Appendix K. ECOTOX Open Literature Reviews.

Open Literature Review Summary

Chemical Name: Carbaryl

CAS No: 63-25-2

ECOTOX Record Number and Citation: 13800 Peterson, H. G., C. Boutin, P. Martin, K. E. Fremark, N. J. Ruecker, and M. J. Moody. 1994. Aquatic phyto-toxicity of 23 pesticides applied at expected environmental concentrations. Aquatic Toxicology 28(314): 275 – 292.

Purpose of Review (DP Barcode or Litigation): Endangered species assessment in response to litigation.

Date of Review: May 27, 2007

Summary of Study Findings: All species of algae and cyanobacteria tested were from established laboratory cultures, maintained as chemostat cultures (steady-state populations of nutrient-limited cells using defined media and set dilution rates). Species included: diatom (*Cyclotella meneghiana*), green algae (*Scenedesmus quadricauda* and *Pseudokirchneriella subcapitata*), unicellular cyanobacteria (*Microcystus aeruginosa* (PPC7820 and U2063), filamentous cyanobacteria (*Pseudoanabaena* sp. and *Oscillatoria* sp.), and filamentous cyanobacteria (nitrogen-fixing) (*Aphanizomenon flos-aquae* and *Anabaena inaequalis*). Duckweed (*Lemna gibba*) was obtained from a pond near Saskatoon, Saskatchewan (CN).

For algae, each treatment unit consisted of a 7 ml vial filled with 2 ml of media and innoculated with 0.2 ml of pesticide solution (total volume 2.2 ml). Mixtures were incubated for 6 hours, then 0.01 µCi of $NaH^{14}CO_3$ were added and then further inclubated for 16 hours while undergoing constant agitation. Afterward 200 µL of 12.5% HCl was added to terminate the incubations and to convert any “inorganic” (unfixed by the algae) ^{14}C to the gas phase, which was then exhausted. Tests were replicated in triplicate.

Duckweed was incubated in 6-well 12 ml microplate containing 10-ml fill volume containing 3 mature duckweed leaves per well with 4 replicates. Leaves were counted after 7 days. Growth inhibition was expressed as a portion of of controls.

Pesticide exposure was based on the estimated environmental concentration resulting from maximum registered application label rate for agriculture use in Canada

Results of the single concentration toxicity tests are presented in **Tables 25 – 28.** Inhibition exeeded 75% for each of the triazines in all species except the nitrogen-fixing cyanobacterium Anabaena inaequalis, for which inhibition ranged from 58 to 65% (**Table 25**). Triazines caused $\geq$95% growth inhibition of duckweed. The four sulfonylurea herbicides had little to no inhibition of algal species at the concentrations tested but did cause significant stimulation of growth in some of the species tested (**Table 26**). For three of the four sulfonylurea herbicides, growth was inhibited $\geq$63% in duckweed. The phenoxyaldane and pyridine herbicides tested had low toxicity to algal species at the concentrations tested and caused less than 50% inhibition of growth in duckweed (**Table 27**). Picloram had not significant impact on any of the test species while triclopyr cause significant stimulation of growth in green algae and nitrogen-fixing cyanobacteria. Triclopyr significantly reduced plant growth in *Pseudoanabaena* and duckweed but stimulated growth of Nitzchia by 40% (**Table 28**). Acrolein and tebuthiuron inhibited growth by >70% in almost all of the species tested. Glyphosate significantly inhibited growth $\geq$73% in only 3 of the species tested (**Table 27**). The two forms (formulated and technical) of the fungicide propioconazole had <20% inhibition in all species tested and stimulated growth in cyanobacteria and diatoms. Carbaryl caused >50% inhibition in 9 of the 10 algal species tested; diatoms were less sensitive (33% inhibition) (**Table 28**); however, carbofuran had relativley low inhibition in the plants tested. Carbofuran though significantly inhibited Scendesmus, Microcystis and duckweed by 21 – 31%.

The authors proceed to rank the pesticides based on the known EEC/EC_{50} (EC_{50} values were not determined in this study) ratios based on the results of this study. The following categories were developed: very high EEC/EC_{50}>1 since the EEC tested caused >50% difference in growth; high where 25 – 50% differences in growth; moderate where 5 – 25% differences in growth; potentially low where<5% differences in growth. Based on these rankings, the authors concluded that the triazine herbicides, diquat, acrolein, tebuthiuron and carbaryl were classified as high hazards to almost all of the plant species tested and only picloram presented a low hazard.

The authors noted the high algal toxicity of carbaryl at its estimated environmenal concentration and speculated that because carbaryl is not as acutely toxic to insects or vertebrates as carbofuran, it is registered for insect control at much higher rates and that while it may not have a greater intrinsic toxicity to algae, its higher rate of use and hence 5-fold higher EEC makes it a greater hazard to the aquatic environment.

Table 1. Percent inhibition of plant growth across herbicides; values in parentheses represent standard deviation. Exposure based on maximum label rates. Simazine is tested as formulated endproduct while other herbicides are technical grade.

Family	Species	Triazine					Sulfonylurea			
		Atrazine 2.67 mg/L	Cyanazine 2.67 mg/L	Hexazione 2.87 mg/L	Metribuzine 2.67 mg/L	Simazine 2.67 mg/L	Chlorsulfuron 0.020 mg/L	Ethametsulfuron 0.015 mg/L	Metsulfuron 0.003 mg/L	Trisulfuron 0.018 mg/L
Algae	***C. meneghiana***	**97* (1)**	**98* (0)**	**98* (1)**	**98* (0)**	**83* (5)**	**-8 (6)**	**-4 (3)**	**-16 (9)**	**13 (14)**
	Nitzschia	**99* (0)**	**99* (0)**	**99* (0)**	**99* (0)**	**82* (5)**	**-6 (10)**	**-10 (12)**	**-9 (8)**	**-39* (9)**
	S. quadricauda	**96* (1)**	**95* (2)**	**96* (1)**	**96* (1)**	**93* (2)**	**-3 (10)**	**0 (5)**	**-6 (11)**	**-8 (13)**
	P. subcapitat	**99* (0)**	**100* (0)**	**100* (0)**	**100* (0)**	**99* (0)**	**-13 (12)**	**-11 (8)**	**27* (3)**	**-3 (10)**
Cyano-bacteria	***M.* (PCC7820)**	**96* (1)**	**98* (0)**	**96* (0)**	**97* (1)**	**96* (1)**	**-1 (17)**	**0 (6)**	**1 (9)**	**-15 (4)**
	***M.* (U2063)**	**84* (0)**	**97* (0)**	**95* (0)**	**94* (0)**	**92* (0)**	**-23* (3)**	**16 (3)**	**14* (4)**	**-10 (4)**
	Oscilatoria	**87* (0)**	**87* (0)**	**76* (2)**	**87* (1)**	**86* (3)**	**-17 (14)**	**-12* (3)**	**2 (7)**	**8 (3)**
	Pseudoanabaena	**91* (0)**	**97* (1)**	**96* (1)**	**97* (0)**	**96* (0)**	**-2 (7)**	**13 (9)**	**-7 (12)**	**1 (2)**
	Anabaena	**65* (2)**	**92* (3)**	**58* (8)**	**94* (2)**	**63* (2)**	**-4 (6)**	**0 (3)**	**-9 (8)**	**15 (4)**
	Aphanisomenon	**97* (1)**	**98* (1)**	**96* (1)**	**97* (1)**	**88* (5)**	**4 (14)**	**-9 (12)**	**-36* (5)**	**-13 (13)**
Duck-weed	***Lemna***	**95* (5)**	**100* (0)**	**100* (0)**	**100* (0)**	**100* (0)**	**86* (5)**	**33* (6)**	**63* (0)**	**91* (0)**

*statistically siginificant at 95%

Table 2. Percent inhibition of plant growth across herbicides; values in parentheses represent standard deviation. Exposure based on maximum label rates. Herbicides tested are technical grade.

Family	Species	Phenoxyalkanes		Pyridines		Brominated Herbicides	
		2,4-D	MCPA	Picloram	Triclopyr	Bromoxoil	Diquat
		2.92 mg/L	1.4 mg/L	1.76 mg/L	2.56 mg/L	0.28 mg/L	0.73 mg/L
Algae	***C. meneghiana***	**0 (5)**	**-3 (8)**	**-12 (5)**	**-15 (12)**	**6 (3)**	**99* (1)**
	Nitzschia	**1 (10)**	**-18* (5)**	**-7 (21)**	**-4 (3)**	**-40* (11)**	**100* (0)**
	S. quadricauda	**-1 (12)**	**1 (3)**	**-7 (12)**	**13 (9)**	**-11 (8)**	**53* (13)**
	P. subcapitat	**-2 (9)**	**-18* (8)**	**-2 (8)**	**-24* (6)**	**14 (2)**	**69* (8)**
Cyano-bacteria	***M.* (PCC7820)**	**9 (8)**	**0 (24)**	**3 (8)**	**-10 (8)**	**0 (7)**	**100* (0)**
	***M.* (U2063)**	**11 (13)**	**8 (5)**	**-27 (6)**	**-2 (12)**	**-6 (20)**	**100* (0)**
	Oscilatoria	**4 (9)**	**-7 (16)**	**8 (1)**	**-9 (3)**	**-11 (20)**	**100* (0)**
	Pseudoanabaena	**-7 (6)**	**19* (2)**	**15 (10)**	**13* (3)**	**24 (12)**	**100* (0)**
	Anabaena	**-14 (8)**	**-15 (11)**	**14 (8)**	**-4 (13)**	**-12 (8)**	**100* (0)**
	Aphanisomenon	**0 (1)**	**11 (7)**	**0 (17)**	**-34* (16)**	**5 (2)**	**100* (0)**
Duck-weed	***Lemna***	**34* (5)**	**42* (3)**	**10 (5)**	**23* (4)**	**-4 (2)**	**100* (0)**

Table 3. Percent inhibition of plant growth across herbicides; values in parentheses represent standard deviation. Exposure based on maximum label rates. Glyphosate is tested as formulated endproduct while other herbicides are technical grade.

Family	Species	Acrolein 1.0 mg/L	Glyphosate 2.85 mg/L	Imazethapyr 0.067 mg/L	Metolachlor 3.0 mg/L	Tebuthiuron 5.87 mg/L
Algae	***C. meneghiana***	**97* (1)**	**73* (3)**	**-5 (5)**	**-5 (1)**	**98* (1)**
	Nitzschia	**99* (0)**	**77* (5)**	**-11 (8)**	**0 (4)**	**99* (0)**
	S. quadricauda	**99* (0)**	**3 (1)**	**10 (5)**	**15 (6)**	**90 (4)**
	P. subcapitat	**97* (2)**	**18 (15)**	**7 (5)**	**24* (12)**	**100* (0)**
Cyano-bacteria	***M.* (PCC7820)**	**100* (0)**	**-41 (5)**	**29* (3)**	**3 (11)**	**90* (1)**
	***M.* (U2063)**	**96* (1)**	**16 (5)**	**16 (5)**	**6 (4)**	**88* (2)**
	Oscilatoria	**95* (1)**	**-12 (4)**	**-2 (7)**	**12 (1)**	**76* (0)**
	Pseudoanabaena	**100* (0)**	**12 (6)**	**3 (5)**	**19* (8)**	**93* (1)**
	Anabaena	**100* (0)**	**11 (11)**	**-16 (3)**	**0 (4)**	**26* (3)**
	Aphanisomenon	**100* (0)**	**74* (1)**	**10 (9)**	**-15 (17)**	**89* (3)**
Duck-weed	***Lemna***	**73* (2)**	**0 (4)**	**46* (0)**	**81* (0)**	**100* (0)**

Table 4. Percent inhibition of plant growth across pesticides; values in parentheses represent standard deviation. Exposure based on maximum label rates. Propiconazolee is tested as formulated endproduct and technical grade while other pesticides are technical grade alone.

Family	Species	Carbaryl 3.67 mg/L	Carbofuran 0.67 mg/L	Propiconazole (tech) 0.083 mg/L	Propiconazol (form) 0.083 mg/L
Algae	***C. meneghiana***	**35* (8)**	**4 (4)**	**3 (5)**	**-28* (11)**
	Nitzschia	**58* (7)**	**-6 (23)**	**32 (3)**	**-36* (4)**
	S. quadricauda	**67* (12)**	**31* (5)**	**0 (6)**	**13* (8)**
	P. subcapitat	**68* (2)**	**1 (3)**	**13 (3)**	**-10 (8)**
Cyano-bacteria	***M.* (PCC7820)**	**76* (5)**	**24* (3)**	**3 (6)**	**-4 (10)**
	***M*. (U2063)**	**70* (3)**	**8 (6)**	**-13 (5)**	**8 (7)**
	Oscilatoria	**56* (4)**	**3 (15)**	**-6 (8)**	**-15* (4)**
	Pseudoanabaena	**86* (2)**	**8 (12)**	**-10 (5)**	**-13 (3)**
	Anabaena	**86* (6)**	**5 (21)**	**-14 (18)**	**-1 (22)**
	Aphanisomenon	**73* (1)**	**-2 (7)**	**-16 (1)**	**-25 (12)**
Duck-weed	***Lemna***	**33* (9)**	**21* (8)**	**32* (6)**	**10 (4)**

Description of Use in Document (QUAL, QUAN, INV): Qaulitative

Rationale for Use: Even though only a single concentration is tested, the study provides useful information on the potential effects of pesticides on aquatic plants at concentrations that may be considered environmentally relevant.

Limitations of Study: Duckweed was collected from the wild and prior exposure history is uncertain. Only a single concentration is tested at each. Test concentrations are nominal and were not measured. Light source and intensity during the study were not reported.

Primary Reviewer: Thomas Steeger, Ph.D., Senior Biologist.

Chemical Name: Carbaryl

CAS No: 63-25-2

ECOTOX Record Number and Citation: 17138 Brooke, L. T. 1991. Results of freshwater exposures with the chemicals atrazine, biphenyl, butachlor, carbaryl, carbazole, dibenzofuran, 3, 3'-dichlorobenzidine, diclorovos, 1, 2-epoxyethylbenzene (styrene oxide), isophorone, isopropalin, oxychlordane, pentachloroanisole, propoxur (baygon), tetrabromobisphenol A, 1, 2, 4, 5-tetrachlorobenzene, and 1, 2, 3-trichloropropane to selected freshwater organisms. Center for Lake Superior Environmental Studies, Environmental Health Laboratory, Cooperative Research Unit, The University of Wisconsin – Superior.

Purpose of Review (DP Barcode or Litigation): Endangered species assessment in response to litigation.

Date of Review: May 31, 2007

Summary of Study Findings: In-lab cultures of fathead minnows (*Pimephales promelas*), waterfleas (*Daphnia magna* and *Ceriodaphnia dubia*), annelids (Lubriculus variegatus), freshwater hydra (*Hydra americana*), snails (*Physella virgata*), and amphipods (Hyalella azteca) and stoneflies (*Acroneuria* sp.) collected from the Eau Claire River (Gordon, WI) were used in acute (48 – 96 hr)) and chronic (21-day) toxicity tests. Chemical concentrations for tests with daphnids were measured at 0, 24 and 48 hours for acute tests and were measured at solution renewal days (Mondays, Wednesday, Friday). Flow-through studies with fathead minnows, annelids, amphipods and stoneflies and static tests with fathead minnows were samples at 0, 48 and 96 hrs. For newel tests with annelids, snails and hydras, samples were collected at 24-hr intervals. For the 21-day chronic studies with dichlorovos using D. magna, the only concentration measured was the new solution from the high exposure. All other exposure concentrations, including the old high solutions after 24 hours or more, were below the detection limit of 70 μg/L.

Flow-through acute toxicity studies with fathead minnows (30 $\pm$ 5 days old) were conducted in a modified Benoit mini-diluter using 5.8-L glass aquaria contain 2.4 L. Static studies with fathead minnows were conducted in 6.4-L or 4-L glass beakers with a 4-L volume. Temperature ranged from 21.1 – 23.3^{o}C; hardness and alkalinity ranged between 36 – 75.8 and 38 – 70.9 mg/L as $CaCO_3$, respectively. Early life stage studies were conducted with fathead minnow embryos <24 hrs post-fertilization placed in glass incubation cups with cup bottoms consisting of nylon mesh; on hatch, 15 fry were transferred to 3.4-L tanks containing 2.4 L of fill volume; young fish were fed 3 X daily with live brine shrimp and fish were exposed for 28 days.

Toxicity studies with *D. magna* ($\leq$24-hr neonates) were conducted in 118-mL plastic Solo® cups containing 50 mL except for studies with isopropalin which were conducted in 100-mL glass beakers containing 50 mL fill. Studies with *C. dubia* (<24-hr neonates) were conducted in 30-mL plastic Solo® cups containing 50 mL fill. Acute exposures were renewed at 24 hrs and chronic exposures on a MWF regime. Temperature maintained at 22 $\pm$ 2^{o}C with dissolved oxygen >75% in both acute and chronic studies.

Flow-through studies with adult annelids (mean weight: 0.003 g) were conducted in 250-mL glass beakers with screened holes on the sides suspended in 3.4-L containing 200 mL fill volume. Static renewal studies were conducted in 250-mL glass beakers containing 200 mL of solution. Temperatures were maintained at 21 $\pm$ 2^{o}C and dissolved oxygen >60%; hardness and alkalinity ranged from 51.9 – 73.8 and 44.0 – 58.0 mg/L as $CaCO_3$, respectively.

Static-renewal studies with hydras were conducted in 250-mL glass beakers containing 200 mL of test solution. Temperature was maintained at 21.1 $\pm$ 0.3^{o}C and dissolved oxygen of 90.1 $\pm$ 3.7%; hardness and alkalinity means were 48.9$\pm$3.8 and 45.0 $\pm$ 3.8 mg/L as $CaCO_3$, respectively.

Toxicity tests with snails (mean weight 0.052 $\pm$ 0.022 g) were conducted in 250 mL glass beakers containing 200 mL exposure solution. Snails were placed in 3x12 cm screen cage within beaker. Temperature was maintained at 22 $\pm$ 1^{o}C with dissolved oxygen > 67%. Hardness and alkalinity ranged from 43.9 – 79.8 and 40.0 – 52.0 mg/L as $CaCO_3$, respectively.

Adult amphipod (mean weight: 0.002 g) flow-through studies were conducted in 250 mL glass beakers with screened holes on the sides and suspended in 3.4_L glass aquaria. Temperature ranged between 19.0 – 21.0^{o}C and dissolved oxygen was >73%; hardness and alkalinity ranged from 47.9 – 89.8 and 36.0 – 64.0 mg/L as $CaCO_3$, respectively.

Flow-through studies with the stonefly nymphs (mean wt: 0.145 $\pm$ 0.076 g) were conducted in 3.4-L glass aquaria with 2.4 L of exposure solution containing a 10 cm (3.5 cm diameter) PVC pipe for cover. Temperature was 19.7 $\pm$ 0.4^{o}C and dissolved oxygen was >73%; mean hardness and alkalinity were 67.4 $\pm$ 19.0 and 50.0 $\pm$ 14.0 mg/L as $CaCO_3$, respectively.

Table 28 provides a summary of the toxicity test results.

TABLE 28. Summary of Toxicity.

Compound	Test Organism	Stage or Age	Type of Test	96-H LC50
Atrazine	Jitonefly (Acroneuria sp.)	nymphs	Flow-thru acute	6700 (5
Atrazine	Hvallela azteca	adults	Flow-thru acute	14700 (1
Atrazine	Annelid (Lumbriculus variegatus)	adults	Flow-thru acute	>
Atrazine	Snail (Physella virqata	adults	Static renewal 96-hr acute	>
Atrazine	Hydra americana	adults	Static renewal 96-hr acute	3
Biphenyl	Fathead minnow	30 + 5 day	Flow-thru acute	1950 (1
Biphenyl	Fathead minnow	30 + 5 day	Static acute[1]	3500 (2
Biphenyl	Tathead minnow	30 + 5 day	Static acute[2]	2940 (2
Biphenyl	Fathead minnow	30 + 5 day	Static acute[3]	1450 (1
Butachlor	fathead minnow	30 + 2 day	Flow-thru acute	280 (
Butachlor	Fathead minnow	30 + 2 day	Static acute[1]	750 (
Butachlor	Fathead minnow	30 + 2 day	Static acute[2]	750 (
Butachlor	fathead minnow	30 + 2 day	Static acute[3]	640 (
Butachlor	[3. maqna	<24-hr	Static renewal	1050 (
Carbaryl	C. dubia	<24-hr	Static renewal 48-hr acute	3.06"(

Compound	Test	Organism	Stage or Age	Type of Test	96-H LC50 (95% CI) ug/L
Carbaryl	D. <u>magna</u>		<24-hr	Static renewal 48-hr acute 21-day chronic	10.1[b] (7.95-12.8) d
Carbaryl	D. magna		<24-hr		
Carbazole	Fathead	minnow	30 ±5 day	Flow-thru acute	930'
Carbazole	Fathead	minnow	30 ±4 day	Static acute[1]	<1500
Carbazole	Fathead	minnow	30 ±4 day	Static acute[2]	<1490
Carbazole	Fathead	minnow	30 ±4 day	Static acute[3]	<1140
Carbazole	D. <u>magna</u>		<24-hr	Static renewal 48-hr acute	3350" (2300-4880)
Dibenzofuran	Fathead	minnow	30 ±5 day	Flow-thru acute	1050 (840-1310)
Dibenzofuran	Fathead	minnow	30 ±5 day	Static acute[1]	3620 (3200-4100)
Dibenzofuran	Fathead	minnow	30 ±2 day	Static acute[2]	750 (2670-3430)
Dibenzofuran	Fathead	minnow	30 ±5 day	Static acute[3]	1140 (1040-1250)
3,3'-Dichloro-benzene	Fathead	minnow	30 ±4 day	Static acute[1] #1	3240'
3,3'-Dichloro-benzene	Fathead	minnow	30 ±4 day	Static acute[2] #1	2770'
3,3'-Dichloro-benzene	Fathead	minnow	30 ±4 day	Static acute[3] #1	2080'
3,3'-Dichloro-benzene	D. <u>magna</u>		<24-hr	Static renewal 48-hr acute	1050 (810-1360)

Compound	Test Organism	Stage or Age	Type of Test	96-H LC50 (95% CD uq/L
3,3'-Dichloro-benzene	Fathead minnow	3 0 + 2 day	Flow-thru acute	1770 (1640-1920)
3,3'-Dichloro-benzidine	Fathead minnow	3 0 + 2 day	Static acute[1] #2	2150 (1840-2500)
3,3'-Dichloro-benzidine	Fathead minnow	3 0 + 2 day	Static acute[2] #2	1880 (1610-2200)
3,3'-Dichloro-benzidine	Fathead minnow	3 0 + 2 day	Static acute[3] #2	1050 (820-1340)
Dichlorovos	Annelids (Lumbriculus varieqatus)	adults	Static renewal 96-hr acute	2180 (1960-2440)
Dichlorovos	Snail (Chysella virgata)	adults	Static renewal 96-hr acute	170 (140-200)
Dichlorovos	C. dubia	<24-hr	Static renewal 48-hr acute	0.149" (0.127-0.175)
Dichlorovos	D. magna	<24-hr	Static renewal 48-hr acute	0.266" (0.244-0.286)
Dichlorovos	D. magna	<24-hr	21-day chronic	>0.109[d]
Dichlorovos	Fathead minnow	3 0 + 4 day	Flow-thru acute	3090 (2570-3730)
Dichlorovos	Fathead minnow #1	<24-hr	28-day post hatch chronic flow-thru	d
Dichlorovos 28-day post hatch chronic	Fatheed minnow #2	<24-hr flow-thru		

TABLE 28 Cont. Summary o-[r] Toxicity.

Compound	Test Organism	Stage or Age	Type of Test	96-H LC50 (95% CI) ug/L
1,2-Epoxyethyl-benzene (Styrene Oxide)	Fathead minnow	30 + 5 day	Flow-thru acute	4540'
1,2-Epoxyethyl-benzene	Fathead minnow	30 + 5 day	Static acute[1]	13800'
1,2-Epoxyethyl-benzene	Fathead minnow	30 + 5 day	Static acute[2]	26330'
1,2-Epoxyethyl-benzene	Fathead minnow	30 + 5 day	Static acute[3]	10700'
1,2-Epoxyethyl-benzene	D. <u>maqna</u>	<24-hr	Static renewal 48-hr acute	11600" (10200-13100)
Isophorone	Fathead minnow	30 + 5 day	Flow-thru acute	253000 (228000-280000)
Isophorone	Fathead minnow	30 + 5 day	Static acute[1]	319000 (285000-356000)
Isophorone	Fathead minnow	30 + 5 day	Static acute[2]	275000 (246000-308000)
Isophorone	Fathead minnow	30 + 2 day	Static acute[3]	240000 (213000-271000)
Isophorone	Fathead minnow	30 + 2 day	Flow-thru acute	270 (220-3350)
Isopropalin	Fathead minnow	30 + 2 day	Static acute[1]	610 (510-730)
Isopropalin	Fathead minnow	30 + 2 day	Static acute[2]	670 (560-790)
Isopropalin	Fathead minnow	30 + 2 day	Static acute[3]	310 (280-360)
Isopropalin	D. <u>maqna</u>	<24-hr	Acute renewal 48-hr acute	30[b] (22-40)

TABLE 6 Cont. Summary of Toxicity.

Compound	Test Organism	Stage or Age	Type of Test	96-H LC50 (95% CD uq/L
Oxychlordane	Fathead minnow	3 0 + 2 day	Flow-thru acute	2.45
Oxychlordane	Fathead minnow	3 0 + 2 day	Static acute[1]	4.31 (3.81-4.88)
Oxychlordane	Fathead minnow	3 0 + 2 day	Static acute[2]	6.32 (5.55-7.19)
Oxychlordane	Fathead minnow	3 0 + 2 day	Static acute[3]	2.63 (2.23-3.10)
Oxychlordane	D. <u>magna</u>	<24-hr	Static renewal 48-hr acute	1300 (860-1960)
Pentachloroanisole	Fathead minnow	3 0 + 4 day	Flow-thru acute	650 (500-840)
Pentachloroanisole	Fathead minnow	3 0 + 4 day	Static acute	>1190
Pentachloroanisole	D. <u>maqna</u>	<24-hr	Static renewal 48-hr acute	180" (170-200)
Propoxur (baygon)	Annelid	Adults	Static renewal 96-hr acute	146000'
Propoxur	D. <u>maqna</u>	<24-hr	Static renewal 48-hr acute	27.2" (20.9-36.5)
Propoxur	D. <u>maqna</u>	<24-hr	21-day chronic	>17.2[d]
Tetrabromobis-phenol A	Fathead minnow	2 6 + 2 day	Flow-thru acute	1040 (999-1100)
Tetrabromobis-phenol A	Fathead minnow	30 + 2 day	Static acute[1]	710*
Tetrabromobis-phenol A	Fathead minnow	3 0 + 2 day	Static acute[2]	890*

TABLE 6 Cont. Summary of Toxicity.

Compound	Test Organism	Stage or Age	Type of Test		96-H LC50 (95% CI) ug/L
Tetrabromobis-phenol A	Fathead minnow	30 ± 2 day	Static acute[3]	60'	
Tetrabromobis-phenol A	0. <u>magna</u>	<24 hr	Static renewal 48-hr acute	7900[b]	(6800-200)
1,2,4,5-Tetra-chlorobenzene	Tathead minnow	3 0 + 5 day	Flow-thru acute	320'	
1,2,4,5-Tetra-chlorobenzene	Fathead minnow	3 0 + 5 day	Static acute[1]	>460	
1,2,4,5-Tetra-chlorobenzene	Fathead minnow	3 0 + 5 day	Static acute[2]	>320	
1,2,4,5-Tetra-chlorobenzene	Fathead minnow	3 0 + 5 day	Static acute	>89	
1,2,3-Trichloro-propane	Fathead minnow	3 0 + 4 day	Flow-thru acute		50800"
1,2,3-Trichloro-propane	Fathead minnow	3 0 + 4 day	Static acute[1]	69900	(67100-72900)
1,2,3-Trichloro-propane	Fathead minnow	3 0 + 4 day	Static acute[2]	57600	(55400-59900)
1,2,3-Trichloro-propane	Fathead minnow	3 0 + 4 day	Static acute[3]	27400	(25900-28900)
1,2,3-Trichloro-propane	[). <u>magna</u>	<24-hr	Static renewal 48-hr acute	33800	[b] (27800-41100)

[a] Due to no partial mortalities, the 95% confidence intervals could not be determined.

[b] 48-hr EC50.

[c] 96-hr EC50.

[d] NOEC.

[1] LC50 based on nominal concentrations.

[2] LC50 based on 0-hr concentrations.[3] LC50 based on all concentrations.

Description of Use in Document (QUAL, QUAN, INV): Qualitative

Rationale for Use: Study provides useful information to characterize toxicity of carbayl to aquatic invertebrates.

Limitations of Study: Raw data are not available to verify EC50 values

Primary Reviewer: Thomas Steeger, Ph.D., Senior Biologist