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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
 WASHINGTON, D.C. 20460

10 JUN 1985

OFFICE OF  
 PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Peer Review of Terbufos Field Study

TO: Peer Review Panel Members

Mike Slimak has asked me to set up a peer review of the Terbufos Avian Field Study reviewed by John Bascietto, dated May 24, 1985. I, therefore, request that the following persons peer review said study:

Tom Armitage, Chairman

Dan Rieder

~~Charlie Lewis~~ ED FITE

Richard Lee

If anyone has a problem with this, please let me know.

*Norm Cook*  
 Norm Cook, Acting Chief  
 Ecological Effects Branch

Attachment

cc: John Bascietto  
 Dave Coppage

MEMORANDUM

SUBJECT: Peer Review of Terbufos Field Study

FROM: Peer Review Panel: Armitage, Fite, Lee, Reider

TO: Michael Slimak, Chief  
Ecological Effects Branch

The peer review panel has completed its evaluation of the Terbufos Avian Field Study reviewed by John Bascietto. The stated objectives of the field study were: 1) To monitor avian populations inhabiting areas in and around test fields before and after two separate applications of Counter 15G, (Terbufos) 2) To perform intensive carcass searches to determine whether acute mortality of mammals and birds can be caused by ground and aerial applications of Counter 15G to corn 3) To collect dead and moribund birds and other animals for whole body residue analysis in order to document levels of exposure to Terbufos.

On the basis of available study data, the peer review panel concurs with the following conclusions drawn by the reviewer:

- 1) The study partially fulfills the requirement for testing of the acute mortality potential of Counter 15G as specified by the June, 1983, E.P.A. publication of re-registration guidance.
- 2) The study fulfills a requirement to determine the incremental acute risk to birds and mammals posed by an amendment to the re-registration standard to add aerial and ground broadcast applications of Counter 15G on corn.
- 3) The study demonstrates that when Counter 15G is applied with ground equipment at 16 oz. per 1000 ft. of row, acute mortality of birds and reptiles results.
- 4) The study demonstrates that when Counter 15G is applied aerially at 6.7 lbs. per acre, mammal, bird and reptile mortalities result.
- 5) Fish are killed by aerial applications of Counter 15G.
- 6) Exposure of wildlife to Terbufos was clearly demonstrated by analysis of whole body residues.
- 7) The avian census data derived from the study were useful in determining the species and relative numbers of individuals within each species that were present during the study. However, the census techniques used

in the study do not enable the reviewer to draw conclusions about the effect of Terbufos upon bird populations.

- 8) Currently registered ground-applied, soil-incorporated uses of Terbufos must be classified as restricted.

The reviewer has used data presented in the study to derive expected mortality of fish and wildlife resulting from the use of Terbufos on 9.3 million acres of corn.

It is the consensus of the peer review panel that the study data should be interpreted with caution when estimating expected avian, mammalian, and reptilian mortality.

The following weaknesses in study design raise questions regarding the use of study data to develop quantitative estimates of expected mortality:

- 1) No control data are available to establish baseline values for natural mortality.
- 2) Estimates of carcass search efficiency (50%) may be unrealistic because carcasses were not randomly distributed, and were instead placed "within a reasonable distance of a search transect".
- 3) Because of the small sizes of fields used in this study, experimental results cannot be extrapolated to draw conclusions with respect to large use areas.

It is, therefore, the recommendation of the peer review panel that reference to specific estimates of expected pesticide induced mortality be modified in the data evaluation record and the review of Terbufos. Members of the peer review panel suggest that the reviewer may want to indicate that the results of the study raise great concern over the use of Terbufos, which is applied to more than 9.3 million acres of corn annually. Based on the results of this study, the reviewer would be justified in stating that the resultant mortality of birds, mammals, and reptiles could be on an order of magnitude reaching millions of these organisms.

It is, furthermore, the consensus of the peer review panel that additional field studies be required to better quantify the effects of this pesticide upon aquatic and terrestrial species. Additional terrestrial field studies should be conducted within a larger study area and over a longer period of time, using more sophisticated techniques to estimate population effects upon avian, mammalian, and reptilian species. Mark and recapture techniques, radio telemetry, measurement of year class strength and recruitment success, and or other appropriate techniques should be used to derive quantitative estimates of the impact of pesticide use upon populations of

exposed organisms. Control studies should also be undertaken to provide baseline data. Protocol for these studies should be approved by EEB's field study committee prior to study initiation.

Submitted by Peer Review Panel,

Thomas Armitage *Thomas Armitage 6-27-85*

Ed Fite *Ed Fite 6/24/85*

Richard Lee *Richard M. Lee 6/24/85*

Daniel Reider *Daniel Reider 6/24/85*

cc: John Bascietto

To: Panel Members on peer review team for Terbufos field study  
From: Tom Armitage

We have been asked to look at John Bascietto's review of the Terbufos field study.

### Background

Terbufos is currently registered for use on corn. Application methods are limited to ground machinery. The registrant has applied for a label amendment to permit application using aerial methods. A field study was required to evaluate incremental risk resulting from aerial application, and also as part of the reregistration data package. Upon review of the field study John has concluded that:

- a) Terbufos should be a restricted use pesticide when ground application is used.
- b) Aerial application of Terbufos should not be permitted.

Attached please find copies of:

- a) John's DER of the study.
- b) John's Review of Terbufos.
- c) Materials and methods, Results, and Discussion taken from the field study.

### Meeting

After you have looked at these items I would like to meet to discuss John's review. I would like to meet on Thursday 6/20, some time in the morning. Let me know if this presents

We may wish to consider the following:

- 1) John has classified the study as core.  
Do we concur? Is the study scientifically sound?
- 2) Based upon study results John has estimated the number of birds, mammals, and reptiles that could be expected to die if Terbufos is applied to corn. Can we really extrapolate these values from the results of the study? Should an alternative method or approach be used to estimate mortalities?
- 3) Can the study be used to show any population effects? Should another study be required to provide more useful information, or is this study adequate for the risk assessment.

## Conclusions

- 1) Scientifically sound
- 2) Demonstrates that when coumatralb is applied with ground equipment at 16 oz per 1000 ft of row acute mortality of birds and reptiles results.
- 3) when applied aerially at 6.7 lbs per acre significant mammal bird and reptile mortalities result.
- 4) Fish are also killed by aerial applications.
- 5) Exposure to terbuthos was clearly demonstrated by analysis of whole body residues.

multi-year, multi-site avian, mammalian and reptilian studies should be undertaken to determine potential for population impacts. Studies may include but not be limited to - nesting effects - reproductive parameters - behavioural ecology - population stability.

Meeting - ERS - IED American Cyanamid - Wildlife International. Specifically agreed that objective of single year use study - establish whether acute

- a) mortality of mammals and birds can be caused by applications to corn
- b) if so could exposure to terbuthos be established in carcasses of dead animals found in corn fields

- validity of studies should depend on how well they simulated registered label and proposed label amendment.

## Study weaknesses

- no controls
- aerial application not marked on ground.

## Field observations

- [unclear]



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### Study weaknesses

- no controls
- animal activities not marked on ground.

### Field observations

- location
- activity
- habitat type
- species

### Effect of Predator Removal Evaluation

25-18 carcasses

observed 24-48-72 hrs after placement

initial scavenged removed

4 in field  
others adjacent

land

<u>predator removal</u>		
intact	82%	24 hrs
	60%	48 hrs
	36%	72 hrs

<u>aerial</u>	
94%	24 hrs
89%	48 hrs
50%	72 hrs

Search efficiency

ground  
mean 46%

aerial  
64%

sk

~~no inclusions~~

ground

- Authors conclusions - no conclusion from bird survey
- Death of rat snake box-turtle may not have been compound related
  - Mummy does not likely killed due to exposure
  - Recovery from sublethal exposure?

aerial search

- Aerial surveys showed no substantial evidence to indicate that any significant impact occurred on avian populations
- woodchuck death not turbotos related - no residues
- mammal tracks
- potential routes of exposure - dermal real contact poisoning ingestion while feeding
- impact on raccoon & cottontail populations is uncertain

John's conclusion

Census Data

used to study spp & relative number exposed  
 population estimate  
 not necessary to study sex, year class distribution,  
 breeding condition nesting success, physiological condition

General

- ~~no conclusions~~
- Authors conclusions - no conclusion from bird survey
- Deaths of rat snake box turtles may not have been compared related
- Mowing does not likely killed due to exposure
- Recovery from sublethal exposure?

Aerial spray

- Aerial surveys showed no substantial evidence to indicate that any significant impact occurred on avian populations
- woodchuck deaths not turtles related - no residues -
- mammal tracks
- potential routes of exposure - dermal and contact poisoning, ingestion while feeding.
- impact on raccoon & cottontail populations is uncertain.

John's  
conclusion

### Census Data

used to study spp & relative number exposed  
population estimate

not necessary to study sex, year class distribution,  
breeding condition, nesting success, physiological condition.

### Carcass

- no measurement of cop interia
- lack of control fields - small rodents only

## Avian Survey

- Total # of bird observations
- total number of bird observations in the field
- total bird observations of feeding in field
- total survey miles
- total bird species

conclusion

author states - No pattern of change in total bird numbers at test site that could be attributed to counter 156

Results  
of  
ground  
applic:

~~1-22~~ ~~bird observations~~ 7-9 days pre application  
statistical analysis?

Bird survey shows little if any bird.

## Carcass Searching

vertebrates

5 dead animals  
3 birds & reptiles

} ~~and~~

2 ~~straw~~ with  
conceivable herbicide residue

others

7 feather spots

2 birds exhibit toxicity

1 decomposing snake

1 *L. garyi* snake.

aerial  
application:

Post application reduction

## Carcass Searches

acres treated = 177

more species more killed than in ground phase

7 birds w/ residues

14 mammals w/ residues

1 owl w/ residues

Residuals  
&  
Ground  
applic:

~~8-22 day observation 7-9 days pre application~~  
~~Statistical analysis? Bird survey show little if anything.~~

Carcass Searching

mortality

~~5 dead animals } ~~only~~ 2 ~~observed~~ with  
3 birds & reptiles } demonstrable ~~terbufos~~ residue~~

other

~~7 feather spots 2 birds exhibit toxic  
1 decomp snake 1 ~~lethal~~ snake.~~

aerial  
application:

Post application reduction

Carcass Searches

aces treated = 177

more species more killed than in ground phase

7 birds w/ residues }  
14 mammals w/ residues }  
1 snake w/ residue }  
several fish w/ residues } other

3 odor of dead animal  
1 urine section  
5 feather spots  
1 skunk fur

estimated mortality assigned  
Zoochore carcasses reported  
feather spots  
decomposition  
Other sources of mortality

- only one extra carcass per site assigned to predators removed & recovery

- Rainfall
- recovered birds
- lack of control fields further assumption of mortality

need for aquatic study

Residual analysis - marginal use - no explanation of treatment

Lack of control fields - reason for reporting study >

~~purpose, purpose, problem  
impact~~

Application Precision

Ground phase - adequate calibration of distance

aerial phase - acceptable level of precision not accomplished

But... impacts

EEP Estimate

1) All feather spots > crop-related

recovered more  
- lack of control fields & like assessment of mortality  
need for aquatic stud

Residue analysis - normal use - no explanation of treatment

Lack of control fields - reason for registering study?

~~Organic phosphorus problem  
impact~~

application procedure

Ground phase - adequate calibration & delivery

aerial phase - variable level of residue in environment

Round

Estimate of impact

EER Estimate

1) All further spots } comp related  
mortality  
residue  
operated status

50% efficiency in search }  
20% removal by predation } 70% loss

airial - 2000

ppm residue much higher



Extrapolate - made clear if this is  
a potential to show that there  
would be potential for a central  
overlook -

narrow it - if this type of  
report is exceed over million of acres  
could be the budget of National of  
Buds killed / year. large problem.

Drop out number estimates out,  
will back fire -

Reduce emphasis.

Pages used on 7.3 x 10<sup>6</sup> acres  
if study is report of report over all  
includes by report in books now out  
million. Don't show calculations.

Quantity

Point in DER -

acceptable study - core accept results of  
study - meet guideline requirement.

Search efficacy study - Should have rounded  
put in. faults of concern said.  
- can't use as extrapolate -

Drop out numerical estimates out,  
will backfire -

Reduce emphasis -

Paige used on  $9.3 \times 10^6$  cases  
if study is report of most one or  
individual by most in best seen out  
million. Don't show calculations.

Quantities

Point in DER -

acceptable study - core accept results of  
study - meet guideline requirement.

Search efficacy study - Should have rounded  
put in - faults of common sense  
- can't use as extrapolation -

- residues - adequate does implicate tuberos.

More detail in DER's provide more information.

General formulae in DER - Section about  
BCC.

No further statistical analysis.

Populit  
~~Sheet~~

need layer area and near spherical  
features. Radio telemetry.

lack of  
i) Controls cast doubt -

objective - as tuberos going to kill multiple -  
2 transects - study needs objectives.

Both operations killed - objective of study.

Determined if killed birds mammals reptiles:

- Search efficacy - only used transects
- 50% -

can't depend calculation - dispatcher review.

could lead to large mortalities.  
Justify additional studies.

- suggest study on mammals -

Permitted

Permitted additional studies on ground - additional studies.

overall - need own mammal study  
more intense.

Restrict use and more

- Search efficacy - only used transects
- 50% -

can't defend calculation - dispatcher review.

could lead to large mortalities.  
Justify additional studies.

- suggest study on mammals -

Registered

Recommend additional studies on ground - <sup>additional</sup> studies.

areal - need more mammal work  
more intense.

Restricted use and more

months studies of a larger scale required  
to evaluate impact on avian and mammal assemblage

need to look at Johns temperature

---

of Speculator about recent  
deficit shows.

Answer

Given

9.6 →

study did not allow records based

p. 8 9,500,000 acres

$$\frac{\text{area available } 9.3 \times 10^6 \times .7 - .12}{(6.5 \times 10^5 - 1.6 \times 10^5)} \text{ / acre}$$

found

$$\frac{6.4 \times 10^5 - 7 \times 10^5}{1000}$$

Answer

.06 - .33 / acre based

.05 - .24 / acre assumed based

.02 - .33 / acre water

.07 / acre reptile

$$\times 9.3 \times 10^6 \text{ acres}$$


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CARCASS SEARCH RESULTS BY STUDY SITE - GROUND APPLICATION

DATE	FERRY NECK I	FERRY NECK II	FOX HARBOR	BUSHY HEATH	CAMPER	NORMANDIE
05/24/84 25 26 27	-	-	-6 7 8 9 -10	-	-	-
05/28/84	-	-	-11	-	-	-
05/29/84	-	-	-12	-	-	-
05/30/84 31	-	-	-13	-	-	-
06/01/84 2 3 4 5	-	-	141 dead mourning 15 dove in field found 16 during bird survey 17 - less than 0.05 18 ppm	-	-	-
06/06/84	-	-	19	Group of black feathers on wood edge	-	-
Total No. Carcasses	1	1	1	1	1	0

*Ground Results*

TABLE 7

RESULTS OF ANALYSIS FOR TERBUFOS RESIDUES

GROUND APPLICATION

DATE	DAY*	FIELD	ANIMAL	RESIDUE (PPM)
05/15/84	1	FN I	Affected bluejay	0.24
05/16/84	2	FN I	Black rat snake	**
05/16/84	2	FN II	Box turtle	**
05/18/84	0	FH	Affected American robin	**
06/01/84	14	FH	Mourning dove	**
05/18/84	4	BH	Affected Brown-headed cowbird	**
05/23/84	9	BH	Fledgling	0.15

*measured  
for 2/2/80  
1/2/80*

\* Days after application.

\*\* Below detection limit of 0.05 ppm.  
(BH = Bushy Heath, CA = Camper, FH = Fox Harbor, FN I = Ferry Neck I,  
FN II = Ferry Neck II, ND = Normandie).