US EPA ARCHIVE DOCUMENT

034401

MAY 5/9/78 (B)

EEB BRANCH REVIEW

DATE: IN 11/17/77 OUT 5/9/78 IN _____ OUT _____ IN _____ OUT _____

FISH & WILDLIFE ENVIRONMENTAL CHEMISTRY EFFICACY

FILE OR REG. NO. 1769-203

PETITION OR EXP. PERMIT NO. _____

DATE DIV. RECEIVED _____

DATE OF SUBMISSION _____

DATE SUBMISSION ACCEPTED _____

TYPE PRODUCTS(S): I, D, H, F, N, R, S _____

DATA ACCESSION NO(S). _____

PRODUCT MGR. NO. Gee

PRODUCT NAME(S) Skychoda

COMPANY NAME National Chemsearch

SUBMISSION PURPOSE Added Uses

CHEMICAL & FORMULATION

006501 Aromatic Petroleum Solvent..... 59%

034401 Naled..... 35%

Inert Ingredients..... 6%

100%

Skychoda TM: Amended Registration

100.0 Pesticidal Use

Added pests such as houseflies, mosquitoes, gnats, fruit flies, roaches and brown dog ticks.

Product currently registered for trickle filter fly larvae control.

100.1 Application Methods/Directions/Rates

As a Space Spray for Control of Resistant and Non-resistant House Flies, Little House Flies, Mosquitoes, Gnats and Fruit Flies (Drosophila species) in and around Garbage Dumps, Outside Meat Packing Establishments (including Federally Inspected), docks, ramps, disposal areas, commercial dwellings, open air theatres, restaurants and drive-ins: use 1 oz in 1 gallon water and direct the spray throughout the fly infested area. For increased residual control, concentrate spray application to walls, beams, rafters and around windows, doorways and other fly resting areas. Add 1/2 pound sugar or 1/2 pink Karo syrup when 40 gallons of water is used for best results. Fruit Flies (Drosophila sp.) in and around Food Processing Plants, Loading Docks, cull Piles and Refuse Area and Cider Mills--Use 2 oz in 1 gallon water. Apply as a course spray to walls, floors, doorways, windows, refuse piles and cull piles. Apply every 5 to 7 days as long as necessary to maintain control.

Adult Mosquito, Gnat and House Fly Control--Residential Areas, Woodlands and Swamps--Time application for peak infestation and repeat as necessary. Do not apply to crop areas. Mist Blower Application: 1-1/2 to 2-1/2 gallons in 100 gallons water. Calibrate equipment (rate of travel and output) to apply 1 to 25 lbs. technical naled per acre. Treat shrubbery and vegetation where mosquitoes may rest. Shrubbery and vegetation around stagnant pools, marshy areas, ponds and shore lines may be treated. Direct application to water is prohibited.

Roaches (All Species of Resistant and Nonresistant Cockroaches, including German, Brownbanded, Oriental and American Roaches) inside and outside of apartments, hotels, motels, restaurants, institutions

and other buildings: For Use by Trained Personnel Only. Dilute 3 fl. oz. in 1 gallon of water. Apply as a fine stream or coarse spray into cracks, crevices and where insects can be contacted.

Brown Dog Ticks in Kennels: Do not use this dilution on animals. Use 3-1/2 oz. to 2 gallons of water. Apply as a directed coarse, wet spray, being especially careful to hit all cracks and crevices in floor, walls and ceiling. Also spray outside runways. Repeat treatment in 7 days if continual tick activity is observed.

100.3 Precautionary Labelling

ENVIRONMENTAL HAZARDS: This pesticide is toxic to fish. Keep out of lakes, streams and ponds. Do not contaminate water by cleaning of equipment or disposal of wastes. Do not use prior to periods of heavy rainfall.

101.0 Chemical and Physical Properties

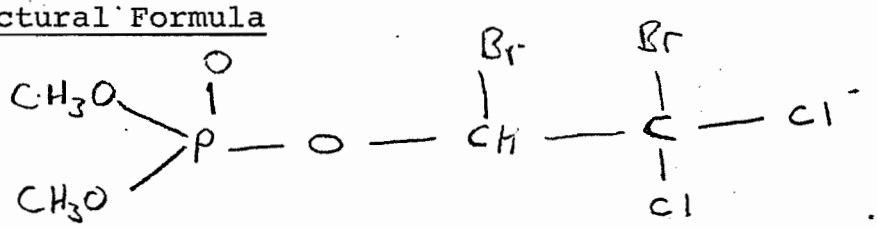
101.1 Chemical Name

1, 2 dibromo - 2, 2 dichloroethyl dimethyl phosphate

101.2 Common Name

Naled, dibrom

101.3 Structural Formula



101.4 Molecular Weight

$C_4 H_7 Br_2 Cl_2 O_4 P = 381$

101.5 Physical State

White, crystalline solid

101.6 Solubility (Environmental Chemistry - Mohawk Laboroatory, 1972)

Water..... <0.5% (5000 ppm)

Xylene..... Completely miscible

Hexane..... <8.0%

102.0 Behavior in the Environment

102.1 Soil

1/2 Life in Hours (R. Ney Review: 2/71)

Soil Type	10ppm Naled	10ppm DDVP
Loam	4.0	5.8
Sandy loam	1.4	3.5
Silt	3.1	2.3
Sand	2.6	8.0

102.2 Water

1/2 Life in Hours

Temp	pH 5	pH 7	pH 9
21°C	24.9	15.9	0.27
37°C	6.0	4.4	0.05

Rate is higher in basic pH range and at higher temperature.

R. Ney 3/20/75.

102.4 Animal

"Levels of Naled in water declined to zero after 4 days while levels of DDVP increased to 0.0053-0.0250 after one day. No detectable levels of Naled showed up in fish analysis. After 1 hour exposure, DDVP residues showed up in fish at 2X. In mussels Naled accumulated to 1/2 X while DDVP showed no accumulation. Crabs showed no accumulation of Naled or DDVP.

Accumulation of Naled residues in marine organisms is not a problem." Ronald Ney 4/22/76.

103.0 Toxicological Properties

103.1 Acute Toxicity

103.1.1 Mammal

Acute oral LD_{50} Rats = 430 mg/kg
Acute oral LD_{50} Guinea Pig = 197 mg/kg

103.1.2 Birds

Mallards LD_{50} = 52.2 mg/kg
Short-tailed grouse LD_{50} = 64.9 mg/kg
Canada Geese LD_{50} = 36.9 mg/kg

(Handbook of Toxicity of Pesticides to Wildlife, Tucker, 1970. No Core studies available).

103.1.3 Fish *

Channel Catfish	LC_{50} (96 hr)	= 0.71 ppm
Rainbow Trout	LC_{50} (96 hr)	= 0.15 ppm
Bluegill Sunfish	LC_{50} (96 hr)	= 0.018 ppm

* No core studies available.

103.1.4 Aquatic Invertebrates

Daphnia pulex	48 hr EC_{50}	= 3.5 ppb
Stonefly	24 hr LC_{50}	= 16.0 ppb
Blue Crab	24 hr ED_{50}	= 0.33 ppm
Pink Shrimp	24 hr ED_{50}	= 0.0055 ppm

103.3.0 Subacute *

Dibrom	LD_{50} (ppm)
Bobwhite	2117
Japanese Quail	1327
Ring-necked Pheasant	2538
Mallard	2724

* USDI, Fish and Wildlife, SSP, No. 191

DDVP (Degradation Product)	LC_{50} (ppm)
Japanese Quail	298
Ring-necked Pheasant	568
Mallard (16 days old)	>5000
Mallard (5 days old)	1317

FORMULATION:			IA	IB	T	FW	EC	R		
% a.i.	SC#	CHEMICAL NAME	Validator:					Date:		
?		Dibrom	Richard Balcomb					4/15/78		
			Test Type: Fish Acute: Warm and Cold Water							
			Test ID.# ES-F & B							

CITATION: A letter from Oliver B. Cope of the U. S. Fish and Wildlife Service, dated 12/15/65, contained the data discussed in this review

VALIDATION CATEGORY: Supplemental

RESULTS:

Fish Species	Temp.	LC_{50} (ppm) 24 hr	48 hr	96 hr
Channel Catfish *	65°F	1.2	0.94	0.71
Rainbow Trout *	55°F	0.25	0.20	0.15
Rainbow Trout**	-	.0035	.0014	--
Bluegill Sunfish	-	.22	.022	.018

* Unusually resistant strain to DDT

** Unusually susceptible strain to DDT

VALIDATION CATEGORY RATIONALE: No test methods and pesticide formulation details are provided as required.

REPAIRABILITY: Must submit complete test and statistical data.

FORMULATION:			IA	IB	T	FW	EC	R	
% a.i.	SC#	CHEMICAL NAME	Validator:					Date:	
96.1		Dibrom Technical	Richard Balcomb					4/15/78	
			Test Type: Oyster larvae Bioassay						
			Test ID.# ES-R-1						

CITATION: Haskin, Dr. Harold, and Dr. R. G. Haines. Fish and Wildlife Toxicology Report, 1960. Doc. No. 04-0787. Chevron Chemical, Moorestown, N. J.

VALIDATION CATEGORY: Supplemental

RESULTS:

Amount active Insecticide (ppm)	% Mortality 8 hrs	32 hrs
0.5	0	0
1.0	0	0
2.0	5	15
4.0	90	100
100.0	100	-

Test used 200 1-day old larvae in each of three replicates per concentration level. Filtered seawater was the medium. Results are the average of the 3 replicates.

VALIDATION CATEGORY RATIONALE: The study was run for only 32 hours and the following data were not reported: test species, water temperatu and LC_{50} values. In addition, the experimenter used 200 larvae in 10 ml. of seawater whereas standard methods recommends 20,000-30,00 larvae in one liter of water with effects determined from 200 larvae samples. Furthermore, the experimenter determined death as lack of larvae mobility and frothy accumulation attached to hinge while stan dard methods[1] prefers toxicant effects to be described in terms of larvae development, i.e., a normally developing larvae is fully shelled in 48 hours.

REPAIRABILITY: Not repairable, test run for only 32 hours.

[1]Standard Methods for the Examination of Water and Waste Water. 14th Edition, 1975.

FORMULATION:			IA	IB	T	FW	EC	R	
% a.i.	SC#	CHEMICAL NAME	Validator: Richard Balcomb					Date: 4/15/78	
96.1		Dibrom Technical	Test Type: Oyster larvae: Crassastrea virginiea Biassay:						
			Test ID.# ES-R-2						

CITATION: Haskin, Dr. Harold, and Dr. R. G. Haines. Fish and Wildlife Toxicology Report. Chevron Chemical Co. OR-513 No. 241-36, 37, 38. August 31, 1960.

VALIDATION CATEGORY: Supplemental

RESULTS: Approximate LD_{50} = 3.5 ppm

Material	Amount Active/ Replicate (ppm)	% Mortality Replicates (Avg. of 3) 21 hrs.	45 hrs.	Observations 21 hr.	45 hr.
DIBROM Technical (96.1%)	0.5	0	3.3	protozoa alive	
	1.0	0	1.3	"	
	2.0	0	5.0	"	
	2.5	0	10.0	"	
	3.0	0	15.0	"	
	3.5	15.0	55.0	none alive	
	4.0	45.0	95.0	"	
	8.0	100.0	100.0	"	
Check	--	0	0	protozoa alive	
Acetone Ck (5000 ppm)	--	0	0	"	

PROCEDURE: 100-200, 1 week-old larvae, were placed in total volume of 10 ml in Syracuse water glass. Toxicants diluted with 50 ml. aceton and appropriate amounts sand-filtered sea-water to give final concentrations. Counts made with binocular, 60 x.

VALIDATION CATEGORY: The study was deemed supplemental as: (1) test does not follow currently recommended procedures (see previous study ES-R-1 and Standard Methods, 1975), (2) an LD_{50} with 95% confidence limits was not calculated, and (3) water temperature is not reported.

REPAIRABILITY: Test is considered at too wide variance from currently recognized "standard procedures" to be considered for core status.

ADDITIONAL COMMENTS: Toxicant knocks young oysters down to the bottom of the test vessel at approximately 1 ppm though feeding action continues. An EC_{50} evaluation therefore, might be more ecologically meaningful than the death criteria used.

FORMULATION:			IA	IB	T	FW	EC	R	
% a.i.	SC#	CHEMICAL NAME	Validator: Richard Balcomb					Date: 4/14/78	
?		Dibrom DVPP	Test Type: Fish Acute 96 hr LC_{50} Goldfish and Guppies						
			Test ID.# ES-F						

CITATION: California Spray-Chemical Corporation (Bio-lab Investigation Request). Dibrom, Phosphamidon and Other Chemical Pesticides -- Toxicity to Fish File # 721.11 (1958).

VALIDATION CATEGORY: Supplemental

RESULTS:

Chemical	LC_{50} (24 hr.) Goldfish	Guppy
Dibrom.....	2-5 ppm	1-2 ppm
DDVP	>10 ppm	>10 ppm

VALIDATION CATEGORY RATIONALE: The experimental methods are at wide variance with EPA guidelines, e.g., 1 fish per treatment level, fish species unacceptable, 24 hr. exposure.

REPAIRABILITY: Study is not repairable.

FORMULATION:	IA	IB	T	FW	EC	R	
% a.i. SC# CHEMICAL NAME	Validator: Richard Balcomb					Date: 4/14/78	
SX-9: Dibrom Technical (88.36% wt), [redacted]	Test Type: 96-hr Fish Acute LC_{50}: Rainbow Trout						
SX-10: Dibrom Technical (88.36% wt), [redacted]	Test ID.# ES-G						

CITATION: Four-Day Fish Toxicity Studies on SX-9 and SX-10. IBT No. A [illegible] S-6, March 23, 1966.

VALIDATION CATEGORY: Supplemental

RESULTS: * SX-9: 96-hr. LC_{50} = 0.13 ppm (0.09-0.18, 95% C.L.)

SX-10: 96-hr. LC_{50} = 0.28 ppm (0.22-0.35, 95% C.L.)

Young rainbow trout, average body weight one to two grams, were maintained for at least ten days prior to experimental use for observation. The tanks were aerated prior to testing and the fish maintained on a standard laboratory diet until three days prior to testing. Four concentration levels were used for each formulation and each contained ten fish. One control group was used. No water temperature was given.

* Statistics by Litchfield-Wilcoxon Method.

VALIDATION CATEGORY RATIONALE: The study can not be considered core without water temperature information . This reviewer recalculated the statistics via Finney Probit and obtained comparable results: SX-9 LC_{50} = 0.136 ppm, SX-10 LC_{50} = 0.297 ppm.

REPAIRABILITY: The study can be considered for core status upon submission of the temperature at which the study was run.

Inert Ingredient Information is not Included

VALIDATION SHEET CRF#_____ PAGE 1 OF 1

FORMULATION: Dibrom 8 Emulsive			IA	IB	T	FW	EC	R	
% a.i.	SC#	CHEMICAL NAME	Validator:					Date:	
?		Dibrom	Richard Balcomb					4/17/78	
			Test Type: Fish Toxicity						
			Test ID.# ES-GG						

CITATION: Westman, Dr. J. R., and Dr. R. G. Haines. Fish and Wildlife Toxicity Report: Dibrom 8 Emulsive. OR-513 No. 229-32. 1960. (Contains Progress Report, Dept. of Wildlife Conservation-9/30/60. Proj. No. 756).

VALIDATION CATEGORY: Supplemental

RESULTS: The only results reported follow:

"This pesticide has been far less toxic in the experiments conducte to date. At a concentration of 1.7 ppm, for example, only one common sunfish was killed and this at 90 deg., and at 3.4 ppm two fish survived for 24 hours at a temperature of 55 deg.

At 3.4 ppm all bluegill sunfish, golden shiners, pickerel, largemou bass and yellow perch were killed at all temperatures tested.

At 1.7 ppm largemouth bass survived for 96 hours at 70 deg., but al pickerel were killed within 16 hours. Experiments are continuing."

VALIDATION CATEGORY RATIONALE: Incomplete test methods and results were submitted. Only four fish per concentration level were used, therefore, the tests cannot be used as core data, i.e., not repaira

FORMULATION: Dibrom 8 Emulsive

% a.i.	SC#	CHEMICAL NAME
?		Dibrom

IA	IB	T	FW	EC	R		

Validator: Richard Balcomb

Date: 4/18/78

Test Type: Fish Acute Toxicity: Pumpkinseed Sunfish

Test ID.# ES-F

CITATION: Westman, Dr. James R., Fish and Wildlife Toxicology Report. Document No. 04-1367. OR-513 No. 243-3. 1960.

VALIDATION CATEGORY: Supplemental

RESULTS:

Toxicant/aquaria (ppm)	Water Temp (°F)	No. Fish	Time (hr)	% Mortal
2.0	55°	4	24	0
2.0	65°	4	24	0
2.0	75°	4	24	0
2.0	90°	4	1-1/2	100
6.0	55-90°	4	7	100

Water temperature was varied to simulate different pond depths.

VALIDATION CATEGORY RATIONALE: Details of testing procedure not presented No statistical analysis performed. Experimental design not in accord with EPA guidelines (insufficient treatment levels and number organis per treatment). The test is not repairable.

FORMULATION:			IA	IB	T	FW	EC	R		
% a.i.	SC#	CHEMICAL NAME	Validator:					Date:		
?		Dibrom	Richard Balcomb					4/18/78		
			Test Type: Avian Subacute Toxicity Study							
			Test ID.# ES-GG							

CITATION: Haines, Dr. Robert. Dibrom-Pheasant, Quail Toxicity studies. California Spray-Chemical Corporation. 1960. No. 229-29. (Submission included letter from U.S.D.I. Fish and Wildlife Service reporting toxicity test results).

VALIDATION CATEGORY: Supplemental

RESULTS: Adult pheasants were fed dibrom at rates up to 5000 ppm in their normal diet. Newly hatched quail were fed levels up to 1000 ppm in their feed.

(1) No mortality was observed after 5 weeks among pheasants receiving 5000 ppm dibrom in their diet. [1]

(2) Moderate mortality was observed among newly hatched quail (1000 ppm) after 5 weeks.

VALIDATION CATEGORY RATIONALE: Details concerning the test compound, test design, methodology, etc., were not provided. The California Spray-Chemical Corporation has essentially presented a summary of work done at Patuxent.

REPAIRABILITY: The study does not appear to resemble either EPA's avian chronic or avian subacute toxicity protocols, however, the registrant may submit complete testing details and have the study reconsidered.

[1] Reviewer is assuming the birds received the toxicant for 5 weeks.

FORMULATION:			IA	IB	T	FW	EC	R		
% a.i.	SC#	CHEMICAL NAME	Validator: Richard Balcomb					Date: 4/18/78		
?		Dibrom	Test Type: Avian Toxicity Studies							
			Test ID.# ES-GG							

CITATION: Messel, R. Toxicity of Dibrom to Birds. California Spray-Chemical Corporation. 1962. No. 502-35. (Submission contained a letter from U.S.D.I. Fish and Wildlife Service, 8/13/62, reporting test results).

VALIDATION CATEGORY: Supplemental

RESULTS: Levels tested (ppm in diet) and mg/kg consumed under conditions (1) 50 percent of test animals died within 10 days; (2) 50 percent of test animals died within 100 days; (3) more than 50 percent of test animals survived for more than 100 days [figures for mg/kg under (3) represent quantity of toxicant consumed by surviving birds]

		Test Conditions		
Test Animal		(1)	(2)	(3)
Ducks, Young	(ppm)	5000		
LD_{50}	(mg/kg)	6750		
Ducks, Adult	(ppm)			
LD_{50}	(mg/kg)			
Pheasants, Young	(ppm)	5000		
LD_{50}	(mg/kg)	1000		
Pheasants, Adult	(ppm)		5000,2500,1000	
LD_{50}	(mg/kg)		1350,1400,2300	
Quail, Young	(ppm)	2500,1000	500, 250	100
LD_{50}	(mg/kg)	1200,2300	2365, 650	1100
Quail, Adult	(ppm)	5000,2500,1250		
LD_{50}	(mg/kg)	275, 245, 420		
Red Winged Blackbirds, Adult	(ppm)	1000	500, 250	
LD_{50}	(mg/kg)	1260	1300, 210	
Cowbirds, Adult	(ppm)	1000, 500, 250		
LD_{50}	(mg/kg)	530, 945, 520		
Crackles, Adult	(ppm)	500, 250		
LD_{50}	(mg/kg)	650, 540		
Starlings, Adult	(ppm)	1000, 500, 250		
LD_{50}	(mg/kg)	450, 150, 610		

VALIDATION CATEGORY RATIONALE: Only a summary of tests run at Patuxent is presented.

REPAIRABILITY: The studies do not resemble the standard 8-day dietary or avian chronic however, if the registrant can rework the original data such that the requirements of basic avian studies are met, the studies may be repairable.

FORMULATION:			IA	IB	T	FW	EC	R	
% a.i.	SC#	CHEMICAL NAME	Validator: Richard Balcomb					Date: 4/18/78	
?		Dibrom	Test Type: Avian Toxicity						
			Test ID.# ES-GG						

CITATION: The submitted data was contained in a letter from James B. Dewi of the U. S. Fish and Wildlife, Department of the Interior to Mr. G. S. Hensill of Chevron Chemical Company. November 4, 1965.

VALIDATION CATEGORY: Supplemental

RESULTS: Attached

VALIDATION CATEGORY RATIONALE: Only a summary of results is presented. The testing procedures appear to be significantly different than either EPA's 8-Day subacute or chronic avian toxicity protocols and thus the submitted test cannot be used to support registration.

REPAIRABILITY: The registrant may be able to salvage this study by obtaining the original data and reworking it in the form of the standard avian 8-day dietary study. A valid LC_{50} resulting from observations over 8 days would be required.

DIBROM

Species	Age	No. Birds	ppm in diet	Duration of test-days	Mortality %	Time of % Mortality 30%	50%	100%	mg/kg/ eaten
Bobwhite	Young	25	2500	5	100	3	3	5	400
		25	1000	29	84	7	8	-	285
		25	500	29	88	24	26	-	91
		25	250	9	84	8	9	-	71
		25	100	113	20	-	-	-	11
	Adult	10	5000	6	100	3	4	6	69
		10	2500	9	100	6	7	9	35
		10	1250	36	100	10	10	36	42
		20	100	119	5	-	-	-	9
Redwinged Blackbirds-	Adult	11	1000	19	100	3	9	19	140
		11	500	29	100	9	13	29	106
		11	250	30	72.7	6	10	-	21
	Adult	12	1000	8	100	3	5	8	176
		72	500	11	100	3	9	11	105
		10	250	16	100	7	8	16	65
Crackles	Adult	12	500	15	100	8	10	15	65
		10	250	30	70	7	7	-	77
Starlings	Adult	12	1000	19	100	4	5	19	90
		10	500	7	100	3	3	7	50
		10	250	30	90	5	10	-	61
Mallards	Young	27	5000	13	66.7	6	9	-	750
		20	2500	81	50	65	77	-	206
	Adult	10	5000	55	80	27	29	-	155
Pheasants	Adult	16	5000	49	100	10	14	49	97
		15	2500	43	100	20	24	43	58
		15	1000	57	100	45	46	57	50
	Young	28	5000	27	89	3	4	-	540

FORMULATION:			IA	IB	T	FW	EC	R	
% a.i.	SC#	CHEMICAL NAME	Validator:					Date:	
?		Dibrom	Richard Balcomb					4/17/78	

Test Type:
Acute Toxicity to Marine Organisms

Test ID.# ES-GG

CITATION: Favorite, Major Frank G., et al. Biological Evaluation of Aerial Dispersal of Insecticides. Project No. 6X61-01-001. 1962.

VALIDATION CATEGORY: Supplemental

RESULTS:

Test Animal	Dibrom ppm
Oyster, 96-hr ED_{50}	0.64
Blue crab, 24-hr ED_{50}	0.33
Pink shrimp, 24-hr ED_{50}	0.0055
White mullet, 24-hr LD_{50}	0.6

VALIDATION CATEGORY RATIONALE: No information is given concerning testir methodology and pesticide formulation. The crab, shrimp and mullet data are 24-hour figures which cannot meet core requirements.

REPAIRABILITY: If complete test details are submitted, the oyster test may be considered for core status. The other studies are not repairable, i.e., only 24 hours.

FORMULATION:			IA	IB	T	FW	EC	R	
% a.i.	SC#	CHEMICAL NAME	Validator:					Date:	
		Naled	Richard Balcomb					4/15/78	
?		-	Test Type:						
		Dibrom	Simulated field study						
			Test ID.# ES-CC						

CITATION: Mulla, M. S. et al. Field Studies on the Effects of Insecticid on Some Aquatic Wildlife Species. Journal of Economic Entomology. April 1963.

VALIDATION CATEGORY: Supplemental

RESULTS: Species	Material	lbs.a.i./A	Mortality (%) Days after treatment 1	2	3	7	10
Gambusia affinis	Naled EC,8	0.5	0	0	-	-	-
		2.0	20	0	-	0	-
Rana catesbeiana (tadpoles)	" "	0.5	0	(24-hr. only)			

The experimenters concluded that naled manifests no toxicity of larvicidal or lower doses to the fish and tadpoles tested.

METHODS: The toxicant was applied to 1/16 acre test ponds as aqueous spr prepared from emulsion concentrate. Water depth was 8-12 inches and product was tested between May and November 1961.

Fish and pollywogs were confined to small screen cages. A total of 50 fish were used per pond per reading interval and 10 to 20 pollywogs depending on availability.

The animals were exposed within 1 hour of treatment and mortality re 24 hours later.

VALIDATION CATEGORY RATIONALE: (1) No data has been supplied concerning ingredients or other characteristics of the formulation called Naled EC,8. A core simulated field study should be conducted with the formulated product for which registration is sought (or at least one similar enough for reasonable extrapolation).

(2) Given the experimental design the study addresses only acute effects, i.e., 0-7 days for fish and 24 hours for tadpoles.

(3) The study did not measure the concentration of the pesticide in the ponds or report other important water parameters.

REPAIRABILITY: The study may be repaired if the questions raised in item 1 and 3 above are addressed.

FORMULATION: Dibrom 14 Concentrate

% a.i.	SC#	CHEMICAL NAME
		Dibrom

IA	IB	T	FW	EC	R		

Validator: Richard Balcomb

Date: 4/27/78

Test Type: Simulated field test

Test ID.# ES-BB

CITATION: Kelley, B. J. Jr., A Field Test of the Effects of 4 and 6 oz./Acre Concentrations of Dibrom 14 Concentrate (Naled) Applied from the Air on Estuarine Animals.

VALIDATION CATEGORY: Supplemental

RESULTS: "1. A field study has been made of the effects of aerial application of 4 and 6 oz/acre concentrations of Dibrom 14 on several aquatic estuarine animals.

2. Because the test represents a single repetition, a statistical comparison of results cannot be made.

3. By inspection of the data, it seems probable that 6 oz/acre concentrations can not be used without harm to non-target organisms." p.6

VALIDATION CATEGORY RATIONALE: The tests assess the effects of an exposu of only one hour and as such have somewhat limited general applicabi The experimenter applied no statistical tests to his data but believe the data showed significant differences between controls and test organisms. This reviewer applied a non-parametric test (Friedman's test for randomized blocks) and found no significant treatment effec ($X^2 = 3.105$, $X^2_{(0.05)} = 5.99$)*. The experiment is not scientifica unsound, however, the data can only be said to suggest an acute toxi effect to test animals.

* This is the "worst case" situation; i.e., the killifish data, which had control mortality, were eliminated.

REPAIRABILITY: N/A

TEST DETAILS:

Species	% Mortality 6oz.	4oz.	Control	No. animals at s (Aug)	
White shrimp	15	21	0	20	P. setiferus
Hardback shrimp	15	4	0	25	Palaeomonetes s
Killifish	5	5	25	20	F. heteroditus
Blue crabs	25	0	0	12	C. sapidus

The test animals were netted in estuarine habitat near Charleston, So Carolina. In the laboratory they were maintained in large, aerated fiberglass tanks and shallow "wading pools" (30% salinity at 23°C).

Simulated field te
Test ID# ES-BB

After acclimatization of 1-14 days the organisms were transported to test site and held in Church Creek in floating cages. Three sites were used with one receiving (aerially) dibrom at the rate of 6 oz/A, another at 4 oz/A and a control receiving no treatment. The animals were permitted a one hour field exposure then returned to laboratory culture tanks. Counts of dead organisms were made at 1, 3, 24, and 48 hours.

Among control animals only killifish suffered mortality during the test. Inspection of preserved specimens indicated the fish may have been suffering from malnutrition. The killifish data were, therefore, eliminated from the Friedman's test discussed previously.

104.0 Hazard Assessment

104.1 Discussion

Four use patterns are proposed for registration:

(1) As an outdoor space spray and coarse spray for the control of mosquitoes and various flies around dumps, meat packing establishments and other industrial and commerical sites with flying insect problems.

(2) As a coarse spray for roaches both inside and outside apartments, motels, hotels, restaurants and other buildings.

(3) As a coarse spray for brown dog ticks in and around kennels (not on dogs).

(4) As a mist blower spray (.1-.25 lbs. a.i./A) for the control of adult mosquitoes, gnats, and house flies in residential areas woodlands and swamps.

Uses 1-3 should not involve significant application to areas frequented by wildlife, however, the proposed mosquito/fly control use (#4) raises serious concern over aquatic contamination. Mist-blower spray to vegetation around standing and running water is assumed to result in direct application of the pesticide to water. The following aquatic contamination and terrestrial residues were calculated for use #4:

Concentration of Dibrom in Water

lb. a.i./Acre	Water Depth (Ft.) (ppm) 0.5	1	2	4	10
0.1	.0734	.0367	.0183	.0091	.0037
0.25	.184	.092	.046	.0229	.0092

Residues on Vegetation (ppm)

lb.a.i./Acre	Short Grass	Long Grass	Leafy Vegetation	Forage	Pods & Seeds	Fruit
0.25	60	27	33	15	3	1.75

104.1.1 Likelihood of Non-target Exposure

The proposed uses for the control of flies, mosquitoes, roaches and dog ticks in and around industrial and commercial buildings should not result in significant exposure to terrestrial or aquatic organisms. These uses involve the preparation of small quantities of spray, 1 to 3 oz. pesticide in 1 gallon of water, and directions that the spray be applied in localized areas where garbage, food waste, or canine habitation have caused an insect problem.

The proposed use of skychoda (dibrom) for the control of mosquitoes, gnats and flies in residential areas, woodland, and swamps by mist blower application may present unreasonable hazards to aquatic organisms. The directions indicate that shrubbery and vegetation where mosquitoes may rest should be treated including those areas around stagnant pools, marsh, areas, ponds and shorelines. It is the policy of the Environmental Safety Section to consider such uses as direct applications to water.

This reviewer has determined that the anticipated maximum concentration of dibrom resulting from the direct application of .25 lb./A 6" water would exceed RPAR triggers for several fish and aquatic invertebrates. A detailed discussion is presented in section 106.0 (RPAR).

Dibrom has a relatively short half-life in water, ranges for a pH 7 are 4.4-15.9 hours and for sewage water 23 hours. The major metabolite of dibrom is dichlorvos (DDVP) and this chemical is even more toxic to aquatic organisms than the parent compound (Table I). In Table II is indicated the rapid dissipation of dibrom in water with the accompanying increase of dichlorvos:

Table I

Organism	Exposure Time (hr)	LC_{50} - PPM
Amphipod	24	0.002
Sand shrimp	24	0.018
Stonefly	48	0.010
Waterflea	48	0.00007
Hermit crab	24	0.150

Table II

Rate of Decay of Naled at pH 7 and 23°C

Sampling Interval (hours)	Naled (µg/ml)	Dichlorvos (µg/ml)
	106	1.10
0	110	1.40
	53.7	3.30
17	62.0	1.60
	50.9	1.60
20	49.1	1.60
	42.8	1.40
24	39.2	1.70
	29.4	1.60
45	30.0	1.60
	2.7	2.70
118	2.5	2.80

(R. Ney, File Symbol 1769-LR, 3/20/75).

The short half-life of dibrom is not seen as a factor sufficient to offset potential hazards as the 24-hr LC_{50} for numerous aquatic organisms are within the maximum water contamination levels predicted. In addition, label directions indicate application on an as necessary basis which we must assume will result in repeated aquatic contamination.

In addition to tripping RPAR triggers the proposed mosquito use exceeds 3 of 6 of the following aquatic hazard benchmarks established by the A.I.B.S. task force:

(A) LC_{50} less than 1 mg/l (ppm)

Bluegill (96 hr) = 0.018 ppm
Daphnia pulex (48 hr) = 0.00035

(B) Estimated Environmental Concentration (EEC) greater than 1/10 of the LC_{50}

(1) Direct application to 6" water (.25 lb.a.i/A) EEC - 0.184 ppm

$$\frac{\text{EEC}}{\text{Bluegill } LC_{50}} = \frac{0.184}{0.018} = 10,$$ which is greater than 1/10

(B) (2) $\frac{\text{EEC} \times \frac{1}{10}}{LC_{50}\ \text{Rainbow trout}} = \frac{0.184}{0.150} = 1.22 > \frac{1}{10}$

(3) Drift resulting in $\frac{1}{10}$ the normal application rate:

(i) $\frac{\text{EEC} \times \frac{1}{10}}{\text{Bluegill } LC_{50}} = \frac{0.018}{0.018} = 1 > \frac{1}{10}$

(ii) $\frac{\text{EEC} \times \frac{1}{10}}{\text{Rainbow } LC_{50}} = \frac{0.018}{0.15} = 0.12 > 0.1$

(iii) $\frac{\text{EEC} \times \frac{1}{10}}{\text{Daphnia } LC_{50}} = \frac{0.018}{0.00035} = 514 > \frac{1}{10}$

(C) Pesticide used on a major crop or otherwise to be broadly used.

The directions call for the use of this product around aquatic habitat without geographic limitations of limits on the frequency of use.

(D) Water solubility value <0.5 ppm or octanol: water partition coefficient greater than 1000.

This product has been described as 0.5% soluble in water. This converts to 5000 ppm which is considerably greater than the 0.5 ppm trigger stated above. No bioaccumulation indicated.

(E) Half-life greater than 4 days. Estimated half-life is less than one day.

(F) Avian safety, mammalian safety or efficacy test results produce abnormal, reproductive, and/or other unusual effects at low dosages or concentrations.

No such effects known.

The fact that three of these hazard criteria are triggered indicates the potential for adverse ecological effects posed by this pesticide. Of particular concern are the acute toxicity properties. As I have outlined in (B) above, if just 1/10 of the maximum application rate reaches 6" of water the LC_{50} for Bluegills (Ref. 3) and daphnia (Ref. 5) will be equaled or exceeded.

No data are available concerning possible chronic effects to aquatic organisms. Despite the short half-life, multiple applications raise this possibility and such testing has been requested (107.5).

As a final step in the hazard assessment process this reviewer contacted several biologists currently working in the field of mosquito control to assess their views on the safety of applying Naled to vegetation bordering aquatic areas.

(1) Donald E. Payne, Asst. Director, Jefferson Parish Mosquito Control Dept., Metairie, La. (8-504-733-0163).

Mr. Painer has used Naled, currently as ULV, since the early 1960's. He has had few reports of mortality to aquatic organisms. He stated that bait shops have reported kills in open tanks of shrimp following aerial applications. He stressed the importance of keeping droplet size down (possibly less aquatic contamination and less damage to auto finishes) and said the mist-blowers probably produce relatively large droplets. Mist-blowers are not used in his district nor does he know of any area where they are used.

(2) B. W. Clements, Administrator of West Florida Arthropod Research Lab (904-785-6159).

In Florida, Naled is used widely in ULV treatments to kill mosquitoes. It is his experience that this pesticide is field safe so long as it is not sprayed directly into water. Mr. Clements stated that treating vegetation on shorelines by mist-blower application might be hazardous and that label restrictions keeping equipment 25-50 ft. from the water might be advantageous.

He knew of no mist-blower mosquito adulticide operations in the south.

(3) Dr. Jacques Berlin, Medical Entomologist, N. Y. State Dept. of Health (8-716-862-4116).

In New York, Naled is used primarily as an ULV spray for mosquitoes. Dr. Belin was unaware of any mist-blower operations at the present time.

He stated that such applications would produce larger droplets (>ULV) and that this might increase the 1/2 life of the pesticide to ∿24 hours. He further stated that due to the relatively small areas that can be treated by mist-blower application that this method would be little used.

Summary

1. The use of dibrom for fly/roach/tick control around commercial establishments does not pose a significant threat to wildlife.

2. Due to the high toxicity of dibrom to aquatic organisms the proposed mist-blower applications to vegetation bordering water are considered potentially hazardous. Such applications are considered direct applications to water and at label rates exceed RPAR acute triggers.

3. Experts contacted in the field of mosquito control attested to dibromo's relative safety (ULV) but stressed aquatic contamination must be avoided. They stated that mist-blower applications were rare for mosquito control at the present time. In addition, they acknowledged the potential hazard of treating vegetation at water edges.

Course of Action

Sufficient core studies do not exist for classification or RPAR decisions. Therefore, the next step in the registration process should be advising the registrant of the basic and special testing required. In section 107.5 I have separately listed the requirements for uses 1-3 and use 4.

104.1.2 Endangered Species Considerations

Historically, mosquito control operations have been so widespread that registering skychoda for use as an adulticide can conceivably pose a threat to all endangered fish but those inhabiting inaccessible areas.

More specifically the mist-blower operations require truck mounted apparatus which in turn require passable roads. This application requirement should reduce the hazard to endangered fish in remote habitat.

Based on the data now available, the hazard to fish is believed to be primarily one of acute poisoning at the application site. Endangered fish, therefore, can probably be protected via labelling or geographic restrictions given the selectivity possible with mist-blower applications.

Thus, transfer mechanisms exist to defuse the endangered species issue.

104.1.4 Additional Data Required

(1) The required six basic studies are not in place and have been requested (see conclusion section).

Mosquito control around streams, rivers, lakes, swamps, salt marshes, and estuaries is expected to result in direct spray contamination of aquatic environment, therefore, the following additional studies are necessary:

(A) Shrimp, crab and a marine or estuarine fish (technical and formulated product).

(B) 48-hour LC_{50} for oyster embryo-larvae or 96-hr LC_{50} shell deposition data.

(C) Life-cycle tests are required for one species of invertebrate and one species of freshwater fish (Fathead minnow).

(D) A short-term simulated field test where confined populations are monitored. As the available acute toxicity data trigger RPAR this type of testing is necessary to aid in assessing the actual field hazard.

105.0 Classification

(A) The uses of skychoda in and around commercial establishments for the control of various flies, mosquitoes, roaches and brown dog ticks are not expected to result in significant contamination of wildlife habitat or aquatic areas. The potential hazard of these uses are additionally reduced by the small quantities to be used (1-3 oz. pesticide in 1 gallon of water).

The basis studies requirement has not yet been met [Data Requests 107.5(A)] therefore classification cannot be completed. Data available indicates general use classification may be appropriate.

(B) The use of this pesticide for the control of adult mosquitoes, gnats and house flies in residential areas, woodlands and swamps is expected to result in direct application to water and as such the acute toxicity RPAR triggers are not (see 106.0 - RPAR Criteria). However, classification cannot be completed until core studies are received [Section 107.5 (B)].

INTERIM CLASSIFICATION

PARAMETERS	ORGANISM	GENERAL	RESTRICTED	REBUTTABLE PRESUMPTION
A	MAMMAL	$<1/5\ LD_{50}$	$\geq 1/5\ LD_{50}$ to LD_{50}	$\geq LD_{50}$
	Rat [1]:	<1680 ppm	>1680 ppm to <8400	≥8400 ppm
B	AVIAN (see over)	$<1/5\ LC_{50}$	$\geq 1/5\ LC_{50}$ to $<LC_{50}$	$\geq LC_{50}$
	Bobwhite: [2]	<1/5(2117 ppm)= <423.4ppm	≥423.4 ppm to<2117 ppm	≥2117 ppm
	Pheasant: [2]	<1/5(2538) = <507.6ppm	≥507.6 ppm to 2538 ppm	≥2538 ppm
C	AQUATIC (see over)	$<1/10\ LC_{50}$	$\geq 1/10\ LC_{50}$ to $1/2\ LC_{50}$	$>1/2\ LC_{50}$
	Rainbow: [3]	<1/10(.15ppm)=<0.015 ppm	≥0.015ppm to 0.075ppm	>0.075 ppm
	Bluegill: [3]	< 1/10(0.18)=<0.018ppm	≥0.018ppm to 0.09ppm	>0.09 ppm

The pesticide causes, under conditions of label use, or widespread and commonly recognized practice of use, only minor and no discernible adverse effects on the physiology, growth, population levels, or reproduction rates of non-target organisms, resulting from exposure to the product ingredients, their metabolites or degratdation products, whether due to direct application or otherwise resulting from application such as through volatilization, drift, leaching or lateral movement in soil.

The pesticide causes, under conditions of label use, or widespread and commonly recognized practice of use discernible adverse effects on the physiology growth, population levels, or reproduction rates of non-target organisms, resulting from exposure to the product ingredients, their metabolites, or degradation products, whether due to direct application, such as through volatilization, drift, leaching or lateral movement in soil.

Chronic Toxicity:

Can reasonably be anticipated to result in significant local, regional, or natio population reductions in non-tar organisms, or fatality to memb of endangered sp

INTERIM
CLASSIFICATION (Cont.)

A. Avian LD_{50}'s:

ORGANISM	GENERAL	RESTRICTED	RPAR
Mallard[4/]	<1/5(52.2 mg/kg)= <10.44 mg/kg	≥10.44 mg/kg	≥52.2 mg/kg
Sharp-tailed[4/] Grouse	<1/5(64.9 mg/kg) = <12.98 mg/kg	≥12.98 mg/kg	≥64.9 mg/kg
Canada Geese[4/]	<1/5(36.9 mg/kg) = <7.38 mg/kg	≥ 7.37 mg/kg	≥36.9 mg/kg

B. Aquatic LC_{50}'s:

ORGANISM	GENERAL	RESTRICTED	RPAR
Brook Trout[5/]	< 1/10(0.078 ppm)= <0.0078 ppm	≥0.0078 ppm	>0.039 ppm
Daphnia [5/]	< 1/10(0.0035 ppm)= < 0.00035 ppm	≥0.00035 ppm	>0.00175 ppm
StoneFly[5/]	< 1/10(0.016 ppm) = <0.0016 ppm	≥0.0016 ppm	>0.008 ppm
Red Crawfish[6/]	<1/10(4.0 ppm) = <0.4 ppm	≥0.4 ppm	>2.0 ppm
Amphipod[5/]	< 1/10(0.16 ppm) = <0.016 ppm	≥0.016 ppm	>0.08 ppm

REFERENCES

1/ Acc. No. 090644 submitted by Chevron Chem. Co., Ref. 1, Hazelton Laboratory, February, 1957.

2/ Heath, Robert G., et. al., Lethal Dietary Toxicities of Environmental Pollutants to Birds, USDI, USFWS, Special Scientific Report - Wildlife No. 191. 1975.

3/ PP. No. 7F0532, Acc. No. 090646, Section C, Reference 28a, p. 13, submitted by Chevron Chem. Co. Data cited in a letter from O. B. Cope, Fish and Wildlife Service, to Chevron.

4/ Tucker, Richard K and D. Glen Crabtree, Handbook of Toxicity of Pesticides to Wildlife, BSFW, Denver Wildlife Research Center, Resource Publication No. 84, March, 1970.

* 5/ FWPCA. 1968. Water Quality Criteria. Report of the National Tech. Adm. Comm. to Secr. of the Interior. Fed. Water Pollution Contr. Adm. USDI. 234 p.

* 6/ Muncy, R. J., and A. D. Oliver. 1963. Toxicity of ten insecticides to the red crawfish, Procambarus clarki (Girard). Trans. Am. Fish. Soc. 92:428-431.

* Original reports not examined. Data cited in "Ecological Effects of Pesticides on Non-target Species," David Pimental, 1971.

106.0 RPAR Criteria

Direct aquatic application of this pesticide is expected to result from mosquito-gnat-fly control spray operation around swamps, lakes, streams and other aquatic habitat adjacent to treated vegetation.

Direct application to 6" water at the minimum rate (0.1 lbs. a.i./A) is estimated to result in pesticide concentrations of 0.073 ppm. The maximum rate of application (0.25 lbs. a.i./A) is estimated to result in pesticide concentrations of 0.184 ppm in 6" water.

The contamination resulting from the maximum rate of application exceeds 1/2 of the LC_{50} for all but one (Red Crawfish) of the organisms listed in the classification sheets. The minimum rate of application is estimated to produce aquatic concentrations greater than 1/2 the LC_{50} for the aquatic invertebrates listed and is close enough to the RPAR levels for all fish listed as to be, perhaps, realistically indistinguishable.

As all of the RPAR calculations here presented are based on supplemental test results a final RPAR determination is deferred until core studies are received.

107.0 Conclusions

107.1 Acknowledgement

Environmental chemistry reviews were used in the preparation of this report. Toxicology data (rat studies) were obtained from previous Environmental Safety studies.

107.2 Recommendations

Environmental Safety does not concur with the amended registration of skychoda:

(1) The proposed use of this pesticide for fly/roach/tick control around commercial establishments and kennels is not supported by the six basic Environmental Safety studies [See 107.5(A)].

(2) The proposed use of skychoda for mosquito and fly control in residential and woodland areas, particularly spray operations around swamps and shorelines is not supported by the basic six Environmental Safety studies. Furthermore, such usage has been determined to present a possible severe hazard to aquatic organisms and as such additional studies [107.5(B)] are necessary.

107.4 Data Adequacy

The following evaluations were made concerning the data submitted in support of the proposed registration:

(1) The fish toxicity data contained in a letter from Oliver B. Cope (U. S. Fish and Wildlife Service, 12/15/65) is unacceptable and cannot be used to support registration. No test methods and pesticide formulation details are provided as required. If a complete report is available the test can be reconsidered.

(2) The oyster larvae bioassay (Haskin and Haines, 1960) is unacceptable as the test was run for only 32 hours.

(3) The second oyster larvae bioassay (Haskin and Haines, Aug. 31, 1960) is unacceptable as the study does not follow currently recommended procedures, e.g. too few test organisms per test vessel, time period too short, and no statistical analysis.

(4) The fish acute study with Goldfish and Guppies (California Spray-Chemical Corp., 1958) is unacceptable as the test organisms are not recommended test species.

(5) The 96-hr fish acute toxicity, Rainbow trout IBT No. A 4132-1966, is unacceptable as the test temperature at which the study was run was not reported. If this information is supplied the study will be reconsidered as support for registration.

(6) The fish toxicity study (Westman and Haines, 1960) utilizing Dibrom 8 Emulsive is unacceptable as only four fish were tested per concentration level.

(7) The Pumpkinseed Sunfish toxicity study (Westman, 1960) is unacceptable as only four fish were used per concentration level.

(8) The Pheasant and Quail dietary toxicity data (Haines, 1960 - U.S.F.W.S. data cited) are unacceptable. Details concerning the test compound, test design, and methodology are not reported. If the missing data are supplied the pheasant portion of the study will be considered for registration support.

(9) The avian dietary studies (Messel, R. 1962- U.S.F.W.S. data cited) are unacceptable. Only a summary of results are presented, if complete details of methodology and statistical analysis are supplied the studies may be reconsidered for registration support. If the data can be presented in the format required for the standard 8-day avian dietary study, with appropriate statistical analysis, the test can be reconsidered.

(10) The avian toxicity data cited in a letter from James Dewitt of the U.S.F.W.S. to G. S. Hensill, (Chevron Chem. Co.) dated 11/4/65, are unacceptable in their present form. If the data can be presented in the format required for the standard 8-day avian dietary study, with appropriate statistical analysis, the submission can be reconsidered as registration support material.

(11) The acute marine toxicity data (Maj. Frank Favorite-1962-Biological Evaluation of Aerial Dispersal of Insecticides) are unacceptable. The blue crab, shrimp and mullet studies were run for only 24 hours. If complete testing details are supplied concerning the 96-hour oyster study, it can be reconsidered as registration support material.

(12) The two submitted field studies - (1) B. J. Kelly, Jr., 1970, (2) M. S. Mulla, et. al., 1963 - can be utilized as background information but do not qualify as field tests of the proposed use. An appropriate field simulation must use the pesticide according to label direction to permit accurate hazard assessment.

107.5 (A) Fly/Roach/Tick Control in and about commercial buildings (label uses 1-3).

Prior to consideration of registration of the proposed use the following basic studies are required:

(a) the avian acute oral LD_{50} for one species of waterfowl (Mallard Duck, preferably) or one species of upland game bird (Bobwhite Quail or Ring-necked Pheasant);

(b) the dietary LC_{50} for one species of waterfowl (Mallard Duck) and one species of upland game bird (Bobwhite Quail or Ring-necked Pheasant). One of the three species selected for these studies must be the same species selected for the acute oral avian study.

(c) the 96-hour LC_{50}'s for a coldwater species (Rainbow Trout) and a warmwater species (Bluegill Sunfish) of fish;

(d) the acute 48-hour LC_{50} for an aquatic invertebrate (Daphnia sp., preferably).

The above basic studies are required on the technical of each active ingredient.

107.5 (B) Mosquito/Fly Control in residential areas, woodlands and swamps.

Prior to consideration of registration of this use certain basic and special studies are required:

(a) the avian acute oral LD_{50} for one species of waterfowl (Mallard Duck, preferably) or one species of upland game bird (Bobwhite Quail or Ring-necked Pheasant);

(b) the dietary LC_{50} for one species of waterfowl (Mallard Duck) and one species of upland game bird (Bobwhite Quail or Ring-necked Pheasant). One of the three species selected for these studies must be the same species selected for the acute oral avian study.

(c) the 96-hour LC_{50}'s for a coldwater species (Rainbow Trout) and a warmwater species (Bluegill Sunfish) of fish;

The above basic studies are required on the technical of each active ingredient.

(d) the acute 48-hour LC_{50} for an aquatic invertebrate (Daphnia sp., preferably), must be determined for the technical and the formulated product.

(e) the 96-hour LC_{50} must be determined for shrimp, crab and an estuarine or marine fish. The technical and the formulated product must be tested.

(f) the 48-hour LC_{50} for the oyster embryo-larvae or 96-hour LC_{50} shell deposition data must be submitted for the technical and the formulated product. A representative mollusc such as the American oyster must be used.

(g) aquatic life-cycle tests are required for one species of invertebrate (daphnia magna is suggested) and one species of freshwater fish (fathead minnow). The life-cycle test

requires that aquatic organisms be cultured in the presence of the test substance (technical grade) from egg to egg or from one stage of the life-cycle to the same of the next generation.

(h) a short-term simulated field test with confined populations is required. The study is requested for a freshwater site where vegetation bordering a shallow body of water (preferably a small pond) is sprayed at the maximum rate of application. The protocols for such tests are approved on a case by case basis and must be submitted to Environmental Safety in advance. It is considered necessary as a minimum, that one species of fish and one species of aquatic arthropod be tested in sufficient numbers to provide statistically reliable results. It is also required that water and sediment residues be examined before and after application.

Questions concerning testing requirements or calculations of previously submitted studies should be directed to the Environmental Safety Section. Field studies should be discussed with Environmental Safety prior to testing.

Richard Balcomb
EEEB-RD WH507
May 10, 1978