expected

Avg. Body Wgt. @ Day 9-14 = 100-200 grams

Avg. Food Consump. = about 20% (20-40 grams)

D) Dieldrin Controls

Avg. Body Wgt. = 135-162 grams

Avg. Food Consump. = 19

Reviewer: Betz
7/13/79

TEST: Avian Dietary LC_{50}

SPECIES: Bobwhite quail

RESULTS: LC_{50} = 140 (107-183) ppm

Dose levels were 25-350 ppm (6 treatments).

Mortality began at the 25 ppm level (10%) and was 100% at 350 ppm.

Average body weight of test birds was about 16 grams and food consumption was 13 gms/bird/day or 81% of body weight. I spoke with Cannon Labs. (Mr. Sam Charles, November 7, 1978) concerning the food consumption figure which is obviously too high. He had no explanation other than spillage of feed that was not accounted for. I decided to accept the study since it is adequate in other respects.

CHEMICAL: Terbufos (86% a.i.)

TITLE: 8-Day Dietary LC_{50} Study of Terbufos in Bobwhite Quail and Mallard Ducks.

AUTHOR: Cannon Labs. Inc.

STUDY DATE: October 21, 1976

ACCESSION NO. 226950

REGISTRANT: Aceto Agricultural Chemicals Corp.

VALIDATION CATEGORY: Core

Bobwhite quail

A) Test Birds (10-15 days old)

Avg. Body Wgt. @ Day 0 = 14-19.5 grams

Avg. Food Consump. = 4.8-6.5 gms/bird/day = 30%

B) Controls

Avg. Body Wgt. @ Day 0 = 15.5-17.0 grams

Avg. Food Consump. = 13 gms/bird/day = 81%

C) Expected

Avg. Body Wgt. @ Day 9-14 = 16-30 grams

Avg. Food Consump. = 4-5 gms/bird/day = 23%

D) Dieldrin Controls

Avg. Body Wgt. = 26-35 grams

Avg. Food Consump. = 9.8

FELKEL TERBUFOS BOBWHITE LC50 (R+W)

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
350	10	10	100	0.09765625
250	10	9	90	1.074219
200	10	4	40	37.69531
125	10	6	60	37.69531
75	10	1	10	1.074219
25	10	1	10	1.074219

THE BINOMIAL TEST SHOWS THAT 75 AND 250 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 136.9306

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
4	0.2328721	142.8813	102.5795	214.2015

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
6	1.179076	2.576121	0.03559946

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

SLOPE = 2.710246
95 PERCENT CONFIDENCE LIMITS =-0.2326819 AND 5.653175

LC50 = 128.0151
95 PERCENT CONFIDENCE LIMITS = 0 AND +INFINITY

LC10 = 43.51802
95 PERCENT CONFIDENCE LIMITS = 0 AND 100.2426

Reviewer
Retz 7/13/79

TEST: Avian Dietary LC_{50}

SPECIES: Mallard

RESULTS: LC_{50} = 520 (400-676) ppm

CHEMICAL: Terbufos Technical (86% a.i.)

TITLE: Report Avian Dietary LC_{50} (5-Day Dietary Exposure) of Enlist Technical (Terbufos Technical) EPA File Symbol UEL to Mallard Duck.

AUTHOR: John W. Krize, Cannon Labs. Inc.

STUDY DATE: December 3, 1979

ACCESSION NO.

REGISTRANT: Aceto Chemical Co.

VALIDATION CATEGORY: Core

COMMENTS:

Age of birds was stated as 10-15 days. Mean body weights were 267 to 310 grams at beginning of test. Expected body weights for birds in this age class is 100-250 grams.

Food consumption was suppressed at all treatment levels, to the extent that birds in the highest treatment level ate 0.4 grams feed/day or less for four consecutive days (<0.2% of body weight/day). It is obvious that the toxicant acted as a repellent and that the true dietary toxicity of terbufos was not determined in this test. However, the study is acceptable in meeting agency registration requirements. For the purpose of hazard evaluation, the Bobwhite quail LC_{50} (140 ppm) should be used. This conclusion is based, in part, on discussions with Richard Tucker (EEB 6/26/79).