Phase III: Diazinon Criteria Report

Appendix D

Data summary sheets

Abbreviations used in this appendix:

NA = Not Applicable
NC = Non Calculable
NR = Not Reported

Unused lines deleted from tables

Within each section, studies are listed in alphabetical order by species name, when there are multiple summaries for one species, they are listed in alphabetical order by author.

Appendix D1

Studies rated RR

Ceriodaphnia dubia

Toxicity Data Summary

Study: Bailey HC, Miller JL, Miller MJ, Wiborg LC, Deanovic L, Shed T. 1997. Joint acute toxicity of diazinon and chlorpyrifos to *Ceriodaphnia dubia.* Environ Toxicol Chem 16: 2304-2308.

Relevance	Reliability
Score: 92.5 (no control description)	Score: 85
Rating: R	Rating: R

Bailey *et al.* 1997		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1991; EPA 600/4-90/027	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	N. America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	24, 48, 72, 96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	<10%	
Temperature	25 $\pm$ 1 ^{o}C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Moderately hard synthetic water	
pH	7.40-8.23	Water quality
Hardness	80-100 mg/L as $CaCO_3$	within guidelines
Alkalinity	100-120 mg/L as $CaCO_3$	in USEPA 1991

Appendix D1: Acceptable data rated RR

Bailey *et al.* 1997		***C. dubia***
Parameter	**Value**	**Comment**
Conductivity	290-300 umhos/cm	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	None	
Concentrations measured?	Yes	
Measured is what % of nominal?	106%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	< 0.1%	
Concentration 1 Nom (µg/L)	0.008	Reps: 4 w/5 per
Concentration 2 Nom (µg/L)	0.016	Reps: 4 w/5 per
Concentration 3 Nom (µg/L)	0.033	Reps: 4 w/5 per
Concentration 4 Nom (µg/L)	0.066	Reps: 4 w/5 per
Concentration 5 Nom (µg/L)	0.132	Reps: 4 w/5 per
Control	Methanol at < 0.1%	Reps: 4 w/5 per
LC50 (95% ci); µg/L	Test 1 24-h: 0.58 (0.54-0.63); Test 1 48-h: 0.58 (0.54-0.63); Test 1 72-h: 0.35 (0.29-0.42); Test 1 96-h: 0.32 (0.27-0.38); Test 2 24-h: 0.75 (0.69-0.80); Test 2 48-h: 0.48 (0.41–0.56); Test 2 72-h: 0.40 (0.36–0.44); Test 2 96-h: 0.35 (0.32–0.38); Test 3 24-h: 0.37 (0.33–0.42); Test 3 48-h: 0.26 (0.21–0.32); Test 4 24-h: 0.65 (0.46–0.92); Test 4 48-h: 0.29 (0.19–0.46)	Trimmed Spearman-Karber or binomial; based on measured values

Reliability points taken off for:
Documentation: Dissolved oxygen (4), Hypothesis tests (8)

Appendix D1: Acceptable data rated RR

Acceptability: Carrier solvent > 0.5 mL/L (4), Adequate # per rep (2), Organisms acclimated (1), Dissolved oxygen (6), Random design (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Ceriodaphnia dubia

Toxicity Data Summary

Study: Bailey HC, Krassoi R, Elphick JR, Mulhall A-M, Hunt P, Tedmanson L, Lovell A. 2000. Application of *Ceriodaphnia dubia* for whole effluent toxicity tests in the Hawkesbury-Nepean watershed, New South Wales, Australia: method development and validation. Environ Toxicol Chem 19: 88-93.

Relevance- acute
Score: 100
Rating: R

Relevance -chronic
Score: 85 (no values)
Rating: L

Reliability- acute
Score: 78
Rating: R

Bailey *et al.* 2000		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1993, 1994 (acute and chronic)	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	N. Amer.	
Age/size at start of test/growth phase	Acute: < 24 h Chronic: < 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	Acute: 48 h Chronic: 3 broods (6-8 d)	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	Acute: $\geq$ 90% Chronic: within test guidelines	
Temperature	25 $\pm$ 1^{o}C	
Test type	Acute: static Chronic: static renewal	

Appendix D1: Acceptable data rated RR

Bailey *et al.* 2000		***C. dubia***
Parameter	**Value**	**Comment**
	(daily)	
Photoperiod/light intensity	16L:8D	
Dilution water	20% Perrier	
pH	"Within satisfactory limits"	
Hardness	"Within satisfactory limits"	
Alkalinity	"Within satisfactory limits"	
Conductivity	"Within satisfactory limits"	
Dissolved Oxygen	"Within satisfactory limits"	
Feeding	Acute: none Chronic: daily with renewal	
Purity of test substance	Analytical grade	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	< 0.1% methanol; < 1 mL/L	
Concentration 1 Meas (µg/L)	5 concentrations, but levels NR	Acute reps: 4 w/ 5 per Chronic reps: 10 w/1 per
Control	Dilution water; no mention of a solvent control	Acute reps: 4 w/ 5 per Chronic reps: 10 w/1 per
LC50; µg/L	Acute: 0.329 $\pm$ 0.030 (mean of 12 tests); Chronic: 0.14 (one test)	Trimmed Spearman-Karber or binomial probability

NOEC values for chronic test NR; no reproduction numbers reported for chronic test.

Reliability points taken off for:
Documentation: Control type (8), Nominal concentrations (3), Measured concentrations (3), Hypothesis tests (8)
Acceptability: Control type (6), Measured conc within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Orgs randomly assigned (1), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Ceriodaphnia dubia

Toxicity Data Summary

Study: Bailey HC, Elphick JR, Krassoi R, Lovell A. 2001. Joint acute toxicity of diazinon and ammonia to *Ceriodaphnia dubia*. Environ Toxicol Chem 20: 2877-2882.

Relevance
Score: 100
Rating: R

Reliability
Score: 78.5
Rating: R

Bailey *et al.* 2001		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1993	Full reference below
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	0%	
Temperature	25 $\pm$ 1^{o}C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Moderately hard water	
pH	8.0	
Hardness	90 mg/L	
Alkalinity	80 mg/L	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	

Bailey *et al.* 2001		***C. dubia***
Parameter	**Value**	**Comment**
Purity of test substance	99%	
Concentrations measured?	Yes, but only the highest concentration	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	< 0.1% methanol	
Concentration 1 Nom (µg/L)	0.06	Reps: 4 w/5 per
Concentration 2 Nom (µg/L)	0.12	Reps: 4 w/5 per
Concentration 3 Nom (µg/L)	0.25	Reps: 4 w/5 per
Concentration 4 Nom (µg/L)	0.50	Reps: 4 w/5 per
Concentration 5 Nom (µg/L)	1.0	Reps: 4 w/5 per
Control	Dilution water	Reps: 4 w/5 per
LC50; µg/L	Test 1 24 h: 0.46 Test 1 48 h: 0.38 Test 2 24 h: 0.57 Test 2 48 h: 0.33	Trimmed Spearman-Karber; Geomean of concentrations bracketing LC50 w/binomial probability if no partial responses

USEPA. 1993. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms, 3rd edition. EPA 600/4-90/027F. US Environmental Protection Agency, Washington, DC.

Reliability points taken off for:
Documentation: Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Hypothesis tests (8)
Acceptability: Appropriate control (6), Measured concentration w/in 20% of nominal (4), Carrier solvent > 0.05% (4), Dissolved oxygen (6), Conductivity (1), Random design (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Ceriodaphnia dubia

Toxicity Data Summary

Study: Banks KE, Wood SH, Matthews C, Thuesen KA. 2003. Joint acute toxicity of diazinon and copper to *Ceriodaphnia dubia*. Environ Toxicol Chem 22: 1562-1567.

Relevance	Reliability
Score: 92.5 (Controls not described)	Score: 83
Rating: R	Rating: R

Banks *et al.* 2003		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1993	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	< 10%	
Temperature	25 $\pm$ 1^{o}C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Reconstituted hard water	
pH	8.35-8.36	
Hardness	175 $\pm$ 11.5 mg/L as $CaCO_3$	
Alkalinity	136 $\pm$ 9.5 mg/L as $CaCO_3$	
Conductivity	542 µmhos/cm	
Dissolved Oxygen	8.27 $\pm$ 0.06 mg/L	
Feeding	None	

Appendix D1: Acceptable data rated RR

Banks *et al.* 2003		***C. dubia***
Parameter	**Value**	**Comment**
Purity of test substance	99.8%	
Concentrations measured?	No; stock solutions measured	
Measured is what % of nominal?	Stock solutions: 105%	
Chemical method documented?	Yes, but calibration range makes no sense	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L)	0.05	Reps: 4 w/5 per
Concentration 2 Nom (µg/L)	0.10	Reps: 4 w/5 per
Concentration 3 Nom (µg/L)	0.20	Reps: 4 w/5 per
Concentration 4 Nom (µg/L)	0.40	Reps: 4 w/5 per
Concentration 5 Nom (µg/L)	0.80	Reps: 4 w/5 per
Control	Not described	Reps: 4 w/5 per
LC50 (95% ci); µg/L	0.45 (0.36-0.57)	Logistic regression

Reliability points taken off for:
Documentation: Control type (8), Measured concentrations (3), Hypothesis tests (8)
Acceptability: Appropriate control (6), Measured conc w/in 20% of nominal (4), Random design (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Ceriodaphnia dubia

Toxicity Data Summary

Banks KE, Turner PK, Wood SH, Matthews C. 2005. Increased toxicity to *Ceriodaphnia dubia* in mixtures of atrazine and diazinon at environmentally realistic concentrations. *Ecotoxicol Environ Safety* 60: 28-36.

Relevance	Reliability
Score: 100	Score: 92
Rating: R	Rating: R

Banks *et al.* 2005		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1993 acute	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	$\leq$ 10%	
Temperature	25 $\pm$ 1^{o} C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Reconstituted hard water	
pH	8..35-8.36	
Hardness	175 $\pm$ 11.5 mg/L as $CaCO_3$	
Alkalinity	136 $\pm$ 9.5 mg/L as $CaCO_3$	
Conductivity	542 $\pm$ 7.6 uS/cm	
Dissolved Oxygen	8.27 $\pm$ 0.06 mg/L	
Feeding	None	

Appendix D1: Acceptable data rated RR

Banks *et al.* 2005		***C. dubia***
Parameter	**Value**	**Comment**
Purity of test substance	99.8%	
Concentrations measured?	Yes	
Measured is what % of nominal?	93%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (µg/L)	0.10/NR	Reps: 4 w/5 per
Concentration 2 Nom/Meas (µg/L)	0.20/NR	Reps: 4 w/5 per
Concentration 3 Nom/Meas (µg/L)	0.40/NR	Reps: 4 w/5 per
Concentration 4 Nom/Meas (µg/L)	0.6/NR	Reps: 4 w/5 per
Control	Dilution water	Reps: 4 w/5 per
LC50; µg/L	0.21 (0.17-0.25)	Curve-fitting; logistic response model

Reliability points taken off for:
Documentation: Measured concentrations (3), Hypothesis tests (3)
Acceptability: Random design (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Ceriodaphnia dubia

Toxicity Data Summary

Study: CDFG. 1998 a. Test No. 122. 96-h acute toxicity of diazinon to *Ceriodaphnia dubia*, Aquatic Toxicology Laboratory, Elk Grove, California.

Relevance
Score: 100
Rating: R

Reliability
Score: 96
Rating: R

CDFG No. 122 1998 a		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1993; ASTM 1988 (E729-88 and E1192-88)	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	N. Amer.	
Age/size at start of test	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	0%	
Temperature; mean (range); ^{o}C	24.7 (24.2-25.2)	
Test type	Static; renewal	
Photoperiod	16L:8D	
Dilution water	Aquat Tox Lab well water	
pH; mean (range)	8.055 (7.62-8.19)	
Hardness; mg/L as $CaCO_3$	132-140	Measurement NR, but this is typical well water level
Alkalinity; mg/L as $CaCO_3$	144-159	Measurement NR, but this is typical well water level

CDFG No. 122 1998 a		***C. dubia***
Parameter	**Value**	**Comment**
Conductivity; mean (range); uS/cm	267 (263-271)	
Dissolved Oxygen; mean (range); mg/L	7.69 (6.23-8.19)	
Feeding	YCT:*Selenastrum*; 2 h prior to test; 2 h prior to each renewal	
Purity of test substance	87.3%	
Concentrations measured?	Yes	
Measured is what % of nominal?	81.6%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Meas (µg/L)	0.1	Reps: 4 w/5 per
Concentration 2 Meas (µg/L)	0.17	Reps: 4 w/5 per
Concentration 3 Meas (µg/L)	0.25	Reps: 4 w/5 per
Concentration 4 Meas (µg/L)	0.4	Reps: 4 w/5 per
Concentration 5 Meas (µg/L)	0.8	Reps: 4 w/5 per
Control	Dilution water; measured 0.14 ppm in one rep; 0 ppm in second rep	Reps: 4 w/5 per
LC50 (95% ci); ug/L	0.436 (0.342-0.504)	Moving average
NOEC; indicate calculation method	0.25	Likely Chi-Square, but NR
LOEC; indicate calculation method	0.4	
MATC (GeoMean NOEC,LOEC)	0.32	
% of control at NOEC	95%	
% of control at LOEC	60%	

Reliability points taken off for:
Documentation: Nominal concentrations (3), Significance level (2), Minimum significant difference (2)
Acceptability: Minimum significant difference (1)

Appendix D1: Acceptable data rated RR

Ceriodaphnia dubia

Toxicity Data Summary

Study: CDFG. 1992 a. Test No. 157. 96-h acute toxicity of chlorpyrifos to *Ceriodaphnia dubia*.

Relevance
Score: 100
Rating: R

Reliability
Score: 96
Rating: R

CDFG No. 157 1992 a		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	ASTM 1988; USEPA 1993	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	N. Amer.	
Age/size at start of test	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	96 h	
Data for multiple times?	Yes; see study	
Effect 1	Mortality	
Control response 1	5%	
Temperature; mean (range); ^{o}C	24.41 (23.8-24.9)	
Test type	Static renewal; daily renewal	
Photoperiod	16L:8D	
Dilution water	Aquat Tox Lab well water	
pH; mean (range)	8.27 (7.79-8.50)	
Hardness; mean (range); mg/L as $CaCO_3$	123.5 (123-124)	
Alkalinity; mean (range); mg/L as $CaCO_3$	112	
Conductivity; mean (range); uS/cm	382.5 (360-400)	
Dissolved Oxygen; mean (range);	8.03 (7.61-8.60)	

Appendix D1: Acceptable data rated RR

CDFG No. 157 1992 a		***C. dubia***
Parameter	**Value**	**Comment**
mg/L		
Feeding	YCT:*Selenastrum* 2 h prior to test and 2 hr prior to each renewal	
Purity of test substance	88%	
Concentrations measured?	Yes	
Measured is what % of nominal?	104.7%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	0.026 mL/L	
Concentration 1 Meas (µg/L)	0.105	Reps: 4 w/5 per
Concentration 2 Meas (µg/L)	0.200	Reps: 4 w/5 per
Concentration 3 Meas (µg/L)	0.354	Reps: 4 w/5 per
Concentration 4 Meas (µg/L)	0.625	Reps: 4 w/5 per
Concentration 5 Meas (µg/L)	1.10	Reps: 4 w/5 per
Control	Dilution water; solvent (triethylene glycol dimethyl ether, triethylene glycol, ≤ 0.0263 mL/L)	Reps: 4 w/5 per
LC50 (95% ci); ug/L	0.470 (0.354-0.625); ci doesn't seem right; numbers are same as NOEC and LOEC	Non-linear interpolation
NOEC; ug/L	0.354	Chi square
LOEC; ug/L	0.625	
MATC (GeoMean NOEC,LOEC)	0.470	
% of control at NOEC	100%	
% of control at LOEC	0%	

Reliability points taken off for:
Documentation: Nominal concentrations (3), Significance level (2), Minimum significant difference (2)
Acceptability: Minimum significant difference (1)

Appendix D1: Acceptable data rated RR

Ceriodaphnia dubia

Toxicity Data Summary

Study: CDFG. 1992b. Test No. 163. 96-h acute toxicity of chlorpyrifos to *Ceriodaphnia dubia*.

Relevance
Score: 100
Rating: R

Reliability
Score: 97
Rating: R

CDFG 163 1992b		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	ASTM 1988; USEPA 1993	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	N. Amer.	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	96 h	
Data for multiple times?	Yes; see study	
Effect 1	Mortality	
Control response 1	0%	
Temperature; mean (range)	24.4 (24.0-24.7) ^{o}C	
Test type	Static renewal; daily renewal	
Photoperiod/light intensity	16L:8D	
Dilution water	Aquat Tox Lab well water	
pH; mean (range)	8.5 (8.2-8.8)	
Hardness; mean (range)	125 (124-126) mg/L $CaCO_3$	
Alkalinity; mean (range)	100 (100-100) mg/L $CaCO_3$	
Conductivity; mean (range)	389 (385-390) uS/cm	
Dissolved Oxygen; mean (range)	7.8 (6.9-9.0) mg/L	
Feeding	YCT:*Selenastrum* 2 h prior	

CDFG 163 1992b		***C. dubia***
Parameter	**Value**	**Comment**
	to test and 2 hr prior to each renewal	
Purity of test substance	88%	
Concentrations measured?	Yes	
Measured is what % of nominal?	105%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	≤ 0.0267 mL/L; triethylene glycol dimethyl ether; triethylene glycol	
Concentration 1 Meas (µg/L)	0.1	Reps: 2 w/5 per
Concentration 2 Meas (µg/L)	0.17	Reps: 2 w/5 per
Concentration 3 Meas (µg/L)	0.345	Reps: 2 w/5 per
Concentration 4 Meas (µg/L)	0.605	Reps: 2 w/5 per
Concentration 5 Meas (µg/L)	1.1	Reps: 2 w/5 per
Control	Dilution water; solvent (triethylene glycol dimethyl ether, triethylene glycol, ≤ 0.0267 mL/L)	Reps: 2 w/5 per
LC50; (95% ci); µg/L	0.507 (0.42-0.71)	Non-linear interpolation
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	0.345 µg/L	Method: Not available; likely Chi square p: 0.05 MSD: NR
LOEC; indicate calculation method	0.605 µg/L	
MATC (GeoMean NOEC,LOEC)	0.46 µg/L	
% control at NOEC	100%	
% of control LOEC	20%	

Reliability points taken off for:
Documentation: Nominal concentrations (3), Minimum significant difference (2)
Acceptability: Minimum significant difference (1)

Appendix D1: Acceptable data rated RR

Chironomus dilutus (tentans)

Toxicity Data Evaluation

Study: Ankley GT, Collyard SA. 1995. Influence of piperonyl butoxide on the toxicity of organophosphate insecticides to three species of freshwater benthic invertebrates. Comp Biochem Physiol 110C: 149-155.

Notes: Using only data for diazinon only exposures; water quality information, test substance purity, replication, other information given as ranges for all tests and compounds; not possible to match specific data with each test.

Relevance
Score: 92.5 (Control response NR)
Rating: R

Reliability
Score: 76.5
Rating: R

Ankley & Collyard 1995		***C. dilutus***
Parameter	**Value**	**Comment**
Test method cited	None cited, but appears to follow EPA acute methods	Study by EPA staff
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	*Chironomus*	
Species	*tentans*	
Native to	North America	
Age/size at start of test	Third instar	
Test duration	96 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Data for multiple times?	No	
Effect 1	Mortality/immobility	
Control response 1	NR	
Temperature	23 $\pm$ 1 ^{o}C	
Test type	Static	
Photoperiod	16L:8D	
Dilution water	Lake Superior water; as is, or with added hardness	
pH	7.4-8.5	

Ankley & Collyard 1995		***C. dilutus***
Parameter	**Value**	**Comment**
Hardness	42-47 mg/L as $CaCO_3$	Hardness adjusted to 105 mg/L as $CaCO_3$, but not clear for which species in the study
Alkalinity	39-46 mg/L as $CaCO_3$	
Conductivity	NA	
Dissolved Oxygen	5.2-8.1 mg/L	
Feeding	None	
Purity of test substance	$\geq$ 95% pure	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	$\leq$ 15% (15 mL/L; shown to be non-toxic)	
Concentration 1 Nom/Meas (µg/L)	NR	Reps: 2-4 w/5-10 per
Concentration 2 Nom/Meas (µg/L)	NR	Reps: 2-4 w/5-10 per
Concentration 3 Nom/Meas (µg/L)	NR	Reps: 2-4 w/5-10 per
Concentration 4 Nom/Meas (µg/L)	NR	Reps: 2-4 w/5-10 per
Control?	Methanol carrier at $\leq$ 1.5%	Reps: 2-4 w/5-10 per
LC50; (95% ci)	10.7 ug/L (7.55-15.2)	Trimmed Spearman-Karber

Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Conductivity (2), Hypothesis tests (8)
Acceptability: Control response (9), Measured conc w/in 20% nominal (4), Carrier solvent (4), Organisms randomized (1), Conductivity (1), Random design (2), Dilution factor (2), Hypothesis tests (3)

Chironomus dilutus (tentans)

Toxicity Data Summary

Study: Belden JB, Lydy MJ. 2000. Impact of atrazine on organophosphate insecticide toxicity. *Environ Toxicol Chem* 19: 2266-2274.

Notes: Study showed significant synergism between diazinon and atrazine. Only data for diazinon alone is shown here for use in criteria derivation, but synergism data is useful for consideration of mixtures.

Relevance
Score: 92.5 (Control response NR)
Rating: R

Reliability
Score: 79
Rating: R

Belden & Lydy 2000		***C. dilutus***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1994	See full reference below
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	*Chironomus*	
Species	*tentans*	
Found in	North America	
Age/size at start of test	4^{th} instar; 0.63-0.71 mm wide; $\geq$ 1.0 cm long	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Immobility + Mortality	
Control response 1	NR	
Temperature	20 ± 1^{o} C	
Test type	Static	
Photoperiod	16L:8D	
Dilution water	MHSFW	
pH	7.3-7.8	

Belden & Lydy 2000		***C. dilutus***
Parameter	**Value**	**Comment**
Hardness	NR	
Alkalinity	NR	
Conductivity	320-350 uS/cm	
Dissolved Oxygen	> 70%	
Feeding	NR	
Purity of test substance	> 98%	
Concentrations measured?	Yes	Nominal values used in calcs since measured values were w/in 10% (likely w/in error of extraction and analysis procedure)
Measured is what % of nominal?	> 90%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	50 µL/L acetone	
Concentration 1 Nom/Meas (µg/L)	NR; post-test values were 76-85% of initial values	Reps: 3 w/10 per
Concentration 2 Nom/Meas (µg/L)	NR; post-test values were 76-85% of initial values	Reps: 3 w/10 per
Concentration 3 Nom/Meas (µg/L)	NR; post-test values were 76-85% of initial values	Reps: 3 w/10 per
Concentration 4 Nom/Meas (µg/L)	NR; post-test values were 76-85% of initial values	Reps: 3 w/10 per
Concentration 5 Nom/Meas (µg/L)	NR; post-test values were 76-85% of initial values	Reps: 3 w/10 per
Control	Dilution water; solvent	Reps: 3 w/10 per
ECx (95% ci); ug/L	EC1: 4.4 (2.0-7.1) EC5: 7.7 (4.2-11) EC15: 13 (8.2-17) EC50: 30 (24-36)	probit

USEPA. 1994. Methods for measuring the toxicity and bioaccumulation of sediment-associated contaminant with freshwater invertebrates. EPA/600/R-94/024. US Environmental Protection Agency, Washington, DC.

Reliability points taken off for:
Documentation: Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Hypothesis tests (8)
Acceptability: Control response (9), Organisms randomized (1), Appropriate feeding (3), Hardness (2), Alkalinity (2), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Chironomus dilutus (formerly *tentans*)

Toxicity Data Summary

Study: Lydy MJ, Austin KR. 2004. Toxicity assessment of pesticide mixtures typical of the Sacramento-San Joaquin Delta using *Chironomus tentans*. Arch Environ Contam Toxicol 48: 49-55.

Relevance
Score: 100
Rating: R

Reliability
Score: 83
Rating: R

Lydy & Austin 2004		***C. tentans***
Parameter	**Value**	**Comment**
Test method cited	EPA/600/R-94/024	USEPA 1994
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	*Chironomus*	
Species	*tentans*	
Found in	North America	
Age/size at start of test/growth phase	4^{th} instar	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Unable to perform figure 8 when prodded	
Control response 1	< 10%	
Temperature	$21 \pm 2^{o}C$	
Test type	Static	
Photoperiod/light intensity	16:8	
Dilution water	MHSFW	
pH	7.8-8.2	
Hardness	MH water (NR)	
Alkalinity	MH water (NR)	
Conductivity	320-360 uS/cm	
Dissolved Oxygen	> 75%	

Appendix D1: Acceptable data rated RR

Lydy & Austin 2004		***C. tentans***
Parameter	**Value**	**Comment**
Feeding	None	
Purity of test substance	99.5%	
Concentrations measured?	Yes	
Measured is what % of nominal?	> 90%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	100 uL/L	
Concentration 1 Nom/Meas (μg/L)	5 concentrations; levels NR	Reps: 3 w 10 per
Control	Solvent	Reps: 3 w 10 per
EC50 (95% ci); ug/L	19.1 (13.6-24.1)	Method NR

Reliability points taken off for:
Documentation: Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Statistical method (5), Hypothesis tests (8)
Acceptability: Organisms randomized (1), Hardness (2), Alkalinity (2), Temperature held +/- 1^{o}C (3), Statistical methods (2), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Daphnia magna

Toxicity Data Summary

Surprenant DC. 1988a. The chronic toxicity of ^{14}C-diazinon technical to *Daphnia magna* under flow-through conditions, EPA guidelines No. 72-4. Agricultural Division, Ciba-Geigy Corporation, Greensboro, NC.

Acute and chronic

Relevance
Score: 100
Rating: R

Reliability
Score: chronic: 93, acute: 90
Rating: R

Surprenant 1988a		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1985	Reference below
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Found in	N. America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	21 d	
Data for multiple times?	Yes; acute & chronic	
Effect 1	Survival/immobilization	
Control response 1	97% @ 21 d	
Effect 2	Growth (length)	
Control response 2	4.6 mm	
Effect 3	Reproduction	
Control response 3	131 offspring/surviving female	
Temperature	20 ± 1^{o} C	
Test type	Flow-through	
Photoperiod/light intensity	16L:8D	

Surprenant 1988a		***D. magna***
Parameter	**Value**	**Comment**
Dilution water	Fortified well water, filtered	
pH	8.1-8.3	
Hardness	170-180 mg/L as $CaCO_3$	
Alkalinity	130 mg/L as $CaCO_3$	
Conductivity	490 µmhos/cm	
Dissolved Oxygen	> 60%	
Feeding	Yeast, algae, protein/fatty acid mix; 2-3x daily	
Purity of test substance	87.7%	
Concentrations measured?	Yes	
Measured is what % of nominal?	Mean of all solns: 64% Mean of highest conc: 91%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	24 µL/L	
Concentration 1 Nom/Meas (µg/L)	0.063/0.027	Reps: 4 w/ 10 per
Concentration 2 Nom/Meas (µg/L)	0.13/0.082	Reps: 4 w/ 10 per
Concentration 3 Nom/Meas (µg/L)	0.25/0.17	Reps: 4 w/ 10 per
Concentration 4 Nom/Meas (µg/L)	0.50/0.32	Reps: 4 w/ 10 per
Concentration 5 Nom/Meas (µg/L)	1.0/0.83	Reps: 4 w/ 10 per
Control	Dilution water; solvent	Reps: 4 w/ 10 per
EC50 (95% ci; immobilization); µg/L	48-h: 0.78 (0.32-infinity) 96-h: 0.52 (0.32-0.83) 7-d: 0.41 (0.32-0.83) 14-d: 0.23 (0.17-0.32) 21-d: 0.20 (0.16-0.25)	Non-linear interpolation
NOEC; µg/L	0.17 (survival @ 21 d); no differences from control with growth or reproduction	Method: Kruskal-Wallis ANOVA by ranks p: 0.05 MSD: NR
LOEC; µg/L	0.32 (survival @ 21 d)	
MATC (GeoMean NOEC,LOEC); µg/L	0.23 (survival @ 21 d)	
% control at NOEC	102%	
% of control LOEC	0%	

USEPA. 1985. Toxic substances control act guidelines. Federal Register, Vol. 50, No. 188, September 27, 1985. Daphnid toxicity test," pp. 39333-39336, US Environmental Protection Agency, Washington, DC.

ACR = 96-h EC50/MATC = 0.52/0.23 = 2.26

Appendix D1: Acceptable data rated RR

Reliability points taken off for:
Documentation: Minimum significant difference (2)
Acceptability: Measured conc w/in 20% of nominal (4), Appropriate feeding (3 – acute only), Random design (2), Minimum significant difference (1)

Appendix D1: Acceptable data rated RR

Gammarus pseudolimnaeus

Toxicity Data Summary

Study: Hall LW Jr, Anderson RD. 2005. Acute toxicity of diazinon to the amphipod, *Gammarus pseudolimnaeus*: implications for water quality criteria. Bull Environ Contam Toxicol 74: 94-99.

Relevance	Reliability
Score: 100	Score: 85.5
Rating: R	Rating: R

This study has raw acute data that may be used with the ACE program to estimate chronic toxicity.

Study also includes a note indicating that the LC50 value of 0.2 µg/L reported for *G. fasciatus* by Johnson & Finley (1980) and Mayer and Ellersieck (1986) is not correct and should be 2 µg/L. Those tests were not accepted for chlorpyrifos criteria derivation and are not likely to meet quality requirements for diazinon criteria.

Hall & Anderson 2005		***G. pseudolimnaeus***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1986; modified as per Hall & Anderson 2004	Full references below
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Gammaridae	
Genus	*Gammarus*	
Species	*pseudolimnaeus*	
Found in	N. America	
Age/size at start of test/growth phase	Mature	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	May be used with ACE program
Effect 1	Mortality	
Control response 1	< 20%	
Temperature	17.8-18.1^{o}C	

Appendix D1: Acceptable data rated RR

Hall & Anderson 2005		***G. pseudolimnaeus***
Parameter	**Value**	**Comment**
Test type	Static-renewal	
Photoperiod/light intensity	NR	
Dilution water	Well water	
pH	8.26-8.31	
Hardness	62.5 mg/L	
Alkalinity	100 mg/L	
Conductivity	261.1-263.1 µS/cm	
Dissolved Oxygen	8.95-9.44 mg/L	
Feeding	NR	
Purity of test substance	100%	
Concentrations measured?	Yes	
Measured is what % of nominal?	105%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (µg/L)	2/2.24	Reps: 4 w/10 per
Concentration 2 No/Meas (µg/L)	4/4.34	Reps: 4 w/10 per
Concentration 3 Nom/Meas (µg/L)	8/8.32	Reps: 4 w/10 per
Concentration 4 Nom/Meas (µg/L)	16/15.52	Reps: 4 w/10 per
Concentration 5 Nom/Meas (µg/L)	32/32.48	Reps: 4 w/10 per
Control	Dilution water	Reps: 4 w/10 per
LC50 (95% ci); µg/L	48 h: 27.29 (22.45-33.18) 72 h: 20.21 (15.79-25.87) 96 h: 16.82 (12.82-22.08)	Trimmed-Spearman Karber

USEPA. 1986. Ecological effects test guidelines OPPTS 850.1020 Gammarid acute toxicity test. EPA 712-C-96-130, US Environmental Protection Agency, Office of Water, Office of Science and Technology, Health and Criteria Division, Washington, DC.

Hall LW, Anderson RD. 2004. Acute toxicity of diazinon to the amphipod *Gammarus pseudolimnaeus*. Data report. University of Maryland, Wye Research and Education Center, Queenstown, MD.

Reliability points taken off for:
Documentation: Photoperiod (3), Hypothesis tests (8)
Acceptability: Control response (9), Organisms randomized (1), Appropriate feeding (3), Random design (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Hyalella azteca

Toxicity Data Summary

Study: Anderson TD, Lydy MJ. 2002. Increased toxicity to invertebrates associated with a mixture of atrazine and organophosphate insecticides. Environ Toxicol Chem 21: 1507-1514.

Relevance
Score: 92.5
Rating: R

Reliability
Score: 76
Rating: R

Anderson & Lydy 2002		***H. azteca***
Parameter	**Value**	**Comment**
Test method cited	EPA -600-R-94-024	USEPA 1994
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Hyalellidae	
Genus	*Hyalella*	
Species	*azteca*	
Found in	N. America	
Age/size at start of test/growth phase	14-21 d	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	$20 \pm 1^{o}C$	
Test type	Static	
Photoperiod/light intensity	16:8	
Dilution water	NR	
pH	7.3-7.5	
Hardness	NR	
Alkalinity	NR	
Conductivity	331-359 uS/cm	
Dissolved Oxygen	$\geq$ 81%	
Feeding	None	

Appendix D1: Acceptable data rated RR

Anderson & Lydy 2002		***H. azteca***
Parameter	**Value**	**Comment**
Purity of test substance	≥ 98%	
Concentrations measured?	Yes	
Measured is what % of nominal?	≥ 90%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	100 uL per test vessel; size of vessel NR	
Concentration 1 Nom/Meas (µg/L)	5 concentrations; levels NR	Reps: 3 w/10 per
Control	Solvent	Reps: 3 w/10 per
LC50 (95% ci); µg/L	4.3 (3.7-5.6)	Log-probit

Reliability points taken off for:
Documentation: Nominal concentrations (3), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2)
Acceptability: Control response (9), Carrier solvent (4), Organisms randomized (1), Dilution water (2), Hardness (2), Alkalinity (2), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Jordanella floridae

Toxicity Data Summary

Allison DT, Hermanutz RO. 1977. Toxicity of diazinon to brook trout and fathead minnows. EPA-600/3-77-060. Environmental Research Laboratory-Duluth, Office of Research and Development, US Environmental Protection Agency, Duluth, MN.

Relevance
Score: 92.5 (Control response NR)
Rating: R

Reliability
Score: 81.5
Rating: R

Allison & Hermanutz 1977		***J. floridae***
Parameter	**Value**	**Comment**
Test method cited	Acute: APHA Chronic: methods recommended by committee on aquatic bioassays, ERL-Duluth w/ noted exceptions	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyprinodontiformes	
Family	Cyprinodontidae	
Genus	*Jordanella*	
Species	*floridae*	
Found in	N. America	
Age/size at start of test/growth phase	Test 1: 6 wk, 18.1 mm Test 2: 7 wk, 17.8 mm	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	$25 \pm 0.5^{o}C$	
Test type	Flow-through	
Photoperiod/light intensity	NR	
Dilution water	Lake Superior	
pH	7.2-7.8	
Hardness	42-47 mg/L	
Alkalinity	39-44 mg/L	

Allison & Hermanutz 1977		***J. floridae***
Parameter	**Value**	**Comment**
Conductivity	NR	
Dissolved Oxygen (range)	Acute 1: 105% (103-107) Acute 2: 103% (102-105)	
Feeding	NR	
Purity of test substance	92.5%	
Concentrations measured?	Yes	
Measured is what % of nominal?	NC	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	24 mg/L (0.03 mL/L) acetone; Triton-X surfactant at 3% of diazinon concentration in both acute & chronic	Conversion to mL/L based on density of 0.785 g/mL at 25^{o} C
Concentration 1, Meas (range); mg/L	Test 1: 0.20 (0.17-0.22) Test 2: 0.68 (0.60-0.77)	Reps: Test 1: 2 w/40 per Test 2: 2 w/40 per
Concentration 2, Meas (range); mg/L	Test 1: 0.36 (0.35-0.38) Test 2: 0.92 (0.91-0.95)	Reps: Test 1: 2 w/40 per Test 2: 2 w/40 per
Concentration 3, Meas (range); mg/L	Test 1: 0.82 (0.76-0.85) Test 2: 1.3 (1.2-1.4)	Reps: Test 1: 2 w/40 per Test 2: 2 w/40 per
Concentration 4, Meas (range); mg/L	Test 1: 1.6 (1.5-1.8) Test 2: 2.1 (1.8-2.2)	Reps: Test 1: 2 w/40 per Test 2: 2 w/40 per
Concentration 5, Meas (range); mg/L	Test 1: 3.1 (2.9-3.3) Test 2: 3.0 (2.9-3.2)	Reps: Test 1: 2 w/40 per Test 2: 2 w/40 per
Control	Dilution water; solvent	Reps: Test 1: 2 w/40 per Test 2: 2 w/40 per
LC50 (95% ci); µg/L	Test 1: 1500 (1200-1900) Test 2: 1800 (1600-2000) GeoMean: 1650	Litchfield & Wilcoxon

Reliability points taken off for:
Documentation: Nominal concentrations (3), Conductivity (2), Photoperiod (3), Hypothesis tests (8)
Acceptability: Control response (9), Measured conc 20% of nominal (4), Appropriate feeding (3), Conductivity (1), Photoperiod (2), Random design (2)

Appendix D1: Acceptable data rated RR

Lepomis macrochirus

Toxicity Data Summary

Allison DT, Hermanutz RO. 1977. Toxicity of diazinon to brook trout and fathead minnows. EPA-600/3-77-060. Environmental Research Laboratory-Duluth, Office of Research and Development, US Environmental Protection Agency, Duluth, MN.

Relevance
Score: 92.5 (Control response NR)
Rating: R

Reliability
Score: 81.5
Rating: R

Allison & Hermanutz 1977		***L. macrochirus***
Parameter	**Value**	**Comment**
Test method cited	Acute: APHA Chronic: methods recommended by committee on aquatic bioassays, ERL-Duluth w/ noted exceptions	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	*Lepomis*	
Species	*macrochirus*	
Found in	N. America	
Age/size at start of test/growth phase	Test 1:1 yr, 50 mm Test 2: 1 yr, 56.6 mm	
Source of organisms	Federal hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	$25 \pm 0.5^{o}C$	
Test type	Flow-through	
Photoperiod/light intensity	NR	
Dilution water	Lake Superior	
pH	7.2-7.8	
Hardness	42-47 mg/L	

Allison & Hermanutz 1977		***L. macrochirus***
Parameter	**Value**	**Comment**
Alkalinity	39-44 mg/L	
Conductivity	NR	
Dissolved Oxygen (range)	Acute 1: 100% (93-103) Acute 2: 98% (88-103)	
Feeding	NR	
Purity of test substance	92.5%	
Concentrations measured?	Yes	
Measured is what % of nominal?	NC	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	24 mg/L (0.03 mL/L) acetone; Triton-X surfactant at 3% of diazinon concentration in both acute & chronic	Conversion to mL/L based on density of 0.785 g/mL at 25^{o} C
Concentration 1, Meas (range); mg/L	Test 1: 0.04 (0.02-0.06) Test 2: 0.04 (0.04-0.05)	Reps: Test 1: 2 w/10 per Test 2: 2 w/20 per
Concentration 2, Meas (range); mg/L	Test 1: 0.08 (0.07-0.09) Test 2: 0.10 (0.09-0.11)	Reps: Test 1: 2 w/10 per Test 2: 2 w/20 per
Concentration 3, Meas (range); mg/L	Test 1: 0.22 (0.21-0.23) Test 2: 0.22 (0.21-0.24)	Reps: Test 1: 2 w/10 per Test 2: 2 w/20 per
Concentration 4, Meas (range); mg/L	Test 1: 0.44 (0.43-0.45) Test 2: 0.44 (0.38-0.47)	Reps: Test 1: 2 w/10 per Test 2: 2 w/20 per
Concentration 5, Meas (range); mg/L	Test 1: 0.89 (0.86-0.93) Test 2: 0.80 (0.69-0.88)	Reps: Test 1: 2 w/10 per Test 2: 2 w/20 per
Control	Dilution water; solvent	Reps: Test 1: 2 w/10 per Test 2: 2 w/20 per
LC50 (95% ci); µg/L	Test 1: 480 (340-670) Test 2: 440 (310-620) GeoMean: 460	Litchfield & Wilcoxon

Reliability points taken off for:
Documentation: Nominal concentrations (3), Conductivity (2), Photoperiod (3), Hypothesis tests (8)
Acceptability: Control response (9), Measured conc 20% of nominal (4), Appropriate feeding (3), Conductivity (1), Photoperiod (2), Random design (2)

Neomysis mercedis

Toxicity Data Summary

Study: CDFG. 1992c. Test No. 162. 96-h acute toxicity of diazinon to *Neomysis mercedis*, Aquatic Toxicity Laboratory, Elk Grove, CA.

Relevance	Reliability
Score: 100	Score: 93
Rating: R	Rating: R

CDFG No. 162 1992c		***N. mercedis***
Parameter	**Value**	**Comment**
Test method cited	ASTM 1988 (E729-88)	
Phylum/subphylum	Arthropoda/crustacean	
Class	Malacostraca	
Order	Mysidacea	
Family	Mysidae	
Genus	*Neomysis*	
Species	*mercedis*	
Found in	N. Amer.	
Age/size at start of test	< 5 d post-release	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	96 h	
Data for multiple times?	Yes; see study	
Effect 1	Mortality	
Control response 1	Dilution water: 0% Solvent: 5% Total: 2.5%	
Temperature; mean	17^{o} C	
Test type	Static renewal; daily renewal	
Photoperiod	16L:8D	
Dilution water	Aquat Tox Lab well water plus 2 g/kg artificial sea salt	
pH; mean	8.33	
Hardness; mean	457 mg/L as $CaCO_3$	
Alkalinity; mean	150 mg/L as $CaCO_3$	

Appendix D1: Acceptable data rated RR

CDFG No. 162 1992c		***N. mercedis***
Parameter	**Value**	**Comment**
Conductivity; mean	3003 uS/cm	
Dissolved Oxygen; mean	8.71 mg/L	
Feeding	Artemia nauplii; frequency NR	
Purity of test substance	88%	
Concentrations measured?	Yes	
Measured is what % of nominal?	100%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	$\leq$ 0.208 mL/L triethylene glycol/ triethylene glycol dimethyl ether	
Concentration 1 Meas (µg/L)	0.48	Reps: 20 w/1 per
Concentration 2 Meas (µg/L)	1.01	Reps: 20 w/1 per
Concentration 3 Meas (µg/L)	2.10	Reps: 20 w/1 per
Concentration 4 Meas (µg/L)	4.15	Reps: 20 w/1 per
Concentration 5 Meas (µg/L)	8.32	Reps: 20 w/1 per
Control	< 0.02 ug/L diazinon; dilution water; solvent	Reps: 20 w/1 per
LC50 (95% ci); ug/L	3.57 (2.99-4.36)	Moving average
NOEC; ug/L	2.10	Chi squared
LOEC; ug/L	4.15	
MATC (GeoMean NOEC,LOEC)	2.95	
% of control at NOEC	Dilution: 95% Solvent: 100%	
% of control at LOEC	Dilution: 35% Solvent: 36.8%	

Reliability points taken off for:
Documentation: Nominal concentrations (3), Significance level (2), Minimum significant difference (2)
Acceptability: Appropriate feeding (3), Temperature > +/- 1 ^{o}C (3), Minimum significant difference (1)

Appendix D1: Acceptable data rated RR

Neomysis mercedis

Toxicity Data Summary

Study: CDFG. 1992d. Test No. 168. 96-h acute toxicity of diazinon to *Neomysis mercedis*. Aquatic Toxicology Laboratory, Elk Grove, CA.

Relevance
Score: 100
Rating: R

Reliability
Score: 93
Rating: R

CDFG No. 168 1992d		***N. mercedis***
Parameter	**Value**	**Comment**
Test method cited	ASTM 1988 (E729-88)	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Malacostraca	
Order	Mysidacea	
Family	Mysidae	
Genus	*Neomysis*	
Species	*mercedis*	
Found in	N. Amer.	
Age/size at start of test	< 5 d post-release	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	96 h	
Data for multiple times?	Yes; see original paper	
Effect 1	Mortality/immobility	
Control response 1	0%	
Temperature; mean (range); ^{o}C	17.49 (16.7-19.0)	
Test type	Static renewal; daily renewal	
Photoperiod	16L:8D	
Dilution water	Aquatic Tox Lab well water with 2 g/kg artificial sea salt	
pH	8.36 (7.98-8.48)	
Hardness; mean (range); mg/L $CaCO_3$	465 (446-476)	
Alkalinity; mean (range); mg/L $CaCO_3$	145 (144-148)	
Conductivity; mean (range); uS/cm	2900 (2800-3100)	

Appendix D1: Acceptable data rated RR

CDFG No. 168 1992d		***N. mercedis***
Parameter	**Value**	**Comment**
Dissolved Oxygen; mean (range); mg/L	8.92 (8.33-9.81)	
Feeding	Artemia nauplii (frequency NR)	
Purity of test substance	88%	
Concentrations measured?	Yes	
Measured is what % of nominal?	95.5%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	0.12 mL/L triethylene glycol/triethylene dimethyl glycol	
Concentration 1 Meas (µg/L)	0.57	Reps: 10 w/1 per
Concentration 2 Meas (µg/L)	1.2	Reps: 10 w/1 per
Concentration 3 Meas (µg/L)	2.45	Reps: 10 w/1 per
Concentration 4 Meas (µg/L)	4.5	Reps: 10 w/1 per
Concentration 5 Meas (ug/L)	8.9	Reps: 10 w/1 per
Control	Dilution water; solvent control	Reps: 10 w/1 per; Measured 0.02 ug/L diazinon in solvent control)
LC50 (95% ci); ug/L	4.82 (3.95-6.00)	Moving average
NOEC; ug/L	2.45	Chi square
LOEC; indicate calculation method	4.5	
MATC (GeoMean NOEC,LOEC)	3.32	
% of control at NOEC	100%	
% of control at LOEC	60%	

Reliability points taken off for:
Documentation: Nominal concentrations (3), Significance level (2), Minimum significant difference (2)
Acceptability: Appropriate feeding (3), Temperature > +/- 1^{o}C (3), Minimum significant difference (1)

Appendix D1: Acceptable data rated RR

Physa sp. (pond snail)

Toxicity Data Summary

Study: CDFG. 1998b. Test 132. 96-h toxicity of diazinon to *Physa* sp. Aquatic Toxicology Laboratory, Elk Grove, California.

Relevance
Score: 100
Rating: R

Reliability
Score: 94
Rating: R

CDFG No. 132 1998b		***Physa* sp.**
Parameter	**Value**	**Comment**
Test method cited	ASTM 1988 (E729-88 and E1192-88)	
Phylum	Mollusca	
Class	Gastropoda	
Order	Basommatophora	
Family	Physidae	
Genus	*Physa*	
Species	sp.	
Found in	N. Amer.	
Age/size at start of test	Juvenile	
Source of organisms	Mass culture ponds	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	96 h	
Data for multiple times?	Yes; see original study	
Effect 1	Mortality	
Control response 1	5%	
Temperature; mean (range); ^{o}C	Control: 21.7 (21.0-22.4) Test: 21.6 (21.0-22.1)	Measured in highest test concentration
Test type	Static; daily renewal	
Photoperiod	16L:8D	
Dilution water	Aquatic Tox Lab well water	
pH; mean (range)	Control: 7.43 (6.72-8.18) Test: 7.82 (7.31-8.31)	
Hardness; mean (range); mg/L $CaCO_3$	Control: 110 Test: 122	
Alkalinity; mean (range); mg/L $CaCO_3$	Control: 132 Test: 132	

Appendix D1: Acceptable data rated RR

CDFG No. 132 1998b		***Physa* sp.**
Parameter	**Value**	**Comment**
Conductivity; mean (range); mS/cm	Control: 271 (243-299) Test: 257 (250-263)	
Dissolved Oxygen; mean (range); mg/L	Control: 6.47 (4.12-8.81) Test: 7.09 (3.92-9.05)	
Feeding	None	
Purity of test substance	87% (technical)	
Concentrations measured?	Yes	
Measured is what % of nominal?	48%, but stats based on measured values	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Meas (**m**g/L)	0.55	Reps: 10 w/2 per
Concentration 2 Meas (**m**g/L)	1.1	Reps: 10 w/2 per
Concentration 3 Meas (**m**g/L)	2.16	Reps: 10 w/2 per
Concentration 4 Meas (**m**g/L)	3.94	Reps: 10 w/2 per
Concentration 5 Meas (**m**g/L)	7.50	Reps: 10 w/2 per
Control	Dilution water	Reps: 10 w/2 per
LC50; mg/L	4.41 mg/L	Non-linear interpolation
NOEC; mg/L	2.16	Chi square
LOEC; mg/L	3.94	
MATC (GeoMean NOEC,LOEC); mg/L	2.92	
% of control at NOEC	95%	
% of control at LOEC	68%	

Reliability points taken off for:
Documentation: Nominal concentrations (3), Significance level (2), Minimum significant difference (2)
Acceptability: Measured conc w/in 20% nominal (4), Minimum significant difference (1)

Appendix D1: Acceptable data rated RR

Pimephales promelas

Toxicity Data Summary

Allison DT, Hermanutz RO. 1977. Toxicity of diazinon to brook trout and fathead minnows. EPA-600/3-77-060. Environmental Research Laboratory-Duluth, Office of Research and Development, US Environmental Protection Agency, Duluth, MN.

Relevance
Score: Chronic: 100
Acute 92.5 (control response NR)
Rating: R

Reliability
Score: Chronic: 90
Acute 81
Rating: R

Allison & Hermanutz 1977		***P. promelas***
Parameter	**Value**	**Comment**
Test method cited	Acute: APHA Chronic: methods recommended by committee on aquatic bioassays, ERL-Duluth w/ noted exceptions	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Pimephales*	
Species	*promelas*	
Found in	North America	
Age/size at start of test/growth phase	Acute 1: 15-wk Acute 2: 20-wk Acute 3: 13-wk Chronic 1: 4-d Chronic 2: 5-d	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	Acute: 96 h Chronic: 274 d (longest)	
Data for multiple times?	Yes	
Effects	See below	
Control responses	See below	
Temperature	Acute: 25 $\pm$ 1^{o}C Chronic adult: 25 $\pm$ 1^{o} C	

Allison & Hermanutz 1977		***P. promelas***
Parameter	**Value**	**Comment**
	Chronic larval: 25.5 $\pm$ 1^{o} C	
Test type	Flow-through	
Photoperiod/light intensity	Acute: NR Chronic: Evansville, IN; variable for life cycle	
Dilution water	Lake Superior	
pH	Acute: within chronic test Chronic 7.5 (7.2-7.8)	
Hardness	Acute: within chronic test Chronic: 44 (42-47) mg/L	
Alkalinity	Acute: within chronic test Chronic: 42 (39-44) mg/L	
Conductivity	Acute: NR Chronic: NR	
Dissolved Oxygen (range)	Acute 1: 105% (95-115) Acute 2: 96% (87-101) Acute 3: 104% (100-108) Chronic: 85% (74-107)	
Feeding	Acute: NR Chronic: daily	
Purity of test substance	92.5%	
Concentrations measured?	Yes	
Measured is what % of nominal? (range)	Acute: NC Chronic: 108% (91-122)	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	Acute: 24 mg/L (0.03 mL/L) acetone; Chronic: 2 mg/L (0.002mL/L) acetone; Triton-X surfactant at 3% of diazinon concentration in both acute & chronic	Conversion to mL/L based on density of 0.785 g/mL at 25^{o} C
Concentration 1 Acute: Meas (range); mg/L Chronic: Nom/Meas; µg/L	Acute 1: 1.1 (1.0-1.1) Acute 2: 1.1 (0.9-1.2) Acute 3: 1.7 (1.4-1.9) Chronic 1 adult: 62.5/69 Chronic 2 adult: 3.9/3.2 Chronic 2 larval: 3.9/3.3	Reps: Acute: 2 w/20 per Chronic: 2 w/50 per; thinned to 15 fish at 61 d (test 1) and 167 d (test 2)
Concentration 2 Acute: Meas (range); mg/L Chronic: Nom/Meas; µg/L	Acute 1: 2.1 (1.9-2.3) Acute 2: 1.9 (1.7-2.1) Acute 3: 2.3 (2.1-2.6) Chronic 1 adult: 125/118 Chronic 2 adult: 7.8/6.9 Chronic 2 larval: 7.8/6.8	Reps: Acute: 2 w/20 per Chronic: 2 w/50 per; thinned to 15 fish at 61 d (test 1) and 167 d (test 2)

Allison & Hermanutz 1977		***P. promelas***
Parameter	**Value**	**Comment**
Concentration 3 Acute: Meas (range); mg/L Chronic: Nom/Meas; µg/L	Acute 1: 3.4 (3.2-3.7) Acute 2: 3.4 (2.9-3.8) Acute 3: 3.0 (2.6-3.4) Chronic 1 adult: 250/229 Chronic 2 adult: 15.6/13.5 Chronic 2 larval: not done	Reps: Acute: 2 w/20 per Chronic: 2 w/50 per; thinned to 15 fish at 61 d (test 1) and 167 d (test 2)
Concentration 4 Acute: Meas (range); mg/L Chronic: Nom/Meas; µg/L	Acute 1: 6.0 (5.6-6.5) Acute 2: 4.9 (4.3-5.9) Acute 3: 4.1 (3.6-4.7) Chronic 1 adult: 500/511 Chronic 2 adult: 31.2/28.0 Chronic 2 larval: 31.2/ 28.0	Reps: Acute: 2 w/20 per Chronic: 2 w/50 per; thinned to 15 fish at 61 d (test 1) and 167 d (test 2)
Concentration 5 Acute: Meas (range); mg/L Chronic: Nom/Meas; µg/L	Acute 1: 11.7 (11.0-12.6) Acute 2: 10.6 (8.6-12.3) Acute 3: 7.9 (7.4-8.6) Chronic 1 adult: 1000/1099 Chronic 2 adult: 62.5/60.3 Chronic 2 larval: 62.5/62.6	Reps: Acute: 2 w/20 per Chronic: 2 w/50 per; thinned to 15 fish at 61 d (test 1) and 167 d (test 2)
Control	Dilution water; solvent	Reps: Acute: 2 w/20 per Chronic: 2 w/50 per; thinned to 15 fish at 61 d (test 1) and 167 d (test 2)
LC50; µg/L	Test 1: 6800 Test 2: 6600 Test 3: 10000 GeoMean: 7800	Litchfield & Wilcoxon
NOEC; µg/L	See below	See below

ACR based on geometric mean LC50 from this test and 167-274-d survival:
LC50/MATC = 7800/41 = 190

Acute control survival NR, but standard method followed.

NOEC/LOEC (µg/L) determined by ANOVA, Dunnett's; p = 0.05; MSD NR.

<u>Test 1: Survival at 30 d</u>
NOEC = 1100 (160% of control)
LOEC = > 1100
MATC = NC
Control response: 47%

Appendix D1: Acceptable data rated RR

Test 1: Average total length at 30 d
NOEC = 1100 (78% of control)
LOEC = > 1100
MATC = NC
Control response: 11.1 mm

Test 1: Survival at 61 d
NOEC = 1100 (126% of control)
LOEC = > 1100
MATC = NC
Control response: 38%

Test 1: Average total length
NOEC = 1100 (62% of control)
LOEC = > 1100
MATC = NC
Control response: 19.8 mm

Test 1: Instantaneous growth rate
NOEC = 69 (93% of control)
LOEC = 229 (62% of control)
MATC = 200
Control response: 188 d^{-1}

Test 1: Incidence of scoliosis at 13 wk
NOEC = < 69
LOEC = 69 (860% of control)
MATC = NC
Control response: 7%

Test 2: Incidence of scoliosis at 19 wk Not linked to survival, growth, reproduction
NOEC = 6.9 (137% of control)
LOEC = 13.5 (210% of control)
MATC = 9.7
Control response: 19%

Test 2: Incidence of scoliosis at 24 wk (interrupted dose response)
NOEC = < 3.2
LOEC = 3.2 (162% of control)
MATC = NC
Control response: 21%

Test 2
No significant effects on survival, growth or instantaneous growth of parents rate at 31, 64, 97, 135, 167 d. No significant effects on number of mature females at termination, number of spawnings, total number of eggs, eggs/spawning, eggs/female, estimated larvae/female, mature males, mature females, mature males and females, 30- and 60-d progeny survival, 30- and 60-d progeny average total length, 30- and 60-d progeny average weight.

Test 2: Survival from 167-274 d *********Use this result **********
NOEC = 28.0 (86% of control)
LOEC = 60.3 (54% of control)
MATC = 41
Control response: 93%

Test 2: Hatchability
NOEC = < 3.2
LOEC = 3.2 (71% of control)
MATC = NC
Control response: 92%

Reliability points taken off for:
Documentation: Nominal concentrations (3 - acute only), Conductivity (3), Photoperiod (3 – acute only), Hypothesis tests (8 – acute only), Minimum significant difference (2 – chronic only), Point estimates (8 – chronic only)
Acceptability: Control response (9 – acute only), Appropriate feeding (3 – acute only), Conductivity (1), Photoperiod (2 – acute only), Random design (2), Hypothesis tests (3 – acute only), Minimum significant difference (1 – chronic only), Point estimates (3 – chronic only)

Appendix D1: Acceptable data rated RR

Pimephales promelas

Toxicity Data Summary

Denton DL, Wheelock CE, Murray SH, Deanovic LA, Hammock BD, Hinton DE. 2003. Joint acute toxicity of esfenvalerate and diazinon to larval fathead minnows (*Pimephales promelas*). *Environ Toxicol Chem* 22: 336-341.

Relevance
Score: Mortality: 100; Sublethal 60 (No Std. Method, Endpoint, No values)
Rating: R (Mortality); N (Sublethal)

Reliability
Score: 80 (Mortality)

Rating: R

Denton *et al.* 2003		***P. promelas***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1993 acute	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Pimephales*	
Species	*promelas*	
Found in	North America	
Age/size at start of test/growth phase	7 d	
Source of organisms	Certified supplier	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	$\leq$ 10%	
Effect 2	Carboxylesterase activity	
Control response 2	Baseline	
Effect 3	Acetylcholinesterase activity	
Control response 3	Baseline	
Temperature	20^{o} C	
Test type	Static renewal	
Photoperiod/light intensity	NR	
Dilution water	Synthetic moderately hard	

Denton *et al.* 2003		***P. promelas***
Parameter	**Value**	**Comment**
	water	
pH	Within guidelines	
Hardness	Meets dilution water specs	
Alkalinity	Meets dilution water specs	
Conductivity	Within guidelines	
Dissolved Oxygen	Within guidelines	
Feeding	2 h before start of test; 2 h before each renewal	
Purity of test substance	99.4%	
Concentrations measured?	Yes	
Measured is what % of nominal?	57-100%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	< 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	Number and levels NR	Reps: 3 w/10 per
Control	solvent	
LC50; µg/L	Test 1: 6393 Test 2: 5048 Test 3: 7969 GeoMean: 6470	probit

No toxicity values were generated for carboxylesterase and acetylcholinesterase activity. Some diazinon effects were seen, but no statistical analysis was done to determine significance. These endpoints are not linked to survival, growth or reproduction (analysis was done only on animals surviving to end of test).

Reliability points taken off for:
Documentation: Nominal concentrations (3), Measured concentrations (3), Photoperiod (3), Hypothesis tests (8)
Acceptability: Measured conc w/in 20% of nominal (4), Organisms randomized (1), Appropriate feeding (3), Temperature > +/- 1^{o}C (3), Photoperiod (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Pimephales promelas

Toxicity Data Summary

Study: Geiger DL, Call DJ, Brooke LT. 1988. Acute toxicities of organic chemicals to fathead minnows (*Pimephales promelas*). Center for Lake Superior Environmental Studies, University of Wisconsin-Superior. Pp279-280.

Relevance-mortality
Score: 90 (No standard method)
Rating: R

Relevance—sublethal effects
Score: 75 (No standard method; Endpoints not linked to survival, growth, reproduction)
Rating: L

Reliability -- mortality & sublethal effects
Score: 86
Rating: R

Geiger *et al.* 1988		***P. promelas***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Pimephales*	
Species	*promelas*	
Found in	N. Amer.	
Age/size at start of test/growth phase	31 d	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes, see below	
Effect 1	Mortality	
Control response 1	0%	
Effect 2	Loss of equilibrium	
Control response 2	0% affected fish	
Temperature	24.5 $\pm$ 0.32	

Geiger *et al.* 1988		***P. promelas***
Parameter	**Value**	**Comment**
Test type	Flow-through	
Photoperiod/light intensity	NR	
Dilution water	Lake Superior or dechlorinated tapwater (waters shown to be very similar)	
pH	7.6 $\pm$ 0.05	
Hardness	43.6 mg/L as $CaCO_3$	
Alkalinity	42.6 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	6.6 $\pm$ 0.49	
Feeding	None	
Purity of test substance	87.1	
Concentrations measured?	Yes	
Measured is what % of nominal?	78-92%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (mg/L)	3.35/2.61 (A)	Reps: 1 w/20 per
Concentration 2 Nom/Meas (mg/L)	5.15/4.43 (B)	Reps: 1 w/20 per
Concentration 3 Nom/Meas (mg/L)	7.93/6.80 (C)	Reps: 1 w/20 per
Concentration 4 Nom/Meas (mg/L)	12.2/10.1 (D)	Reps: 1 w/20 per
Concentration 5 Nom/Meas (mg/L)	18.8/17.2 (E)	Reps: 1 w/20 per
Control	Dilution water	Reps: 1 w/20 per
LC50 (95% ci); mg/L	9.35 (8.12-10.8)	Trimmed Spearman-Karber
EC50 (95% ci); mg/L	7.46 (6.67-8.34)	Trimmed Spearman-Karber

Mortalities by concentration and day (20 fish per concentrations at start):

	Control	A	B	C	D	E
24 h	0	0	0	2	5	16
48 h	0	0	0	4	9	18
72 h	0	0	0	4	10	18
96 h	0	0	0	4	12	19

Reliability points taken off for:
Documentation: Conductivity (2), Photoperiod (3), Hypothesis tests (8)
Acceptability: No standard method (5), Conductivity (1), Photoperiod (2), Random design (2), Adequate replicates (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Pimephales promelas

Toxicity Data Summary

Study: Jarvinen AW, Tanner DK. 1982. Toxicity of selected controlled release and corresponding unformulated technical grade pesticides to the fathead minnow *Pimephales promelas*. Environ Poll (Series A). 27: 179-195.

Relevance
Score: Acute: 92.5 (Control response NR); Chronic: 100
Rating: R (both)

Reliability
Score: Acute: 78; Chronic: 86
Rating: R

Jarvinen & Tanner 1982		***P. promelas***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1975 (acute studies); ERL Duluth 1979 (embryo-larval)	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyriniformes	
Family	Cyprinidae	
Genus	*Pimephales*	
Species	*promelas*	
Native to	North America	
Age/size at start of test	Newly hatched (4-d tests); Newly hatched (embryo-larval)	
Test duration	96-h static; 96-h flow-through acute; 32-d flow-through embryo-larval	
Data for multiple times?	No	
Effect 1	Mortality (static and FT)	
Control response 1	Acute: NR; 32-d exposure: 0%	
Effect 2	Weight	
Control response 2		
Temperature	23.5-26.0 ^{o}C	
Test type	Static (Pyrex beakers) Flow-through	Flow-through at 15 ml/min; 99% replacement in 3 h
Photoperiod	16L:8D	
Dilution water	Lake Superior; sand-filtered, sterilized	
pH	7.4-7.8	

Jarvinen & Tanner 1982		***P. promelas***
Parameter	**Value**	**Comment**
Hardness	45.8 mg/L	
Alkalinity	43.1 mg/L	
Salinity	NA	
Dissolved Oxygen	Flow-through: > 75% saturation; 6.5-8.4 mg/L in all	
Feeding	Acute: not mentioned; 32-d: 2-3 X daily (nauplii)	
Purity of test substance	Technical: 87.1%; Knox Out 2 FM: 23%	
Concentrations measured?	Yes	
Concentration 1 Meas (**m**g/L)	Acute studies: NR Chronic technical: 0.05 ± 0.01; Chronic Knox Out: 0.04 ± 0.05	Reps: Static: 2 w/10 per; 4-d FT: 2 w/20 per; 32-d FT: 2 w/15 per
Concentration 2 Meas (**m**g/L)	Acute studies: NR Chronic technical: 0.09 ± 0.02 Chronic Knox Out: 0.076 ± 0.006	Reps: Static: 2 w/10 per; 4-d FT: 2 w/20 per; 32-d FT: 2 w/15 per
Concentration 3 Meas (**m**g/L)	Acute studies: NR Chronic technical: 0.14 ± 0.01; Chronic Knox Out: 0.125 ± 0.01	Reps: Static: 2 w/10 per; 4-d FT: 2 w/20 per; 32-d FT: 2 w/15 per
Concentration 4 Meas (**m**g/L)	Acute studies: NR Chronic technical: 0.29 ± 0.03; Chronic Knox Out: 0.26 ± 0.03	Reps: Static: 2 w/10 per; 4-d FT: 2 w/20 per; 32-d FT: 2 w/15 per
Concentration 5 Meas (**m**g/L)	Acute studies: NR Chronic technical: 0.50 ± 0.06; Chronic Knox Out: 0.49 ± 0.07	Reps: Static: 2 w/10 per; 4-d FT: 2 w/20 per; 32-d FT: 2 w/15 per
Control?	0.00007-0.0001 mg/L; no carriers	Reps: Static: 2 w/10 per; 4-d FT: 2 w/20 per; 32-d FT: 2 w/15 per
LC50 (95% ci); **m**g/L	Static, 96-h, technical, un-aged: 4.3 (3.4- 5.2); Static, 96-h, technical, aged: 2.1 (1.7-2.9);	Moving average

Jarvinen & Tanner 1982		***P. promelas***
Parameter	**Value**	**Comment**
	Static, 96-h, Knox, un-aged: 6.1 (5.0-7.6); Static, 96-h, Knox, aged: 5.1 (4.4-6.1); FT, 96-h, technical: 6.9 (6.2-7.9); FT, 96-h, Knox: NC (not enough mortality)	
NOEC; (32-d FT); **m**g/L	Survival, technical: 0.14; Weight, technical: 0.05; Survival, Knox: 0.26; Weight, Knox: 0.04	ANOVA; Dunnett's
LOEC; **m**g/L	Survival, technical: 0.29; Weight, technical: 0.09; Survival, Knox: 0.49; Weight, Knox: 0.076	
MATC (GeoMean NOEC,LOEC)	Survival, technical: 0.20; Weight, technical: 0.067; Survival, Knox: 0.36; Weight, Knox: 0.055	
% of control at NOEC	Survival, technical: 93.3%; Weight, technical: 90.4%; Survival, Knox: 100%; Weight, Knox: 93.2%	
% of control at LOEC	Survival, technical: 63.4%; Weight, technical: 89.9%; Survival, Knox: 83.4%; Weight, Knox: 88.9%	

Other data:

Stock toxicant solutions were made using a saturator system; acute static tests were done weekly over an 11 week period to see if toxicity changed as solutions aged.

Water solubility of technical diazinon: 40 mg/L
Water solubility of Knox Out: 34 mg/L

$t_{1/2}$ = 30 d for technical grade; determined in static half-life studies using Lake Superior water separate from tox studies
$t_{1/2}$ = > 230 d for Knox Out

Text clearly says that embryo-larval exposures were started with larvae; doesn't make sense, but that's what it says.

LC50s for STATIC tests

2.1 (aged) *** use this value ******
4.3 (new)

Reliability points taken off for:
Documentation: Nominal concentrations (3), Measured concentrations (3 – acute only), Conductivity (2), Hypothesis tests (8 – acute only), Significance level (2 – chronic only), Minimum significant difference (2 – chronic only), Point estimates (8 – chronic only)
Acceptability: Control response (9 – acute only), Measured conc w/in 20% of nominal (4), Appropriate feeding (3 – acute only), Conductivity (1), Number of concentrations (3 – acute only), Random design (2), Adequate replicates (2 – acute only), Hypothesis tests (3 – acute only), Minimum significant difference (1 – chronic only), Point estimates (3 – chronic only)

Appendix D1: Acceptable data rated RR

Pimephales promelas

Toxicity Data Summary

Surprenant DC. 1988b. The toxicity of diazinon technical to fathead minnow (*Pimephales promelas*) embryos and larvae. Agricultural Division, Ciba-Geigy Corporation, Greensboro, NC.

Chronic only

Relevance
Score: 100
Rating: R

Reliability
Score: 93.5
Rating: R

Surprenant 1988b		***P. promelas***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1981; ASTM 1986	References below
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyriniformes	
Family	Cyprinidae	
Genus	*Pimephales*	
Species	*promelas*	
Found in	N. America	
Age/size at start of test	Embryo	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	34 d	
Data for multiple times?	No	
Effect 1	Survival at hatch	No significant effects seen
Control response 1	81%	
Effect 2	Larval survival	No significant effects seen
Control response 2	94%	
Effect 3	Larval growth (weight)	
Control response 3	129 mg	
Effect 4	Larval growth (length)	
Control response 4	25 mm	
Temperature	25 ± 0.5^{o} C	
Test type	Flow-through	
Photoperiod/light intensity	16L:8D	

Surprenant 1988b		***P. promelas***
Parameter	**Value**	**Comment**
Dilution water	Well water	
pH	6.8-7.5	
Hardness	29-30 mg/L as $CaCO_3$	
Alkalinity	26-27 mg/L as $CaCO_3$	
Conductivity	120-150 μmhos/cm	
Dissolved Oxygen	7.9-8.6 mg/L	
Feeding	Larvae: brine shrimp 2-3x daily;	
Purity of test substance	Technical; 87.7%	
Concentrations measured?	Yes	
Measured is what % of nominal?	99%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	0.018 mL/L	
Concentration 1 Nom/Meas (mg/L)	0.094/0.092	Reps: 2 w/60 embryos per; 40 larvae carried thru
Concentration 2 Nom/Meas (mg/L)	0.19/0.17	Same as above
Concentration 3 Nom/Meas (mg/L)	0.38/0.38	Same as above
Concentration 4 Nom/Meas (mg/L)	0.75/0.76	Same as above
Concentration 5 Nom/Meas (mg/L)	1.5/1.6	Same as above
Control	Dilution water; solvent	Same as above
NOEC; mg/L; length endpoint	0.092	Method: ANOVA, Dunnett's p: 0.05 MSD: 1.6 mm
LOEC; mg/L	0.17	Length endpoint
MATC mg/L (GeoMean NOEC,LOEC)	0.13	Length endpoint
% control at NOEC	96%	
% of control LOEC	88%	

ASTM 1985. Proposed new standard guide for conducting early life-stage toxicity tests with fishes. ASTM Committee E-47 on Biological Effects and environmental Fate, Draft No. 10, July, 1986. American Society for Testing and Materials, Conshohocken, PA.

USEPA. 1981. Recommended bioassay procedures for fathead minnows (*Pimephales promelas*) chronic tests. Bioassay Committee of the National Water Quality Laboratory, EPA/ERL Duluth, MN.

Reliability points taken off for:
Documentation: Point estimates (8)
Acceptability: Random design (2), Point estimates (3)

Appendix D1: Acceptable data rated RR

Pomacea paludosa

Toxicity Data Summary

Study: Call DJ (1993) Validation study of a protocol for testing the acute toxicity of pesticides to invertebrates using the apple snail (Pomacea paludosa).

Relevance
Score: 100
Rating: R

Reliability
Score: 80.5
Rating: R

Call 1993		***P. paludosa***
Parameter	**Value**	**Comment**
Test method cited	OPP methods	draft protocol
Phylum	Mollusca	
Class	Gastropoda	
Order	Architaenioglossa	
Family	Ampullariidae	
Genus	*Pomacea*	
Species	*paludosa*	
Family in North America?	Yes	
Age/size at start of test/growth phase	Test 1 - 1d, Test 2 - 7 d Test 3 - 7 d	
Source of organisms	eggs collected in Florida	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	yes	
Effect 1	Mortality (3 tests)	
Control response 1	5%, 0%, 0%	
Temperature	27.4, 26.0, 26.3	
Test type	FT	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated city amended with salts to 180mg/L	
pH	NR	
Hardness	180mg/L	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	78-97%, 74-99%, 66-100	
Feeding	no	

Call 1993		***P. paludosa***
Parameter	**Value**	**Comment**
Purity of test substance	87%	
Concentrations measured?	Yes	
Measured is what % of nominal?	93-97%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	0.044ml/L	
Concentration 1 Nom/Meas (µg/L)	254, 367, 510	2 Reps of 10
Concentration 2 Nom/Meas (µg/L)	653, 711, 1080	2 Reps of 10
Concentration 3 Nom/Meas (µg/L)	1490, 1280, 1760	2 Reps of 10
Concentration 4 Nom/Meas (µg/L)	3700, 3450, 4050	2 Reps of 10
Concentration 5 Nom/Meas (µg/L)	7070, 7490, 7340	2 Reps of 10
Control	Yes	2 Reps of 10
LC50; indicate calculation method	Test 1 = 2950 Test 2 = 3270 Test 3 = 3390 Trimmed Spearman-Karber	

Other notes:
3 tests with different ages a beginning of test: 1 day old, 7 day old, 7 day old a second time. Document obtained from EPA. Appendix missing, may contain parameters like hardness etc.

Reliability points taken off for:
Documentation: Alkalinity (2), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8)
Acceptability: Organisms randomized (1), Alkalinity (2), Appropriate temperature (6), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix D1: Acceptable data rated RR

Procloeon sp.

Toxicity Data Summary

Study: Anderson BS, Phillips BM, Hunt JW, Connor V, Richard N, Tjeerdema RS. 2006. Identifying primary stressors impacting macroinvertebrates in the Salinas River (California, USA): Relative effects of pesticides and suspended particles. Environ Poll 141: 402-408.

Relevance
Score: 100 for Test 1; 92.5 for Test 2; and Test 3 (control survival <90%)
Rating: R

Reliability
Score: Test 1: 88.5; Test 2: 84; Test 3: 82.5
Rating: all: R

Anderson et al. 2006		***Procloeon* sp.**
Parameter	**Value**	**Comment**
Test method cited	USEPA 1993	Pers. comm.
Phylum	Arthropoda	
Class	Insecta	
Order	Ephemeroptera	
Family	Baetidae	
Genus	*Procloeon*	
Species	sp.	
Found in	N. America	
Age/size at start of test/growth phase	0.5-1cm (age unknown)	
Source of organisms	Field collected from clean site	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	Dilution water: 80-84% MeOH: 84-100%	Pers. comm.
Temperature	22.1^{o}C	From data sheet
Test type	Static renewal; daily	
Photoperiod/light intensity	NR	
Dilution water	Well water	

Appendix D1: Acceptable data rated RR

Anderson et al. 2006		***Procloeon* sp.**
Parameter	**Value**	**Comment**
pH	7.4-8.1	From data sheet
Hardness	NR	
Alkalinity	NR	
Conductivity	670-682 µS/cm	From data sheet
Dissolved Oxygen	7.7-8.0 mg/L	From data sheet
Feeding	None	
Purity of test substance	99%	
Concentrations measured?	Yes	
Measured is what % of nominal?	113% (range: 103-127%)	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	1% methanol (10 mL/L)	
Concentration 1 Nom/Meas (µg/L)	0.5/0.59	Reps: 3-5 w/5 per
Concentration 2 Nom/Meas (µg/L)	1.0/1.03	Reps: 3-5 w/5 per
Concentration 3 Nom/Meas (µg/L)	2.5/3.18	Reps: 3-5 w/5 per
Concentration 4 Nom/Meas (µg/L)	5.0/5.27	Reps: 3-5 w/5 per
Control	Dilution water; 1% methanol	Reps: 3-5 w/5 per
LC50; µg/L	Test 1: 1.53* Test 2: 2.11* Test 3: 1.77*	Trimmed Spearman-Karber

*Individual test results obtained via personal communication with the authors.

Reliability points taken off for:
Documentation: Hardness (2), Alkalinity (2), Photoperiod (3), Minimum significant difference (2 – Test 3 only)
Acceptability: Control response (9 – Tests 2, 3 only), Carrier solvent (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Temperature > +/- 1 ^{o}C (3), Photoperiod (2), Random design (2), Minimum significant difference (1 – Test 3 only)

Salvelinus fontinalis

Toxicity Data Summary

Allison DT, Hermanutz RO. 1977. Toxicity of diazinon to brook trout and fathead minnows. EPA-600/3-77-060. Environmental Research Laboratory-Duluth, Office of Research and Development, US Environmental Protection Agency, Duluth, MN.

Relevance
Score: Acute: 92.5 (Control response NR); Chronic: 100
Rating: R (both)

Reliability
Score: Acute: 79; Chronic: 89.5
Rating: R (both)

Allison & Hermanutz 1977		***S. fontinalis***
Parameter	**Value**	**Comment**
Test method cited	Acute: APHA Chronic: methods recommended by committee on aquatic bioassays, ERL-Duluth w/ noted exceptions	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Salvelinus*	
Species	*fontinalis*	
Found in	North America	
Age/size at start of test/growth phase	Acute 1: 1 yr Acute 2: 1 yr Acute 3: 1 yr Chronic 1: 1 yr Chronic 2: 1 yr	
Source of organisms	Federal hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	Acute: 96 h Chronic: 173 d (yearlings) plus 122 d post-hatch (progeny)	
Data for multiple times?	Yes	
Effects	See below	
Control responses	See below	

Allison & Hermanutz 1977		***S. fontinalis***
Parameter	**Value**	**Comment**
Temperature	Acute: 12 ± 0.5°C Chronic: ± 1° C from recommended temperature according to date	
Test type	Flow-through	
Photoperiod/light intensity	Acute: NR Chronic: Evansville, IN; variable for life cycle	
Dilution water	Lake Superior	
pH	Acute: within chronic test Chronic 7.3 (7.0-7.6)	
Hardness	Acute: within chronic test Chronic: 45 (42-47) mg/L	
Alkalinity	Acute: within chronic test Chronic: 42 (40-47) mg/L	
Conductivity	Acute: NR Chronic: NR	
Dissolved Oxygen (range)	Acute 1: 65% (43-106) Acute 2: 75% (58-107) Acute 3: 86% (78-95) Chronic adult: 86% (54-103) Chronic larval: 101% (88-109)	
Feeding	Acute: NR Chronic: 2x daily (adults); 5x daily (juveniles, alevins)	
Purity of test substance	92.5%	
Concentrations measured?	Yes	
Measured is what % of nominal? (range)	Acute: NC Chronic: 117% (94-136)	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	Acute: 24 mg/L (0.03 mL/L) acetone; Chronic: 2 mg/L (0.002mL/L) acetone; Triton-X surfactant at 3% of diazinon concentration in both acute & chronic	Conversion to mL/L based on density of 0.785 g/mL at 25° C
Concentration 1 Acute: Meas (range); mg/L Chronic: Nom/Meas; µg/L	Acute 1: 0.04 (0.04-0.06) Acute 2: 0.03 (0.03-0.04) Acute 3: None Chronic adult: 0.75/0.55 Chronic larval: 0.75/0.80	Reps: Acute: 2 w/20 per Chronic 1 & 2: 2 w/12 per; thinned to 2 males, 4 females

Allison & Hermanutz 1977		***S. fontinalis***
Parameter	**Value**	**Comment**
		at 173 d
Concentration 2 Acute: Meas (range); mg/L Chronic: Nom/Meas; µg/L	Acute 1: 0.08 (0.07-0.1) Acute 2: 0.06 (0.05-0.07) Acute 3: 0.23 (0.20-0.26) Chronic adult: 1.5/1.1 Chronic larval: 1.5/1.4	Reps: Acute: 2 w/20 per Chronic 1 & 2: 2 w/12 per; thinned to 2 males, 4 females at 173 d
Concentration 3 Acute: Meas (range); mg/L Chronic: Nom/Meas; µg/L	Acute 1: 0.16 (0.14-0.18) Acute 2: 0.14 (0.12-0.16) Acute 3: 0.51 (0.46-0.57) Chronic adult: 3.0/2.4 Chronic larval: 3.0/2.7	Reps: Acute: 2 w/20 per Chronic 1 & 2: 2 w/12 per; thinned to 2 males, 4 females at 173 d
Concentration 4 Acute: Meas (range); mg/L Chronic: Nom/Meas; µg/L	Acute 1: 0.39 (0.34-0.47) Acute 2: 0.35 (0.28-0.39) Acute 3: 0.93 (0.88-1.0) Chronic adult: 6.0/4.8 Chronic larval: 6.0/5.6	Reps: Acute: 2 w/20 per Chronic 1 & 2: 2 w/12 per; thinned to 2 males, 4 females at 173 d
Concentration 5 Acute: Meas (range); mg/L Chronic: Nom/Meas; µg/L	Acute 1: 0.92 (0.76-1.2) Acute 2: 0.76 (0.68-0.82) Acute 3: 2.3 (1.9-2.6) Chronic adult: 12.0/9.6 Chronic larval: 12.0/11.1	Reps: Acute: 2 w/20 per Chronic 1 & 2: 2 w/12 per; thinned to 2 males, 4 females at 173 d
Control	Dilution water; solvent	Reps: Acute: 2 w/20 per Chronic 1 & 2: 2 w/12 per; thinned to 2 males, 4 females at 173 d
LC50; µg/L	**Test 1: 800 (440-1140)** **Test 2: 450 (320-630)** **Test 3: 1050 (720-1520)** GeoMean: 723	Litchfield & Wilcoxon
NOEC; µg/L	See below	See below

ACR based on geometric mean LC50 from this test and 167-274-d survival:
LC50/MATC = 723/6.8 = 106

Acute control survival NR, but standard method followed.

NOEC/LOEC (µg/L) determined by ANOVA, Dunnett's; p = 0.05; MSD NR.

Incidence of scoliosis not significant at 91 or 173 d

Survival at 91 d
NOEC = 4.8 (100% of control)
LOEC = 9.6 (92% of control)
MATC = 6.8
Control response: 100%

Average total length at 91 d
NOEC = 9.6 (88.5% of control)
LOEC = > 9.6
MATC = NC
Control response: 252.5 mm

Average weight at 91 d
NOEC = 9.6 (62.7% of control)
LOEC = > 9.6
MATC = NC
Control response: 178.5 g

Instantaneous growth rate at 91 d
NOEC = 2.4 (87% of control)
LOEC = 4.8 (27% of control)
MATC = 3.4
Control response: 44 d^{-1}

Survival at 173 d
NOEC = 4.8 (96% of control)
LOEC = 9.6 (75% of control)
MATC = 6.8
Control response: 100%

Average total length at 173 d
NOEC = 9.6 (83% of control)
LOEC = > 9.6
MATC = NC
Control response: 286 mm

Average weight at 173 d
NOEC = 9.6 (55% of control)
LOEC = > 9.6
MATC = NC
Control response: 266 g

Instantaneous growth rate at 173 d
NOEC = 9.6 (68% of control)

LOEC = > 9.6
MATC = NC
Control response: 48.5 d^{-1}

No significant results for number of females spawning, total number of eggs spawned, number of eggs/female, viability of eggs, or gonadal development (males or females).

Progeny average total length at 2 d
NOEC = 5.6 (96% of control)
LOEC = 11.1 (94% of control)
MATC = 7.9
Control response: 15.8 mm

Progeny survival at 30 d
NOEC = 11.1 (100% of control)
LOEC = > 11.1
MATC = NC
Control response: 100%

Progeny average total length at 30 d (interrupted dose response)
NOEC = < 0.80
LOEC = 0.80 (94% of control)
MATC = NC
Control response: 22.5 mm

Progeny instantaneous growth rate at 90 d
NOEC = 5.6 (88% of control)
LOEC = 11.1 (86% of control)
MATC = 7.9
Control response: 126 d^{-1}

Progeny survival at 122 d
NOEC = 11.1 (83% of control)
LOEC = > 11.1
MATC = NC
Control response: 88%

Progeny average total length at 122 d (interrupted dose response)
NOEC = < 0.80
LOEC = 0.80 (85% of control)
MATC = NC
Control response: 65.8 mm

Progeny instantaneous growth rate at 122 d (interrupted dose response)
NOEC = < 0.80
LOEC = 0.80 (90% of control)

MATC = NC
Control response: 155 d^{-1}

Progeny average weight at 122 d (interrupted dose response)
NOEC = < 0.80
LOEC = 0.80 (60% of control)
MATC = NC
Control response: 2.76 g

EPA used a chronic value of < 0.08 based on effects on growth of progeny.

No scoliosis in progeny.

BCF determined in this study:

Adults exposed for 6 months at 4.8 µg/L, based on levels in blood: 13
Adults exposed for 6 months at 1.1 µg/L, based on levels in blood: 17
Mean for blood: 15

Adults exposed for 8 months at 9.6 µg/L, based on levels in muscle: 34
Adults exposed for 8 months at 4.8 µg/L, based on levels in mature male muscle: 24
Adults exposed for 8 months at 4.8 µg/L, based on levels in immature male muscle: 51
Adults exposed for 8 months at 4.8 µg/L, based on levels in spawned female muscle: 19
(mean of above 3 values = 31)
Adults exposed for 8 months at 2.4 µg/L, based on levels in muscle: 35
Adults exposed for 8 months at 1.1 µg/L, based on levels in muscle: 25
Adults exposed for 8 months at 0.55 µg/L, based on levels in muscle: 25
Mean for muscle: 30

Overall mean: 27

Reliability points taken off for:
Documentation: Nominal concentrations (3 – acute only), Conductivity (2), Photoperiod (3 – acute only), Hypothesis tests (8 – acute only), Minimum significant difference (2 – chronic only), Point estimates (8 – chronic only)
Acceptability: Control response (9 – acute only), Measured conc w/in 20% nominal (4 – acute only), Appropriate feeding (3 – acute only), Conductivity (1), Photoperiod (2 – acute only), Adequate replicates (2), Random design (2), Hypothesis tests (3 – acute only), Minimum significant difference (1 – chronic only), Point estimates (3 – chronic only)

Appendix D1: Acceptable data rated RR

Selenastrum capricornutum

Toxicity Data Summary

Study: Hughes JS. 1988. Toxicity of Diazinon Technical to *Selenastrum Capricornutum.* CIBA-GEIGY Lab Sty N. 0267 – 40-1100-1. EPA MRID 40509806.

Relevance
Score: 100 (except NOEC not calculable 85)
Rating: R: EC50, EC25 (L: NOEC)

Reliability
Score: 79
Rating: R

Hughes 1988		***S. capricornutum***
Parameter	**Value**	**Comment**
Test method cited	EPA method	
Phylum	Chlorophyta	
Class	Chlorophyceae	
Order	Sphaeropleales	
Family	Selenastraceae	
Genus	*Selenastrum*	
Species	*capricornutum*	
Family in North America?	Yes	
Age/size at start of test/growth phase	6- 8 day old culture	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Plants acclimated and disease-free?	Yes	
Plants randomized?	NR	
Test vessels randomized?	NR	
Test duration	7 days	
Data for multiple times?	yes	
Effect 1	Mean standing crop, cells/mL	
Control response- Test 1	4,920,000	
Control response – Test 2	6,193,333	
Temperature	24 +/- 2	
Test type	Static	
Photoperiod/light intensity	Constant illumination/4306 lumens/m2	
Dilution water	Deionized, nutrients added	
pH	NR in test, 7.5 medium	
Hardness	NR	nutrient solution recipe included
Alkalinity	NR	"
Conductivity	NR	"
Dissolved Oxygen	NR	

Hughes 1988		***S. capricornutum***
Parameter	**Value**	**Comment**
Feeding	Nutrient medium	
Purity of test substance	87.7%	
Concentrations measured?	Yes	
Measured is what % of nominal?	32-97%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	No carrier	
Concentration 1 Nom/Meas (µg/L)	32,000/ 20,600	3 Reps w/ 3000 cells/mL
Concentration 2 Nom/Meas (µg/L)	16,000/ 13,900	"
Concentration 3 Nom/Meas (µg/L)	8,000/ 4,340	"
Concentration 4 Nom/Meas (µg/L)	4,000/ 1830	"
Concentration 5 Nom/Meas (µg/L)	2,000/ 980	"
Concentration 6 Nom/Meas (µg/L)	1,000/ 410	"
Control	(nutrient medium) control	"
Test 2		32- 83% of nom
Concentration 1 Nom/Meas (µg/L)	2,000/ 1,120	
Concentration 2 Nom/Meas (µg/L)	1,000 / 500	
Concentration 3 Nom/Meas (µg/L)	500 / 250	
Concentration 4 Nom/Meas (µg/L)	250/ 120	
Concentration 5 Nom/Meas (µg/L)	125/ 60	
Control	(nutrient medium) control	
EC50; indicate calculation method	6,400	Linear regression
EC25; indicate calculation method	4,250	
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	<60 µg/L	Method: p: MSD:
LOEC; indicate calculation method	410 µg/L	
MATC (GeoMean NOEC,LOEC)	Cannot be determined	
% control at NOEC	Cannot be determined	
% of control LOEC	90%	

Other notes:
In second test 60 ug/L only 10% less than control but statistically different.
All plant/algae data is considered chronic

Reliability points taken off for:

Appendix D1: Acceptable data rated RR

Documentation: Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Statistical significance (2), Minimum significant difference (2), % control at NOEC/LOEC (2)
Acceptability: Measured conc w/in 20% nominal (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature > +/- 1 ^{o}C (3), pH (2), Random design (2), Minimum significant difference (1), NOEC reasonable (1).

Appendix D2

Supplemental data rated RL, LR, or LL

Appendix D2: Supplemental data rated RL, LR, or LL

Toxicity Data Summary

Anguilla anguilla

Ferrando MD, Sancho E, Andreu-Moliner E. 1991. Comparative acute toxicities of selected pesticides to *Anguilla anguilla*. *J Environ Sci Health B* 26: 491-498.

Rating:

Relevance:	Reliability
Score: 100	Score: 64
Rating: R	Rating: L

Appears to be same study as Sancho *et al.* 1992

Ferrando *et al.* 1991		***A. anguilla***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1975	
Phylum	Chordata	
Class	Actinopterygii	
Order	Anguilliformes	
Family	Anguillidae	
Genus	*Anguilla*	
Species	*anguilla*	
Found in	European Atlantic	
Age/size at start of test/growth phase	20-30 g; 16-20 cm	
Source of organisms	Albufera Lake, Spain	
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	0%	
Temperature	20^{o} C (holding conditions)	Test conditions NR
Test type	Static	
Photoperiod/light intensity	12L:12D	
Dilution water	Tapwater	
pH	7.9 $\pm$ 0.2 (holding conditions)	Test conditions NR
Hardness	250 mg/L as $CaCO_3$ (holding conditions)	Test conditions NR
Alkalinity	4.1 mmol/L (holding	Test conditions NR

Ferrando *et al.* 1991		***A. anguilla***
Parameter	**Value**	**Comment**
	conditions)	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	92%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (mg/L)	Number & levels NR	Reps: 1 w/10 per
Control	Solvent (acetone)	Reps: 1 w/10 per
LC50 (95% ci); mg/L	24-h: 0.16 (0.10-0.23) 48-h: 0.11 (0.08-0.14) 72-h: 0.09 (0.07-0.11) 96-h: 0.08 (0.06-0.10)	probit

Reliability points subtracted 3.7:
Analytical methods (4), Nominal concentrations (3), Measured Concentrations (3), Water hardness (2), Water alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8
Measured concentrations within 20% nominal(4), Concentrations do not exceed 2x water solubility (4), Carrier solvent concentrations (4), Organism prior contaminant exposure (4), Organism randomly assigned to test containers(1), Adequate number per replicate/appropriate cell density (2), Organism acclimation and disease free conditions (1), Dilution water source (2), Water hardness (2), Water alkalinity (2), Dissolved oxygen (6), Conductivity (1), Adequate replication (2), Random block (2), Appropriate spacing (2), Minimum significant difference(MSD) upper bound (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1)

Toxicity Data Summary

Brachionus calyciflorus

Fernández-Casalderrey A, Ferrando MD, Andreu-Moliner E. 1992a. Acute toxicity of several pesticides to rotifer (*Brachionus calyciflorus*). *Bull Environ Contam Toxicol* 48: 14-17.

Relevance
Score: 92.5 (No standard method)
Rating: R

Reliability
Score: 72
Rating: L

Fernández-Casalderrey *et al.* 1992a		***B. calyciflorus***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum	Rotifera	
Class	Monogononta	
Order	Ploima	
Family	Brachionidae	
Genus	*Brachionus*	
Species	*calyciflorus*	
Found in	N. America	
Age/size at start of test/growth phase	Newly hatched	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	0%	
Temperature	25°C	
Test type	Static	
Photoperiod/light intensity	Darkness	
Dilution water	Synthetic fresh water	
pH	7.4-7.8	
Hardness	80-100 mg/L as $CaCO_3$	
Alkalinity	60-70 mg/L as Ca CO_3	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	

Fernández-Casalderrey *et al.* 1992a		***B. calyciflorus***
Parameter	**Value**	**Comment**
Purity of test substance	92%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (mg/L)	6 concentrations; levels NR	Reps: 9 w/30 per
Control	Solvent (acetone)	Reps: 9 w/30 per
LC50 (95% ci); mg/L	29.22 (28.47-29.96)	Moving average

Reliability points subtracted 3.7:
Analytical methods (4), Nominal concentrations (3), Measured Concentrations reported (3), Dissolved oxygen (4), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8
Acceptable standard method (5), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Carrier solvent concentrations (4), Organisms randomly assigned to test containers(1), Dissolved oxygen (6), Conductivity (1), Random block (2), Appropriate spacing between concentrations (2), Minimum significant difference(MSD) upper bound was not reported (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control (1)

Toxicity Data Summary

Brachionus calyciflorus

Fernández-Casalderrey A, Ferrando MD, Andreu-Moliner E. 1992b. Effect of sublethal diazinon concentrations on the demographic parameters of *Brachionus calyciflorus* Pallas (Rotifera). *Bull Environ Contam Toxicol* 48: 202-208.

Relevance
Score: 90 (no standard method)
Rating: R

Reliability
Score: 71
Rating: L

Fernández-Casalderrey *et al.* 1992b		***B. calyciflorus***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum	Rotifera	
Class	Monogononta	
Order	Ploima	
Family	Brachionidae	
Genus	*Brachionus*	
Species	*calyciflorus*	
Found in	N. America	
Age/size at start of test/growth phase	Neonates	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	10-11 d	
Data for multiple times?	No	
Effect 1	Net reproductive rate (multiplication rate per generation)	
Control response 1	6-7	
Effect 2	Generation time (d)	
Control response 2	3-3.5 d	
Effect 3	Life expectancy (d)	
Control response 3	8-9 d	
Temperature	25^{o}C	
Test type	Static renewal	
Photoperiod/light intensity	Darkness	
Dilution water	Synthetic freshwater	

Fernández-Casalderrey *et al.* 1992b		***B. calyciflorus***
Parameter	**Value**	**Comment**
pH	7.4-7.8	
Hardness	80-100 mg/L as $CaCO_3$	
Alkalinity	60-70 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Daily	
Purity of test substance	92%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	1.5 mL/L	
Concentration 1 Nom (mg/L)	5	Reps: 4 w/6 per
Concentration 2 Nom (mg/L)	7	Reps: 4 w/6 per
Concentration 3 Nom (mg/L)	14	Reps: 4 w/6 per
Concentration 4 Nom (mg/L)	19	Reps: 4 w/6 per
Control	Dilution water; solvent	Reps: not clear
EC50; mg/L	Net reproduction rate: 5.20 Generation time: 8.49 Life expectancy at hatching: 12.33	Method NR

Other endpoints were reported, but no toxicity values were derived.

Acute 24-h LC50 of 29.22 mg/L was determined in a preliminary test, but no test details were given so this value is not usable.

Reliability points subtracted 3.7:
Analytical methods (4), Measured Concentrations (3), Dissolved oxygen (4), Conductivity (2), Statistical methods (5), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8
Acceptable standard method (5), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Carrier solvent concentrations (4), organisms randomly assigned to test containers(1), Dissolved oxygen (6), Conductivity (1), Random block (2), Appropriate spacing between concentrations(2), Minimum significant difference(MSD) upper bound (1), NOEC was not reported (1), LOEC was not reported (1).

Toxicity Data Summary

Brachionus calyciflorus

Study: Fernández-Casalderrey A, Ferrando MD, Andreu-Moliner E. 1992c. Filtration and ingestion rates of *Brachionus calyciflorus* after exposure to endosulfan and diazinon. Comp Biochem Physiol 103C: 357-361.

Relevance
Score: 75 (No standard method; Endpoint not linked to survival, growth, reproduction)
Rating: L

Reliability
Score: 63
Rating: L

Fernández-Casalderrey *et al.* 1992c		***B. calyciflorus***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Rotifera	
Class	Monogononta	
Order	Ploima	
Family	Brachionidae	
Genus	*Brachionus*	
Species	*calyciflorus*	
Found in	North America	
Age/size at start of test/growth phase	Neonates	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	5 hr	
Data for multiple times?	No	
Effect 1	Filtration rate (μL/individual/h)	
Control response 1	5.7	Estimated from Fig 3
Effect 2	Ingestion rate	(cells/individual/h)
Control response 2	2600	Estimated from Fig 4
Temperature	NR	
Test type	Static	
Photoperiod/light intensity	Darkness	
Dilution water	Synthetic freshwater	

Fernández-Casalderrey *et al.* 1992c		***B. calyciflorus***
Parameter	**Value**	**Comment**
pH	7.8 (culture); NR for test	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Part of test	
Purity of test substance	96%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	1.5 mL/L	
Concentration 1 Nom (mg/L)	7	Reps: 5 w/150 per
Concentration 2 Nom (mg/L)	14	Reps: 5 w/150 per
Concentration 3 Nom (mg/L)	19	Reps: 5 w/150 per
Concentration 4 Nom (mg/L)	29	Reps: 5 w/150 per
Control	Dilution water; solvent	Reps: 5 w/150 per
EC50; mg/L	Filtration: 14.39 Ingestion: 14.22	probit
NOEC; mg/L	Filtration: 7 Ingestion: 7	Method: ANOVA and Duncan p: 0.05 MSD: NR
LOEC; mg/L	Filtration: 14 Ingestion: 14	
MATC; mg/L; (GeoMean NOEC,LOEC)	Filtration: 9.9 Ingestion: 9.9	
% control at NOEC	Filtration: 91% Ingestion: 89%	Estimated from Figures 3 & 4
% of control LOEC	Filtration: 61% Ingestion: 59%	Estimated from Figures 3 & 4

Reliability points subtracted 3.7:
Analytical methods (4), Measured Concentrations (3), Water Hardness (2), Water alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Minimum significant difference (2), Point estimates (8)
Reliability points subtracted 3.8
Standard method (5), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Carrier solvent (4) Organisms randomized (1), Organisms/replicate (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), Random block (2), Minimum significant difference (1).

Appendix D2: Supplemental data rated RL, LR, or LL

Toxicity Data Summary

Brachionus calyciflorus

Study: Snell TW, Moffat BD. 1992. A 2-d life cycle test with the rotifer *Brachionus calyciflorus*. Environ Toxicol Chem 11: 1249-1257.

This 2-day test represents a chronic exposure as it covers 2 generations.

Relevance
Score: 75 (no standard method, purity NR)
Rating: L

Reliability
Score: 62.5
Rating: L

Snell & Moffat 1992		***B. calyciflorus***
Parameter	**Value**	**Comment**
Test method cited	New method	
Phylum	Rotifera	
Class	Monogononta	
Order	Ploima	
Family	Brachionidae	
Genus	*Brachionus*	
Species	*calyciflorus*	
Geographic Range	North America	
Age at start of test	< 2 h	
Test duration	48 h (2 generations)	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Data for multiple times?	No	
Effect 1	Intrinsic rate of increase (r)	
Control response 1	r > 0.65	
Temperature	25 ^{o}C	
Test type	Static	
Photoperiod	Darkness	
Dilution water	Moderately hard synthetic fresh water (MHSFW)	
pH	7.5	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	

Snell & Moffat 1992		***B. calyciflorus***
Parameter	**Value**	**Comment**
Feeding	Algal suspension	
Purity of test substance	NR	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (mg/L)	Number and level NR	Reps: 5 w/6 per; experiment conducted 4x
Experiment done multiple times?	Yes, 4 times	
Control	Dilution water	Reps: 5 w/6 per
LCx; indicate calculation method	LC50 = 31 ug/L (not from this study; not referenced)	
ECx; indicate calculation method	11 mg/L	Linear regression; 50% reduction in r compared to control
NOEC; indicate calculation method	8.0 mg/L; offspring/female/day (r)	ANOVA; Dunnett's P:NR, MSD:NR
LOEC; indicate calculation method	13 mg/L	ANOVA; Dunnett's
MATC (GeoMean NOEC,LOEC)	10 mg/L	called chronic value
% of control at NOEC	91%	
% of control at LOEC	36%	

Other data:
Application factors or ACRs: ACR = 2.8 = LC50/EC50; LC50 is not from same study and is not referenced. ACR from MATC = LC50/MATC = 31/10 = 3.1

Other notes:
Study is of population effects.

$$r = \frac{\ln N_t - \ln N_0}{T}$$

r = intrinsic rat of increase
N_t = # of rotifers in tube after 2 d
N_0 = initial # of rotifers
T = time = 2 d

NOEC, LOEC, EC50 are based on r

Reliability points subtracted 3.7:
Grade or purity of chemical (5), Analytical methods (4), Nominal concentrations (3), Measured Concentrations (3), Water hardness (2), Water alkalinity (2), Dissolved oxygen

(4), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2)

Reliability points subtracted 3.8
Acceptable standard method (5), Chemical Purity (10), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Carrier solvent concentrations (4), organisms were randomly assigned test containers (1), Water hardness (2), Alkalinity (2), Temperature (6), Conductivity (1), Random block (2), Appropriate spacing (2), MSD upper bound acceptable(1)

Toxicity Data Summary

Brachydanio rerio

Bresch H. 1991. Early life-stage test in zebrafish versus a growth test in rainbow trout to evaluate toxic effects. *Bull Environ Contam Toxicol* 46: 641-648.

Relevance	Reliability
Score: 75 (no standard method, no MATC value)	Score: 77
Rating:L	Rating: R

Bresch 1991		***B. rerio***
Parameter	**Value**	**Comment**
Test method cited	Bresch et al. 1990; No standard method cited	
Phylum	Chordata	
Class	Osteichthyes	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Brachydanio*	
Species	*rerio*	
Found in	N. America	Invasive
Age/size at start of test/growth phase	embryos	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	42 d	
Data for multiple times?	Yes	
Effect 1	Embryo survival	
Control response 1	74%	
Effect 2	Hatching	
Control response 2	97%	
Effect 3	Survival at 20 d	
Control response 3	90%	
Effect 4	Survival at 42 d	
Control response 4	86.5%	
Effect 5	Growth at 4 wk	
Control response 5	NR	

Bresch 1991		***B. rerio***
Parameter	**Value**	**Comment**
Temperature	26 ± 1°C	
Test type	Flow-through	
Photoperiod/light intensity	NR	
Dilution water	Tapwater	
pH	7.4	
Hardness	360 mg/L as $CaCO_3$	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	> 60%	
Feeding	3x per day	
Purity of test substance	Analytical grade	
Concentrations measured?	Yes	
Measured is what % of nominal?	≥ 80%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Meas (mg/L)	0.008	Reps: 2 w/100 per
Concentration 2 Meas (mg/L)	0.04	Reps: 2 w/100 per
Concentration 3 Meas (mg/L)	0.2	Reps: 2 w/100 per
Control	Dilution water	Reps: 2 w/100 per
NOEC; mg/L	0.2 (highest tested; same for all endpoints)	Method: ANOVA, Scheffe's test p: 0.05 MSD: NR
LOEC; mg/L	> 0.2	
MATC (GeoMean NOEC,LOEC)	NC	
% control at NOEC	Embryo survival: 98% Hatching: 102% Survival (20-d): 97% Survival (42-d): 99%	
% of control LOEC	NC	

Reliability points subtracted 3.7:
Water alkalinity (2), Conductivity (2), pH (3), Photoperiod (3), Statistical significance (2), Minimum significant difference (2), Point estimate (LC50 EC50 etc) (8)

Reliability points subtracted 3.8
Acceptable standard method (5), Carrier solvent concentrations (4), Organisms were fed during the test (3), Alkalinity (2), Conductivity (1), Photoperiod (2), Random block (2), Minimum significant difference(MSD) upper bound (1), NOEC (1), Point estimates not provided (LC50 EC50 etc) (3).

Toxicity Data Summary

Carassius auratus

Study: Beliles RP (1965) Diazinon Safety evaluation on fish and wildlife (bobwhite quail, goldfish, sunfish, and rainbow trout). Woodward Research Corp. EPA doc. 3046-013-02

Relevance
Score: 100
Rating: R

Reliability
Score: 64.5
Rating: L

Beliles 1965		***C. auratus***
Parameter	**Value**	**Comment**
Test method cited	NR	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Carassius*	Goldfish
Species	*auratus*	
Family in North America?	yes	
Age/size at start of test/growth phase	2.5-6 cm	
Source of organisms	Hatchery in Maryland	
Have organisms been exposed to contaminants?	no	
Animals acclimated and disease-free?	yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	yes	
Effect 1	mortality	
Control response 1	0%	
Temperature	11-17 C	
Test type	static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted deionized	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	no	

Beliles 1965		***C. auratus***
Parameter	**Value**	**Comment**
Purity of test substance	91%	
Concentrations measured?	no	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	4mL/L	
Concentration 1 Nom/ (µg/L)	32000	2 Rep and 5 per jar
Concentration 2 Nom/ (µg/L)	18000	2 Rep and 5 per jar
Concentration 3 Nom/ (µg/L)	10000	2 Rep and 5 per jar
Concentration 4 Nom/ (µg/L)	5600	2 Rep and 5 per jar
Concentration 5 Nom/ (µg/L)	3200	2 Rep and 5 per jar
Concentration 5 Nom/ (µg/L)	1000	2 Rep and 5 per jar
Concentration 5 Nom/ (µg/L)	320	2 Rep and 5 per jar
Control	yes	2 Rep and 5 per jar
LC50; indicate calculation method	9000	Litchfield and Wilcoxon 1949

Other notes:

Reliability points subtracted 3.7:
Analytical methods (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8
Acceptable standard method (5), Measured concentrations within 20% of nominal (4), Carrier solvent concentrations (4), organisms were randomly assigned to test containers(1), Water hardness (2), Water Alkalinity (2), Dissolved oxygen (6), Water temperature (6), Conductivity (1), pH (2), Photoperiod (2), Random block (2), Minimum significant difference(MSD) upper bound (1), % NOEC (1), %LOEC (1).

Toxicity Data Summary

Carassius auratus

Study: Nishiuki Y, Hashimoto Y. 1967. Toxicity of pesticide ingredients to some fresh water organisms. Botyu-Kagaku 32: 5-11.

Only a summary of this study and tables are available in English so most details cannot be determined. The fish tests were 48 hours, thus are not long enough to be usable for criteria derivation. The USEPA (2005) did not use these data for criteria derivation, but judged them of high enough quality to use as supporting data. Thus the rating of LL is being assigned to this study.

Relevance
Score: Cannot determine
Rating: L

Reliability
Score: Cannot determine
Rating: L

Nishiuki & Hashimoto 1967		***C. auratus***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Carassius*	
Species	*auratus*	
Found in	N. America	
Purity of test substance	Technical	As per USEPA 2005
LC50; mg/L	5.1	Method not determined

Rows for information not available were deleted.

Toxicity Data Summary

Caridina laevis

Sucahyo D, van Straalen NM, Krave A, van Gestel C. 2008. Acute toxicity of pesticides to the tropical freshwater shrimp Caridina laevis. Ecotoxicology and environmental safety 69 (3):421 -427.

Relevance
Score: 75 (no std method, 60 % purity)
Rating: L

Reliability
Score: 71
Rating: R

Sucahyo *et al.* 2008		***C. laevis***
Parameter	**Value**	**Comment**
Test method cited	None	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Decapoda	
Family	Atyidae	
Genus	*Caridina*	
Species	*laevis*	
Family in North America?	yes	
Age/size at start of test/growth phase	Juvenile shrimp average length 8–10 mm Adults were 15–20 mm.	
Source of organisms	laboratory culture	
Have organisms been exposed to contaminants?	no	
Animals acclimated and disease-free?	2 weeks	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24 and 96 h	
Effect 1	mortality	
Control response 1	Not exceeded 10%	
Temperature	26–27 1C.	
Test type	Static	
Photoperiod/light intensity	12 h light:12 h dark	
Dilution water	De-chlorinated tap water	
pH	6.9–7.2	
Hardness	NR for test	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	6.4–6.9	
Feeding	not fed	

Sucahyo *et al.* 2008		***C. laevis***
Parameter	**Value**	**Comment**
Purity of test substance	600 g/L	
Concentrations measured?	No	
Measured is what % of nominal?	n/a	
Chemical method documented?	n/a	
Concentration of carrier (if any) in test solutions	None	
Concentrations Nom only (µg/L)	concentrations were spaced by a factor of 2. Seven test concentrations and a control were used	5 Reps and 20 per rep
Control	Water only	
LC_{50}	For juveniles 24 h: 0.76 (0.67–0.87) ug/L 96 h: 0.59 (0.51–0.69) ug/L for adults 96 h: 1.32–1.58 mg/L	Method: Trimmed Spearman–Karber method

Other notes:

Reliability points subtracted 3.7:
Analytical methods (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Conductivity (2), pH (3), Photoperiod (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8
Acceptable standard method (5), Chemical Purity (10), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), organisms were randomly assigned to test containers(1), Water hardness (2), Water Alkalinity (2), Conductivity (1), Random block (2), Hypothesis tests (3)

Toxicity Data Summary

Ceriodaphnia dubia

Study: Dwyer FJ, Hardesty DK, Ingersoll CG, Whites DW, Augspurger T, Canfield TJ, Mount DR, Mayer FL. 2005. Assessing contaminant sensitivity of endangered and threatened aquatic species: Part III. Effluent toxicity tests. Arch Environ Contam Toxicol 48: 174-183.

Relevance
Score: 77.5 (no tox values, control not described)
Rating: R

Reliability
Score: 70.5
Rating: L

Dwyer *et al.* 2005		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1994	Full reference below
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	3-broods in control	
Data for multiple times?	No	
Effect 1	Biomass (combines survival and reproduction into one endpoint)	
Control response 1	Survival ≥ 80% Reproduction: NR	Biomass baseline
Temperature	25°C	
Test type	Static renewal; daily	

Dwyer *et al.* 2005		***C. dubia***
Parameter	**Value**	**Comment**
Photoperiod/light intensity	16L:8D	
Dilution water	ASTM hard water	
pH	< 8.6	
Hardness	160-180 mg/L as $CaCO_3$	
Alkalinity	110-120 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	> 40%	
Feeding	Daily	
Purity of test substance	99%	
Concentrations measured?	No; stocks measured, but exposure concentrations not measured	
Measured is what % of nominal?	NA	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	Acetone used, but concentration NR	
Concentration 1 Nom (µg/L)	Number and levels NR	Reps: 10 w/1 per
Control	Not described	Reps: 10 w/1 per
IC25 (95% ci); µg/L; concentrations reducing response by 25% versus control	< 62.5	ICp (Norberg-King 1993)

USEPA. 1994. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms (EPA 600/4-91-002). US Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, OH.

Norberg-King TJ. 1993. A linear interpolation method for sublethal toxicity: the inhibition concentration (ICp) approach (technical report no. 03-93). National Effluent Toxicity Assessment Center, Duluth, MN.

Reliability points subtracted 3.7:
Control type (8), Analytical methods (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Photoperiod (3), Minimum significant difference (2)

Reliability points subtracted 3.8
Acceptable standard method (5), Appropriate Control (6), Measured concentrations within 20% of nominal (4), Carrier solvent concentrations (4), Organism feeding (3), organisms were randomly assigned to test containers (1), Water hardness (2), Water Alkalinity (2), Photoperiod (2), Not adequate number of concentrations (3), Random block (2), Appropriate spacing between concentrations (2), Minimum significant difference (MSD) upper bound (1)

Toxicity Data Summary

Ceriodaphnia dubia

Study: Norberg-King, T.J. 1987. Toxicity Data on Diazinon, Aniline, 2,4-Dimethylphenol. U.S.EPA, Duluth, MN: 11 p. Memorandum to C. Stephan, U.S.EPA, Duluth, MN; D. Call and L. Brooke, Center for Lake Superior Environmental Studies, Superior, WI, August 31.

Acute tests 1 & 3

Relevance	Reliability
Score: 82.5 (no Std Method, No Control Desc.)	Score: 68
Rating: L	Rating: L

Acute Test 15 & Chronic

Relevance	Reliability
Score: 90 (no Std Method)	Score: see below
Rating: R	Rating: L

Other Acute Tests LL to N see below

Norberg-King 1987		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	None stated, but EPA Lab	
Phylum	Arthropoda / Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Family in North America?	Yes	
Age/size at start of test/growth phase	Acute: < 24h and various see table, chronic: <6h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	Yes (chronic)	
Test duration	48hr (acute), 7day (chronic)	
Data for multiple times?	No , but several tests of different duration	
Effect 1	Mortality (acute)	
Control response 1	0%	
Effect 2	Mortality (chronic)	
Control response 2	0%	

Norberg-King 1987			***C. dubia***
Parameter	**Value**		**Comment**
Effect 3	Reproduction (chronic)		
Control response 3	21.2 young per female		
Temperature	All 16 test 25 ± 2 C, see below		Within tests ± 1C
Test type	Static (acute), Static w/ daily renewal (chronic)		
Photoperiod/light intensity	NR		
Dilution water	Four Types: 1) Lake Superior Water (LSW) 2) Reconstituted water (RCW) 3) Diluted mineral artificial water (DMW) 4) Lake superior culture water (LSCW), which is enriched from goldfish living in the water		
	LSW -Test 2	**RCW- Test 3**	**DMW-Test 1**
Temp	25.2- 26.6	25.1- 26.2	24.4-26.0
pH	7.4-8.0	7.3-7.6	7.3- 7.5
Hardness	NR for each test		
Alkalinity	NR for each test		
Conductivity	100-108	112-152	90-94
Dissolved Oxygen	7.1- 8.7	7.0- 8.7	6.9-8.6
Feeding	Yes, unless otherwise noted		
Purity of test substance	85%		
Concentrations measured?	Acute: no, Chronic & Acute Test 15: yes		
Measured is what % of nom	NA		
Chemical method documented?	Yes for chronic/test 15		
Concentration of carrier (if any) in test solutions	methanol		
Concentration 1 Nom (µg/L)	**Acute** concentrations NR		2 Reps w/ 5 per rep
Chronic - 7 day			
Concentration 1 Nom (µg/L)	0.900		1 Reps w/ 10 per rep
Concentration 2 Nom (µg/L)	0.520		1 Reps w/ 10 per rep
Concentration 3 Nom (µg/L)	0.220		1 Reps w/ 10 per rep
Concentration 4 Nom (µg/L)	0.109		1 Reps w/ 10 per rep
Concentration 5 Nom (µg/L)	0.093		1 Reps w/ 10 per rep
Control	DMW		1 Reps w/ 10 per rep
LC50 48 hr	Test1 (DMW) 0.57 (0.47 - 0.70) µg/L Test 2 (LSW) 0.66 (0.58 - 0.75) µg/L Test 3 (RCW) 0.57 (0.47 - 0.70) µg/L		Spearman-Karber
NOEC	0.220 µg/L survival &		Method: NR

Norberg-King 1987		***C. dubia***
Parameter	**Value**	**Comment**
	reproduction	p:.025, MSD:NR
LOEC; indicate calculation method	0.520 µg/L survival & reproduction	
MATC	0.34 µg/L	
% control at NOEC	100% survival 106% reproduction	
% of control LOEC	0 survival & reproduction	

ACUTE DATA- 15 different tests

Test number	dilution water	Fed?	Conc. Meas?	Age at start	48hr LC50 µg/L	Rating, reliability score
1	DMW	Yes	Nom	< 24 h	0.57 (0.47 - 0.70)	LL, 68
2	LSW	Yes	Nom	< 24 h	0.66 (0.58 - 0.75)	LL, 67
3	RCW	Yes	Nom	< 24 h	0.57 (0.47 - 0.70)	LL, 68
Routine water chemistry not done or not reported for tests below (tests 4-14) These would lose 10.5 more points for missing parameters						
4	LSCW	No	Highest only	< 48 h	0.35 (0.31 - 0.45)	LL, 61.5
5	LSCW	No	Nom	< 48 h	0.35	LL, 61.5
6	LSCW	Yes	Nom	< 24 h	> 1.0	N
7	DMW	No	Nom	< 24 h	>0.6	N
8	LSCW	No	Stock only	< 6 h	0.25 (0.22-0.29)	LL, 63
9	LSCW	No	Nom	< 24 h	0.33 (0.29-0.38)	LL, 63
10	LSCW	No	Nom	< 48 h	0.35	LL, 61.5
11	LSCW	?	Nom	< 48 h	0.59	LL, 60
12	LSCW	?	Nom	< 48 h	0.43 (0.36-0.51)	LL, 60
13	LSCW	?	Nom	< 48 h	0.35	LL, 60
14	LSCW	?	Nom	< 48 h	0.36	LL, 60
Test 15 was the first 48 hr of the chronic test for which measure concentrations are reported as above						
15	DMW	Yes	Yes, all meas. Same conc's as chronic	< 6 h	0.66	RL, 66.5

-Acute test 6 & 7 did not determine a value would score 67.5 RELEVANCE (no Std Method, No Control Desc., no values) so N

-Acute tests also have various issues (which points were taken off for):

- Organisms > 24 old at start
- in some tests organisms were fed
- some tests did not determine an LC 50 , results is > X
- LSCW not acceptable dilution water

-Acute tests 1, 3 score (73 + 63)/2 =68

-Acute tests 2 score (73 + 61)/2 =67 (-2 for inappropriate dilution water)

-With out water quality parameters, acute tests 4-14 (except 6 & 7) would have a reliability score of 68-10.5 =62.5and rating of N. No measurements were reported for LSCW and repots stated that these were not monitored. – 1 for unacceptable dilution water =61.5.
-Those that use a life stage older than 48 hours lose 3 pts /2 =1.5, score 61, many of these also use LSCW water and score 60. These did not include feeding has more points (60 + (3/2)), and scores 61.5
-Acute test 15 has more points because measured concentrations are reported for the chronic test and rates 66.5 (L). Acute test 15 was the first 48hrs of the chronic test. Chronic test rates as 60 (L).
-Though done in an EPA lab, points were not given for standard method because the description of tests procedure does not follow EPA methods (i.e.: feeding in acute tests, organisms > 24 old at start, dilution water source (LSCW, LSW), water chemistry not monitored in many tests).

Acute Tests 1 & 3 - Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organism age (3), Organisms randomized (1), Hardness (2), Alkalinity (2), Photoperiod (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Acute Test 15 - Reliability points taken off for:
Documentation: Nominal concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Feeding (3), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (3), Conductivity (1), pH (2), Photoperiod (2), Adequate replicates (2), Hypothesis tests (3).

Chronic - Reliability points taken off for:
Documentation: Nominal concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Statistical methods (5), Minimum significant difference (2), % control of NOEC/LOEC (2), Point estimates (8).
Acceptability: No standard method (5), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (3), Conductivity (1), pH (2), Photoperiod (2), Adequate replicates (2), Statistical method (2), Minimum significant difference (1), Point estimates (3).

Toxicity Data Summary

Chironomus riparius

Landrum PF, Fisher SW, Hwang H. 1999. Hazard evaluation of ten organophosphorus insecticides against the midge, *Chironomus riparius* via QSAR. *SAR and QSAR in Environmental Research* 10: 423-450.

Relevance		Reliability
Score: 82.5	(Control response NR, No std. method)	Score: 62
Rating: L		Rating: L

Landrum *et al.* 1999		***C. riparius***
Parameter	**Value**	**Comment**
Test method cited	NR	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	*Chironomus*	
Species	*riparius*	
Family in North America?	Yes	
Age/size at start of test/growth phase	4th instar	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Immobility	
Control response 1	NR	
Temperature	11, 18, and 25 C	
Test type	Static	
Photoperiod/light intensity	14:11 light : dark	
Dilution water	EPA Hard water	
pH	6, 7 and 8	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR-none	
Purity of test substance	> 97%	

Landrum *et al.* 1999		***C. riparius***
Parameter	**Value**	**Comment**
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	1 mL/L acetone	
Concentrations	NR	3 Reps and 24 per rep
Control	Solvent control	3 Reps and 24 per rep
EC50; indicate calculation method Ph 7 data used only		probit
at 11 ˚C	64.9 ug/L (213.5 nmol/L)	
at 18 ˚C	24.4 ug/L (80.3 nmol/L)	
at 25 ˚C	11.6 ug/L (38.2 nmol/L)	

Other notes: performed test also with pH 6 and PH 8, but these EC50s did not differ significantly from pH 7 tests. Only pH 7 data is summarized here. Also included sediment tests that were not summarized here.

EC50s reported in nmol/L. Converted to ug/L

Example at 18 ˚C the EC 50 was 80.3 nmol/L

$$\frac{80.3\ \text{nmol}}{\text{L}} \times \frac{1\ \text{umol}}{1000\ \text{nmol}} \times \frac{304\ \text{ug}}{\text{umol}} = 24.4\ \text{ug/L}$$

Reliability points subtracted 3.7:
Analytical methods (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8
Acceptable standard method (5), Appropriate control response (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Carrier solvent concentrations (4), Organism size/age/growth phase (3), organisms were randomly assigned to test containers (1), Water hardness (2), Water Alkalinity (2), Dissolved oxygen (6), Conductivity (1), Random block (2), Appropriate spacing between concentrations (2), Hypothesis tests (3)

Appendix D2: Supplemental data rated RL, LR, or LL

Toxicity Data Evaluation

Chironomus riparius

Stuijfzand SC, Poort L, Greeve GD, Van der Geest HG, Kraak MHS. 2000. Variables Determining the Impact of Diazinon on Aquatic Insects: Taxon, Developmental Stage, and Exposure Time. *Environ Toxicol Chem* 19:582-587.

1st instar (4th instar has a separate summary)

Relevance
Score: Survival growth: 90 (no std method)
Rating:R

Reliability
Score: 68.5
Rating: L

Score: Activity: 52.5 (no std method; endpoint not linked to s, g, r; not 96 h LC50; control response NR);
Rating: N

Stuijfzand *et al.* 2000		***C. riparius***
Parameter	**Value**	**Comment**
Test method cited	NR	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	*Chironomus*	
Species	*riparius*	
Found in	N. America	
Age/size at start of test/growth phase	Newly hatched larvae (1st instar); avg length = 1 mm	
Source of organisms	Laboratory Culture	
Have organisms been exposed to contaminants?	NR, assumed no	
Animals acclimated and disease-free?	NR	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	48, 96 hours	
Data for multiple times?	Yes	Triplicate
Effect 1	Lethality	
Control response 1	Lethality = 7.4 +/- 1.4 %	
Effect 2	Decreased Activity	
Control response 2	NR	
Effect 3	Decreased Growth	
Control response 3	See 'Other Data'	
Temperature	20° C	

Stuijfzand *et al.* 2000			***C. riparius***
Parameter	**Value**		**Comment**
Test type	Static		
Photoperiod/light intensity	16:8, light:dark		
Dilution water	DSW (Dutch Standard Water)		
pH	NR		
Hardness	NR		
Alkalinity	NR		
Conductivity	NR		
Dissolved Oxygen	NR		
Feeding	0.5 mL food suspension		
Purity of test substance	99.7 % diazinon		
Concentrations measured?	Yes, but NR		
Measured is what % of nominal?	NR		
Concentration of carrier (if any) in test solutions	None used		
Chemical method documented?	NR		
48 h Concentration 1 Nom (µg/L)	1		3 reps x 25
48 h Concentration 2 Nom (µg/L)	3		3 reps x 25
48 Concentration 3; 96 h Concentration 1 Nom (µg/L)	10		3 reps x 25
96 h Concentration 2 (µg/L)	15		3 reps x 25
48 h Concentration 4, 96 h Concentration 3 Nom (µg/L)	30		3 reps x 25
48 Concentration 5; 96 h Concentration 4 Nom (µg/L)	50		3 reps x 25
48 h Concentration 6 Nom (ug/L)	70		3 reps x 25
48 h Concentration 7 Nom (ug/L)	100		3 reps x 25
Control	Dilution water		
LC50	See below	Sigmoidal dose-response curves (Haanstra et al. 1985)	
EC50	See below	Sigmoidal dose-response curves (Haanstra et al. 1985)	

Other data:
Average growth (48 hours):
Control (48 hours) = 0.4 – 0.7 mm
Control (96 hours) = 1.0 – 1.1 mm

Experiment Time	Parameter	LC50 / EC50 (ug/L)	95% Confidence Limit
48 hours	Mortality	32.0	30.0 – 34.1
48 hours	Activity	22.6	4.8 – 105.8
48 hours	Growth	35.2	32.2 – 38.5
96 hours	Mortality	22.8	19.7 – 26.3
96 hours	Activity	NR	NR
96 hours	Growth	57.3	31.7 – 103.7

Survival/Growth - Reliability points taken off for:
Documentation: Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: No standard method (5), Measured concentrations within 20% of nominal (4), Feeding (3), Organism acclimation (1), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Random design (2), Hypothesis tests (3).

Toxicity Data Evaluation

Chironomus riparius

Stuijfzand SC, Poort L, Greeve GD, Van der Geest HG, Kraak MHS. 2000. Variables Determining the Impact of Diazinon on Aquatic Insects: Taxon, Developmental Stage, and Exposure Time. *Environ Toxicol Chem* 19:582-587.

4th instar (1st instar has a separate summary)

Relevance
Score: Survival growth: 90 (no std method)
Rating:R
Score: Activity: 68.5 (no std method; endpoint not linked to s, g, r; control response NR); Rating: N

Reliability
Score: 68.5
Rating: L

Stuijfzand *et al.* 2000		***C. riparius***
Parameter	**Value**	**Comment**
Test method cited	NR	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	*Chironomus*	
Species	*riparius*	
Found in	N. America	
Age/size at start of test/growth phase	2 weeks old; 4th instar	
Source of organisms	Laboratory Culture	
Have organisms been exposed to contaminants?	NR, assumed no	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	48, 96 hours	
Data for multiple times?	Yes	
Effect 1	Lethality	
Control response 1	Lethality = 1.9 +/- 1.1 %	
Effect 2	Decreased Activity	
Control response 2	NR	
Temperature	20 degrees C	
Test type	Static	
Photoperiod/light intensity	16:8, light:dark	
Dilution water	DSW (Dutch Standard	

Stuijfzand *et al.* 2000		***C. riparius***
Parameter	**Value**	**Comment**
	Water)	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	1.5 mL suspension feed	
Purity of test substance	99.7 % diazinon	
Concentrations measured?	Yes, but NR	at least 2 replicates in each x 30 larvae
Measured is what % of nominal?	NR	
Concentration of carrier (if any) in test solutions	None used	
Chemical method documented?	NR	
96 h Concentration 1 Nom (µg/L)	10	> 2 reps x 30
48 h Concentration 1 Nom (µg/L)	30	> 2 reps x 30
96 h Concentration 2 Nom (µg/L)	50	> 2 reps x 30
48 h Concentration 2; 96 h Concentration 3 Nom (µg/L)	100	> 2 reps x 30
48 Concentration 3; 96 h Concentration 4 Nom (µg/L)	150	> 2 reps x 30
96 h Concentration 5 (µg/L)	200	> 2 reps x 30
48 h Concentration 4 Nom (µg/L)	250	> 2 reps x 30
96 h Concentration 6 Nom (ug/L)	300	> 2 reps x 30
48 Concentration 5 Nom (µg/L)	350	> 2 reps x 30
48 h Concentration 6 Nom (ug/L)	450	> 2 reps x 30
Control	Dilution water	> 2 reps x 30
LC50	See below	Sigmoidal dose-response curves (Haanstra et al. 1985)
EC50	See below	Sigmoidal dose-response curves (Haanstra et al. 1985)

Experiment Time	Parameter	LC50 / EC50 (µg/L)	95 % Confidence Limit
48 hours	Mortality	> 268	NR
48 hours	Activity	19.9	7.6 – 51.9
96 hours	Mortality	167.0	75.1 – 371.5
96 hours	Activity	17.9	15.9 – 20.2

Appendix D2: Supplemental data rated RL, LR, or LL

Survival/Growth - Reliability points taken off for:
Documentation: Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: No standard method (5), Measured concentrations within 20% of nominal (4), Feeding (3), Organism acclimation (1), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Random design (2), Hypothesis tests (3).

Appendix D2: Supplemental data rated RL, LR, or LL

Toxicity Data Summary

Chironomus tentans

Study: Schuler LJ, Trimble AJ, Belden JB, Lydy MJ. 2005. Joint toxicity of triazine herbicides and organophosphate insecticides to the midge *Chironomus tentans*. *Arch Environ Contam Toxicol* 49: 173-177.

Notes: Study includes a mixture component of triazine herbicides in combination with OPs. Simazine, cyanazine, hexazinone, atrazine, and deisopropylatrazine all synergized diazinon.

Relevance	Reliability
Score: 82.5 (no control response, no std. method)	Score: 73
Rating:L	Rating: L

Schuler *et al.* 2005		***C. tentans***
Parameter	**Value**	**Comment**
Test method cited	EPA 1994 cited for culturing procedures, but not for test	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	*Chironomus*	
Species	*tentans*	
Found in	N. Amer.	
Age/size at start of test	4^{th} instar larvae	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Normal swimming motion	Linked to survival
Control response 1	NR	
Temperature	$21 \pm 1^{o}C$	
Test type	Static	
Photoperiod	16L:8D	
Dilution water	MHSFW	
pH	7.7-8.2	

Schuler *et al.* 2005		***C. tentans***
Parameter	**Value**	**Comment**
Hardness	NR, but moderately hard	
Alkalinity	NR	
Conductivity	340-370 uS/cm	
Dissolved Oxygen	≥ 70%	
Feeding	None	
Purity of test substance	99.5%	
Concentrations measured?	No	Authors contend that concentrations are stable (>80% of initial level maintained), but that does not confirm initial levels
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	100 uL/L acetone	
Concentration 1 Nom (µg/L)	5 concentrations; levels NR	Reps: 3 w/10 per
Control	Dilution water; solvent	Reps: 3 w/10 per
ECx (95% ci); ug/L	EC1: 8.0 (4.2-11.5) EC5: 11.9 (7.3-15.9) EC15: 17.1 (11.9-21.3) EC50: 31.3 (25.7-37.3) Slope: 3.92 Intercept: -0.86	Log-probit

Reliability points subtracted 3.7:
Analytical methods (4), Measured concentrations (3), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Photoperiod (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8
Acceptable standard method (5), Control response within guideline (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), organisms were randomly assigned to test containers(1), Water hardness (2), Water Alkalinity (2), Random block (2), Adequate replication (2), Hypothesis tests (3)

Toxicity Data Summary

Chironomus tepperi

Study: Stevens MM. 1992a. Toxicity of organophosphorus insecticides to fourth-instar larvae of Chironomus tepperi Skuse (Diptera: Chironimidae). J Aust Ent Soc 31:335-337.

Relevance
Score: 75 (No standard method, 800 g/L diazinon formulation)
Rating:L

Reliability
Score: 65.5
Rating:L

Stevens 1992a		***C. tepperi***
Parameter	**Value**	**Comment**
Test method cited	NR	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironimidae	
Genus	*Chironomus*	
Species	*tepperi*	
Family in North America?	Yes	
Age/size at start of test/growth phase	4th -instar	
Source of organisms	Y. Ag. Institute	
Have organisms been exposed to contaminants?	?eggs used from larvae collected in field (as eggs)	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 hr	
Data for multiple times?	no	
Effect 1	Mortality or no response	
Control response 1	NR	
Temperature	25 +- 1C	
Test type	Static, w/ paper tissue	
Photoperiod/light intensity	15L:9D	
Dilution water	NR	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	no	

Stevens 1992a		***C. tepperi***
Parameter	**Value**	**Comment**
Purity of test substance	800g/L Commercial formulation	
Concentrations measured?	no	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentrations 1 Nom/Meas (µg/L)	NR	Reps NR
Control	yes	Reps and # per (cell density for single
LC50	35.5ug/L	Method: probit

Other notes:

Reliability points subtracted 3.7:
Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod not reported (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8
Acceptable standard method (5), Control response within test guidance (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Organisms randomly assigned to test containers(1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Random block reported (2), Appropriate spacing between concentrations (2), Minimum significant difference(MSD) upper bound acceptable (1), NOEC reasonable compared to control (1) LOEC reasonable compared to control (1)

Toxicity Data Summary

Cyprinella monacha

Study: Dwyer FJ, Hardesty DK, Ingersoll CG, Whites DW, Augspurger T, Canfield TJ, Mount DR, Mayer FL. 2005. Assessing contaminant sensitivity of endangered and threatened aquatic species: Part III. Effluent toxicity tests. Arch Environ Contam Toxicol 48: 174-183.

Relevance
Score: 92.5 (control not described)
Rating: R

Reliability
Score: 67
Rating: L

This is a threatened and/or endangered species.

Dwyer et al. 2005		***C. monacha***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1994	Full reference below
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyriniformes	
Family	Cyprinidae	
Genus	*Cyprinella*	
Species	*monacha*	
Found in	N. America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Conservation Fisheries, Inc.	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	7 d	
Data for multiple times?	No	
Effect 1	Biomass (combines survival and growth into one endpoint)	
Control response 1	Survival: ≥ 85% Growth: NR	77% survival tests accepted
Temperature	25°C	

Dwyer et al. 2005		***C. monacha***
Parameter	**Value**	**Comment**
Test type	Static renewal; daily	
Photoperiod/light intensity	16L:8D	
Dilution water	ASTM hard water	
pH	< 8.6	
Hardness	160-180 mg/L as $CaCO_3$	
Alkalinity	110-120 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	> 40%	
Feeding	Daily	
Purity of test substance	99%	
Concentrations measured?	No; stocks measured, but exposure concentrations not measured	
Measured is what % of nominal?	NA	
Chemical method documented?	Yes, but NA	
Concentration of carrier (if any) in test solutions	Acetone used, but concentration NR	
Concentration 1 Nom (µg/L)	Number and levels NR	Reps: 3-4 w/10 per
Control	Not described	Reps: 3-4 w/10 per
IC25 (95% ci); µg/L; concentrations reducing response by 25% versus control	4115 (2281-5654)	ICp (Norberg-King 1993)

USEPA. 1994. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms (EPA 600/4-91-002). US Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, OH.

Norberg-King TJ. 1993. A linear interpolation method for sublethal toxicity: the inhibition concentration (ICp) approach (technical report no. 03-93). National Effluent Toxicity Assessment Center, Duluth, MN.

Reliability points subtracted 3.7:
Control type (8), Analytical method (4), Measured concentrations (3), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8
Control appropriate (6), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Carrier solvent (4), Organisms randomly assigned to test containers(1), Dissolved oxygen (6), Conductivity (1), Adequate number of concentrations (3), Random block was not reported (2), Appropriate spacing between concentrations (2), Appropriate statistical method used (2), Hypothesis tests (3)

Toxicity Data Summary

Cyprinus carpio

Study: Alam MK, Maughan OE. 1992. The effect of malathion, diazinon, and various concentrations of zinc, copper, nickel, lead, iron, and mercury on fish. Biol Trace Elem Res 34: 225-236.

Relevance
Score: 75 (No standard method; 35% diazinon formulation)
Rating: L

Reliability
Score: 62.5
Rating: L

Alam & Maughan 1992		***C. carpio***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Cyprinus*	
Species	*carpio*	
Found in	N. America	
Age/size at start of test/growth phase	Juvenile	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	0%	
Temperature	25^{o}C	
Test type	Static renewal; daily-2x daily	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	7.1	

Alam & Maughan 1992		***C. carpio***
Parameter	**Value**	**Comment**
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	6.5 mg/L	
Feeding	None	
Purity of test substance	35%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L)	4800	Reps: 1 w/10 per
Concentration 2 Nom (µg/L)	7200	Reps: 1 w/10 per
Concentration 3 Nom (µg/L)	9600	Reps: 1 w/10 per
Concentration 4 Nom (µg/L)	12200	Reps: 1 w/10 per
Control	Dilution water	Reps: 1 w/10 per
LC50; µg/L	Test 1: 4974.5 Test 2: 3426.8	Probit; Trimmed Spearman-Karber

Reliability points subtracted 3.7:
Organism source (5), Analytical method (4), Measured concentrations (3), Dilution water source (3), Hardness (2), Alkalinity (2), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC(2)

Reliability points subtracted 3.8
Acceptable standard method (5), Chemical Purity (10), Measured concentrations within 20% of nominal (4), No prior contaminant exposure (4), Organisms randomly assigned to test containers(1), Dilution water source acceptable (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), Random block was not reported (2), Adequate replication (2), Minimum significant difference(MSD) upper bound acceptable (1), NOEC reasonable compared to control (1), LOEC reasonable compared to control (1)

Toxicity Data Summary

Cyprinus carpio

Study: Aydin R, Köprücü K. 2005. Acute toxicity of diazinon on the common carp (*Cyprinus carpio* L.) embryos and larvae. Pest Bioch Physiol 82: 220-225.

Relevance
Score: 75 (No standard method; 63% diazinon formulation)
Rating: L

Reliability
Score: 68.5
Rating: L

Aydin Y Köprücü 2005		***C. carpio***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Cyprinus*	
Species	*carpio*	
Found in	N. America	
Age/size at start of test/growth phase	Embryo Larvae	
Source of organisms	Lab cultures of adults obtained from fish hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Cannot determine	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	Embryos: 48 h Larvae: 96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	Embryo: 3.5% Larvae: 4.5% at 96 h	
Effect 2	Hatching success	
Control response 2	96.5%	No statistical analysis of results
Temperature	24 $\pm$ 1^{o}C	
Test type	Static renewal; 12 h renewal	

Aydin Y Köprücü 2005		***C. carpio***
Parameter	**Value**	**Comment**
Photoperiod/light intensity	NR	
Dilution water	Not clearly described	
pH	7.1 ± 0.2	
Hardness	125.1 ± 2.2 mg/L	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	7.4 ± 0.1 mg/L	
Feeding	None	
Purity of test substance	63%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Acetone used, but concentration NR	
Concentration 1 Nom (mg/L)	0.25	Reps: 5 / 200 per
Concentration 2 Nom (mg/L)	0.5	Reps: 5 / 200 per
Concentration 3 Nom (mg/L)	1.0	Reps: 5 / 200 per
Concentration 4 Nom (mg/L)	2.0	Reps: 5 / 200 per
Concentration 5 Nom (mg/L)	4.0	Reps: 5 / 200 per
Concentration 6 Nom (mg/L)	8.0	Reps: 5 / 200 per
Control	Solvent (acetone)	Reps: 5 / 200 per
LC50 (95% ci); mg/L	Embryos 24 h: 0.999 (0.698-1.427) Larvae: 24 h: 3.688 (2.464-8.495) 48 h: 2.903 (2.019-5.433) 72 h: 2.358 (1.672-4.005) 96 h: 1.530 (1.009-3.948)	Probit

Reliability points subtracted 3.7:
Analytical method (4), Measured concentrations (3), Dilution water source (3), Alkalinity (2), Conductivity (2), Photoperiod not reported (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8
Acceptable standard method (5), Chemical purity (10), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomly assigned to test containers(1), Adequate number per replicate (2), Organisms properly acclimated and disease free (1), Dilution water source (2), Alkalinity (2), Conductivity (1), Photoperiod and light intensity (2), Random block was not reported (2), Minimum significant difference(MSD) upper bound acceptable (1), NOEC reasonable compared to control (1), LOEC reasonable compared to control (1)

Toxicity Data Summary

Cyprinus carpio

Study: Nishiuki Y, Hashimoto Y. 1967. Toxicity of pesticide ingredients to some fresh water organisms. Botyu-Kagaku 32: 5-11.

Only a summary of this study and tables are available in English so most details cannot be determined. The fish tests were 48 hours, thus are not long enough to be usable for criteria derivation. The USEPA (2005) did not use these data for criteria derivation, but judged them of high enough quality to use as supporting data. Thus the rating of LL is being assigned to this study.

Relevance
Score: Cannot determine
Rating: L

Reliability
Score: Cannot determine
Rating: L

Nishiuki & Hashimoto 1967		***C. carpio***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Cyprinus*	
Species	*carpio*	
Found in	N. America	
Purity of test substance	Technical	As per USEPA 2005
LC50; mg/L	3.2	Method not determined

Rows for information not available were deleted.

Toxicity Data Summary

Cyrnus trimaculatus

Study: Van Der Geest HG, Greve GD, Kroon A, Kuijl S, Kraak MHS, Admiraal W. 2000a. Sensitivity of characteristic riverine insects, the caddisfly *Cyrnus trimaculatus* and the mayfly *Ephoron virgo*, to copper and diazinon. Environ Poll 109: 177-182.

Relevance
Score: 92.5 (control not described)
Rating: R

Reliability
Score: 63.5
Rating: L

Van Der Geest *et al.* 2000a		***C. trimaculatus***
Parameter	**Value**	**Comment**
Test method cited	Greve et al. 1998, 1999	Full reference below
Phylum	Arthropoda	
Class	Insecta	
Order	Trichoptera	
Family	Polycentropopidae	
Genus	*Cyrnus*	
Species	*trimaculatus*	
Found in	Europe	
Age/size at start of test/growth phase	2nd instar larvae	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	22%	
Temperature	20°C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Dutch Standard Water	
pH	8.2	
Hardness	210 mg/L as $CaCO_3$	
Alkalinity	1.2 meq/L	
Conductivity	NR	
Dissolved Oxygen	NR	

Van Der Geest *et al.* 2000a		***C. trimaculatus***
Parameter	**Value**	**Comment**
Feeding	At test initiation	
Purity of test substance	99.7%	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (µg/L)	Level and number NR	Reps: ≥ 2 w/10 per
Control	Not described	Reps: ≥ 2 w/10 per
LCx (95% ci); µg/L	LC10: 0.2 (0.1-0.6) LC50: 1.1 (0.7-1.7)	Non-linear curve-fitting

Greve GD, Van Der Geest HG, Stuijfzand SC, Engels S, Kraak MHS. 1998. Development of ecotoxicity tests using laboratory reared larvae of the riverine caddisflies *Hydropsyche angustipennis* and *Cyrnus trimaculatus*. Proc Exp Appl Entomol, Leiden, NEV Amsterdam 9: 205-210.

Greve GD, Van Der Geest HG, Stuijfzand SC, Kureck A, Kraak MHS. 1999. Development and validation of an ecotoxicity test using field collected eggs of the riverine mayfly *Ephoron virgo*. Proc Exp Appl Entomol, Leiden, NEV Amsterdam 10: 105-110.

Reliability points subtracted 3.7:
Measured concentrations (3), Nominal concentrations (3), Dissolved oxygen (4), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Control appropriate (6), Control response within test guideline (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Organisms randomly assigned to test containers(1), Dissolved oxygen (6), Conductivity (1), Adequate number of concentrations (3), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Minimum significant difference(MSD) upper bound acceptable (1), NOEC reasonable compared to control (1), LOEC reasonable compared to control(1)

Toxicity Data Summary

Danio rerio

Osterauer R, Koehler H-R. 2008. Temperature-dependent effects of the pesticides thiacloprid and diazinon on the embryonic development of zebrafish (Danio rerio). Aquatic Toxicology vol: 86 iss: 4 pg: 485 -494

Relevance
Score: 70 (purity not reported, values)
Rating: L

Reliability
Score: 60
Rating: L

Osterauer & Koehler 2008		***D. rerio***
Parameter	**Value**	**Comment**
Test method cited	OECD guideline	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Danio*	
Species	*rerio*	
Family in North America?	yes	
Age/size at start of test/growth phase	eggs	
Source of organisms	Culture: Max-Planck-Institute for Developmental Biology Toubingen.	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	probably	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	yes	
Effect 1	heart rate (heart rates per minute)	
Control response 1	Less than 10%	
Effect 2	mortality	
Control response 2	Less than 10%	
Effect 3	hatching success	
Control response 3	Less than 10%	
Other effects (w/o significant response)	percentage of individuals showing gastrulation, somite formation, blood circulation, pigmentation, tail detachment, defects of the eyes and the brain, edemas,	
Temperature	26, 28, 30 and 33.5 ◦C	
Test type	Static renewal	
Photoperiod/light intensity	12:12	

Osterauer & Koehler 2008		***D. rerio***
Parameter	**Value**	**Comment**
Dilution water	Reconstituted water (OECD Guideline for Testing of Chemicals)	
pH	7.5–8 culture (not reported for tests)	
Hardness	NR	
Alkalinity	NR	
Conductivity	400 uS/cm culture (not reported for tests)	
Dissolved Oxygen	NR	
Feeding	none	
Purity of test substance	NR	
Concentrations measured?	No	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (µg/L)	100	4 Reps/ 10 per rep
Concentration 2 Nom/Meas (µg/L)	500	4 Reps/ 10 per rep
Concentration 3 Nom/Meas (µg/L)	1000	4 Reps/ 10 per rep
Concentration 4 Nom/Meas (µg/L)	2000	4 Reps/ 10 per rep
Concentration 5 Nom/Meas (µg/L)	3000	4 Reps/ 10 per rep
Control	Water only	4 Reps/ 10 per rep
TEMPERATURES Tested	28, 30 and 33.5 ◦C, control at 26 ◦C	
LCx; indicate calculation method	None calculated, see below	
ECx; indicate calculation method	NR	
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	NR	Method: ANOVA w/ Wilcoxon's *U*-test p: .05 MSD:
LOEC; indicate calculation method	NR	
MATC (GeoMean NOEC,LOEC)	NR	
% control at NOEC	NR	
% of control LOEC	NR	

Other notes: Tests done at 26 28, 30 and 33.5 ◦C. LC50s observed in highest concentrations (1000, 2000, 3000 ug/L) only at 30 and 33.5 degrees. Actual responses not reported could estimate from graph to determine LC 50 at high temps. However the chemical grad and much info also not reported so study will not rate RR, so will not be of much use.

Reliability points subtracted 3.7:
Grade or purity (5), Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Appendix D2: Supplemental data rated RL, LR, or LL

Reliability points subtracted 3.8:
Purity 80% pure (10), Measured concentrations within 20% of nominal (4), Organisms randomly assigned to test containers (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Random block was not reported (2), Appropriate spacing between concentrations (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control(1), Point estimates (LC 50 EC 25 etc) (3)

Toxicity Data Summary

Daphnia magna

Study: Dortland RJ. 1980. Toxicological evaluation of parathion and azinphosmethyl in freshwater model ecosystems. Agric Res Rep (Versl. Landbouwk. Onderz.) 898, Center for Agricultural Publishing and Documentation, Wageningen, the Netherlands.

Relevance - chronic
Score: 90 (No standard method)
Rating: R

Relevance - acute
Score: 8.25 (No std. method, control response NR)
Rating: L

Reliability - chronic
Score: 61
Rating: L

Reliability - acute
Score: 59.5 (No std. method, control response NR
Rating: N

Dortland 1980		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	Acute: 48 h Chronic: 21 d	
Data for multiple times?	Yes	
Effect 1	Mortality/immobilization	
Control response 1	NR	
Effect 2	Offspring per daphnid (does not specify females)	
Control response 2	52.5 (mean response)	
Temperature	17-19^{o}C	
Test type	Acute: static Chronic: static-renewal	

Dortland 1980		***D. magna***
Parameter	**Value**	**Comment**
	w/renewal 3x per week	
Photoperiod/light intensity	14L:10D	
Dilution water	Standard Test Medium (STM) or modified Flückiger	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Acute: none Chronic: daily	
Purity of test substance	99%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	$\leq$ 25 mg/L (very high)	
Concentration 1 Nom (µg/L)	Number and levels NR	Reps: 2 w/20 per
Control	Dilution water; solvent	Reps: 2 w/20 per
EC50; mg/L (g/m^3)	48 h: 1.5 at 48 h sub-acute: 0.75 (geo-mean of duplicate tests) 21 d: 0.23 (geo-mean of duplicate tests)	Log-probit; Litchfield & Wilcoxon (1949) or graphical
NOEC; µg/L (mg/m^3)	Immobilization: 0.2 Reproduction: 0.2	Method: NR p: NR MSD: NR
LOEC; indicate calculation method	Immobilization: 0.3 Reproduction: 0.3	
MATC (GeoMean NOEC,LOEC)	Immobilization: 0.24 Reproduction: 0.24	
% control at NOEC	Immobilization: NC Reproduction: 113%	
% of control LOEC	Immobilization: NC Reproduction: 60%	

Acute - Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Dilution

water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Chronic - Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Significance Level (2), Minimum significant difference (2), Point estimates (8).
Acceptability: No standard method (5), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Dilution factor (2), Minimum significant difference (1), Point estimates (3).

Toxicity Data Summary

Daphnia magna

Study: Fernández-Casalderrey A, Ferrando MD, Andreu-Moliner E. 1995. Chronic toxicity of diazinon to *Daphnia magna*: effects on survival, reproduction, and growth. Toxicol Environ Chem 49: 25-32.

Relevance
Score: Acute: 100; Chronic: 90 (No standard method)
Rating: R (acute and chronic)

Reliability - acute
Score: 63
Rating: L

Reliability - chronic
Score: 61
Rating: L

Fernández-Casalderrey *et al.* 1995		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	Acute: EEC Chronic: No standard method cited for	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	Acute: 24 h Chronic: 21 d	
Data for multiple times?	Yes	
Effect 1	Acute: mortality (%) Chronic: longevity (d)	
Control response 1	Mortality: 0% $Longevity_{blank}$: 20 d $Longevity_{solvent}$: 21 d	
Effect 2	Mean young per female	

Fernández-Casalderrey *et al.* 1995		***D. magna***
Parameter	**Value**	**Comment**
Control response 2	Blank: 57 Solvent: 58	
Effect 3	Maximum no. broods	
Control response 3	Blank: 6 Solvent: 6	
Effect 4	Mean brood size	
Control response 4	Blank: 11.5 Solvent: 12.8	
Effect 5	Mean no. broods	
Control response 5	Blank: 4.8 Solvent: 4.9	
Effect 6	Mean days to 1st reproduction	
	Blank: 8.6 Solvent: 8.2	
Effect 7	Length	
Control response 7	Blank: 0.81 cm Solvent: 0.87 cm	
Effect 8	Intrinsic rate of increase (r)	
Control response 8	Blank: 0.3 Solvent: 0.275	Estimated from Figure 1
Temperature	22 ± 1°C (culture); test NR	
Test type	Acute: static Chronic: static renewal; 48-h renewal	
Photoperiod/light intensity	12L:12D (culture); test NR	
Dilution water	Dechlorinated tapwater	
pH	7.9 ± 0.2 (culture); test NR	
Hardness	250 mg/L as $CaCO_3$ (culture); test NR	
Alkalinity	4.1 mmol/L, test NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Acute: none Chronic: daily	
Purity of test substance	92%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	66 µL/L acetone	
Concentration 1 Nom (µg/L)	Acute: 6 concentrations; level NR;	Acute reps: 3 w/10 per;

Fernández-Casalderrey *et al.* 1995		***D. magna***
Parameter	**Value**	**Comment**
	Chronic: 0.15	Chronic: 15 w/1 per
Concentration 2 Nom (µg/L)	Chronic: 0.18	Acute reps: 3 w/10 per; Chronic: 15 w/1 per
Concentration 3 Nom (µg/L)	Chronic: 0.22	Acute reps: 3 w/10 per; Chronic: 15 w/1 per
Concentration 4 Nom (µg/L)	Chronic: 0.25	Acute reps: 3 w/10 per; Chronic: 15 w/1 per
Concentration 5 Nom (µg/L)	Chronic: 0.30	Acute reps: 3 w/10 per; Chronic: 15 w/1 per
Control	Dilution water; solvent	Acute reps: 3 w/10 per; Chronic: 15 w/1 per
LC50; µg/L	0.86	Litchfield & Wilcoxon (1949)
NOEC; µg/L	Mean longevity: 0.22 (interrupted dose-response) Mean young/female: 0.15 Maximum no. broods: 0.30 Mean brood size: < 0.15 Mean no. broods: 0.15 Mean days to repr: 0.22 Length: < 0.15 r: < 0.15	Method: ANOVA and Duncan p: 0.05 MSD: NR
LOEC; µg/L	Mean longevity: 0.18 (interrupted dose-response) Mean young/female: 0.18 Maximum no. broods: > 0.3 Mean brood size: 0.15 Mean no. broods: 0.18 Mean days to repr: 0.25 Length: 0.15 r: 0.15	
MATC; µg/L; (GeoMean NOEC,LOEC)	Mean longevity: 0.16 Mean young/female: NC Maximum no. broods: NC Mean brood size: NC Mean no. broods: 0.16 Mean days to repr: 0.24 Length: NC r: NC	

Fernández-Casalderrey *et al.* 1995		***D. magna***
Parameter	**Value**	**Comment**
% control at NOEC	Mean longevity: 75% Mean young/female: 79% Maximum no. broods: 50% Mean brood size: NC Mean no. broods: 98% Mean days to repr: 113% Length: NC r: NC	Based on solvent control
% of control LOEC	Mean longevity: 60% Mean young/female: 46% Maximum no. broods: NC Mean brood size: 76% Mean no. broods: 76% Mean days to repr: 119% Length: 80% r: 79%	For r, value is estimated from Figure 1

Acute
Reliability points subtracted 3.7:
Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod not reported (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2),

Reliability points subtracted 3.8:
Measured concentrations within 20% of nominal (4), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Minimum significant difference(MSD) upper bound acceptable (1), LOEC reasonable compared to control(1), NOEC reasonable compared to control (1)

Chronic
Reliability points subtracted 3.7:
Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod not reported (3), Minimum significant difference (2), Point estimates (8)

Reliability points subtracted 3.8
Measured concentrations within 20% of nominal (4), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Minimum significant difference(MSD) upper bound acceptable (1), LOEC reasonable compared to control(1)

Appendix D2: Supplemental data rated RL, LR, or LL

Toxicity Data Summary

Daphnia magna

Study: Kikuchi M, Sasaki Y, Wakabayashi M. 2000. Screening of organophosphate insecticide pollution in water by using *Daphnia magna*. Ecotox Environ Safety 47: 239-245.

Diazinon results are from Kikuchi & Wakabayashi 1997 (in Japanese) conducted under same conditions reported in Kikuchi et al. 2000. Test details are taken from Kikuchi et al. 2000; EC50 value for diazinon is from data obtained in Kikuchi & Wakabayashi 1997, but was recalculated by Kikuchi et al. 2000.

Relevance
Score: 92.5 (controls not described)
Rating: R

Reliability
Score: 72
Rating: L

Kikuchi *et al.* 2000		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	Japanese Industrial Standard Method	Full reference below
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Immobility	
Control response 1	0%	
Temperature	21^{o}C	
Test type	Static	
Photoperiod/light intensity	18L:8D (sic); perhaps 16L:8D?	
Dilution water	Mineral water	

Kikuchi *et al.* 2000		***D. magna***
Parameter	**Value**	**Comment**
pH	7.4-7.9	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	7.8 mg/L	
Feeding	NR	
Purity of test substance	Analytical grade	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions; Density of acetone = 0.8 g/mL Density of DMSO = 1.1 g/mL	< 10 mg/L; either acetone or DMSO; not specified which solvent was used for which pesticides	If DMSO: 0.009 mL/L; If acetone: 0.01 mL/L
Concentration 1 Nom/Meas (μg/L)	Number and levels NR; dilution factor = 1.8	Reps: 4 w/5 per
Control	Not described	Reps: 4 w/5 per
EC50 (95% ci); μg/L	0.87 (0.74-1.0)	Probit

Japanese Industrial Standard (JIS K 0229). 1992. Testing Methods for Determination of the Inhibition of the Mobility of *Daphnia* by Chemicals.

Reliability points subtracted 3.7:
Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Control appropriate (6), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of solubility (4), Organisms randomly assigned to test containers (1), Adequate number per replicate/ appropriate cell density (2), Organisms not fed in acute tests (3), Hardness (2), Alkalinity (2), Conductivity (1), Adequate number of concentrations (3), Random block was not reported (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control(1)

Appendix D2: Supplemental data rated RL, LR, or LL

Toxicity Data Summary

Daphnia magna

Study: Sánchez M, Ferrando MD, Sancho E, Andreu-Moliner E. 1998. Evaluation of a *Daphnia magna* renewal life-cycle test method with diazinon. J Environ Sci Health B33: 785-797.

As per USEPA diazinon criteria document (USEPA 2005), units reported in this study as ng/L should be µg/L.

Acute LC50 of 0.86 µg/L determined by Fernandez et al. 1995 may be used with these results to calculate an acute-to-chronic-ratio (same lab, same dilution water).

Relevance
Score: 100
Rating: R

Reliability
Score: 63.5
Rating: L

Sánchez *et al.* 1998		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	ASTM 1988	Full reference below
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	7 d 21d	
Data for multiple times?	Yes	
Effect 1	Survival	
Control response 1	≥ 90%	
Effect 2	Length	
Control response 2	0.49 cm (blank)	

Sánchez *et al.* 1998		***D. magna***
Parameter	**Value**	**Comment**
	0.51 cm (acetone)	
Effect 3	Longevity	
Control response 3	21.0 d (blank) 18.7 d (acetone)	
Effect 4	Days to first brood	
Control response 4	7.8 (blank) 8.2 (acetone)	
Effect 5	No. of young per adult	
Control response 5	131.7 (blank) 136.8 (acetone)	
Effect 6	Brood size	
Control response 6	25.9 (blank) 30.2 (acetone)	
Effect 7	No. broods per adult	
Control response 7	5.1 (blank) 4.4 (acetone)	
Effect 8	Intrinsic rate of increase (r)	
Control response 8	0.32 (blank) 0.32 (acetone)	
Temperature	$22 \pm 1^{o}C$	Reported for culture; test NR
Test type	Static renewal; daily	
Photoperiod/light intensity	12L:12D	
Dilution water	Synthetic medium (full reference not given)	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Daily	
Purity of test substance	96.1%	
Concentrations measured?	No	
Measured is what % of nominal?	Na	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	5 μL/L acetone	
Concentration 1 Nom (μg/L)	0.05	Reps: 15 w/1 per
Concentration 2 Nom (μg/L)	0.1	Reps: 15 w/1 per
Concentration 3 Nom (μg/L)	0.5	Reps: 15 w/1 per
Concentration 4 Nom(μg/L)	0.75	Reps: 15 w/1 per
Concentration 5 Nom (μg/L)	1.0	Reps: 15 w/1 per
Control	Dilution water	Reps: 15 w/1 per

Sánchez *et al.* 1998		***D. magna***
Parameter	**Value**	**Comment**
NOEC; µg/L	7-d Survival: 0.1 21-d Survival: < 0.05 Length: < 0.05 Longevity: < 0.05 Days to first brood: NC (interrupted dose-response) No. young per adult: 0.05 Brood size: 0.05 No. broods per adult: 0.05 r: 0.5	Method: ANOVA w/Duncan p: 0.05 MSD: NR
LOEC; µg/L	7-d Survival: 0.5 21-d Survival: 0.05 Length: 0.05 Longevity: 0.05 Days to first brood: NC (interrupted dose-response) No. young per adult: 0.10 Brood size: 0.10 No. broods per adult: 0.10 r: 0.75	
MATC; µg/L; (GeoMean NOEC,LOEC)	7-d Survival: 0.22 21-d Survival: NC Length: NC Longevity: NC Days to first brood: NC (interrupted dose-response) No. young per adult: 0.07 Brood size: 0.07 No. broods per adult: 0.07 r: 0.61	
% control at NOEC	7-d Survival: 102% 21-d Survival: NC Length: NC Longevity: NC Days to first brood: NC (interrupted dose-response) No. young per adult: 75% Brood size: 74% No. broods per adult: 104% r: 91%	Based on solvent control
% of control LOEC	7-d Survival: 75% 21-d Survival: 67% Length: 92% Longevity: 90%	

Sánchez *et al.* 1998		***D. magna***
Parameter	**Value**	**Comment**
	Days to first brood: NC (interrupted dose-response) No. young per adult: 49% Brood size: 64% No. broods per adult: 77% r: 72%	

ASTM. 1988. Standard guide for conducting renewal life-cycle toxicity tests with *D. magna*. E 1193-87. 1990 Annual Book of Standards, Vol. 11.04. American Society for Testing and Materials, Philadelphia, PA. pp. 765-781.

Reliability points subtracted 3.7:
Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Minimum significant difference (2), Point estimates (LC50 EC25 etc)

Reliability points subtracted 3.8:
Control appropriate (6), Measured concentrations within 20% of nominal (4), Organisms randomly assigned to test containers (1), Hardness (2), Alkalinity (2), Conductivity (1), Dissolved Oxygen (6), Temperature (6), pH (2), Random block was not reported (2), Minimum significant difference (MSD) upper bound acceptable (1), LC/EC point estimates values calculable (3)

Toxicity Data Summary

Daphnia magna

Study: Sánchez M, Ferrando MD, Sancho E, Andreu E. 2000. Physiological perturbations in several generations of *Daphnia magna* Straus exposed to diazinon. Ecotox Environ Safety 46: 87-94.

This study may be linked to that of Fernández et al. 1995 for calculation of an acute-to-chronic ratio (Toxicol Environ Chem 49: 25-32)

Relevance
Score: 90 (no standard method)
Rating: R

Reliability
Score: 67
Rating: L

Sánchez *et al.* 2000		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	F_o generation: no F_1 generation: yes	
Animals acclimated and disease-free?	F_o: yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	21 d	
Data for multiple times?	No	
Effect 1	Longevity (days)	
Control response 1	F_0 (blank): 21.0 F_0 (solvent): 18.7 F_{1first} (blank): 21.0 F_{1first} (solvent): 20.1 F_{1third} (blank): 20.7 F_{1third} (solvent): 19.7	F_{1first} = first brood of F_1 generation; F_{1third} = third brood of F_1 generation
Effect 2	Time to first reproduction (days)	
Control response 2	F_0 (blank): 7.8	

Sánchez *et al.* 2000		***D. magna***
Parameter	**Value**	**Comment**
	F_0 (solvent): 8.2 F_{1first} (blank): 8.4 F_{1first} (solvent): 7.6 F_{1third} (blank): 8.1 F_{1third} (solvent): 7.6	
Effect 3	Total number of neonates	
Control response 3	F_0 (blank): 131.7 F_0 (solvent): 136.8 F_{1first} (blank): 134.5 F_{1first} (solvent): 161.9 F_{1third} (blank): 114.7 F_{1third} (solvent): 157.3 (significantly higher than blank)	
Effect 4	Number of broods	
Control response 4	F_0 (blank): 5.1 F_0 (solvent): 4.4 F_{1first} (blank): 5.0 F_{1first} (solvent): 4.7 F_{1third} (blank): 4.9 F_{1third} (solvent): 4.7	
Effect 5	Brood size	
Control response 5	F_0 (blank): 25.9 F_0 (solvent): 30.2 F_{1first} (blank): 26.9 F_{1first} (solvent): 32.4 F_{1third} (blank): 23.2 F_{1third} (solvent): 31.4 (significantly higher than blank)	
Effect 6	Body length (cm)	
Control response 6	F_0 (blank): 0.49 F_0 (solvent): 0.51 F_{1first} (blank): 0.48 F_{1first} (solvent): 0.49 F_{1third} (blank): 0.48 F_{1third} (solvent): 0.49	
Effect 7	Intrinsic rate of increase	
Control response 7	F_0 (blank): 0.32 F_0 (solvent): 0.32 F_{1first} (blank): 0.31 F_{1first} (solvent): 0.33 F_{1third} (blank): 0.31 F_{1third} (solvent): 0.33	Solvent values estimated from figures

Sánchez *et al.* 2000		***D. magna***
Parameter	**Value**	**Comment**
Temperature	$22 \pm 1^{o}C$	Reported for culture, not for test
Test type	Static renewal	
Photoperiod/light intensity	12L:12D	Reported for culture, not for test
Dilution water	Dechlorinated tapwater	
pH	7.9 ± 0.2	Reported for culture, not for test
Hardness	182 mg/L $CaCO_3$	Reported for culture, not for test
Alkalinity	4.1 mmol/L	Reported for culture, not for test
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	5×10^5 cells/mL *Nannochloris oculata*	
Purity of test substance	96.1%	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	10^{-4} µL/L acetone	
Concentration 1 (µg/L); not clear if nominal or measured	0.05	Reps: 15 w/1 per
Concentration 2 (µg/L); not clear if nominal or measured	0.1	Reps: 15 w/1 per
Concentration 3 (µg/L); not clear if nominal or measured	0.5	Reps: 15 w/1 per
Concentration 4 (µg/L); not clear if nominal or measured	0.75	Reps: 15 w/1 per
Concentration 5 (µg/L); not clear if nominal or measured	1.0	Reps: 15 w/1 per
Control	Dilution water; solvent	Reps: 15 w/1 per
EC50; µg/L	F_0 longevity: 0.67 F_0 young/female: 0.35 F_0 brood size: 0.47 F_0 broods/female: 0.43 F_0 intrinsic rate of increase: 0.72 F_{1first} longevity: 0.41 F_{1first} young/female: 0.20 F_{1first} brood size: 0.29 F_{1first} broods/female: 0.29	Regression

Sánchez *et al.* 2000		***D. magna***
Parameter	**Value**	**Comment**
	F_{1first} intrinsic rate of increase: 0.44 F_{1third} longevity: 0.35 F_{1third} young/female: 0.22 F_{1third} brood size: 0.27 F_{1third} broods/female: 0.25 F_{1third} intrinsic rate of increase: 0.47	
NOEC; µg/L	F_0 longevity: < 0.05 F_0 first brood: NC F_0 young/female: < 0.05 F_0 brood size: 0.05 F_0 broods/female: 0.05 F_0 intrinsic rate of increase: 0.5 F_{1first} longevity: < 0.05 F_{1first} first brood: 0.5 F_{1first} young/female: < 0.05 F_{1first} brood size: 0.05 F_{1first} broods/female: < 0.05 F_{1first} intrinsic rate of increase: 0.5 F_{1third} longevity: 0.05 F_{1third} first brood: 0.05 F_{1third} young/female: 0.05 F_{1third} brood size: 0.05 F_{1third} broods/female: 0.05 F_{1third} intrinsic rate of increase: 0.05	Method: ANOVA and Duncan p: 0.05 MSD: NR NC = not calculable due to interrupted dose response
LOEC; indicate calculation method	F_0 longevity: 0.05 F_0 first brood: 0.5 F_0 young/female: 0.05 F_0 brood size: 0.1 F_0 broods/female: 0.1 F_0 intrinsic rate of increase: 0.75 F_{1first} longevity: 0.05 F_{1first} first brood: > 0.5 F_{1first} young/female: 0.05 F_{1first} brood size: 0.1 F_{1first} broods/female: 0.05 F_{1first} intrinsic rate of increase: 0.75 F_{1third} longevity: 0.1	

Sánchez *et al.* 2000		***D. magna***
Parameter	**Value**	**Comment**
	F_{1third} first brood: 0.1 F_{1third} young/female: 0.1 F_{1third} brood size: 0.1 F_{1third} broods/female: 0.1 F_{1third} intrinsic rate of increase: 0.1	
MATC (GeoMean NOEC,LOEC)	F_0 longevity: NC F_0 first brood: NC F_0 young/female: NC F_0 brood size: 0.07 F_0 broods/female: 0.07 F_0 intrinsic rate of increase: 0.61 F_{1first} longevity: NC F_{1first} first brood: NC F_{1first} young/female: NC F_{1first} brood size: 0.07 F_{1first} broods/female: NC F_{1first} intrinsic rate of increase: 0.61 F_{1third} longevity: 0.07 F_{1third} first brood: 0.07 F_{1third} young/female: 0.07 F_{1third} brood size: 0.07 F_{1third} broods/female: 0.07 F_{1third} intrinsic rate of increase: 0.07	
% control at NOEC	F_0 longevity: NC F_0 first brood: NC F_0 young/female: NC F_0 brood size: 74% F_0 broods/female: 105% F_0 intrinsic rate of increase: 72% F_{1first} longevity: NC F_{1first} first brood: 107% F_{1first} young/female: NC F_{1first} brood size: 64% F_{1first} broods/female: NC F_{1first} intrinsic rate of increase: 100% F_{1third} longevity: 99% F_{1third} first brood: 109% F_{1third} young/female: 73%	Based on solvent control

Sánchez *et al.* 2000		***D. magna***
Parameter	**Value**	**Comment**
	F_{1third} brood size: 79% F_{1third} broods/female: 96% F_{1third} intrinsic rate of increase: 94%	
% of control LOEC	F_0 longevity: 90% F_0 first brood: 107% F_0 young/female: 76% F_0 brood size: 64% F_0 broods/female: 77% F_0 intrinsic rate of increase: 72% F_{1first} longevity: 89% F_{1first} first brood: NC F_{1first} young/female: 53% F_{1first} brood size: 32% F_{1first} broods/female: 83% F_{1first} intrinsic rate of increase: 0% F_{1third} longevity: 82% F_{1third} first brood: 147% F_{1third} young/female: 20% F_{1third} brood size: 31% F_{1third} broods/female: 45% F_{1third} intrinsic rate of increase: 61%	

As per USEPA (2000) final diazinon criteria document, concentrations reported as ng/L in paper are supposed to be μg/L.

Points taken off for:
Documentation (3.7): Nominal concentrations (3), hardness (2), alkalinity (2), dissolved oxygen (4), temperature (4), conductivity (2), pH (2), photoperiod (3), Minimum significant difference (2).
Acceptability (3.8): Standard method (5), Measured concentrations within 20% of nominal (4), Organisms randomized (1), Hardness (2), alkalinity (2), dissolved oxygen (6), temperature (6), conductivity (1), pH (2), Photoperiod (2), random design (2), minimum significant difference (1).

Toxicity Data Summary

Daphnia magna

Vilkas AG. 1976. Acute toxicity of diazinon technical to the water flea *Daphnia magna* Straus, EPA guidelines No. 72-2, Agricultural Division, Ciba-Geigy Corporation, Greensboro, NC. EPA MRID 00109022.

Relevance
Score: 85 (Controls not described or reported)
Rating: L

Reliability
Score: 70.5
Rating: L

Vilkas 1976		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1975	Reference below
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Found in	N. America	
Age/size at start of test/growth phase	< 20 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR, but standard method	
Temperature	17^{o} C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Lake water, filtered	
pH	7.90	
Hardness	50 mg/L as $CaCO_3$	
Alkalinity	25 mg/L as $CaCO_3$	
Conductivity	140 µmhos/cm	
Dissolved Oxygen	8.6-9.2 mg/L	
Feeding	None	

Vilkas 1976		***D. magna***
Parameter	**Value**	**Comment**
Purity of test substance	Technical	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Acetone used; concentration NR	
Concentration 1 Nom (µg/L)	0.18	Reps: 4 w/5 per
Concentration 2 Nom (µg/L)	NR	Reps: 4 w/5 per
Concentration 3 Nom (µg/L)	0.56	Reps: 4 w/5 per
Concentration 4 Nom (µg/L)	NR	Reps: 4 w/5 per
Concentration 5 Nom (µg/L)	1.80	Reps: 4 w/5 per
Control	Mentioned, but not described	Reps: 4 w/5 per
LC_{50} (95% ci); µg/L	0.96 (0.83-1.10)	Spearman-Karber
NOEC; µg/L	0.56	Method: NR p: NR MSD: NR
LOEC; indicate calculation method	NR	
MATC (GeoMean NOEC,LOEC)	NR	

USEPA. 1975. Methods for acute toxicity with fish, macroinvertebrates and amphibians. EPA-660/3-75-00, US Environmental Protection Agency, Washington, DC.

Reliability points subtracted 3.7:
Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Photoperiod and or light intensity (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC(2)

Reliability points subtracted 3.8:
Control appropriate (6), Response within test guidance (9), Measured concentrations within 20% of nominal (4), Organisms randomly assigned to test containers (1), Photoperiod and light intensity within organisms tolerance (2), Random block was not reported (2), Appropriate spacing between concentrations (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1)

Toxicity Data Summary

Daphnia pulex

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington, DC.

Relevance
Score: 85 (Controls not described or reported)
Rating: L

Reliability
Score: 62
Rating: L

Johnson & Finley 1980		***D. pulex***
Parameter	**Value**	**Comment**
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoetger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*pulex*	
Found in	N. America	
Age/size at start of test/growth phase	First instar.	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 hr	
Data for multiple times?	NR	
Effect 1	Immobilization	
Control response 1	NR	
Temperature	15 ± 1^{o} C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	

Johnson & Finley 1980		***D. pulex***
Parameter	**Value**	**Comment**
pH	7.2 – 7.5	
Hardness	40 – 50 mg/L	
Alkalinity	30 – 35 mg/L	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not fed	
Purity of test substance	Technical grade	89%
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	At least 6 different concentrations tested, values not given
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	$\leq$ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used
LCx; indicate calculation method	NR	
EC50 (95% ci)	0.8 (0.6-1.1) µg/L	Litchfield & Wilcoxon (1949)

Reliability points subtracted 3.7:
Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Temperature (4), Conductivity (2), Photoperiod (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Control appropriate (6), Control Response within test guideline (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of solubility (4), Organisms randomly assigned to test containers (1), Adequate number per replicate/ appropriate cell density (2), Dissolved oxygen (6), Conductivity (1), Photoperiod and light intensity within organism tolerance (2), Random block was not reported (2), Adequate replication (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control(1)

Toxicity Data Summary

Daphnia pulex

Study: Nishiuki Y, Hashimoto Y. 1967. Toxicity of pesticide ingredients to some fresh water organisms. Botyu-Kagaku 32: 5-11.

Only a summary of this study and tables are available in English so most details cannot be determined. The cladoceran tests were 3 hours, thus are not long enough to be usable for criteria derivation. The USEPA (2005) did not use these data for criteria derivation, but judged them of high enough quality to use as supporting data. Thus the rating of LL is being assigned to this study.

Relevance
Score: Cannot determine
Rating: L

Reliability
Score: Cannot determine
Rating: L

Nishiuki & Hashimoto 1967		***D. pulex***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*pulex*	
Found in	North America	
Purity of test substance	Technical	As per USEPA 2005
LC50; mg/L	0.0078	Method not determined

Rows for information not available were deleted.

Toxicity Data Summary

Ephoron virgo

Study: Van Der Geest HG, Greve GD, Kroon A, Kuijl S, Kraak MHS, Admiraal W. 2000a. Sensitivity of characteristic riverine insects, the caddisfly *Cyrnus trimaculatus* and the mayfly *Ephoron virgo*, to copper and diazinon. Environ Poll 109: 177-182.
Relevance
Score: 77 (Species does not reside in N. America, control not described)
Rating: L
Reliability
Score: 65.5
Rating: L

Van Der Geest *et al.* 2000a		***E. virgo***
Parameter	**Value**	**Comment**
Test method cited	Greve et al. 1998, 1999	Full reference below
Phylum	Arthropoda	
Class	Insecta	
Order	Ephemeroptera	
Family	Polymitarcyidae	
Genus	*Ephoron*	
Species	*virgo*	
Found in	Europe	
Age/size at start of test/growth phase	2-day old larvae	
Source of organisms	Field-collected egg masses	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	Cannot determine	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	2%	
Temperature	20^{o}C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Dutch Standard Water	
pH	8.2	
Hardness	210 mg/L as $CaCO_3$	
Alkalinity	1.2 meq/L	
Conductivity	NR	
Dissolved Oxygen	NR	

Van Der Geest *et al.* 2000a		***E. virgo***
Parameter	**Value**	**Comment**
Feeding	At test initiation	
Purity of test substance	99.7%	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (µg/L)	Level and number NR	Reps: ≥ 2 w/10 per
Control	Not described	Not described
LCx (95% ci); µg/L	LC10: 5.3 (3.0-9.0) LC50: 11.8 (9.9-14.1)	Non-linear curve-fitting

Greve GD, Van Der Geest HG, Stuijfzand SC, Engels S, Kraak MHS. 1998. Development of ecotoxicity tests using laboratory reared larvae of the riverine caddisflies *Hydropsyche angustipennis* and *Cyrnus trimaculatus*. Proc Exp Appl Entomol, Leiden, NEV Amsterdam 9: 205-210.
Greve GD, Van Der Geest HG, Stuijfzand SC, Kureck A, Kraak MHS. 1999. Development and validation of an ecotoxicity test using field collected eggs of the riverine mayfly *Ephoron virgo*. Proc Exp Appl Entomol, Leiden, NEV Amsterdam 10: 105-110.

Reliability points subtracted 3.7:
Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Control appropriate (6), Response within test guidance (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of solubility (4), Organisms randomly assigned to test containers (1), Adequate number per replicate/ appropriate cell density (2), Organisms not fed in acute tests (3), Dissolved oxygen (6), Conductivity (1), Adequate number of concentrations (3), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control(1)

Toxicity Data Summary

Ephoron virgo

Study: Van Der Geest HG, Greve GD, Boivin M-E, Kraak MHS, Gestel CAM. 2000b. Mixture toxicity of copper and diazinon to larvae of the mayfly (*Ephoron virgo*) judging additivity at different effect levels. Environ Toxicol Chem 19: 2900-2905.

Relevance
Score: 85 (Species not in N. America)
Rating: L

Reliability
Score: 74.5
Rating: R

Van Der Geest *et al.* 2000b		***E. virgo***
Parameter	**Value**	**Comment**
Test method cited	Greve *et al.* 1999	Full reference below
Phylum	Arthropoda	
Class	Insecta	
Order	Ephemeroptera	
Family	Polymitarcyidae	
Genus	*Ephoron*	
Species	*virgo*	
Found in	Europe	
Age/size at start of test/growth phase	0-2-day larvae	
Source of organisms	Field-collected egg masses	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	95 $\pm$ 7%	
Temperature	20^{o}C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Dutch Standard Water (DSW)	
pH	8.2	
Hardness	210 mg/L as $CaCO_3$	
Alkalinity	1.2 meq/L	
Conductivity	NR	

Van Der Geest *et al.* 2000b		***E. virgo***
Parameter	**Value**	**Comment**
Dissolved Oxygen	NR	
Feeding	At test initiation	
Purity of test substance	99.7%	
Concentrations measured?	Yes, but NR	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L)	1	Reps: NR w/20 per
Concentration 2 Nom (µg/L)	3	Reps: NR w/20 per
Concentration 3 Nom (µg/L)	10	Reps: NR w/20 per
Concentration 4 Nom (µg/L)	30	Reps: NR w/20 per
Concentration 5 Nom (µg/L)	100	Reps: NR w/20 per
Control	Dilution water	Reps: NR w/20 per
LC50 (95% ci); µg/L	6.9 (4.7-10.1)	Nonlinear curve-fitting

Greve GD, Van Der Geest HG, Stuijfzand SC, Kureck A, Kraak MHS. 1999. Development and validation of an ecotoxicity test using field collected eggs of the riverine mayfly *Ephoron virgo*. Proceedings, Experimental and Applied Entomology, Leiden, The Netherlands, December 18, 1998. Pp. 105-110.

Reliability points subtracted 3.7:
Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Measured concentrations within 20% of nominal (4), No prior contaminant exposure (4), Organisms randomly assigned to test containers (1), Adequate number per replicate/ appropriate cell density (2), Organisms not fed in acute tests (3), Organisms properly acclimated (1), Dissolved oxygen (6), Conductivity (1), Random block was not reported (2), Adequate replication (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control(1)

Toxicity Data Summary

Ephoron virgo

Study: Van Der Geest HG, Soppe WJ, Greve GD, Kroon A, Kraak MHS. 2002. Combined effects of lowered oxygen and toxicants (copper and diazinon) on the mayfly *Ephoron virgo*. Environ Toxicol Chem 21: 2002.

Relevance
Score: 75 (No standard method; Species not in N. America)
Rating: L

Reliability
Score: 76.5
Rating: R

Van Der Geest et al. 2002		***E. virgo***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Arthropoda	
Class	Insecta	
Order	Ephemeroptera	
Family	Polymitarcyidae	
Genus	*Ephoron*	
Species	*virgo*	
Found in	Europe	
Age/size at start of test/growth phase	0-2-d-old larvae	
Source of organisms	Eggs collected in wild	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated & disease free?	Cannot determine	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24, 48, 72, 96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	0%	
Temperature	20^{o}C	
Test type	Static	
Photoperiod/light intensity	18L:6D	
Dilution water	Synthetic water	
pH	8.1	
Hardness	210 mg/L as $CaCO_3$	
Alkalinity	1.2 meq/L	
Conductivity	NR	
Dissolved Oxygen	100% saturation; 50% saturation	Controlled during test
Feeding	At test initiation	
Purity of test substance	99.7%	

Van Der Geest et al. 2002		***E. virgo***
Parameter	**Value**	**Comment**
Concentrations measured?	Yes, but NR	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (µg/L)	5 concentrations; levels NR	Reps:50%saturation: 3 w/ 20 per; 100% saturation: 1-2 w/20 per (only the 96-h test had 2 reps)
Control	Dilution water at 100% oxygen saturation	Reps: 1 w/20 per
LC50 (95% ci); µg/L	72-h 50%: 8.0 (6.0-10.8) 72-h 100%: 4.7 (1.0-13.3) 96-h 50%: 2.4 (1.4-4.3) 96-h 100%: 1.1 (0.5-2.3)	Logistic curve-fitting; 50% &100% saturation experiment had no statistical significance

Reliability points subtracted 3.7:
Nominal concentrations (3), Measured concentrations (3), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Acceptable standard (5), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of solubility (4), No prior contaminant exposure (4), Organisms randomly assigned to test containers (1), Organisms properly acclimated and disease free prior to testing (1), Organisms not fed in acute tests (3), Dissolved oxygen (6), Conductivity (1), Adequate number of concentrations (3), Random block was not reported (2), Appropriate spacing between concentrations (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control(1)

Toxicity Data Summary

Gammarus fasciatus

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:
Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance
Score: 85 (Controls not described or reported)
Rating:L

Reliability
Score: 62.5
Rating:L

Johnson & Finley 1980 Mayer & Ellersieck 1986		***G. fasciatus***
Parameter	**Value**	**Comment**
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Gammaridae	
Genus	*Gammarus*	
Species	*fasciatus*	
Found in	N. America	
Age/size at start of test/growth phase	Mature	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	

Johnson & Finley 1980 **Mayer & Ellersieck 1986**		***G. fasciatus***
Parameter	**Value**	**Comment**
Test vessels randomized?	NR	
Test duration	96 hr	
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	21 $\pm$ 1^{o} C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	
Hardness	40 – 5- mg/L	
Alkalinity	30-35 mg/L	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	Technical grade	89%
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	$\leq$ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	0.2 (0.15-0.28) ug/L	Litchfield & Wilcoxon (1949)

According to EPA criteria doc this value (0.2 ug/L) is misreported; should be 2.0 ug/L

Reliability points subtracted 3.7:
Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Appendix D2: Supplemental data rated RL, LR, or LL

Reliability points subtracted 3.8:
Control appropriate (6), Response within test guidance (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of solubility (4), Organisms randomly assigned to test containers (1), Dissolved oxygen (6), Conductivity (1), Photoperiod (2), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control(1)

Toxicity Data Summary

Gillia altilis

Robertson JB, Mazzella C. 1989. Acute toxicity of the pesticide diazinon to the freshwater snail *Gillia altilis*. *Bull Environ Contam Toxicol* 42: 320-324.

Relevance	Reliability
Score: 82.5 (No std. Method, control response NR)	Score: 60
Rating:L	Rating: L

Robertson & Mazzella 1989		***G. altilis***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum	Mollusca	
Class	Gastropoda	
Order	Neotaenioglossa	
Family	Hydrobiidae	
Genus	*Gillia*	
Species	*altilis*	
Found in	N. America	
Age/size at start of test/growth phase	NR	
Source of organisms	Drainage ditch	
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h w/ 7-d recovery period	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	20.5-23.5^{o}C	
Test type	Static renewal	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated tapwater	
pH	6.7-6.9	
Hardness	22-35 mg/L as $CaCO_3$	
Alkalinity	25-29 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	88.6%	

Robertson & Mazzella 1989		***G. altilis***
Parameter	**Value**	**Comment**
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	0.01M ethanol (0.6 mL/L based on density of 0.8 and MW of 46)	
Concentration 1 Nom (µM); Fig. 1	20 (5.5 mg/L)	Reps: 3 w/20 per
Concentration 2 Nom (µM); Fig. 1	40 (11 mg/L)	Reps: 3 w/20 per
Concentration 3 Nom (µM); Fig. 1	60 (16.5 mg/L)	Reps: 3 w/20 per
Concentration 4 Nom (µM); Fig. 1	80 (22 mg/L)	Reps: 3 w/20 per
Control	Dilution water; solvent	Reps: 3 w/20 per
LC50; mg/L	11	graphical

Reliability points subtracted 3.7:
Age/life stage/size/ growth phase (5), Analytical method (4), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Control response within guidance (9), Measured concentrations within 20% of nominal (4), Appropriate size/age/growth phase(3), No prior contaminant exposure (4), Organisms randomly assigned to test containers (1), Adequate number per replicate/ appropriate cell density (2), Organisms not fed in acute tests (3), Dilution water source (2), Dissolved oxygen (6), Conductivity (1), Photoperiod (2), Random block was not reported (2), Appropriate statistical method used (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control(1)

Toxicity Data Summary

Hyalella azteca

Study: Ankley GT, Collyard SA. 1995. Influence of piperonyl butoxide on the toxicity of organophosphate insecticides to three species of freshwater benthic invertebrates. Comp Biochem Physiol 110C: 149-155.

Notes: Using only data for diazinon only exposures; water quality information, test substance purity, replication, other information given as ranges for all tests and compounds; not possible to match specific data with each test.

Relevance	Reliability
Score: 9 (No std. method; control response NR)	Score: 74
Rating:L	Rating: R

Ankley & Collyard 1995		***H. azteca***
Parameter	**Value**	**Comment**
Test method cited	None cited	Study by EPA staff
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Hyalellidae	
Genus	*Hyalella*	
Species	*Azteca*	
Native to	North America	
Age/size at start of test	7-14 d juveniles	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality/immobility	
Control response 1	NR	
Temperature	23 $\pm$ 1 ^{o}C	
Test type	Static	
Photoperiod	16L:8D	
Dilution water	Lake Superior water; as is, or with added hardness	
pH	7.4-8.5	

Ankley & Collyard 1995		***H. azteca***
Parameter	**Value**	**Comment**
Hardness	42-47 mg/L as $CaCO_3$	Hardness adjusted to 105 mg/L as $CaCO_3$, species unclear in the study
Alkalinity	39-46 mg/L as $CaCO_3$	
Conductivity	NA	
Dissolved Oxygen	5.2-8.1 mg/L	
Feeding	Yeast Cerophyll-Trout Chow at test start	
Purity of test substance	$\geq$ 95% pure	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	$\leq$ 1.5% (15 mL/L, but shown to be non-toxic)	
Concentration 1 Nom/Meas (µg/L)	NR	Reps: 2-4 w/5-10 per
Concentration 2 Nom/Meas (µg/L)	NR	Reps: 2-4 w/5-10 per
Concentration 3 Nom/Meas (µg/L)	NR	Reps: 2-4 w/5-10 per
Concentration 4 Nom/Meas (µg/L)	NR	Reps: 2-4 w/5-10 per
Control	Methanol carrier at $\leq$ 1.5%	Reps: 2-4 w/5-10 per
LC50 (95% ci)	6.51 ug/L (4.90-8.66)	Trimmed Spearman-Karber

Reliability points subtracted 3.7:
Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Acceptable standard method (5), Response within test guidance (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of solubility (4), Carrier solvent (4), Organisms randomly assigned to test containers (1), Organisms not fed in acute tests (3), Conductivity (1), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Appropriate statistical method used (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control(1)

Toxicity Data Summary

Hyalella azteca

Collyard SA, Ankley GT, Hoke RA, Goldenstein T. 1994. Influence of age on the relative sensitivity of *Hyalella azteca* to diazinon, alkylphenol ethoxylates, copper, cadmium, and zinc. *Arch Environ Contam Toxicol* 26: 110-113.

Relevance
Score: 75 (No standard method; Diazinon purity NR)
Rating: L

Reliability
Score: 66.5
Rating:L

Collyard *et al.* 1994		***H. azteca***
Parameter	**Value**	**Comment**
Test method cited	None cited for toxicity tests	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Hyalellidae	
Genus	*Hyalella*	
Species	*azteca*	
Found in	N. America	
Age/size at start of test/growth phase	Range of ages: 0-2, 2-4, 4-6, 6-8…24-26 days	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 hr	
Data for multiple times?	NR	
Effect 1	Mortality	
Control response 1	$\leq$ 20%	
Temperature	25^{o}C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Lake Superior Water, filtered	
pH	7.4 – 8.1	
Hardness	40 mg/L CaCO3	
Alkalinity	40 mg/L CaCO3	
Conductivity	NR	
Dissolved Oxygen	6.3 – 8.2 mg/L	

Collyard *et al.* 1994		***H. azteca***
Parameter	**Value**	**Comment**
Feeding	500 uL of yeast-cerophyll-trout chow at initiation	
Purity of test substance	NR	
Concentrations measured?	No	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (µg/L)	NR	reps: 2 w/10 per
Concentration 2 Nom/Meas (µg/L)	NR	reps: 2 w/10 per
Concentration 3 Nom/Meas (µg/L)	NR	reps: 2 w/10 per
Concentration 4 Nom/Meas (µg/L)	NR	reps: 2 w/10 per
Control	Lake Superior Water	reps: 2 w/10 per
LC50; µg/L	Age 0-2 d: 6.2 Age 2-4: 4.2 Age 6-8: 4.2 Age 8-10: 4.5 Age 12-14: 3.8 Age 16-18: 4.5 Age 20-22: 4.8 Age 24-26: 4.8	Trimmed Spearman-Karber; values estimated from figure 1; precise values not given in text.

Other data:

- LC50 and confidence indicated on Figure 1, but no raw data given. Can only approximate from given information.

Reliability points subtracted 3.7:
Grade of purity (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Acceptable standard (5), Response within test guidance (9), Chemical Purity (10), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of solubility (4), Organisms randomly assigned to test containers (1), Organisms not fed in acute tests (3), Conductivity (1), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control(1), LOEC response reasonable compared to control(1)

Toxicity Data Summary

Hyalella azteca

Study: Werner I, Nagel R. 1997. Stress proteins HSP60 and HSP70 in three species of amphipods exposed to cadmium, diazinon, dieldrin and fluoranthene. Environ Toxicol Chem 16: 2393-2403.

Relevance
Score: 70 (Endpoint not linked to survival, growth, reproduction; Diazinon purity NR)
Rating: L

Reliability
Score: 70
Rating: L

This study reported 24- and 48-h LC50 values of 30 and 19 µg/L, respectively, but these were from a range-finding test with no details given. This study also included tests with marine and estuarine species. Only the freshwater results are summarized.

Werner & Nagel 1997		***H. azteca***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1994	Full reference below
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Hyalellidae	
Genus	*Hyalella*	
Species	*Azteca*	
Found in	North America	
Age/size at start of test/growth phase	NR	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Increases in heat shock proteins, HSP60, HSP70	
Control response 1	Baseline	
Temperature	20^{o}C	

Werner & Nagel 1997		***H. azteca***
Parameter	**Value**	**Comment**
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Moderately hard freshwater	
pH	7.7-8.4	
Hardness	160-180 mg/L as $CaCO_3$	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	8.5-9.0 mg/L	
Feeding	NR	
Purity of test substance	NR	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes, immunoassay	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Meas (µg/L)	0.03	Reps: 3 w/10 per
Concentration 2 Meas (µg/L)	0.6	Reps: 3 w/10 per
Concentration 3 Meas (µg/L)	5.8	Reps: 3 w/10 per
Concentration 4 Meas (µg/L)	32	Reps: 3 w/10 per
Control	Dilution water	Reps: 3 w/10 per
NOEC; µg/L	0.03	Method: ANOVA, t-test p: 0.05 MSD: NR
LOEC; µg/L	0.6	
MATC; µg/L; (GeoMean NOEC,LOEC); dilution factor of 20 between NOEC and LOEC is too large for reasonable MATC estimation	0.13	
% control at NOEC	~100%	Estimated from Figure 2
% of control LOEC	~400%	Estimated from Figure 2

USEPA. 1994. Methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates. EPA 600/R-94/024. US Environmental Protection Agency, Washington, DC.

Reliability points subtracted 3.7:
Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Chemical Purity (10), Measured concentrations within 20% of nominal (4), Appropriate size/age/growth phase (3), Organisms not fed in acute tests (3), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), Random block was not reported (2), Minimum significant difference (MSD) upper bound acceptable (1), LC/EC values calculable (3)

Toxicity Data Evaluation

Hydropsyche angustipennis

Stuijfzand SC, Poort L, Greeve GD, Van der Geest HG, Kraak MHS. 2000. Variables Determining the Impact of Diazinon on Aquatic Insects: Taxon, Developmental Stage, and Exposure Time. *Environ Toxicol Chem* 19:582-587.

1st instar (5th instar has a separate summary sheet)

Relevance - mortality
Score: 90 (no std. method)
Rating: L

Reliability
Score: 70
Rating: L

Relevance - activity
Score: 67.5 (no std. method, no in NA, endpoint)
Rating: N

Reliability
Score: 52.5
Rating: N

Stuijfzand *et al.* 2000		***H. angustipennis***
Parameter	**Value**	**Comment**
Test method cited	NR	
Phylum	Arthropoda	
Class	Insecta	
Order	Trichoptera	
Family	Hydropsychidae	
Genus	*Hydropsyche*	
Species	*angustipennis*	
Found in	Not in N. America	
Age/size at start of test/growth phase	12 day old larvae; 1st instar	
Source of organisms	Laboratory Culture	
Have organisms been exposed to contaminants?	NR, assumed no	
Animals acclimated and disease-free?	NR	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	48, 96 hours	
Data for multiple times?	Yes	
Effect 1	Lethality	
Control response 1	Lethality 13+/- 2 %	
Effect 2	Decrease in Activity	
Control response 2	NR	
Temperature	20° C	
Test type	Static	
Photoperiod/light intensity	16L:8D	

Stuijfzand *et al.* 2000		***H. angustipennis***
Parameter	**Value**	**Comment**
Dilution water	DSW (Dutch Standard Water)	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	At the start of testing	0.5 mL of a food suspension
Purity of test substance	99.7 % Diazinon	
Concentrations measured?	Yes, but NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	None used	
48, 96 h Concentration 1 Nom(µg/L)	0.1	48 h: 3 reps x 20 96 h: 2+ reps x 20
48, 96 h Concentration 2 Nom/Meas (µg/L)	0.3	48 h: 3 reps x 20 96 h: 2+ reps x 20
48, 96 h Concentration 3 Nom (µg/L)	1	48 h: 3 reps x 20 96 h: 2+ reps x 20
96 h Concentration 4 Nom (µg/L)	2	48 h: 3 reps x 20 96 h: 2+ reps x 20
48 h Concentration 4; 96 h Concentration 5 (µg/L)	3	48 h: 3 reps x 20 96 h: 2+ reps x 20
96 h Concentration 6 Nom (µg/L)	4	48 h: 3 reps x 20 96 h: 2+ reps x 20
96 h Concentration 7 Nom (µg/L)	6	48 h: 3 reps x 20 96 h: 2+ reps x 20
96 h Concentration 8 Nom (µg/L	8	48 h: 3 reps x 20 96 h: 2+ reps x 20
48 h Concentration 5; 96 h Concentration 9 Nom (µg/L)	10	48 h: 3 reps x 20 96 h: 2+ reps x 20
Control	DSW Mortality = 13 +/- 2 %	3 reps x 20
LC50	See below	Sigmoidal dose-response curves (Haanstra et al. 1985)
EC50	See below	Sigmoidal dose-response curves (Haanstra et al. 1985)

Experiment Time	Parameter	LC50 / EC50 (µg/L)	95 % Confidence Limit
48 hours	Mortality	2.9	2.2 – 13.9
48 hours	Activity	3.7	3.1 – 4.4
96 hours	Mortality	1.3	1.2 – 1.5
96 hours	Activity	ND	ND

Reliability points subtracted 3.7:
Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Acceptable standard (5), Measured concentrations within 20% of nominal (4), Adequate number per replicate/Appropriate cell density (2), Organisms not fed in acute tests (3), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Random block was not reported (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1)

Toxicity Data Evaluation

Hydropsyche angustipennis

Stuijfzand SC, Poort L, Greeve GD, Van der Geest HG, Kraak MHS. 2000. Variables Determining the Impact of Diazinon on Aquatic Insects: Taxon, Developmental Stage, and Exposure Time. *Environ Toxicol Chem* 19:582-587

5th instar (1st instar has a separate summary sheet)

Relevance - mortality
Score: 90 (no std. method)
Rating: L

Reliability
Score: 70
Rating: L

Relevance - activity
Score: 67.5 (no std. method, no in NA, endpoint)
Rating's

Reliability
Score: 52.5
Rating: N

Stuijfzand *et al.* 2000		***H. angustipennis***
Parameter	**Value**	**Comment**
Test method cited	NR	
Phylum	Arthropoda	
Class	Insecta	
Order	Trichoptera	
Family	Hydropsychidae	
Genus	*Hydropsyche*	
Species	*angustipennis*	
Found in	Family in N. America	
Age/size at start of test/growth phase	5th instar	
Source of organisms	River Erft	Cologne, Germany
Have organisms been exposed to contaminants?	NR, but possible	
Animals acclimated and disease-free?	No; used immediately	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	48, 96 hours	
Data for multiple times?	Yes	Four replicates
Effect 1	Lethality	
Control response 1	5 +/- 5 %	
Effect 2	Decrease in Activity	
Control response 2	NR	
Temperature	20° C	
Test type	Static	
Photoperiod/light intensity	16L:8D	

Stuijfzand *et al.* 2000		***H. angustipennis***
Parameter	**Value**	**Comment**
Dilution water	DSW (Dutch Standard Water)	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	At start of testing, and after 48 hours	5 mL Urtica suspension
Purity of test substance	99.7 % diazinon	
Concentrations measured?	Yes, but NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L)	10	4 reps x 10
Concentration 2 Nom (µg/L)	30	4 reps x 10
Concentration 3 Nom (µg/L)	90	4 reps x 10
Concentration 4 Nom (µg/L)	270	4 reps x 10
Control	DSW 5 +/- 5 % mortality	4 reps x 10
LC50	See below	Sigmoidal dose-response curves (Haanstra et al. 1985)
EC50	See below	Sigmoidal dose-response curves (Haanstra et al. 1985)

Experiment Time	Parameter	LC50 / EC50 (ug/L)	95% Confidence Limit
48 hours	Mortality	242.8	123.1-478.9
48 hours	Activity	14.5	10.3-20.5
96 hours	Mortality	29.4	16.9-51.0
96 hours	Activity	10.3	1.8-58.6

Reliability points subtracted 3.7:
Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Appendix D2: Supplemental data rated RL, LR, or LL

Reliability points subtracted 3.8:
Acceptable standard (5), Measured concentrations within 20% of nominal (4), Adequate number per replicate/Appropriate cell density (2), Organisms not fed in acute tests (3), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Random block was not reported (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1)

Toxicity Data Summary

Hydropsyche angustipennis

Study: Van Der Geest HG, Greve GD, De Haas EM, Scheper BB, Kraak MHS, Stuijfzand SC, Augustijn KH, Admiraal W. 1999. Survival and behavioral responses of larvae of the caddisfly *Hydropsyche angustipennis* to copper and diazinon. Environ Toxicol Chem 18: 1965-1971.

Relevance - mortality
Score: 75 (No standard method; Species not in N. America)
Rating: L

Relevance - behavior
Score: 60 (No standard method; Endpoint not linked to survival, growth, reproduction; Species not in N. America)
Rating: N

Reliability
Score: 74
Rating: R

Van Der Geest *et al.* 1999		***H. angustipennis***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Arthropoda	
Class	Insecta	
Order	Trichoptera	
Family	Hydropsychidae	
Genus	*Hydropsyche*	
Species	*angustipennis*	
Found in	Not in N. America	
Age/size at start of test/growth phase	1st instar; 12-d old	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48, 96, 168 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	< 10% (mean); never > 15%	
Temperature	20^{o}C	

Van Der Geest *et al.* 1999		***H. angustipennis***
Parameter	**Value**	**Comment**
Test type	Static	
Photoperiod/light intensity	18L:8D (sic, meant 18:6?)	
Dilution water	Synthetic water	
pH	8.2	
Hardness	210 mg/L as $CaCO_3$	
Alkalinity	1.2 meq/L	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	At test initiation	
Purity of test substance	99.7%	
Concentrations measured?	Yes, but NR	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L)	0-8; number of concentrations NR	Reps: 2 w/20 per
Control	Dilution water	Reps: 2 w/20 per
LC50 (95% ci); µg/L	48 h: 2.9 (2.2-3.9) 96 h: 1.3 (1.2-1.5) 168 h: 1.0 (0.8-1.1)	Logistic curve-fitting

Reliability points subtracted 3.7:
Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Acceptable standard (5), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Organisms randomly assigned to test containers (1), Adequate number per replicate/Appropriate cell density (2), Organisms not fed in acute tests (3), Dissolved oxygen (6), Conductivity (1), Random block was not reported (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1)

Toxicity Data Summary

Lepomis macrochirus

Johnson WW and Finley MT. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington, DC.

And:
Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance
Score: 85 (Controls not described or reported)
Rating: L

Reliability
Score: 61.5
Rating:L

Johnson & Finley 1980 Mayer & Ellersieck 1986		***L. macrochirus***
Parameter	**Value**	**Comment**
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	*Lepomis*	
Species	macrochirus	
Found in	N. America	
Age/size at start of test/growth phase	1.0 grams	
Source of organisms	Federal/State Hatcheries	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	

Johnson & Finley 1980 **Mayer & Ellersieck 1986**		***L. macrochirus***
Parameter	**Value**	**Comment**
Test vessels randomized?	NR	
Test duration	96 hrs	
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	18 ± 1^{o} C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	
Hardness	40 – 50 mg/L	
Alkalinity	30 – 35 mg/L	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	Technical grade	92%
Concentrations measured?	No	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used
LC50; indicate calculation method	168 (120-220) µg/L	Litchfield & Wilcoxon (1949)

Carrier?

Reliability points subtracted 3.7:
Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Photoperiod (3), Conductivity (2), Hypothesis tests (8)

Reliability points subtracted 3.8:
Control appropriate (6), Control response within test guidance (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Carrier solvent (4), Organisms randomly assigned test containers (1), Dissolved oxygen (6), Conductivity (1), Photoperiod (2), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Hypothesis tests (3)

Toxicity Data Summary

Lepomis macrochirus

Pennwalt Corp. 1978. The acute toxicity of Knox-Out 2FM to the bluegill sunfish *Lepomis macrochirus* Rafinesque. Prepared by Union Carbide Environmental Services, Union Carbide Corporation, Tarrytown, NY.

Relevance - mortality
Score: 77.5 (purity, control response reported)
Rating: L

Reliability
Score: 71
Rating: L

Relevance - behavior
Score: 45 (no std. method, purity, endpoint, not tox values)
Rating: N

Pennwalt Corp. 1978		***L. macrochirus***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1975	Reference below
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	*Lepomis*	
Species	*macrochirus*	
Found in	N. America	
Age/size at start of test/growth phase	4 mo; 39 mm; 0.71 g	
Source of organisms	Hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	NR	
Effect 2	Abnormal behavior	
Control response 2	None observed	
Temperature	21.8 ± 0.3^{o} C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Synthetic soft water	
pH	7.0-7.5	
Hardness	44 mg/L as $CaCO_3$	

Pennwalt Corp. 1978		***L. macrochirus***
Parameter	**Value**	**Comment**
Alkalinity	32 mg/L as $CaCO_3$	
Conductivity	170 μmhos/cm	
Dissolved Oxygen	3.6-9.0	
Feeding	None	
Purity of test substance	23% (Knox-Out 2FM)	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (mg/L)	18.0	Reps: 1 w/10 per
Concentration 2 Nom (mg/L)	32.0	Reps: 1 w/10 per
Concentration 3 Nom (mg/L)	56.0	Reps: 1 w/10 per
Concentration 4 Nom (mg/L)	100.0	Reps: 1 w/10 per
Concentration 5 Nom (mg/L)	180.0	Reps: 1 w/10 per
Control	Dilution water	Reps: 1 w/10 per
LC50 (95% ci); mg/L	24-h: > 180 48-h: 57.0 (44.3-73.4) 96-h: 28.6 (21.8-37.4)	Spearman-Karber
NOEC; mg/L; based on behavioral abnormality	< 18.0	Method: NR p: NR MSD: NR
LOEC; mg/L	18.0	
MATC (GeoMean NOEC,LOEC)	NC	
% control at NOEC	NC	
% of control LOEC	NC	

USEPA. 1975. Methods for acute toxicity tests with fish, macroinvertebrates and amphibians. Committee on methods for toxicity tests with aquatic organisms. EPA-660/3-75-009. US Environmental Protection Agency, Washington, DC.

LC50 close to diazinon water solubility

Reliability points subtracted 3.7:
Analytical method (4), Measured concentrations (3), Photoperiod (3), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Control response within test guidance (9), Chemical purity >80% (10), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Carrier solvent (4), Organisms randomly assigned to test containers (1), Dissolved oxygen (6), Photoperiod (2), Random block was not reported (2), Adequate replication (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1)

Toxicity Data Summary

Lepomis macrochirus

Surprenant DC. 1987. Static acute toxicity of diazinon AG500 to bluegill (*Lepomis macrochirus*) EPA guidelines No. 72-1. Agricultural Division Ciba-Geigy Corporation, Greensboro, NC. EPA MRID 40509802.

Raw data are available for ACE analysis, but since this is a test with a formulation, so will not be usable.

Relevance
Score: 85 (formulation)
Rating:L

Reliability
Score: 88
Rating:R

Surprenant 1987		***L. macrochirus***
Parameter	**Value**	**Comment**
Test method cited	ASTM 1980	Full reference given below
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	*Lepomis*	
Species	*macrochirus*	
Found in	N. America	
Age/size at start of test/growth phase	Mean length: 40 mm Mean wt.: 0.75 g	
Source of organisms	Commercial supplier	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	0%	
Temperature	21-22^{o} C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Deionized, reconstituted well water	
pH	6.9-8.3	

Surprenant 1987		***L. macrochirus***
Parameter	**Value**	**Comment**
Hardness	50 mg/L as $CaCO_3$	
Alkalinity	35 mg/L as $CaCO_3$	
Conductivity	160 μmhos/cm	
Dissolved Oxygen	> 60%	
Feeding	None	
Purity of test substance	48%	
Concentrations measured?	Yes	
Measured is what % of nominal?	123% at start; concentrations decreased by 50% by 96 h	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (mg/L)	0.062/0.055 89%	Reps: 2 w/10 per
Concentration 2 Nom/Meas (mg/L)	0.11/0.12 92%	Reps: 2 w/10 per
Concentration 3 Nom/Meas (mg/L)	0.17/0.14 82%	Reps: 2 w/10 per
Concentration 4 Nom/Meas (mg/L)	0.29/0.26 90%	Reps: 2 w/10 per
Concentration 5 Nom/Meas (mg/L)	0.48/0.40 83%	Reps: 2 w/10 per
Control	Dilution water	Reps: 2 w/10 per
LC50 (95% ci); mg/L	0.21 (0.16-0.29)	Based on mean concentrations (0 and 96 h); probit
NOEC; mg/L	0.055	Method: NR p: NR MSD: NR
LOEC; indicate calculation method	NR	
MATC (GeoMean NOEC,LOEC)	NR	

ASTM. 1980. Standard practice for conducting acute toxicity tests with fishes, macroinvertebrates and amphibians. American Society for Testing and Materials, West Conshohocken, PA.

Reliability points subtracted 3.7:
Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Purity >80% pure (10), Random block was not reported (2), Adequate replication (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1)

Toxicity Data Summary

Lestes congener

Study: Federle PF, Collins WJ. 1976. Insecticide toxicity to three insects from Ohio ponds. Ohio J Sci 76: 19-24.

Relevance
Score: 90 (No standard method cited)
Rating: R

Reliability
Score: 64.5
Rating: L

Federle & Collins 1976		***L. congener***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Arthropoda	
Class	Insecta	
Order	Odonata	
Family	Lestidae	
Genus	*Lestes*	
Species	*congener*	
Found in	N. America	
Age/size at start of test/growth phase	Late instar nymphs; 0.044 g	
Source of organisms	Farm Pond, Ohio St. Univ. campus; no pesticide spraying for 2 yr	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes; 24 hr in lab	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	4%	
Temperature	25 $\pm$ 2^{o}C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Tap water	
pH	7.4	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	

Federle & Collins 1976		***L. congener***
Parameter	**Value**	**Comment**
Purity of test substance	≥ 94%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	1% acetone (10 mL/L)	
Concentration 1 Nom	Four concentrations ranging from 0.001 – 1 mg/L	Reps: 1 w/10 per
Control	Solvent	
LC50; mg/L	0.05 (value is presented as an estimate, but no explanation is give for what that means)	probit

Reliability points subtracted 3.7:
Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Acceptable standard (5), Measured concentrations within 20% of nominal (4), Carrier Solvent (4), No prior contaminant exposure (4), Organisms randomly assigned to test containers (1), Organisms not fed in acute tests (3), Dilution water source acceptable (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), Photoperiod (2), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1)

Toxicity Data Summary

Lumbriculus variegatus

Ankley GT, Collyard SA. 1995. Influence of piperonyl butoxide on the toxicity of organophosphate insecticides to three species of freshwater benthic invertebrates. Comp Biochem Physiol 110C: 149-155.

Notes: Using only data for diazinon only exposures; water quality information, test substance purity, replication, other information given as ranges for all tests and compounds; not possible to match specific data with each test.

Relevance	Reliability
Score: 82.5 (No std. method, control response NR)	Score: 71
Rating: L	Rating: L

Ankley & Collyard 1995		***L. variegatus***
Parameter	**Value**	**Comment**
Test method cited	None cited, but appears to follow EPA acute methods	Study by EPA staff
Phylum	Annelida	
Class	Oligochaeta	
Order	Lumbriculida	
Family	Lumbriculidae	
Genus	*Lumbriculus*	
Species	*variegatus*	
Native to	North America	
Age/size at start of test	Mixed age	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality/immobility	
Control response 1	NR	
Temperature	23 $\pm$ 1 ^{o}C	
Test type	Static	
Photoperiod	16L:8D	
Dilution water	Lake Superior water; as is, or with added hardness	
pH	7.4-8.5	

Ankley & Collyard 1995		***L. variegatus***
Parameter	**Value**	**Comment**
Hardness	42-47 mg/L as $CaCO_3$	Hardness adjusted to 105 mg/L as $CaCO_3$, but species unclear in study
Alkalinity	39-46 mg/L as $CaCO_3$	
Conductivity	NA	
Dissolved Oxygen	5.2-8.1 mg/L	
Feeding	None	
Purity of test substance	$\geq$ 95% pure	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	$\leq$ 15% (15 mL/L; shown to be non-toxic)	
Concentration 1 Nom/Meas (µg/L)	NR; not clear how many concentrations NR	Reps: 2-4 w/5-10 per
Control?	Methanol carrier at $\leq$ 1.5%	Reps: 2-4 w/5-10 per
LC50 (95% ci); µg/L	6160 (5170-7340)	Trimmed Spearman-Karber

Reliability points subtracted 3.7:
Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Acceptable standard (5), Response within test guidance (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x water solubility (4), Carrier solvent (4), Organisms randomly assigned to test containers (1), Conductivity (1), Adequate number of concentrations (3), Random block was not reported (2), Appropriate spacing between concentrations (2), Appropriate statistical method used (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1)

Toxicity Data Summary

Moina macrocopa

Study: Nishiuki Y, Hashimoto Y. 1967. Toxicity of pesticide ingredients to some fresh water organisms. Botyu-Kagaku 32: 5-11.

Only a summary of this study and tables are available in English so most details cannot be determined. The cladoceran tests were 3 hours, thus are not long enough to be usable for criteria derivation. The USEPA (2005) did not use these data for criteria derivation, but judged them of high enough quality to use as supporting data. Thus the rating of LL is being assigned to this study.

Relevance
Score: Cannot determine
Rating: L

Reliability
Score: Cannot determine
Rating: L

Nishiuki & Hashimoto 1967		***M. macrocopa***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Moinidae	
Genus	*Moina*	
Species	*macrocopa*	
Found in	North America	
Purity of test substance	Technical	As per USEPA 2005
LC50; mg/L	0.026	Method not determined

Rows for information not available were deleted.

Toxicity Data Summary

Moina macrocopa

Study: Wong CK. 1997. Effects of diazinon on some population parameters of *Moina macrocopa* (Cladocera). Wat Air Soil Poll 94: 393-399.

Relevance
Score: 75 (No standard method; 60% diazinon formulation)
Rating: L

Reliability
Score: 61.5
Rating: L

Wong 1997		***M. macrocopa***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Moinidae	
Genus	*Moina*	
Species	*macrocopa*	
Found in	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	11-12 d (until all F_0 animals died)	
Data for multiple times?	No	
Effect 1	Survivorship	
Control response 1	12 d	
Effect 2	Number of offspring	
Control response 2	Baseline (numbers NR)	
Effect 3	Population parameters: R = reproductive rate (expected number of young produced in lifetime) T = mean generation time	

Wong 1997		***M. macrocopa***
Parameter	**Value**	**Comment**
	(d) r = intrinsic rate of increase (d^{-1})	
Control response 3	$R_{control}$ = 16.2 $R_{acetone}$ =23.7 $T_{control}$ = 3.6 $T_{acetone}$ = 3.7 $R_{control}$ = 0.77 $R_{acetone}$ = 0.85	
Temperature	26 $\pm$ 1°C	
Test type	Static renewal; daily	
Photoperiod/light intensity	Natural light	
Dilution water	Filtered water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Daily; 5 x 10^4 cells *Chlorella pyrenoidosa*	
Purity of test substance	60%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	0.01 mg/L acetone (10^{-5} mL/L)	
Concentration 1 Nom (µg/L)	0.001	Reps: 5 w/10 per
Concentration 2 Nom(µg/L)	0.01	Reps: 5 w/10 per
Concentration 3 Nom (µg/L)	0.1	Reps: 5 w/10 per
Concentration 4 Nom (µg/L)	1.0	Reps: 5 w/10 per
Concentration 5 Nom (µg/L)	10	Reps: 5 w/10 per
Control	Acetone	Reps: 5 w/10 per
NOEC; µg/L	Survivorship: 0.1 Offspring: 1 (highest with surviving females) Population parameters: all decreased with exposure, but no statistical analysis of values	Method: Kruskal-Wallis and non-parametric multiple comparison p: 0.05 MSD: NR
LOEC; µg/L	Survivorship: 1.0 Offspring: NC; at 10, all females died before	

Wong 1997		***M. macrocopa***
Parameter	**Value**	**Comment**
	reproducing Population parameters: No statistical analysis	
MATC; µg/L; (GeoMean NOEC,LOEC); concentrations are too far apart for derivation of a good MATC	Survivorship: 0.32 Offspring: NC Population parameters: NC	
% control at NOEC	NC; varies with time	
% of control LOEC	NC; varies with time	

Reliability points subtracted 3.7:
Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Significance level (2), Minimum significant difference (2), Point estimates (8)

Reliability points subtracted 3.8:
Acceptable standard (5), Purity > 80% pure (10), Measured concentrations within 20% of nominal (4), Organisms randomly assigned to test containers (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Random block was not reported (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1), LC/EC values (3)

Toxicity Data Summary

Notropis mekistocholas

Study: Dwyer FJ, Hardesty DK, Ingersoll CG, Whites DW, Augspurger T, Canfield TJ, Mount DR, Mayer FL. 2005. Assessing contaminant sensitivity of endangered and threatened aquatic species: Part III. Effluent toxicity tests. Arch Environ Contam Toxicol 48: 174-183.

Relevance
Score: 92.5 (control not described)
Rating: R

Reliability
Score: 69
Rating: L

This is a threatened and/or endangered species.

Dwyer *et al.* 2005		***N. mekistocholas***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1994	See below
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyriniformes	
Family	Cyprinidae	
Genus	*Notropis*	
Species	*mekistocholas*	
Found in	N. America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Conservation Fisheries, Inc.	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	7 d	
Data for multiple times?	No	
Effect 1	Biomass (combines survival and growth into 1 endpoint)	
Control response 1	Survival: ≥ 85% Growth: NR	77% survival tests accepted
Temperature	25°C	
Test type	Static renewal; daily	
Photoperiod/light intensity	16L:8D	
Dilution water	ASTM hard water	
pH	< 8.6	

Dwyer *et al.* 2005		***N. mekistocholas***
Parameter	**Value**	**Comment**
Hardness	160-180 mg/L as $CaCO_3$	
Alkalinity	110-120 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	> 40%	
Feeding	Daily	
Purity of test substance	99%	
Concentrations measured?	No; stocks measured, but exposure concentrations not measured	
Measured is what % of nominal?	NA	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	Acetone used, but concentration NR	
Concentration 1 Nom (µg/L)	Number and levels NR	Reps: 3-4 w/10 per
Control	Not described	
IC25 (95% ci); µg/L; concentrations reducing response by 25% versus control	199 (57-1269) biomass	ICp (Norberg-King 1993)

-USEPA. 1994. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms (EPA 600/4-91-002). US Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, OH.
-Norberg-King TJ. 1993. A linear interpolation method for sublethal toxicity: the inhibition concentration (ICp) approach (technical report no. 03-93). National Effluent Toxicity Assessment Center, Duluth, MN.

Reliability points subtracted 3.7:
Control type (8), Nominal Concentrations (3), Measured concentrations (3), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Control Appropriate (6), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of nominal (4), Carrier solvent (4), Organisms randomly assigned to test containers (1), Dissolved oxygen (6), Conductivity (1), Statistics adequate number of concentrations (3), Random block was not reported (2), Appropriate spacing between concentrations (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1)

Toxicity Data Evaluation

Oncorhynchus clarki

Study: Johnson WW, Finley MT. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance
Score: 85 (Controls not described or reported)
Rating:L

Reliability
Score: 61.5
Rating:L

Johnson & Finley 1980 Mayer & Ellersieck 1986		***O. clarki***
Parameter	**Value**	**Comment**
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970); ASTM 1980 (acc. to Mayer & Ellersieck 1986)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Oncorhynchus*	
Species	*clarki*	
Found in	N. America	
Age/size at start of test/growth phase	2.0 grams	
Source of organisms	Federal/State Hatcheries	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	

Johnson & Finley 1980 **Mayer & Ellersieck 1986**		***O. clarki***
Parameter	**Value**	**Comment**
Test vessels randomized?	NR	
Test duration	96 hr	
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1^{o} C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	
Hardness	162 ppm CaCO3	Tested in Hard Water
Alkalinity	30 – 35 mg/L	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	Technical grade	92%
Concentrations measured?	No	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	$\leq$ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used
LC50 (95% ci); µg/L	Test 1: 1700 (1390-2090) Test 2: 2760 (2280-3330)	Litchfield & Wilcoxon (1949)

Reliability points subtracted 3.7:
Control type (8), Analytical method (4), Nominal Concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC (2)

Reliability points subtracted 3.8:
Control Appropriate (6), Response within test guidance (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of nominal (4), Organisms randomly assigned to test containers (1), Dissolved oxygen (6), Conductivity (1),

Photoperiod (2), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Minimum significant difference (MSD) upper bound acceptable (1), NOEC response reasonable compared to control (1), LOEC response reasonable compared to control (1)

Toxicity Data Summary

Oncorhynchus mykiss

Study: Beauvais SL, Jones SB, Brewer SK, Little EE. 2000. Physiological measures of neurotoxicity of diazinon and malathion to larval rainbow trout (*Oncorhynchus mykiss*) and their correlation with behavioral measures. Environ Toxicol Chem 19: 1875-1880.

Cholinesterase/ neurological endpoints

Relevance

Score: 70 (Endpoint not linked to survival, growth, reproduction; Toxicity values not calculated/calculable)

Rating: L

Reliability

Score: 65.5

Rating: L

Beauvais *et al.* 2000		***O. mykiss***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1975; APHA 1992	Outdated EPA method
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Oncorhynchus*	
Species	*mykiss*	
Found in	California	
Age/size at start of test/growth phase	40 d posthatch; 30.8 $\pm$ 2.9 mm; 0.24 $\pm$ 0.08 g	
Source of organisms	Hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	24 h 96 h 96 h w/48 h recovery	
Data for multiple times?	Yes	
Effect 1	Cholinesterase inhibition	
Control response 1	Baseline	
Effect 2	Muscarinic cholinergic receptor number	No effects seen
Control response 2	Baseline	

Beauvais *et al.* 2000		***O. mykiss***
Parameter	**Value**	**Comment**
Effect 3	Muscarinic cholinergic receptor affinity	No effects seen
Control response 3	Baseline	
Temperature	NR	
Test type	Static renewal; daily	
Photoperiod/light intensity	NR	
Dilution water	Well water	
pH	8.10-8.29	
Hardness	272-304 mg/L as $CaCO_3$	
Alkalinity	242-256 mg/L as $CaCO_3$	
Conductivity	630-641 µS/cm	
Dissolved Oxygen	6.99-10.08 mg/L	In dilution water; not in test chambers
Feeding	None	
Purity of test substance	98%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	$\leq$ 1% acetone	
Concentration 1 Nom (µg/L)	250	Reps: 3 w/30 per; 10 removed after 24 h;10 removed after 96 h; 10 remained for 48-h recovery period
Concentration 2 Nom (µg/L)	500	Reps: 3 w/30 per; 10 removed after 24 h;10 removed after 96 h; 10 remained for 48-h recovery period
Concentration 3 Nom (µg/L)	1000	Reps: 3 w/30 per; 10 removed after 24 h;10 removed after 96 h; 10 remained for 48-h recovery period
Control	Solvent (no plain dilution water)	Reps: 3 w/30 per; 10 removed after 24 h;10 removed after 96 h; 10 remained for 48-h recovery period

Beauvais *et al.* 2000		***O. mykiss***
Parameter	**Value**	**Comment**
LCx; indicate calculation method	No mortality	
NOEC; µg/L	24 h: < 250 96 h: 1000 (interrupted dose-response) 96 h + recovery: < 250	Method: NR p: NR MSD: NR
LOEC	24 h: 250 96 h: 500 (interrupted dose-response) 96 h + recovery: 250	
MATC (GeoMean NOEC,LOEC)	NC in all cases	
% control at NOEC	24 h: NC 96 h: 75% 96 h + recovery: NC	Estimated from Figure 1
% of control LOEC	24 h: 72% 96 h: 62.5% 96 h + recovery: 72%	Estimated from Figure 1

Reliability points taken off for:
Documentation: Analytical method (4), Measured concentrations (3), Dissolved oxygen (4), Temperature (4), Photoperiod (3), Statistical methods (5), Hypothesis tests (6), Point estimates (8).
Acceptability: Measured concentrations within 20% of nominal (4), Carrier solvent (4), Dissolved oxygen (6), Temperature (6), Photoperiod (2), Number of concentrations (3), Random design (2), Statistical method (2), Minimum significant difference (1), Point estimates (3).

Toxicity Data Summary

Oncorhynchus mykiss (formerly *Salmo gairdneri*)

Study: Beliles RP (1965) Diazinon Safety evaluation on fish and wildlife (bobwhite quail, goldfish, sunfish, and rainbow trout). Woodward Research Corp. EPA doc. 3046-013-02

Relevance
Score: 100
Rating: R

Reliability
Score: 65
Rating: L

Beliles 1965		***S. gairdneri***
Parameter	**Value**	**Comment**
Test method cited	NR	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Salmo*	
Species	*gairdneri*	
Family in North America?	yes	
Age/size at start of test/growth phase	3-7 cm	
Source of organisms	Virginia Trout Co., VA	
Have organisms been exposed to contaminants?	no	
Animals acclimated and disease-free?	yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	yes	
Effect 1	mortality	
Control response 1	0% solvent, 5% no solvent	
Temperature	13-18 C	
Test type	static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted deionized	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	no	

Beliles 1965		***S. gairdneri***
Parameter	**Value**	**Comment**
Purity of test substance	91%	
Concentrations measured?	no	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	4mL/L	
Concentration 1 Nom/ (μg/L)	1000	2 Rep and 5 per jar
Concentration 2 Nom/ (μg/L)	560	2 Rep and 5 per jar
Concentration 3 Nom/ (μg/L)	320	2 Rep and 5 per jar
Concentration 4 Nom/ (μg/L)	180	2 Rep and 5 per jar
Concentration 5 Nom/ (μg/L)	100	2 Rep and 5 per jar
Concentration 5 Nom/ (μg/L)	56	2 Rep and 5 per jar
Control	yes	2 Rep and 5 per jar
LC50; indicate calculation method	400	Litchfield and Wilcoxon 1949

Reliability points taken off for:
Documentation: Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (3), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Adequate replicates (2), Hypothesis tests (3).

Toxicity Data Summary

Oncorhynchus mykiss

Bresch H. 1991. Early life-stage test in zebrafish versus a growth test in rainbow trout to evaluate toxic effects. *Bull Environ Contam Toxicol* 46: 641-648.

Relevance
Score: 75 (No std. method, no tox values)
Rating:L

Reliability
Score: 73
Rating: L

Bresch 1991		***O. mykiss***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum	Chordata	Subphylum: Vertebrata
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Oncorhynchus*	
Species	*mykiss*	
Found in	California	
Age/size at start of test/growth phase	1-3 g; fingerlings	
Source of organisms	Commercial supplier	
Have organisms been exposed to contaminants?	NR	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	28 d	
Data for multiple times?	Yes	
Effect 1	Weight	
Control response 1	9.5 g	
Temperature	15-17^{o}C	
Test type	Flow-through	
Photoperiod/light intensity	NR	
Dilution water	Tapwater	
pH	7.4	
Hardness	360 mg/L as $CaCO_3$	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	> 70%	
Feeding	2x per day	
Purity of test substance	Analytical grade	

Bresch 1991		***O. mykiss***
Parameter	**Value**	**Comment**
Concentrations measured?	Yes	
Measured is what % of nominal?	≥ 80%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (mg/L)	0.008	Reps: 2 w/100 per
Concentration 2 Nom (mg/L)	0.04	Reps: 2 w/100 per
Concentration 3 Nom (mg/L)	0.2	Reps: 2 w/100 per
Control	Dilution water	Reps: 2 w/100 per
NOEC; mg/L	No effects seen	Method: ANOVA, Scheffe's test p: 0.05 MSD: NR
LOEC; mg/L	NC	
MATC (GeoMean NOEC,LOEC)	NC	
% control at NOEC	NC	
% of control LOEC	NC	

Reliability points taken off for:
Documentation: Measured concentrations (3), Alkalinity (2), Conductivity (2), Photoperiod (3), Statistical difference (2), Minimum significant difference (2), % control of NOEC/LOEC (2), Point estimates (8).
Acceptability: No standard method (5), Prior contamination (4), Organisms randomized (1), Dilution water (2), Alkalinity (2), Conductivity (1), Photoperiod (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Hypothesis tests (3), Point estimates (3).

Toxicity Data Summary

Oncorhynchus mykiss

Study: Brewer SK, Little EE, DeLonay AJ, Beauvais SL, Jones SB, Ellersieck MR. 2001. Behavioral dysfunctions correlate to altered physiology in rainbow trout (*Oncorhynchus mykiss*) exposed to cholinesterase-inhibiting chemicals. Arch Environ Contam Toxicol 40: 70-76.

Relevance
Score: 70 (Endpoints not linked to survival, growth, reproduction; No toxicity values calculated)
Rating: L

Reliability
Score: 84.5
Rating: R

Brewer *et al.* 2001		***O. mykiss***
Parameter	**Value**	**Comment**
Test method cited	EPA 660/3-75-009; ASTM E-729-88	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Oncorhynchus*	
Species	*mykiss*	
Found in	N. America	
Age/size at start of test/growth phase	Juvenile	
Source of organisms	Lab-reared from hatchery eggs	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Swimming behaviors	
Control response 1	Baseline	
Effect 2	Acetylcholinesterase inhibition	
Control response 2	NR	
Temperature	15^{o}C	

Brewer *et al.* 2001		***O. mykiss***
Parameter	**Value**	**Comment**
Test type	Static-renewal; 24 –h	
Photoperiod/light intensity	NR	
Dilution water	Well water	
pH	8.10-8.29	
Hardness	272-304 mg/L as $CaCO_3$	
Alkalinity	242-256 mg/L as $CaCO_3$	
Conductivity	630-641 µS/cm	
Dissolved Oxygen	6.99-10.08 mg/L	
Feeding	NR	
Purity of test substance	$\geq$ 98%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	< 1% acetone	
Concentration 1 Nom (µg/L)	250	Reps: 3 w/10 per at 24 h, 30 per at 96 hr
Concentration 2 Nom (µg/L)	500	Reps: 3 w/10 per at 24 h, 30 per at 96 hr
Concentration 3 Nom (µg/L)	1000	Reps: 3 w/10 per at 24 h, 30 per at 96 hr
Control	Solvent	Reps: 3 w/10 per at 24 h, 30 per at 96 hr

Reliability points taken off for:
Documentation: Analytical method (4), Measured concentrations (3), Photoperiod (3), Statistical methods (5), Hypothesis tests (8), Point estimates (8).
Acceptability: Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Feeding (3), Photoperiod (2), Number of concentrations (3), Random design (2), Statistical method (2), Hypothesis tests (3), Point estimates (3).

Toxicity Data Summary

Oncorhynchus mykiss

Study: Grade R. (Ciba-Geigy) 1993. Acute toxicity of Rainbow Trout to Diazinon. Ciba-Geigy Test No. 938004. EPA MRID 46364312.

Relevance
Score: 85 (toxicity value not calculable)
Rating:L

Reliability
Score: 74
Rating: R

Grade 1993		***O. mykiss***
Parameter	**Value**	**Comment**
Test method cited	OECD Guideline 203	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Oncorhynchus*	
Species	*mykiss*	
Family in North America?	Y	
Age/size at start of test/growth phase	56mm, 1.5 g	
Source of organisms	Supplier named	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48,72, 96 h	
Effect 1	mortality	
Control response 1	0%	
Effect 2	Swimming behavior, loss of equilibrium, respiratory function, exophtalmus, pigmentation	
Control response 2	0% affected	
Temperature	14 +/- 1 C	
Test type	Static?	
Photoperiod/light intensity	16 h light	
Dilution water	Dechlorinated tap	
pH	8.0 – 8.5	
Hardness	174mg CaCO3/L	
Alkalinity	NR	

Grade 1993		***O. mykiss***
Parameter	**Value**	**Comment**
Conductivity	NR	
Dissolved Oxygen	93 – 105 %	
Feeding	None	
Purity of test substance	99.8%	
Concentrations measured?	Yes	
Measured is what % of nominal?	98 – 105%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	10,000	2 Reps,10 per rep
Concentration 2 Nom/Meas (µg/L)	18,000	2 Reps,10 per rep
Concentration 3 Nom/Meas (µg/L)	32,000	2 Reps,10 per rep
Concentration 4 Nom/Meas (µg/L)	58,000	2 Reps,10 per rep
Concentration 5 Nom/Meas (µg/L)	100,000	2 Reps,10 per rep
Control	Water only	2 Reps,10 per rep
LCx; indicate calculation method	> 100,000	
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	58,000, based on other symptoms (not mortality)	Method: NR p: NR MSD: NR
LOEC; indicate calculation method	NR	
MATC (GeoMean NOEC,LOEC)	NR	
% control at NOEC	NR	
% of control LOEC	NR	

Other notes: no mortality observed at highest concentration 100mg/L, which was over 2x water solubility (about 40mg/L).

Found study in OPP database, FOIA request form EPA

Reliability points taken off for:
Documentation: Measured concentrations (3), Alkalinity (2), Conductivity (2), Statistical methods (5), Hypothesis tests (8), Point estimates (8).
Acceptability: Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Alkalinity (2), Conductivity (1), Random design (2), Adequate replicates (2), Statistical method (2), Hypothesis tests (3), Point estimates (3).

Toxicity Data Summary

Oncorhynchus mykiss

Study: Johnson WW, Finley MT. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:
Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance
Score: 85 (Controls not described or reported)
Rating: L

Reliability
Score: 61.5
Rating: L

Johnson & Finley 1980 Mayer & Ellersieck 1986		***O. mykiss***
Parameter	**Value**	**Comment**
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Oncorhynchus*	
Species	*mykiss*	
Found in	N. America	
Age/size at start of test/growth phase	1.2 grams	
Source of organisms	Federal / State Hatcheries	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	

Johnson & Finley 1980 **Mayer & Ellersieck 1986**		***O. mykiss***
Parameter	**Value**	**Comment**
Test duration	96 hrs	
Data for multiple times?	NR	
Effect 1	Mortality	
Control response 1	NR	No control responses reported
Temperature	$13^{o} \pm 1^{o}$ C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	
Hardness	40 – 50 mg/L	
Alkalinity	30 – 35 mg/L	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	89%	
Concentrations measured?	No	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	$\leq$ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used
LC50; no ci given	90 ug/L	Litchfield & Wilcoxon (1949)

Reliability points subtracted 3.7: Control type (8), Analytical method (4), Nominal Concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Hypothesis tests (8).

Reliability points subtracted 3.8: Control Appropriate (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of nominal (4), Organisms randomly assigned to test containers (1), Dissolved oxygen (6), Conductivity (1), Photoperiod (2), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Hypothesis tests (3).

Toxicity Data Summary

Oncorhynchus tshawytscha

Study: Viant MR, Pincetich CA, Tjeerdema RS. 2006. Metabolic effects of dinoseb, diazinon and esfenvalerate in eyed eggs and alevins of Chinook salmon (*Oncorhynchus tshawytscha*) determined by ^{1}H NMR metabolomics. Aquat Toxicol 77: 359-371.

Relevance-mortality
Score: 100
Rating: R

Relevance-sublethal effects
Score: 75 (No standard method; Endpoints not linked to survival, growth, reproduction)
Rating: L

Reliability
Score: 61.5
Rating: L

Viant *et al.* 2006		***O. tshawytscha***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1994; slightly modified	Full reference below
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Oncorhynchus*	
Species	*tshawytscha*	
Found in	North America	
Age/size at start of test/growth phase	Eyed eggs Alevins	
Source of organisms	Hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	0% (blank and methanol)	

Viant *et al.* 2006		***O. tshawytscha***
Parameter	**Value**	**Comment**
Effect 2	ATP/ADP	ATP: Adenosine Triphosphate ADP: Adenosine Diphosphate
Control response 2	13.47 $\pm$ 0.46 (blank) 13.6 $\pm$ 0.45 (methanol)	
Effect 3	Adenylate Energy Charge (AEC)	
Control response 3	0.93 $\pm$ 0.02 (blank) 0.90 $\pm$ 0.01 (methanol)	
Effect 4	Metabolite levels	
Control response 4	Baseline	
Temperature	10 $\pm$ 1^{o}C	
Test type	Static renewal; 24-h renewal	
Photoperiod/light intensity	Darkness	
Dilution water	EPA soft water	USEPA 1994
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	Technical	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Methanol used, but concentration NR	
Concentration 1 Nom (mg/L)	10	Reps: 5 w/15 per
Concentration 2 Nom (mg/L)	50	Reps: 5 w/15 per
Concentration 3 Nom (mg/L)	100	Reps: 5 w/15 per
Control	Dilution water; solvent	Reps: 5 w/15 per
LC50; mg/L	Eyed eggs: 545* Alevins: 29.5	Maximum likelihood if 2 or more partial responses; otherwise Trimmed Spearman-Karber

Viant *et al.* 2006		***O. tshawytscha***
Parameter	**Value**	**Comment**
NOEC; mg/L	ATP/ADP: no significant effects AEC: no significant effects Metabolite levels-eyed eggs PCr: 50 ATP: 100 AMP: < 10 GDP: 100 ADP: 100 GTP: NC (interrupted dose-response)	ANOVA w/ Tukey-Kramer post-test; AMP: Adenosine Monophosphate GDP: Guanosine Diphosphate GTP: Guanosine Triphosphate P: 0.05 MSD:NR
LOEC; mg/L	Metabolite levels-eyed eggs PCr: 100 ATP: > 100 AMP: 10 GDP: > 100 ADP: > 100 GTP: NC (interrupted dose response)	
MATC; mg/L	Metabolite levels-eyed eggs PCr: 70.7 ATP: NC AMP: NC GDP: NC ADP: > 100 GTP: NC	

USEPA. 1994. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms, 3rd edition. EPA-600-4-91-002. US Environmental Protection Agency, Washington, DC.

*Eyed eggs: 545 LC50 is 10x sol. Outside range of tested concentrations, but didn't test this high.

Reliability points taken off for:
Documentation: Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Minimum significant difference (2), % control of NOEC/LOEC (2).
Acceptability: No standard method (5), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Appendix D2: Supplemental data rated RL, LR, or LL

Toxicity Data Summary

Oreochromis niloticus x *Mossambicus albina*

Study: Palacio JA, Henao B, Vélez JH, González J, Parra CM. 2002. Acute toxicity and bioaccumulation of pesticide diazinon in red tilapia (*Oreochromis niloticus* x *Mossambicus albina*). Environ Toxicol 17: 334-340.

Relevance
Score: 85 (Species not resident in N. America)
Rating: L

Reliability
Score: 78.5
Rating: R

Palacio *et al.* 2002		***O. niloticus* x *M. albina***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1985	Full reference below
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Cichlidae	
Genus	*Oreochromis* *Mossambicus*	Hybrid
Species	*niloticus* *albina*	Hybrid
Found in	S. America; Africa; not N. America	
Age/size at start of test/growth phase	4.27 g; 6.48 cm	
Source of organisms	Commercial supplier	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes, including raw data; see Table V (attached)	
Effect 1	Mortality	
Control response 1	0%	
Temperature	$22 \pm 1^{o}C$	
Test type	Static-renewal; 48-h renewal	
Photoperiod/light intensity	16L:8D	
Dilution water	Dechlorinated tapwater	

Palacio *et al.* 2002		***O. niloticus* x *M. albina***
Parameter	**Value**	**Comment**
pH	6.8-6.9	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	> 60%	
Feeding	NR	
Purity of test substance	97.5%	
Concentrations measured?	No (not in toxicity experiments)	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (mg/L)	2.80	Reps: 2 w/12 per
Concentration 2 Nom (mg/L)	3.08	Reps: 2 w/12 per
Concentration 3 Nom (mg/L)	3.39	Reps: 2 w/12 per
Concentration 4 Nom (mg/L)	3.73	Reps: 2 w/12 per
Concentration 5 Nom (mg/L)	4.10	Reps: 2 w/12 per
Concentration 6 Nom (mg/L)	4.5 (Table V); 5.4 (text)	Reps: 2 w/12 per
Control	Dilution water	Reps: 2 w/12 per
LC50 (95% ci); mg/L	24 h: 6.0 (4.98-30.24) 48 h: 5.65 (4.66-13.15) 72 h: 4.36 (4.09-4.91) 96 h: 3.85 (3.66-4.11)	Acc. to USEPA 1985; Finney 1985; Araújo 1990

-USEPA. 1985. Methods for measuring the acute toxicity of effluents to fresh water and marine organisms. 3rd edition. EPA/600/4-85/013. Environmental Monitoring and Support Laboratory. US Environmental Protection Agency.
-Finney DJ. 1978. Statistical method in biological assay. 3rd ed. London.
-Araújo R. 1990. Métodos de avaliacao de Toxicidade d saneamento ambiental, Sao Paulo, Brazil.

BCF: exposure at 0.38 mg/L for 9 d; 168 fish; chemical methods documented (93% recovery in water; 78.3% recovery in tissue); steady-state reached; static-renewal w/ renewal every 12 h; BCF not reported.

Reliability points taken off for:
Documentation: Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Conductivity (2), Hypothesis tests (8).
Acceptability: Measured concentrations within 20% of nominal (4), Organisms randomized (1), Feeding (3), Hardness (2), Alkalinity (2), Conductivity (1), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Oryzias latipes

Study: Hamm JT, Hinton DE. 2000. The role of development and duration of exposure to the embryotoxicity of diazinon. Aquat Toxicol 403-418.

Relevance
Score: 75 (No standard method; Species not resident in N. America)
Rating: L

Reliability
Score: 61.5
Rating: L

Hamm & Hinton 2000		***O. latipes***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Beloniformes	
Family	Adrianichthyidae	
Genus	*Oryzias*	
Species	*latipes*	
Found in	Native to Japan; not resident in N. Amer.	
Age/size at start of test/growth phase	Test 1: 1-d embryos; Test 2: 3-d embryos Test 3: 5-d embryos Test 4: 1-d embryos Test 5: 3-d embryos	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	Test 1: 4 d exposure Test 2: 4 d exposure Test 3: 4 d exposure Test 4: 8 d exposure Test 5: 6 d exposure	Total test duration 13 d (from developmental stage 1-14 d); exposure stage and duration variable
Data for multiple times?	No	
Effect 1	Embryo mortality	
Control response 1	0%	

Hamm & Hinton 2000		***O. latipes***
Parameter	**Value**	**Comment**
Effect 2	Larval mortality	
Control response 2	0%	
Effect 3	Total hatch	
Control response 3	88-100%	
Effect 4	Day of hatch	
Control response 4	11.0-13.2 d	
Effect 5	Embryos with full swim bladder inflation	
Control response 5	84-96%	
Effect 6	Larval length	
Control response 6	4.46 – 5.46 mm	Note: Table 5 has errors in three control values; decimal points are off (supported by text)
Effect 7	Incidence of spinal deformities	
Control response 7	None	
Temperature	NR for exposure	
Test type	Static non-renewal	May not be appropriate for exposures > 4 d
Photoperiod/light intensity	NR for test	
Dilution water	Embryo rearing medium (ERM)	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	99%	
Concentrations measured?	No; stock solutions measured, but not test solutions	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (mg/L)	1	Reps: 5 w/5 per
Concentration 2 Nom (mg/L)	5	Reps: 5 w/5 per
Concentration 3 Nom (mg/L)	7	Reps: 5 w/5 per

Hamm & Hinton 2000		***O. latipes***
Parameter	**Value**	**Comment**
Concentration 4 Nom (mg/L)	9	Reps: 5 w/5 per
Concentration 5 Nom (mg/L)	13	Reps: 5 w/5 per
Concentration 6 Nom (mg/L)	17	Reps: 5 w/5 per
Concentration 7 Nom (mg/L)	22	Reps: 5 w/5 per
Concentration 8 Nom (mg/L)	26	Reps: 5 w/5 per
Control	ERM	Reps: 5 w/5 per
NOEC; not calculated by authors, but calculable	See below	Method: ANOVA with Scheffe's F-test p: 0.05 MSD: NR
LOEC; indicate calculation method	See below	
MATC (GeoMean NOEC,LOEC)	See below	
% control at NOEC	See below	
% of control LOEC	See below	

NOEC

Embryo mortality: no significant mortality; NOEC = 26 mg/L; LOEC > 26; MATC: NC

Total hatch
Test 1: NOEC = 17 mg/L (88% of control); LOEC = 22 mg/L (80% of control); MATC = 19.3 mg/L
Test 2: NOEC = 17 mg/L (100% of control); LOEC = 22 mg/L (88% of control); MATC = 19.3 mg/L
Test 3: no significant differences; NOEC = 26 mg/L; LOEC > 26; MATC: NC
Test 4: NOEC = 13 mg/L (92% of control); LOEC = 17 mg/L (68% of control); MATC = 14.9 mg/L
Test 5: 17 mg/L (92% of control); LOEC = 22 mg/L (75% of control); MATC = 19.3 mg/L

Mean day of hatch
Test 1: Interrupted dose response; values NC
Test 2: 17 mg/L (105% of control); LOEC = 22 mg/L (114% of control); MATC = 19.3 mg/L
Test 3: Interrupted dose response; values NC
Test 4: Interrupted dose response; values NC
Test 5: Interrupted dose response; values NC

Percentage of embryos w/ full swim bladder inflation
Test 1: Interrupted dose response; values NC
Test 2: NOEC = 9 mg/L (88% of control); LOEC = 13 mg/L (62% of control); MATC = 10.8 mg/L

Test 3: NOEC = 9 mg/L (90% of control); LOEC = 13 mg/L (67% of control); MATC = 10.8 mg/L
Test 4: NOEC = 7 mg/L (88% of control); LOEC = 9 mg/L (46% of control); MATC = 7.9 mg/L
Test 5: NOEC = 7 mg/L (100% of control); LOEC = 9 mg/L (64% of control); MATC = 7.9 mg/L

Total length of larvae
Test 1: NOEC = 1 mg/L (98% of control); LOEC = 5 mg/L (97% of control); MATC = 2.2 mg/L
Test 2: NOEC = 1 mg/L (100% of control); LOEC = 5 mg/L (96% of control); MATC = 2.2 mg/L
Test 3: NOEC = 1 mg/L (83% of control); LOEC = 5 mg/L (80% of control); MATC = 2.2 mg/L
Test 4: NOEC = 1 mg/L (102% of control); LOEC = 5 mg/L (96% of control); MATC = 2.2 mg/L
Test 5: NOEC = 1 mg/L (84% of control); LOEC = 5 mg/L (80% of control); MATC = 2.2 mg/L

Spinal deformities: no significant findings; NOEC = 26 mg/L; LOEC > 26; MATC: NC

Reliability points taken off for:
Documentation: Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Minimum significant difference (2), Point estimates (8).
Acceptability: No standard method (5), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Exposure type (2), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Minimum significant difference (1), Point estimates (3)

Toxicity Data Summary

Oryzias latipes

Study: Nishiuki Y, Hashimoto Y. 1967. Toxicity of pesticide ingredients to some fresh water organisms. Botyu-Kagaku 32: 5-11.

Only a summary of this study and tables are available in English so most details cannot be determined. The fish tests were 48 hours, thus are not long enough to be usable for criteria derivation. The USEPA (2005) did not use these data for criteria derivation, but judged them of high enough quality to use as supporting data. Thus the rating of LL is being assigned to this study.

Relevance
Score: Cannot determine
Rating: L

Reliability
Score: Cannot determine
Rating: L

Nishiuki & Hashimoto 1967		***O. latipes***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Beloniformes	
Family	Adrianichthyidae	
Genus	*Oryzias*	
Species	*latipes*	
Found in	Native to Japan; not resident in N. Amer.	
Purity of test substance	Technical	As per USEPA 2005
LC50; mg/L	5.3	Method not determined

Rows for information not available were deleted.

Toxicity Data Summary

Pimephales promelas

Study: Dwyer FJ, Hardesty DK, Ingersoll CG, Whites DW, Augspurger T, Canfield TJ, Mount DR, Mayer FL. 2005. Assessing contaminant sensitivity of endangered and threatened aquatic species: Part III. Effluent toxicity tests. Arch Environ Contam Toxicol 48: 174-183.

Relevance
Score: 92.5 (control not described)
Rating: R

Reliability
Score: 64.5
Rating: L

Dwyer *et al.* 2005		***P. promelas***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1994	Full reference below
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyriniformes	
Family	Cyprinidae	
Genus	*Pimephales*	
Species	*promelas*	
Found in	N. America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture or commercial source	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	7 d	
Data for multiple times?	No	
Effect 1	Biomass (combines survival and growth into one endpoint)	
Control response 1	Survival 77- > 85% Growth: NR	77% survival tests accepted
Temperature	25°C	
Test type	Static renewal; daily	
Photoperiod/light intensity	16L:8D	
Dilution water	ASTM hard water	
pH	< 8.6	

Dwyer *et al.* 2005		***P. promelas***
Parameter	**Value**	**Comment**
Hardness	160-180 mg/L as $CaCO_3$	
Alkalinity	110-120 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	> 40%	
Feeding	Daily	
Purity of test substance	99%	
Concentrations measured?	No; stocks measured, but exposure concentrations not measured	
Measured is what % of nominal?	NA	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	Acetone used, but concentration NR	
Concentration 1 Nom (µg/L)	Number and levels NR	Reps: 3-4 w/10 per
Control	Not described	
IC25 (95% ci); µg/L; concentrations reducing response by 25% versus control	1176 (413-2261)	ICp (Norberg-King 1993)

USEPA. 1994. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms (EPA 600/4-91-002). US Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, OH.

Norberg-King TJ. 1993. A linear interpolation method for sublethal toxicity: the inhibition concentration (ICp) approach (technical report no. 03-93). National Effluent Toxicity Assessment Center, Duluth, MN.

Reliability points taken off for:
Documentation: Control type (8), Nominal concentrations (3), Measured concentrations (3), Conductivity (2), Hypothesis tests (8), Point estimates (8).
Acceptability: Control description (6), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Dissolved oxygen (6), Conductivity (1), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3), Point estimates (3).

Toxicity Data Summary

Pimephales promelas

Study: Norberg-King TJ. 1989. An evaluation of the fathead minnow seven-day subchronic test for estimating chronic toxicity. *Environ Toxicol Chem* 8: 1075-1089.

Relevance
Score: 92.5 (Controls response NR)
Rating:R

Reliability
Score: 60.5
Rating:L

Norberg-King 1989		***P. promelas***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited, but follows EPA and ASTM methods; EPA lab	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Pimephales*	
Species	*promelas*	
Found in	N. Amer.	
Age/size at start of test	Embryos: < 24 h Larvae: < 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	7 d (larvae; Tests 15, 17-19) 12 d (embryos; Test 16) 32 d (embryos; Test 14)	
Data for multiple times?	No	
Effect 1	Survival	
Control response 1	NR	
Effect 2	Growth	
Control response 2	NR	
Temperature	NR	
Test type	Flow-through (Test 14, 18, 19) Static-renewal (Test 15, 16, 17)	
Photoperiod	16L:8D	

Norberg-King 1989		***P. promelas***
Parameter	**Value**	**Comment**
Dilution water	Filtered, uv-sterilized Lake Superior water	
pH	Measured, but NR	
Hardness	44-49 mg/L as $CaCO_3$	
Alkalinity	42-45 mg/L as $CaCO_3$	
Salinity	NA	
Dissolved Oxygen	$\geq$ 50%	
Feeding	3x per day; Artemia nauplii	
Purity of test substance	88.2%	
Concentrations measured?	Yes, but NR; loss of 50-70% over 24 h in static-renewal	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (µg/L)	5 concentrations; levels NR	Reps: 4 w/10 per
Control	Dilution water	Reps: 4 w/10 per
NOEC; ug/L; for growth	Test 14: 16.5 Test 15: ND Test 16: ND Test 17: 182 Test 18: 160 Test 19: 86.1	ANOVA; Dunnett's; only most sensitive endpoint reported; all growth in this case. p, MSD: NR
LOEC; ug/L; for growth	Test 14: 37.8 Test 15: > 277 Test 16: > 285 Test 17: 347 Test 18: 277 Test 19: 172	Test descriptions below
MATC (GeoMean NOEC,LOEC)	Test 14: 25.0 Test 15: NC Test 16: NC Test 17: 251 Test 18: 210 Test 19: 122	
Difference from control at NOEC	NC	
Difference from control at LOEC	NC	

Test 14: 32-d test; embryos exposed; flow-through (FT); growth based on dry weight
Test 15: 7-d test; embryos not exposed; static renewal; no survival, growth, reproduction effects seen
Test 16: 7-d; embryos exposed; static renewal; no effects seen

Test 17: 7-d; embryos not exposed; static renewal; growth based on wet weight
Test 18: 7-d; embryos not exposed; FT; growth based on wet weight
Test 19: 7-d; embryos not exposed; FT; growth based on wet weight

Reliability points taken off for:
Documentation: Nominal concentrations (3), Measured concentrations (3), Temperature (4), Conductivity (2), pH (3), Statistical methods (5), Significance level (2), Minimum significant difference (2), % control of NOEC/LOEC (2), Point estimates (8).
Acceptability: Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Organisms randomized (1), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Random design (2), Dilution factor (2), Statistical method (2), NOEC/LOEC response reasonable compared to control (2), Minimum significant difference (1), Point estimates (3).

Toxicity Data Summary

Poecilia reticulata

Keizer J, D'Agostino G, Vittozzi L. 1991. The importance of biotransformation in the toxicity of xenobiotics to fish. I. Toxicity and bioaccumulation of diazinon in guppy (*Poecilia reticulata*) and zebra fish (*Brachydanio rerio*). *Aquat Toxicol* 21: 239-254.

Relevance
Score: 85 (Controls not described or reported)
Rating:L

Reliability
Score: 60.5
Rating:L

Keizer *et al.* 1991		***P. reticulata***
Parameter	**Value**	**Comment**
Test method cited	EEC 1979	Reference below
Phylum	Chordata	
Class	Osteichthyes	
Order	Actinopterygii	
Family	Poeciliidae	
Genus	*Poecilia*	Formerly *Lebistes*
Species	*reticulata*	Formerly *reticulatus*
Found in	Invasive in California	
Age/size at start of test/growth phase	Adult females; 0.6 ± 0.15 g	
Source of organisms	Commercial supplier	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	20-22^{o}C	
Test type	Static renewal	
Photoperiod/light intensity	12L:12D	
Dilution water	Dechlorinated tapwater	
pH	7.6	
Hardness	NR	
Alkalinity	NR	
Conductivity	0.6 mS	
Dissolved Oxygen	NR	
Feeding	NR	

Keizer *et al.* 1991		***P. reticulata***
Parameter	**Value**	**Comment**
Purity of test substance	98%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	NR; dimethlysulfoxide used	
Concentration 1 Nom (µg/L)	1-1.6 mg/L; number of concentrations NR	Reps: 2-3 w/ NR per
Control	Not described	Reps: 2-3 w/ NR per
LC50; mg/L	0.8	graphical

BCF: at 0.1 mg/L exposure in static-renewal system: 39 $\pm$ 5 calculated at steady state; 46 $\pm$ 31 calculated from rate constants;

at 0.4 mg/L exposure: 59 $\pm$ 6 calculated at steady state; 56 $\pm$ 8 calculated from rate constants.

EEC. 1979. Directive 79/831. Annex V, Part C, 5.1.1 ENV/286/80. a: 10. European Economic Community.

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Hypothesis tests (8).
Acceptability: Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Organisms randomized (1), Organisms/rep (2), Feeding (3), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Pteronarcys californica

Study: Johnson WW, Finley MT. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:
Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance
Score: 85 (Controls not described or reported)
Rating: L

Reliability
Score: 61.5
Rating: L

Johnson & Finley 1980 Mayer & Ellersieck 1986		***P. californica***
Parameter	**Value**	**Comment**
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Insecta	
Order	Plecoptera	
Family	Pteronarcyidae	
Genus	*Pteronarcys*	
Species	*californica*	
Found in	N. America	
Age/size at start of test/growth phase	Second year class	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	

Johnson & Finley 1980 **Mayer & Ellersieck 1986**		***P. californica***
Parameter	**Value**	**Comment**
Test duration	96 hr	
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	15 ± 1^{o} C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	
Hardness	40 – 50 mg/L	
Alkalinity	30 – 35	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	89%	
Concentrations measured?	No	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	$\leq$ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used
LC50 (95% ci)	25 (20-30) µg/L	Litchfield & Wilcoxon (1949)

Reliability points subtracted 3.7: Control type (8), Analytical method (4), Nominal Concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Hypothesis tests (8).

Reliability points subtracted 3.8: Control Appropriate (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of nominal (4), Organisms randomly assigned to test containers (1), Dissolved oxygen (6), Conductivity (1), Photoperiod (2), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Hypothesis tests (3).

Toxicity Data Summary

Pteronarcys californica

Sanders HO, Cope OB. 1968. The relative toxicities of several pesticides to naiads of three species of stoneflies. *Limnol Oceanogr* 13: 112-117.

Relevance	Reliability
Score: 82.5 (No std. method, control response NR)	Score: 68
Rating:L	Rating:L

Sanders & Cope 1968		***P. californica***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum	Arthropoda	
Class	Insecta	
Order	Plecoptera	
Family	Pteronarcyidae	
Genus	*Pteronarcys*	No diazinon tests
Species	*californica*	with other species
Found in	N. America	
Age/size at start of test/growth phase	30-35 mm	
Source of organisms	Mountain streams	
Have organisms been exposed to contaminants?	Not sure, but likely not	
Animals acclimated and disease-free?	Yes; 48 h in lab before test	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Survival	
Control response 1	NR	
Temperature	15.5 ± 0.5^{o} C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted water	
pH	7.1	
Hardness	NR	
Alkalinity	35 mg/L (methyl orange)	
Conductivity	NR	
Dissolved Oxygen	3-7 mg/L (low level OK for stoneflies)	
Feeding	Driftwood substrate	
Purity of test substance	Technical	

Sanders & Cope 1968		***P. californica***
Parameter	**Value**	**Comment**
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	NR; not clear if one was used or not	
Concentration 1 Nom/Meas (µg/L)	4-5 concentrations; levels NR	Reps: 1 w/10 per
Control	Dilution water	Reps: 1 w/10 per
LC50 (95% ci); µg/L	24-h: 155 (115-209) 48-h: 60 (42-84) 96-h: 25 (20-51)	Litchfield & Wilcoxon

Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Conductivity (2), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Hardness (2), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Rana clamitans

Study: Harris ML, Bishop CA, Struger J, Ripley B, Bogart JP. 1998. The functional integrity of northern leopard frog (*Rana pipiens*) and green frog (*Rana clamitans*) populations in orchard wetlands. II. Effects of pesticides and eutrophic conditions on early life stage development. Environ Toxicol Chem 17: 1351-1363.

Relevance
Score: 75 for Basudin test (No standard method; Formulation);
75 for diazinon technical test (No std. method; no values- LC50 reported as ">").
Rating: L for Basudin test; L for technical test

Reliability
Score: Basudin: 65, Technical: 68
Rating: L

Harris *et al.* 1998		***R. clamitans***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Ranidae	
Genus	*Rana*	
Species	*clamitans*	
Found in	N. America	
Age/size at start of test/growth phase	Embryo	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h in toxicant; 7.5 d in dilution water; 96 more hours in toxicant; total 16 d	
Data for multiple times?	Yes	96-h results reported
Effect 1	Hatch success	
Control response 1	100%	
Effect 2	Mortality	
Control response 2	< 15%	
Effect 3	Deformities	

Harris *et al.* 1998		***R. clamitans***
Parameter	**Value**	**Comment**
Control response 3	0%	
Effect 4	Growth (length)	
Control response 4	Baseline	
Temperature	18.1 ± 1.1°C	
Test type	Discontinuous static renewal; 48-h renewal	
Photoperiod/light intensity	12L:12D	
Dilution water	Reference pond water	
pH	7.35-7.43	Dilution water
Hardness	NR	
Alkalinity	NR	
Conductivity	150-163 µS/cm	Dilution water
Dissolved Oxygen	NR	
Feeding	Every other day; after hatch	
Purity of test substance	Technical Basudin: 50%	
Concentrations measured?	No; some pesticides in the study were measured, but not diazinon	
Measured is what % of nominal?	NA	
Chemical method documented?	Yes, but diazinon not measured	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L)	Basudin: 0.001 (ai) Technical: 0.5	Reps: 2-3 w/10 per
Concentration 2 Nom (µg/L)	Basudin: 0.01 (ai) Technical: 5.0	Reps: 2-3 w/10 per
Concentration 3 Nom (µg/L)	Basudin: 0.1 (ai) Technical: 50	Reps: 2-3 w/10 per
Concentration 4 Nom (µg/L)	Basudin: 1.0 (ai)	Reps: 2-3 w/10 per
Concentration 5 Nom (µg/L)	Basudin: 10 (ai)	Reps: 2-3 w/10 per
Concentration 6 Nom (µg/L)	Basudin: 25 (ai)	
Control	Reference pond water	Reps: 2-3 w/10 per
LC50; µg/L	96 h Basudin: > 25 Technical: > 50 16 d Basudin: 2.8 Technical: 5	Trimmed Spearman-Karber

Harris *et al.* 1998		***R. clamitans***
Parameter	**Value**	**Comment**
EC50; µg/L; based on deformities evaluated at hatch (day 8; after 4 d in toxicant plus 3 d in dilution water)	Basudin: 5.9 Technical: 14	Trimmed Spearman-Karber
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	Hatching success Basudin: 10 Technical: 50 Growth (16 d) Basudin: Can't interpret Technical: 5	Method: ANOVA p: 0.05 MSD: NR Growth data based on two replicates Discontinuous exposure
LOEC; µg/L	Hatching success Basudin: 25 Technical: > 50 Growth (16 d) Basudin: > 1 Technical: 0.5	
MATC (GeoMean NOEC,LOEC)	Hatching success Basudin: 15.8 Technical: NC Growth (16 d) Basudin: NC Technical: 1.6	
% control at NOEC	Hatching success Basudin: 100% Technical: 100% Growth (16 d) Basudin: NC Technical: > 90% (estimate from graph)	
% of control LOEC	Hatching success Basudin: 40% Technical: NC Growth (16 d) Basudin: NC Technical: > 90% (estimate from graph; response at LOEC not significantly different from NOEC)	

CHRONIC is Discontinuous exposure

Reliability points taken off for:
Documentation: Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Minimum significant difference (2), % control of NOEC/LOEC (2).
Acceptability: No standard method (5), Chemical purity (10- Basudin only), Measured concentrations within 20% of nominal (4), Organisms randomized (1), Exposure type (2),

Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Number of concentrations (3 –Technical only), Random design (2), Adequate replicates (2), Dilution factor (2), LOEC response reasonable compared to control (1 – Technical only), Minimum significant difference (1).

Toxicity Data Evaluation

Salvelinus namaycush

Study: Johnson WW, Finley MT. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington, DC.

And:
Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance
Score: 85 (Controls not described or reported)
Rating: L

Reliability
Score: 61.5
Rating: L

Johnson & Finley 1980 Mayer & Ellersieck 1986		***S. namaycush***
Parameter	**Value**	**Comment**
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Salvelinus*	
Species	*namaycush*	
Found in	N. America	
Age/size at start of test/growth phase	3.2 grams	
Source of organisms	Federal/State Hatcheries	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	

Johnson & Finley 1980 **Mayer & Ellersieck 1986**		***S. namaycush***
Parameter	**Value**	**Comment**
Test duration	96 hrs	
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1^{o} C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	
Hardness	162 ppm CaCO3	Tested in hard water
Alkalinity	30 – 35 mg/L	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	Technical grade	92%
Concentrations measured?	No	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	$\leq$ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used
LC50; indicate calculation method	602 (400-906) µg/L	Litchfield & Wilcoxon (1949)

Reliability points subtracted 3.7: Control type (8), Analytical method (4), Nominal Concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Hypothesis tests (8).

Reliability points subtracted 3.8: Control Appropriate (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of nominal (4), Organisms randomly assigned to test containers (1), Dissolved oxygen (6), Conductivity (1), Photoperiod (2), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Hypothesis tests (3).

Toxicity Data Summary

Silurus glanis

Koprucu SS, Koprucu K, Ural MS, Ispir U, Pala M. 2006. Acute toxicity of organophosphorous pesticide diazinon and its effects on behavior and some hematological parameters of fingerling European catfish (*Silurus glanis* L.), *Pestic. Biochem. Physiol.* **86**, pp. 99–105.

Relevance - acute
Score Acute: 70 (63% purity, family not in NA)
Rating: L

Reliability
Score: 79
Rating: R

Relevance - chronic
Score: 55 (63% purity, family not in NA, endpoint)
Rating:N

Koprucu *et al.* 2006		***S. glanis***
Parameter	**Value**	**Comment**
Test method cited	APHA (American Public Health Association)	
Phylum	Chordata	
Class	Actinopterygii	
Order	Siluriformes	
Family	Siluridae	
Genus	*Silurus*	
Species	*glanis*	
Family in North America?	No, Europe, Asia	
Age/size at start of test/growth phase	12–14 g, 10–12 cm	
Source of organisms	Keban Fish Breeding Unit of State Hydraulic Works, Turkey	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	7 days	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 72, and 96 h	
Effect 1	mortality	
Control response 1	No mortality	
Effect 2	Less activity, lost of equilibrium, abnormal swimming, rapid gill movement, and staying motionless on the aquarium bottom, color changes	
Control response 2	Effects not quantified	

Koprucu *et al.* 2006		***S. glanis***
Parameter	**Value**	**Comment**
Effect 3	MCVD = (packed cell vol as %/RBC in millions) x10u3 MCHD = (Hb in g/RBC in millions) x 10 pg MCHCD = (Hb in g/packed cell vol) x100g per 100mL	
Control response 3	See notes and study	
Temperature	16 +/- 1 °C	
Test type	static	
Photoperiod/light intensity	12 hr light	
Dilution water	Dechlorinated tap	
pH	8.3 +/- 0.1	
Hardness	198.5 +/- 12 mg/ L as $CaCO_3$.	
Alkalinity	150.3 +/- 15	
Conductivity	NR	
Dissolved Oxygen	7.4 +/- 0.2mgL	
Feeding	no	
Purity of test substance	63%	
Concentrations measured?	no	
Concentration of carrier (if any) in test solutions	0.14mg/L	
Concentration 1 Nom (µg/L)	1000	5 Reps/20 per rep
Concentration 2 Nom (µg/L)	2000	5 Reps/20 per rep
Concentration 3 Nom (µg/L)	4000	5 Reps/20 per rep
Concentration 4 Nom (µg/L)	8000	5 Reps/20 per rep
Concentration 5 Nom (µg/L)	16000	5 Reps/20 per rep
Concentration 6 Nom (µg/L)	32000	5 Reps/20 per rep
Concentration 7 Nom (µg/L)	64000	5 Reps/20 per rep
Control	2 control groups had solvent	
LC50; indicate calculation method	1h: 14.597 (12.985–16.340), 24 h: 12.487 (11.079–14.471) 48h: 8.932 (7.907–10.348), 72h: 6.326 (no data $p > 0.05$) 96h: 4.142 (no data $p > 0.05$)	probit
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	96 h: MCV (u3): 4 mg/L	Method: p: MSD:
LOEC; indicate calculation method	96 h: Erythrocyte (106): 1 mg/L (no NOEC) Leukocyte (104): 1 mg/L (no NOEC) Hemoglobin (g/100mL): 1 mg/L (no NOEC) Hematocrit (%): 1 mg/L (no NOEC) MCV (u3): 8 mg/L MCH (pg) : 1 mg/L (no NOEC) MCHC (%): 1 mg/L (no NOEC)	
MATC (GeoMean NOEC,LOEC)	MCV : 5.66 mg/L	

Appendix D2: Supplemental data rated RL, LR, or LL

Other notes: lots of data on blood parameters and significant changes recorded, but link to survival, growth, or reproduction not established from discussion in this paper. Also usable effects seen slight higher than LC50 (MCV MATC: 5.66 mg/L vs LC 50 of 4.14 mg/L) and otherwise paper not relevant.

Acute test - Reliability points taken off for:
Documentation: Analytical method (4), Measured concentrations (3), Conductivity (2), Hypothesis tests (8).
Acceptability: Chemical purity (10), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Conductivity (1), Random design (2), Hypothesis tests (3).

Toxicity Data Summary

Simocephalus serrulatus

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington, DC.

And:
Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance
Score: 85 (Controls not described or reported)
Rating: L

Reliability
Score: 61.5
Rating: L

Johnson & Finley 1980 Mayer & Ellersieck 1986		***S. serrulatus***
Parameter	**Value**	**Comment**
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Simocephalus*	
Species	*serrulatus*	
Found in	N. America	
Age/size at start of test/growth phase	first instar.	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 hr	

Johnson & Finley 1980 **Mayer & Ellersieck 1986**		***S. serrulatus***
Parameter	**Value**	**Comment**
Data for multiple times?	NR	
Effect 1	Immobilization	
Control response 1	NR	No control responses reported
Temperature	15 ± 1^{o} C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	
Hardness	40 – 50 mg/L	
Alkalinity	30 – 35 mg/L	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	Technical Grade	89%
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	At least 6 different concentrations tested, values not given
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	$\leq$ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used
EC50 (95% ci)	Test 1:1.4 (1.2-1.6) µg/L Test 2: 1.8 (1.4-2.2) µg/L	Litchfield & Wilcoxon (1949)

Test 2 not reported in Johnson & Finley (1980). Reported in Mayer & Ellersieck (1986).

Reliability points subtracted 3.7: Control type (8), Analytical method (4), Nominal Concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Hypothesis tests (8).
Reliability points subtracted 3.8: Control Appropriate (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations do not exceed 2x of nominal (4), Organisms randomly assigned to test containers (1), Dissolved oxygen (6),

Conductivity (1), Photoperiod (2), Random block was not reported (2), Adequate replication (2), Appropriate spacing between concentrations (2), Hypothesis tests (3).

Toxicity Data Summary

Various bacteria

Study: Bauer NJ, Seidler RJ, Knittel MD. 1981. A simple, rapid bioassay for detecting effects of pollutants on bacteria. Bull Environ Contam Toxicol 27: 577-582.

Relevance
Score: 75 (No standard method, No toxicity value calculated)
Rating: L

Reliability
Score: 62
Rating: L

Bauer *et al.* 1981		**Various bacteria**
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Mixed	
Class	Mixed	
Order	Mixed	
Family	Mixed	
Genus	Mixed	
Species	Mixed sewage microbes	
Found in	N. America	
Age/size at start of test/growth phase	NR	
Source of organisms	Activated sludge or trickle filter effluent	
Have organisms been exposed to contaminants?	Yes	
Animals acclimated and disease-free?	NA	
Animals randomized?	NA	
Test vessels randomized?	NR	
Test duration	Until 50% DO depletion, or for 22 h	
Data for multiple times?	No	
Effect 1	Dissolved oxygen depletion	
Control response 1	Baseline	
Temperature	Short test: 25^{o}C 22-h test: 21^{o}C	
Test type	Static	
Photoperiod/light intensity	NA	
Dilution water	Standard methods buffer (APHA 1975)	

Bauer *et al.* 1981		**Various bacteria**
Parameter	**Value**	**Comment**
pH	7.2	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	Measured and changing throughout	
Feeding	NA	
Purity of test substance	Reagent grade	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (mg/L)	40	Reps: NR; optical density of 0.18-0.20 at 600 nm
Control	Dilution water	Reps: NR; optical density of 0.18-0.20 at 600 nm
NOEC	Only one concentration tested; no effects seen after 22 h at 40 mg/L diazinon	Method: ANOVA; paired t-test p: NR MSD: NR

Reliability points subtracted 3.7:
Age/life stage/Size/Growth phase (5), Analytical methods (4), Measured concentrations (3), Water hardness (2), Water alkalinity (2), Conductivity (2), Statistical significance (2), Significance level (2), Minimum significant difference (2), % of control at NOEC and/or LOEC(2), Point estimates (LC50 EC50)(8)

Reliability points subtracted 3.8
Acceptable standard method (5), Measured concentrations within 20% nominal(4), Concentrations do not exceed 2x water solubility(4), Carrier solvent concentrations (4), Organism prior contaminant exposure (4), Organisms randomly assigned to test containers(1), Organisms properly acclimated and disease free (1), Water hardness (2), Water alkalinity (2), Conductivity (1), Adequate number of concentrations (3), Adequate replication (2), Random block (2), Appropriate spacing (2), Minimum significant difference(MSD) upper bound (1), LOEC response reasonable compared to control(1), Point estimates (LC50 EC50 etc) (3)

Appendix D3

References for unacceptable studies rated RN, LN or N*

*Not necessarily rated N: Some studies were rated L for relevancy, but were not evaluated further because it was for a marine animal or a TIE (not suitable for single species test, but could be field/ecosystem).

Toxicity Data Summary

Aedes aegypti

Study: Klassen W, Keppler WJ, Kitzmiller JB. 1965. Toxicities of certain larvicides to resistant and susceptible *Aedes aegypti* (L.). Bull Wld Hlth Org 33: 117-122.

Relevance
Score: 75 (Not an acceptable standard method; Controls not described or reported)
Rating: L

Reliability
Score: 37
Rating: N

Klassen *et al.* 1965		***A. aegypti***
Parameter	**Value**	**Comment**
Test method cited	WHO 1960	Not an acceptable method
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Culicidae	
Genus	*Aedes*	
Species	*aegypti*	Trinidad strain
Found in	N. America	
Age/size at start of test/growth phase	4^{th} instar	
Source of organisms	Lab culture of DDT resistant strain	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	NR, but WHO guidelines indicate 24 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	$22 \pm 1^{o}C$	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Tapwater	
pH	NR	

Klassen *et al.* 1965		***A. aegypti***
Parameter	**Value**	**Comment**
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	Technical or purified	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Acetone or ethanol used, but concentration NR	
Concentration 1 Nom/Meas (µg/L)	Number and levels NR	Reps: 4 w/25 per
Control	Not described	Not described
LC50; µg/L	350	probit

Reliability points taken off for:
Documentation: Exposure duration (12), Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Chemical purity (10), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organism size (3), Organisms randomized (1), Feeding (3), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Aedes aegypti

Study: Mitsuhashi J, Grace TDC, Waterhouse DF. 1970. Effects of insecticides on cultures of insect cells. *Entomol Exp Appl* 13:327-341.

Relevance
Score: 52.5 (No standard method, Chemical purity not reported, Toxicity value not calculable, Control response not reported)
Rating: N

Summary:

- Looks at effects of insecticides on the growth of insect cells cultivated in vitro.
- Results were evaluated by observing cell death and growth inhibition

Notes:

- Study looks at two organisms, *Antheraea eucalypti* (moth) and *Aedes aegypti* (mosquito), but only *Aedes aegypti* test is rated because it has a larval stage in freshwater, whereas *Antheraea eucalypti* lays eggs on leaves of food-plants

Toxicity Data Summary

Anguilla anguilla

Study: Cerón JJ, Ferrando MD, Sancho E, Gutierrez-Panizo C, Andreu-Moliner E. 1996a. Effects of diazinon exposure on cholinesterase activity in different tissues of European eel (*Anguilla anguilla*). *Ecotox Environ Safety* 35: 222-225.

Relevance
Score: 60 (No standard method; Endpoint not linked to survival, growth, reproduction; No toxicity value calculated or calculable).
Rating: N

Toxicity Data Summary

Anguilla anguilla

Study: Cerón JJ, Sancho E, Ferrando MD, Gutierrez C, Andreu E. 1996b. Metabolic effects of diazinon on the European eel *Anguilla anguilla*. *J Environ Sci Health B* 31:1029-1040.

Relevance
Score: 60 (No standard method; Endpoints not linked to survival, growth, reproduction; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Anguilla anguilla

Study: Sancho E, Ferrando MD, Gamon M, Andreu-Moliner E. 1992b. Organophosphorus diazinon induced toxicity in the fish *Anguilla anguilla*. *Comp Biochem Physiol* 103C: 351-356.

Relevance
Score: 92.5 (Control response NR)
Rating: R

Reliability
Score: 55
Rating: N

Appears to be same study as Ferrando et al. 1991.

Sancho *et al.* 1992b		***A. anguilla***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1975	Full reference below
Phylum	Chordata	
Class	Actinopterygii	
Order	Anguilliformes	
Family	Anguillidae	
Genus	*Anguilla*	
Species	*anguilla*	
Found in	European Atlantic	
Age/size at start of test/growth phase	20-30 g; 16-20 cm	
Source of organisms	Albufera Lake, Spain	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	NR	
Temperature	20^{o}C (culture); test NR	
Test type	Static	
Photoperiod/light intensity	12L:12D	
Dilution water	Tap water	
pH	7.9 $\pm$ 0.2 (culture); test NR	
Hardness	250 mg/L as $CaCO_3$ (culture); test NR	
Alkalinity	4.1 mmol/L (culture); test	

Sancho *et al.* 1992b		***A. anguilla***
Parameter	**Value**	**Comment**
	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	95%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	66 µ/L acetone	
Concentration 1 Nom (µg/L)	Level and number NR	Reps: 4 w/10 per
Control	Solvent	Reps: 4 w/10 per
LC50 (95% ci) µg/L	24 h: 164 (103-234) 48 h: 114 (85-147) 72 h: 92 (73-110) 96 h: 85 (66-102)	Litchfield & Wilcoxon (1949)

USEPA. 1975. Committee on methods for toxicity tests with aquatic organisms. Ecol Res Report No. EPA0660-3/3-75-009.

BCF: determined in static bioassay at 56 µg/L diazinon.
96 h liver: 800
96 h muscle: 1600
96 h gill: 2300

Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Prior contamination (4), Organisms randomized (1), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Anguilla anguilla

Study: Sancho E, Ferrando MD, Andreu E, Gamon M. 1992a. Acute toxicity, uptake and clearance of diazinon by the European eel, *Anguilla anguilla* L. *J Environ Sci Health B* 27:209-221.

Relevance
Score: 92.5 (Control response NR)
Rating: L

Reliability
Score: 57.5
Rating: N

Sancho *et al.* 1992a		***A. anguilla***
Parameter	**Value**	**Comment**
Test method cited	USEPA 1975	Full reference below
Phylum	Chordata	
Class	Actinopterygii	
Order	Anguilliformes	
Family	Anguillidae	
Genus	*Anguilla*	
Species	*anguilla*	
Found in	European Atlantic	
Age/size at start of test/growth phase	20-30 g; 16-20 cm	
Source of organisms	Albufera Lake, Spain	
Have organisms been exposed to contaminants?	Tested clean	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	NR	
Temperature	20^{o}C (culture); NR for test	
Test type	Static	
Photoperiod/light intensity	12L:12D (culture); NR for test	
Dilution water	Tap water	
pH	7.9 $\pm$ 0.2 (culture); NR for test	
Hardness	250 mg/L as $CaCO_3$ (culture)	

Sancho *et al.* 1992a		***A. anguilla***
Parameter	**Value**	**Comment**
Alkalinity	4.1 mmol/L (culture)	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	95%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	66 μL/L acetone	
Concentration 1 Nom (mg/L)	Range: 0.06-0.3 Dilution factor: NR	Reps: 4 w/10 per
Control	Solvent	Reps: 4 w/10 per
LC50 (95% ci); mg/L	24 h: 0.16 (0.10-0.23) 48 h: 0.11 (0.08-0.14) 72 h: 0.09 (0.07-0.11) 96 h: 0.08 (0.06-0.10)	Method: probit

USEPA. 1975. Committee on methods for toxicity tests with aquatic organisms, Ecol Res Report No. EPA-660/3075-009. United States Environmental Protection Agency, Washington, DC.

BCF:
Muscle: 540 at 72 h; 775 at 96 h
Liver: 600 at 48 h; 680 at 72 h; 1850 at 96 h
Static conditions; 0.042 mg/L diazinon; 20 $\pm$ 1^{o}C; 96-h total exposure

Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: Control response (9), Measured concentrations within 20% of nominal (4), Organisms randomized (1), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Anguilla anguilla

Study: Sancho E, M.D. Ferrando, E. Andreu and M. Gamon. 1993. Bioconcentration and Excretion of Diazinon by Eel. *Bull Environ Contam Toxicol* 50:578-585.

- Conducts study of LC50 with 95% CI for several time periods, bioaccumulation factors of liver and muscle, and excretion of diazinon after recovery in clean freshwater

Relevance
Score: 92.5 (control response NR)
Rating: R

Reliability
Score: 54.5
Rating: N

Sancho *et al.* 1993		***A. anguilla***
Parameter	**Value**	**Comment**
Test method cited	USEPA, 1975	
Phylum	Chordata	
Class	Actinopterygii	
Order	Anguilliformes	
Family	Anguillidae	
Genus	*Anguilla*	
Species	*anguilla*	
Found in	English Channel, Mediterranean Sea, North Atlantic	Not native to N. America
Age/size at start of test/growth phase	Weight = 20-30g Length = 16-20 cm	
Source of organisms	Albufera Lake	Valencia, Spain
Have organisms been exposed to contaminants?	Diazinon not measured in eels prior to testing exposure	Detection limit = 0.01 ng/L
Animals acclimated and disease-free?	Acclimated, claimed to be "healthy"	2 week acclimation
Animals randomized?	NR	
Test vessels randomized?	yes	
Test duration	96 hours for LC50	0, 24, 48, 72, and 96 hours tested for bioaccumulation
Data for multiple times?	Raw data not given	Conducted multiple reps
Effect 1	Lethality (LC50)	LC50 values in chart
Control response 1	NR	
Effect 2	Behavioral abnormalities	restlessness, erratic

Sancho *et al.* 1993		***A. anguilla***
Parameter	**Value**	**Comment**
		swimming, convulsions
Control response 2	NR	
Effect 3	Bioaccumulation	
Control response 3	NR	
Temperature	20 degrees C (culture)	
Test type	Static	
Photoperiod/light intensity	12 hour	
Dilution water	Tap water	
pH	7.9 +/- 0.2 (culture)	
Hardness	250 mg/L CaCO3 (culture)	
Alkalinity	4.1 mmol/L (culture)	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not fed	
Purity of test substance	Reagent grade, 95%	From Cequisa (Spain)
Concentrations measured?	0.06 – 0.3 mg/L, specific concentrations tested not given	Dissolved in acetone
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	NR	10 eels x 4 reps
Control	Kept in clean water with equivalent amounts of acetone	10 eels
LC50; indicate calculation method	See Chart below	

Other data:
LC50 and Confidence Limits:

Exposure Time	LC50 (mg/L)	Confidence Interval
24 hours	0.16	0.10-0.23
48 hours	0.11	0.08-0.14
72 hours	0.09	0.07-0.11
96 hours	0.08	0.06-0.10

BCF: 210

- Used 16 eels
- Exposure concentration used was 0.056 mg/L
- Differences ($p < 0.05$) in bioconcentration of liver and muscle, 800 and 1600 respectively

Excretion:

- 24 hours after animals were transferred to diazinon-free water, 57% and 63% of initially bioconcentrated insecticide was eliminated from liver and muscle respectively

Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Prior contamination (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Number of concentrations (3), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Antheraea eucalypti

Study: Mitsuhashi J, Grace TDC, Waterhouse DF. 1970. Effects of insecticides on cultures of insect cells. Ent Exp Appl 13: 327-341.

Relevance
Score: 30 (No standard method; Endpoint not linked to survival, growth, reproduction; Species not in N. America; No valid toxicity values calculated/calculable—dilution factor of 10 is too high for MATC calculation; Controls not described or reported)
Rating: N

Toxicity Data Evaluation

Aulosira fertilissima

Singh PK. 1973. Effect of Pesticides on Blue-Green Algae. *Arch Mikrobiol* 89:317-320.

Relevance
Score: 60 (No std. method, low chemical purity, no toxicity values)
Rating: N

Toxicity Data Summary

Planktonic algae (36 strains)

Study: Butler GL, Deason TR, O'Kelley JC. 1975b. Loss of five pesticides from cultures of twenty-one planktonic algae. *Bull Environ Contam Toxicol* 13:149-152.

Relevance
Score: 60 (No standard method, Endpoint not relevant, No toxicity values)
Rating: N

Explanation:

- Tests amount of Diazinon which can be broken down by strains of planktonic algae metabolism
- Evaluates results by measuring the amount of Diazinon left after a two week growth period for the culture

Notes:

- Does not analyze metabolites, or their toxicity
- Does not conclusively demonstrate metabolism of pesticides by the strains tested
- Does identify strains which might be useful to evaluate what types of metabolites are formed

Toxicity Data Summary

Various algae

Study: Clegg TJ, Koevenig JL. 1974. The effect of four chlorinated hydrocarbon pesticides and one organophosphate pesticide on ATP levels in three species of photosynthesizing freshwater algae. *Botanical Gazette* 135:368-372.

Relevance

Score: 60 (No standard method; Purity of compound not stated; ATP endpoint not linked to survival, growth, reproduction; No effect on cell density; No toxicity values determined)
Rating: N

Toxicity Data Summary

Barilius vagra

Study: Alam MK, Maughan OE. 1992. The effect of malathion, diazinon, and various concentrations of zinc, copper, nickel, lead, iron, and mercury on fish. Biol Trace Elem Res 34: 225-236.

Relevance
Score: 75 (No standard method, 35% diazinon formulation)
Rating: L

Reliability
Score: 50
Rating: N

Alam & Maughan 1992		***B. vagra***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Barilius*	
Species	*vagra*	
Family in North America?	Yes	
Age/size at start of test/growth phase	6.0 cm	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 hr	
Data for multiple times?	No	
Effect 1	Acute: mortality	
Control response 1	0% mortality	
Effect 2	Chronic: impaired dark skin, 7 day	
Control response 2	0% affected	
Temperature	NR	
Test type	Static bidaily renewal	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	
Hardness	NR	
Alkalinity	NR	

Alam & Maughan 1992		***B. vagra***
Parameter	**Value**	**Comment**
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	35%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L)	4800	10 reps, expt repeated 2x
Concentration 2 Nom/Meas (µg/L)	7200	10 reps, expt repeated 2x
Concentration 3 Nom/Meas (µg/L)	9600	10 reps, expt repeated 2x
Concentration 4 Nom/Meas (µg/L)	12000	10 reps, expt repeated 2x
Control	Dilution water	10 reps, expt repeated 2x
LC50; indicate calculation method	2426 ug/L, probit	
ECx; indicate calculation method	NR	
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	NR	Method: NR p: NR MSD: NR
LOEC; indicate calculation method	NR	
MATC (GeoMean NOEC,LOEC)	NR	
% control at NOEC	NR	
% of control LOEC	NR	

Other notes: chronic studies was on survivors of acute –symptoms observed at lowest dose

Documentation: Organism source (5), Analytical method (4), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Chemical purity (10), Measured concentrations within 20% of nominal (4), Prior contamination (4), Organisms randomized (1), Organisms/rep (2), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Hypothesis tests (3).

Toxicity Data Summary

Barilius vagra

Study: Alam MK, Maughan OE. 1993. Acute toxicity of selected organophosphorus pesticides to *Cyprinus carpio* and *Barilius vagra*. *J Environ Health B* 28: 81-89.

Relevance
Score: 67.5 (No standard method; 35% diazinon formulation; Control response NR)
Rating: N

Toxicity Data Summary

Brachionus calyciflorus

Study: Burbank SE, Snell TW. 1994. Rapid toxicity assessment using esterase biomarkers in *Brachionus calyciflorus* (Rotifera). *Environ Toxicol Wat Qual* 9: 171-178.

Notes: Survival and reproduction data included in this study are from other studies so are not summarized here.

Relevance
Score: 52.5 (No std. method, endpoint, purity, control response NR)
Rating: N

Toxicity Data Summary

Brachionus calyciflorus

Study: Juchelka CM, Snell TW. 1994. Rapid toxicity assessment using rotifer ingestion rate. *Arch Environ Contam Toxicol* 26: 549-554.

Relevance
Score: 60 (No std. method, endpoint, purity)
Rating: N

Toxicity Data Summary

Brachionus calyciflorus

Study: Roex EWM, Van Gestel CAM, Van Wezel AP, Van Straalen NM. 2000. Ratios between acute toxicity and effects on population growth rates in relation to toxicant mode of action. *Environ Toxicol Chem* 19:685-693.

Study not rated because it is a review of other toxicity studies.

Explanation:

- Uses toxicological data from previous studies to compute the ACR and gather information on the Log LC50 and Log LOEC
- Does not conduct experimental analysis, only statistical analysis on past data

Notes:

- Parameters are specific to the studies used for statistical analysis, so none are noted
- Summary of statistical data given under "other data"

Data in study:

Log LC50 (uM)	Log LOEC (uM)	ACR	Study
1.98	1.21	5.89	55
2.01	1.63	2.40	19

Studies:

19. Snell TW, Moffat BD. 1992. A 2-d Life Cycle Test with the Rotifer Brachionus calyciflorus. Environ. Toxicol. Chem. 11:1249-1257.

55. Fernandez-Casalderrey A, Ferrando MD, Andreu-Moliner E. 1992. Effect of Sublethal Diazinon Concentrations on the Demographic Parameters of Brachionus calyciflorus Pallas (Rotifera). Bull. Environ. Contam. Toxicol. 48:202-208.

Toxicity Data Summary

Brachionus plicatilis Müller

Study: Marciall HS, Hagiwara A, Snell TW. 2005. Effect of some pesticides on reproduction of rotifer *Brachionus plicatilis* Müller. *Hydrobiologia* 546: 569-575.

Relevance
Score: 77.5 (Saltwater species; Control responses NR)
Rating: L

Since this is a saltwater study it was not evaluated further; it will not be useful even as supporting information.

Toxicity Data Summary

Brachydanio rerio

Study: Ansari BA, Aslam M, Kumar K. 1987. Diazinon toxicity: activities of acetylcholinesterase and phosphatases in the nervous tissue of zebra fish, *Brachydanio rerio*. *Acta Hydrochim Hydrobiol* 15: 301-306.

Relevance
Score: Acute: 67.5 (No standard method; Diazinon purity NR; Control response NR); Chronic: 60 (No standard method; Endpoints not linked to survival, growth, reproduction; Diazinon purity NR)
Rating: Acute: N; Chronic: N

Toxicity Data Summary

Brachydanio rerio

Ansari BA, Kumar K. 1988. Diazinon toxicity: effect on protein and nucleic acid metabolism in the liver of zebrafish, *Brachydanio rerio* (Cyprinidae). *Sci Tot Environ* 76: 63-68.

Relevance
Score: 45 (No std. method, endpoint, purity, no toxicity values)
Rating: N

Toxicity Data Summary

Brachydanio rerio

Study: Devillers J, Neunier T, Chambon P. 1985. Usefulness of the dosage- effect-time relation in ecotoxicology for determination of different chemical classes of toxicants. *Techniques et Sciences Municipales* 80: 329-334 (in French with English abstract)

Article is in French. Without translation, many details cannot be determined. USEPA (2000) did not use these data in the final diazinon criteria document, describing it as a study "conducted without controls, with unacceptable control survival, or with too few test organisms." The study did not report precise EC50 values; rather ranges of values were reported. Thus, it is not useful for criteria derivation. Since other *Brachydanio rerio* studies are available, this one was not pursued further.

Relevance
Score: $\leq$ 85
Rating: N, per explanation above

Toxicity Data Summary

Brachydanio rerio

Keizer J, D'Agostino G, Vittozzi L. 1991. The importance of biotransformation in the toxicity of xenobiotics to fish. I. Toxicity and bioaccumulation of diazinon in guppy (*Poecilia reticulata*) and zebra fish (*Brachydanio rerio*). *Aquat Toxicol* 21: 239-254.

Relevance
Score: 85 (Controls not described or reported)
Rating:L

Reliability
Score: 57.5
Rating: N

Keizer *et al.* 1991		***B. rerio***
Parameter	**Value**	**Comment**
Test method cited	EEC 1979	Reference below
Phylum	Chordata	
Class	Osteichthyes	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Brachydanio*	
Species	*rerio*	
Found in	N. America	Invasive
Age/size at start of test/growth phase	Adults; 0.4 $\pm$ 0.1 g	
Source of organisms	Commercial supplier	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	20-22^{o}C	
Test type	Static renewal	
Photoperiod/light intensity	12L:12D	
Dilution water	Dechlorinated tapwater	
pH	7.6	
Hardness	NR	
Alkalinity	NR	
Conductivity	0.6 mS	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	98%	

Keizer *et al.* 1991		***B. rerio***
Parameter	**Value**	**Comment**
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	NR; dimethlysulfoxide used	
Concentration 1 Nom/Meas (µg/L)	1-16 mg/L; number of concentrations NR	Reps: 2-3 w/ NR per
Control	Not described	Reps: 2-3 w/ NR per
LC50; mg/L	8.0	graphical

BCF: at 0.1 mg/L exposure in static-renewal system: 168 $\pm$ 20 calculated at steady state; 179 $\pm$ 47 calculated from rate constants;

at 0.4 mg/L exposure: 86 $\pm$ 10 calculated at steady state; 123 $\pm$ 85 calculated from rate constants.

EEC. 1979. Directive 79/831. Annex V, Part C, 5.1.1 ENV/286/80. a:10. European Economic Community,

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Hypothesis tests (8).
Acceptability: Control described (6), Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Organisms/rep (2), Feeding (3), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Number of concentrations (3), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Brachydanio rerio

Study: Keizer J, D'Agostino G, Nagel R, Gramenzi F, Vittozzi L. 1993. Comparative diazinon toxicity in guppy and zebra fish: different role of oxidative metabolism. Environ Toxicol Chem 12: 1243-1250.

Relevance
Score: 90 (No standard method, control response NR)
Rating: R

Reliability
Score: 55.5
Rating: N

Keizer *et al.* 1993		***B. rerio***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Osteichthyes	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Brachydanio*	
Species	*rerio*	
Found in	N. America	
Age/size at start of test/growth phase	Adults; 0.4 $\pm$ 0.1 g	
Source of organisms	Commercial supplier	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	Measured, but NR	
Test type	Static renewal; daily	
Photoperiod/light intensity	12L:12D (culture); measured, but NR in test	
Dilution water	Dechlorinated tapwater	
pH	7.6 (culture); measured, but NR in test	

Keizer *et al.* 1993		***B. rerio***
Parameter	**Value**	**Comment**
Hardness	NR	
Alkalinity	NR	
Conductivity	0.6 mS (sic; culture); NR in test	
Dissolved Oxygen	Measured, but NR	
Feeding	None	
Purity of test substance	98%	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	50 µL/L	
Concentration 1 Meas (µg/L)	Five concentrations; levels NR	Reps: ≥ 2 w/10 per
Control	Solvent	Reps: ≥ 2 w/10 per
LC50 (95% ci); µM	23.3 (20.6-26.3) in mg/L: 7.1	

No BCF data shown for zebra fish.

Reliability points taken off for:
Documentation: Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Brachydanio rerio

Study: Lee SK, Freitag D, Steinberg C, Kettrup A, Kim YH. 1993. Effects of dissolved humic materials on acute toxicity of some organic chemicals to aquatic organisms. *Wat Res* 27: 199-204.

Relevance
Score: 75 (No standard method; Controls not described or reported)
Rating: L

Reliability
Score: 47
Rating: N

Lee *et al.* 1993		***B. rerio***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Osteichthyes	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Brachydanio*	
Species	*rerio*	
Found in	N. America	
Age/size at start of test/growth phase	2 mo; 2-3 cm	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Can't determine	
Animals acclimated and disease-free?	Can't determine	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	$21 \pm 1^{o}C$	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Tap water without pre-treatment	
pH	NR	
Hardness	NR	

Lee *et al.* 1993		***B. rerio***
Parameter	**Value**	**Comment**
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	95.4%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	DMSO plus hydrated castor oil used, but concentration NR	
Concentration 1 Nom (µg/L)	Number and levels NR	Reps: 2 w/6 per
Control	Not described	Not described
LC50; mg/L	0 TOC: 11 0.5 mg/L TOC: 11 5.0 mg/L TOC: 11 50 mg/L TOC: 11	Moving average angle; values estimated from figure 1

Reliability points taken off for:
Documentation: Control type (8), Organism source (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Prior contamination (4), Organisms randomized (1), Feeding (3), Organism acclimation (1), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Bufo americanus

Study: Relyea RA. 2004. Growth and survival of five amphibian species exposed to combinations of pesticides. *Environ Toxicol Chem* 23: 1737-1742.

Relevance
Score: 60 (No standard method; 22.4% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Bufo americanus americanus
Rana clamitans melanota
Rana pipiens

Study: Bishop CA, Mahony NA, Struger J, Ng P, Pettit KE. 1999. Anuran development, density and diversity in relation to agricultural activity in the Holland River watershed, Ontario Canada (1990-1992). *Environ Monitor Assess* 57:21-43.

Unacceptable

Explanation:

- Observational study in natural environment with many other known pesticides, including organophosphates, present for anuran exposure.
- No connection between exposure of diazinon and its effects can be made

Notes:

- Study of anuran species and abnormalities as a result of agricultural spraying and storm water run-off.
- Only trace amounts (< 2.2 ug/L) of diazinon found to be present in the water.

Toxicity Data Summary

Bufo bufo japonicus

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. *J Pest Sci* 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating: L

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Carassius auratus

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating: L

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Carassius auratus

Study: Weiss CM. 1959. Stream Pollution; response of fish to sub-lethal exposures of organic phosphorus insecticides. *Sewage and Industrial Wastes* 31: 580-593.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; No toxicity values calculated; Controls not described or reported)
Rating: N

Toxicity Data Summary

Carassius auratus

Study: Weiss CM. 1961. Physiological effect of organic phosphorus insecticides on several species of fish. *Trans Am Fish Soc* 90: 143-152.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Carassius auratus

Study: Weiss CM, Gakstatter JH. 1964. Detection of pesticides in water by biochemical assay. *J Wat Poll Cont Fed* 36: 240-253.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon grade NR; No toxicity values calculated)
Rating: N

Toxicity Data Summary

Ceriodaphnia cornuta

Study: Hong LCD, Becker-Van Slooten K, Tarradellas J. 2004. Tropical ecotoxicity testing with *Ceriodaphnia cornuta*. *Environ Toxicol* 19:497-504.

Relevance
Score: 75 (No standard method, control and response not described)
Rating: L

Reliability
Score: 41
Rating: N

Hong *et al.* 2004		***C. cornuta***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	New test species 5
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*cornuta*	
Native to	Asia	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	1
Test vessels randomized?	NR	2
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Immobilization	
Control response 1	NR	9
Temperature	Cultures at 22 $\pm$ 2^{o}C; test temperature NR	4, 6
Test type	Static	
Photoperiod/light intensity	NR	3, 2
Dilution water	Not clear; probably M4 medium	3, 2
pH	NR	3, 2
Hardness	NR	2, 2

Hong *et al.* 2004		***C. cornuta***
Parameter	**Value**	**Comment**
Alkalinity	NR	2, 2
Conductivity	NR	2, 1
Dissolved Oxygen	NR	4, 6
Feeding	NR	3
Purity of test substance	95%	
Concentrations measured?	No	3
Measured is what % of nominal?	NA	4
Chemical method documented?	NA	4
Concentration of carrier (if any) in test solutions	DMSO used, but concentration NR	4
Concentration 1 Nom (µg/L)	Number and level NR	Reps: 4 w/10 per; test repeated 4x 3, 3, 2
Control	Not described	Not described 8, 6
EC50 (95% ci); µg/L	4.57 (2.13-9.74)	Non-linear regression

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Feeding (3), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Ceriodaphnia dubia

Study: Ankley GT, Dierkes JR, Jensen DA, Peterson GS. 1991. Piperonyl butoxide as a tool in aquatic toxicological research with organophosphate insecticides. Ecotox Environ Saf 21: 266-274.

Relevance	Reliability
Score: 82.5 (No standard method, No control response)	Score: 57.5
Rating: L	Rating: N

Ankley *et al.* 1991		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	None cited, but appears to follows EPA guidance; studies by EPA staff	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	North America	
Age/size at start of test	$\leq$ 48 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	25 ^{o}C	
Test type	Static	
Photoperiod	NR	
Dilution water	10% mineral water in Millipore	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Salinity	NA	

Ankley *et al.* 1991		***C. dubia***
Parameter	**Value**	**Comment**
Dissolved Oxygen	NR	
Feeding	No	
Purity of test substance	95-99%	
Concentrations measured?	No	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	< 1.5% (< 15 mL/L)	
Concentration 1 Nom/Meas (µg/L)	5 concentrations; levels NR	Reps: 2 w/5 per
Concentration 5 Nom/Meas (µg/L)		Reps: 2 w/5 per
Control	Solvent control (< 1.5% methanol)	Reps:2 w/5 per
LC50 (95% ci); ug/L	0.50 (0.43-0.61)	Trimmed Spearman-Karber

Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Ceriodaphnia dubia

Bailey HC, DiGiorgia C, Kroll K, Miller JL, Hinton DE, Starrett G. 1996. Development of procedures for identifying pesticide toxicity in ambient waters: carbofuran, diazinon, chlorpyrifos. *Environ Toxicol Chem* 15: 837-845.

Relevance
Score: 82.5 (Controls not described, no std method)
Rating:L

Reliability
Score: 50.5
Rating: N

Bailey *et al.* 1996		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	None cited for test methods	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*Dubia*	
Found in	N. America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	<10%	
Temperature	NR	
Test type	Static renewal	
Photoperiod/light intensity	NR	
Dilution water	Well water diluted to moderately hard; natural seawater added to increase conductivity	
pH	8.0	
Hardness	NR	
Alkalinity	NR	
Conductivity	700 μmhos/cm	

Bailey *et al.* 1996		***C. dubia***
Parameter	**Value**	**Comment**
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	Reagent grade	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	0.5 dilution factor; number and levels NR	Reps: 10 w/1 per
Control	Not described	Reps: 10 w/1 per
LC50 (95% ci); µg/L	Test 1: 0.47 (0.33-0.66); Test 2: 0.41 (0.29-0.57)	

Reliability points taken off for:
Documentation: Control type (8), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Photoperiod (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Feeding (3), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Photoperiod (2), Number of concentrations (3), Random design (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Ceriodaphnia dubia

Study: Burkepile DE, Moore MT, Holland MM. 2000. Susceptibility of five nontarget organisms to aqueous diazinon exposure. *Bull Environ Contam Toxicol* 64: 114-121.

Relevance
Score: 67.5 (No standard method; 5% diazinon formulation; Control response not reported)
Rating: N

Toxicity Data Summary

Ceriodaphnia dubia

Study: Jun BH, Lee SI, Ryu HD, Kim YJ. 2006. Temperature-based rapid toxicity test using *Ceriodaphnia dubia*. *Wat Sci Tech* 53: 347-355.

Relevance—48-h standard tests
Score: 70 (Diazinon purity NR—"commercial formulation" used; Controls not described or reported)
Rating: L

Relevance--High-temperature tests
Score: 60 (No standard method; Diazinon purity NR—"commercial formulation" used; Controls not described or reported)
Rating: N

Reliability- standard tests
Score: 46.5
Rating: N

Jun *et al.* 2006		***C. dubia***
Parameter	**Value**	**Comment**
Test method cited	EPA, APHA (specific reference not given)	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Ceriodaphnia*	
Species	*dubia*	
Found in	North America	
Age/size at start of test/growth phase	Neonates	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Immobilization	
Control response 1	NR	
Temperature	25^{o}C	
Test type	Static	

Jun *et al.* 2006		***C. dubia***
Parameter	**Value**	**Comment**
Photoperiod/light intensity	NR	
Dilution water	Moderately hard synthetic	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	NR	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L)	Number and levels NR	Reps: 1 w/10 per; test run in triplicate
Control	Not described	Not described
EC50 (95% ci); µg/L	0.059 (0.02-0.01)	Probit

Reliability points taken off for:
Documentation: Control type (8), Chemical purity (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: Control description (6), Control response (9), Chemical purity (10), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Organisms randomized (1), Organism acclimation (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Ceriodaphnia dubia
Daphnia magna
Daphnia pulex
Pimephales promelas

Burkhard LP, Jenson JJ. 1993. Identification of ammonia, chlorine, and diazinon as toxicants in a municipal effluent. *Arch Environ Contam Toxicol* 25: 506-515.

Study is a TIE; not suitable for criteria derivation, but can be used along with multi-species data for comparison to derived criteria.

Burkhard & Jenson 1993		
Parameter	**Value**	**Comment**
Test method cited	USEPA TIE Phases I, II, III	
Phylum	See other summaries	
Class	See other summaries	
Order	See other summaries	
Family	See other summaries	
Genus	See other summaries	
Species	See other summaries	
Found in	N. America	
Age/size at start of test/growth phase	Daphnids: < 48 h Fatheads: < 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	Daphnids: 48 h Fatheads: 96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	25 ± 1^{o} C	
Test type	NR; assume static	
Photoperiod/light intensity	16L:8D	
Dilution water	10% dilute mineral water (DMW)	
pH	DMW: 7.9 Effluent: NR	
Hardness	DMW: 40 mg/L as $CaCO_3$	

	Effluent: NR	
Alkalinity	DMW: 30 mg/L as $CaCO_3$ Effluent: NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Daphnids: fed at test initiation Fatheads: not fed	
Purity of test substance	NA	
Concentrations measured?	Yes	
Measured is what % of nominal?	Recovery NR	
Chemical method documented?	Yes	
Concentration 1 Nom/Meas (µg/L)	Expressed as % effluent	Reps: 2 w/ 5 per
Control	NA	Reps: 2 w/ 5 per
LCx; indicate calculation method	NA	
ECx; indicate calculation method	NA	

Toxicity Data Summary

Channa punctatus

Study: Anees MA. 1974. Changes in starch-gel electrophoretic pattern of serum proteins of a freshwater teleost *Channa punctatus* (Bloch) exposed to sublethal and chronic levels of three organophosphorus insecticides. *Ceylon J Sci* (*Bio Sci*) 11: 53-59.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated)
Rating: N

Toxicity Data Summary

Channa punctatus

Study: Anees MA. 1976. Intestinal pathology in a freshwater teleost, *Channa punctatus* (Bloch) exposed to sub-lethal and chronic levels of three organophosphorus insecticides. *Acta Physiologica Latino Americana* 26: 67-71.

Relevance
Score: 30 (No standard method; Endpoints not linked to survival, growth, reproduction; Diazinon purity NR; Species not resident in N. America; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Channa punctatus

Study: Anees MA. 1978. Hepatic pathology in a fresh-water teleost *Channa punctatus* (Bloch) exposed to sub-lethal and chronic levels of three organophosphorus insecticides. *Bull Environ Contam Toxicol* 19: 524-527.

Relevance
Score: 15 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; Species not in N. America; No toxicity values generated; Controls not described or reported.
Rating: N

Toxicity Data Evaluation

Channa punctatus

Sastry KV, Malik PV. 1982a. Acute and chronic effects of diazinon on the activities of three dehydrogenases in the digestive system of a freshwater teleost fish *Channa punctatus*. *Toxicol Lett* 10: 55-59.

Relevance
Score: 60 (No std. method, endpoint, no toxicity values)
Rating:N

Toxicity Data Summary

Chironomus tepperi

Study: Stevens MM. 1991. Insecticide treatments used against a rice bloodworm, *Chironomus tepperi* (Diptera: Chironomidae): toxicity and residual effects in water. *J Econ Entom* 84: 795-800.

Relevance
Score: 45 (No standard method; 0.13 mg/L diazinon formulation; Species not in N. America; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Chironomus tepperi

Study: Stevens MM, Warren GN. 1992. Insecticide treatments used against a rice bloodworm, *Chironomus tepperi* (Diptera: Chironomidae): suppression of larval populations. *J Econ Entom* 85: 1606-1613.

Relevance
Score: 45 (No standard method; 0.07 mg/L diazinon formulation; Species not in N. America; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Chlamydomonas reinhardtii

Study: Wong PK, Chang L. 1988. The effects of 2,3-D herbicide and organophosphorus insecticides on growth, photosynthesis, and chlorophyll *a* synthesis of *Chlamydomonas reinhardtii* (mt +). *Environ Poll* 55: 179-189.

Relevance
Score: 60 (No standard method; 60% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Cirrhina mrigala

Study: Alam MGM, Al-Arabi SAM, Halder GC, Mazid MA. 1995. Toxicity of diazinon to the fry of Indian major carp *Cirrhina mrigala* (Hamilton). *Bangladesh J Zool* 23: 183-186.

Relevance
Score: 67.5 (No standard method; 6% diazinon formulation; Controls not described)
Rating: N

Toxicity Data Summary

Clarias batrachus

Study: Tripathi G. 1992. Relative toxicity of aldrin, fenvalerate, captan and diazinon to the freshwater food-fish, *Clarias batrachus*. *Biomed Environ Sci* 5: 33-38.

Relevance
Score: 67.5 (No standard method; 20% diazinon formulation; Control results NR)
Rating: N

Toxicity Data Summary

Claris gariepinus

Adedeji OB, Adedeji AO, Adeyemo OK, Agbede SA. 2008. Acute toxicity of diazinon to the African catfish (*Clarias gariepinus*). *African J Biotechnol* 7(5):51-654.

Relevance
Score: 60 (purity, not in NA, no std method
Rating: N

Toxicity Data Summary

Cloeon dipterum

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating:

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Culex pipiens fatigans

Study: Chen P-S, Lin Y-N, Chung C-L. 1971. Laboratory studies on the susceptibility of mosquito-eating fish, *Lebistes reticulatus*, and the larvae of *Culex pipiens fatigans* to insecticides. *JFMA* 70: 28-35.

Relevance
Score: 75 (Std method not acceptable, Control not described or reported)
Rating: L

Reliability
Score: 45.5
Rating: N

Chen *et al.* 1971		***C. pipiens fatigans***
Parameter	**Value**	**Comment**
Test method cited	WHO 1963	Not an acceptable method
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Culicidae	
Genus	*Culex*	
Species	*pipiens fatigans*	
Found in	N. America (invasive)	
Age/size at start of test/growth phase	3-4th instar	
Source of organisms	NK strain: cesspool CC strain: drain	
Have organisms been exposed to contaminants?	Probably	
Animals acclimated and disease-free?	No	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	24-30^{o}C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Not described	
pH	NR	

Chen *et al.* 1971		***C. pipiens fatigans***
Parameter	**Value**	**Comment**
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	Technical	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Ethanol used, but concentration NR	
Concentration 1 Nom (mg/L)	0.04	Reps: NR w/~25 per
Concentration 2 Nom (mg/L)	0.06	Reps: NR w/~25 per
Concentration 3 Nom (mg/L)	0.08	Reps: NR w/~25 per
Concentration 4 Nom (mg/L)	0.10	Reps: NR w/~25 per
Concentration 5 Nom (mg/L)	0.16	Reps: NR w/~25 per
Control	Not described	
LC50; mg/L	NK: 0.08 CC: 0.061	Logarithmic probability paper
LC95; mg/L	NK: 0.19 CC: 0.16	

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organism size (3), Prior contamination (4), Organisms randomized (1), Feeding (3), Organism acclimation (1), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (3), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Adequate replicates (2), Hypothesis tests (3).

Toxicity Data Summary

Culex pipiens fatigans

Rongsriyam Y, Prownebon S, Hirakoso S. 1965. Effects of insecticides on the feeding activity of the guppy, a mosquito-eating fish, in Thailand. *Bull WHO* 39: 977-980.

Relevance
Score: 60 (No standard method, purity NR, control not described and response not reported)
Rating: N

Toxicity Data Summary

Culex pipiens fatigans

Study: Yasuno M, Kerdpibule V. 1967. Susceptibility of larvae of *Culex pipiens fatigans* to organophosphorous insecticides in Thailand. *Japan J Exp Med* 37: 559-562.

Relevance
Score: 75 (No acceptable standard method; Controls not described or reported)
Rating: L

Reliability
Score: 46.5
Rating: N

Yasuno & Kerdpibule 1967		***C. pipiens fatigans***
Parameter	**Value**	**Comment**
Test method cited	WHO (1963)	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Culicidae	
Genus	*Culex*	
Species	*pipiens fatigans*	
Found in	Invasive in California	
Age/size at start of test/growth phase	4^{th} instar	
Source of organisms	Lab cultures of insects from different regions	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	$25^{o}C$	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Tapwater	
pH	NR	
Hardness	NR	
Alkalinity	NR	

Yasuno & Kerdpibule 1967		***C. pipiens fatigans***
Parameter	**Value**	**Comment**
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	"Purified"	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	1 mL/250 mL; 4 mL/L "absolute alcohol"	
Concentration 1 Nom (mg/L)	7 concentrations; -.16--.0025 mg/L	Reps: 2 w/ 20 per
Control	Not described	Not described
LC50; mg/L	10 different regions: 0.0035 0.0057 0.0022 0.0032 0.0046 0.0045 0.0019 0.0018 0.0054 0.0035 Mean: 0.0036	graphical

Reliability points taken off for:
Documentation: Control type (8), Chemical purity (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Feeding (3), Organism acclimation (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Culex tritaeniorhynchus

Study: Takahashi M, Yasutomi K. 1978. Insecticidal resistance of *Culex tritaeniorhynchus* (Diptera: Culicidae) in Japan: genetics and mechanisms of resistance to organophosphorous insecticides. *J Med Ent* 24:595-603.

Relevance	Reliability
Score: 75 (No standard method; Controls not described/reported)	Score: 45
Rating:L	Rating:N

Takahashi & Yasutomi 1978		***C. tritaeniorhynchus***
Parameter	**Value**	**Comment**
Test method cited	NR	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Culicidae	
Genus	*Culex*	
Species	*tritaeniorhynchus*	
Family in North America?	Yes	
Age/size at start of test/growth phase	4th instar	
Source of organisms	colony	
Have organisms been exposed to contaminants?	no	
Animals acclimated and disease-free?	yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	no	
Effect 1	Mortality	
Control response 1	NR	
Temperature	25 C	
Test type	static	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	

Takahashi & Yasutomi 1978		***C. tritaeniorhynchus***
Parameter	**Value**	**Comment**
Feeding	NR	
Purity of test substance	99.8	
Concentrations measured?	no	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	NR	Reps NR
Concentration 2 Nom/Meas (µg/L)	NR	
Concentration 3 Nom/Meas (µg/L)	NR	
Concentration 4 Nom/Meas (µg/L)	NR	
Concentration 5 Nom/Meas (µg/L)	NR	
Control	NR	
LC50; indicate calculation method	15ug/L, probit	

Other notes:

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Organisms/rep (2), Feeding (3), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Cyanophage

Study: Kraus MP. 1985. Cyanophage assay as a new concept in the study of environmental toxicity. *Aquatic Toxicology and Hazard Assessment: Seventh Symposium, ASTM STP 854*. Cardwell RD, Purdy R, Bahner RC, eds. American Society for Testing and Materials. pp. 27-41.

Relevance
Score: 30 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated/calculable; Controls not described or reported)
Rating: N

Study found no effects at diazinon concentrations as high as 1150 **m**g/L.

Toxicity Data Evaluation

Cylindrospermum sp.

Singh PK. 1973. Effect of Pesticides on Blue-Green Algae. *Arch Mikrobiol* 89:317-320.

Relevance
Score: 60 (No std method, purity, no tox values)
Rating: N

Toxicity Data Summary

Cyprinodon variegatus

Study: Goodman LR, Hansen DJ, Coppage DL, Moore JC, Matthews E. 1979. Diazinon®: chronic toxicity to, and brain acetylcholinesterase inhibition in, the sheepshead minnow, *Cyprinodon variegatus*. *Trans Am Fish Soc* 108: 479-488.

Relevance
Score: 75 (No standard method; Estuarine species)
Rating: L

Although this study is rated L for relevancy, it was not evaluated further. It will not be useful as supporting information since the species is estuarine.

Toxicity Data Summary

Cyprinus carpio

Study: Alam MK, Maughan OE. 1992. The effect of malathion, diazinon, and various concentrations of zinc, copper, nickel, lead, iron, and mercury on fish. Biol Trace Elem Res 34: 225-236.

Relevance
Score: 67.5 (No standard method, 35% diazinon formulation, Control response NR)
Rating: N

Toxicity Data Summary

Cyprinus carpio

Study: Alam MK, Maughan OE. 1993. Acute toxicity of selected organophosphorus pesticides to *Cyprinus carpio* and *Barilius vagra*. J Environ Health B28: 81-89.

Relevance
Score: 67.5 (No standard method; 35% diazinon formulation; Control response NR)
Rating: N

Toxicity Data Summary

Cyprinus carpio

Study: Ariyoshi T, Shiiba S, Hasegawa H, Arisono K. 1990. Profile of metal-binding proteins and heme oxygenase in red carp treated with heavy metals, pesticide and surfactants. *Bull Environ Contam Toxicol* 44: 643-649.

Relevance - N see below
Score: 75 (No standard method; Endpoint not linked to survival, growth, reproduction)
Rating: L

Other comments: Exposure was by intraperitoneal injection and so is not comparable to water-based exposures. Study not evaluated further.

Relevance - N

Toxicity Data Summary

Cyprinus carpio

Study: Dembélé K, Haubruge E, Gaspar C. 2000. Concentration effects of selected insecticides on brain acetylcholinesterase in the common carp (*Cyprinus carpio* L.). *Ecotox Environ Safety* 45: 49-54.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; 162 g/L diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Cyprinus carpio

Study: Dutt N, Guha RS. 1988. Toxicity of few organophosphorus insecticides to fingerlings of bound water fishes, *Cyprinus carpio* (Linn.) and *Tilapia mossambicus* Peters. *Indian J Entomol* 50: 403-421.

Relevance
Score: 60 (No standard method; Diazinon purity NR; Controls not described and results not reported)
Rating: N

Toxicity Data Summary

Cyprinus carpio

Hashimoto Y, Okubo E, Ito T, Yamaguchi M, Tanaka S. 1982. Changes in susceptibility of carp to several pesticides with growth. *J Pesticide Sci* 7: 457-461.

Relevance
Score: 60 (No std method, purity NR, Controls not described or response reported)
Rating: N

Toxicity Data Summary

Cyprinus carpio

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating:

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Cyprinus carpio

Study: Malone CR, Blaylock BG. 1970. Toxicity of insecticide formulation to carp embryos reared in vitro. *J Wildlife Management* 34: 460-463.

Relevance
Score: 60 (No standard method; 25% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Cyprinus carpio

Study: Oruc EÖ, Üner N, Sevgiler Y, Usta D, Durmaz H. 2006. Sublethal effects of organophosphate diazinon on the brain of *Cyprinus carpio*. *Drug Chem Toxicol* 1: 57-67.

Relevance
Score: 60 (No standard method; Endpoint not linked to survival, growth, reproduction; 63% diazinon product used)
Rating: N

Toxicity Data Summary

Cyprinus carpio communis

Study: Kaur K, Toor HS. 1980. Role of abiotic factors in the embryonic development of scale carp. *Proc. Indian Natl Sci Acad* 46B: 136-148.

Relevance
Score: 60 (No standard method; Diazinon purity NR; Controls not described or reported)
Rating: N

Toxicity Data Summary

Cyprinus carpio Linnaeus

Study: Kok LT. 1972. Toxicity of insecticides used for Asiatic rice borer control to tropical fish in rice paddies. In: *The Careless Technology: Ecology and International Development*. Farvar MT, Milton JP, eds. The Natural History Press, Garden City, NY. pp. 489-498.

Relevance
Score: 45 (No standard method; Diazinon purity NR; No toxicity values calculated; Controls not described or reported)
Rating: N

Toxicity Data Summary

Cyprinus carpio L.

Study: Luskova V, Svoboda M, Kolarova J. 2002. The effect of diazinon on blood plasma biochemistry in carp (*Cyprinus carpio* L.). *Acta Vet Brno* 71: 117-123.

Relevance-mortality
Score: 60 (No standard method; Endpoint not linked to survival, growth, reproduction; 600 g/L diazinon formulation)
Rating: N

Toxicity Data Summary

Cyprinus carpio L.

Study: Svoboda M, Luskova V, Drastiochova J, Zlabek V. 2001. The effect of diazinon on haematological indices of common carp (*Cyprinus carpio* L.). *Acta Vet Brno* 70: 457-465.

Relevance-mortality
Score: 77.5 (600 g/L diazinon formulation; Control response NR)
Rating: L

Relevance-immune response
Score: 60 (No standard method; 600 g/L diazinon formulation; Endpoint not linked to survival, growth, reproduction)
Rating: N

Reliability-mortality only
Score: 59
Rating: N

Svoboda *et al.* 2001		***C. carpio***
Parameter	**Value**	**Comment**
Test method cited	OECD No.203; ISO 7346/2	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	*Cyprinus*	
Species	*carpio*	
Found in	N. America	
Age/size at start of test/growth phase	Juveniles 9.0 ± 2.32 g 67.2 ± 6.76 mm	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	Cannot determine	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	NR	
Temperature	19-21^{o}C	
Test type	Static renewal; 24-h renewal	
Photoperiod/light intensity	NR	

Svoboda *et al.* 2001		***C. carpio***
Parameter	**Value**	**Comment**
Dilution water	NR	
pH	7.82 (mean??)	
Hardness	14 mg/L (Ca + Mg)	
Alkalinity	1.05 mM	
Conductivity	NR	
Dissolved Oxygen	70-100% saturation	
Feeding	NR	
Purity of test substance	600 g/L	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L)	7 concentrations; levels NR	Reps: 1 w/10 per
Control	Dilution water	Reps and # per (cell density for single
LC50; mg/L	24 h: 35 48 h: 32 72 h: 27.5 96 h: 26.7	Method NR

Reliability points taken off for:
Documentation: Organism source (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dilution water (3), Conductivity (2), Photoperiod (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Prior contamination (4), Organisms randomized (1), Feeding (3), Organism acclimation (1), Dilution water (2), Conductivity (1), Photoperiod (2), Random design (2), Adequate replicates (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Daphnia ambigua

Study: Hanazato T. 1991. Pesticides as chemical agents inducing helmet formation in *Daphnia ambigua*. *Freshwater Biology* 26: 419-424.

Relevance
Score: 60 (No standard method; Endpoint not linked to survival, growth, reproduction; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Daphnia magna

Study: Anderson BG. 1959. The toxicity of organic insecticides to *Daphnia*. Trans 1959 Sem, *Biol Probl Wat Poll*. US Department of Health, Education, and Welfare, Public Health Service. pp.94-95.

Relevance
Score: 67.5 (No standard method; Diazinon purity NR; Control response NR)
Rating: N

Toxicity Data Evaluation

Daphnia magna

Study: Ankley GT, Dierkes JR, Jensen DA, Peterson GS. 1991. Piperonyl butoxide as a tool in aquatic toxicological research with organophosphate insecticides. *Ecotox Environ Saf* 21: 266-274.

Relevance	Reliability
Score: 82.5 (No standard method, control response NR)	Score: 55
Rating: L	Rating: N

Ankley *et al.* 1991		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test	$\leq$ 48 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	25 ^{o}C	
Test type	Static	
Photoperiod	NR	
Dilution water	10% mineral water in Millipore	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Salinity	NA	
Dissolved Oxygen	NR	
Feeding	No	

Ankley *et al.* 1991		***D. magna***
Parameter	**Value**	**Comment**
Purity of test substance	95-99%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	< 1.5% methanol; < 15 mL/L	
Concentration 1 Nom/Meas (µg/L)	Not given	Reps: 2 w/5 per
Concentration 2 Nom/Meas (µg/L)	NR	Reps: 2 w/5 per
Concentration 3 Nom/Meas (µg/L)	NR	Reps: 2 w/5 per
Concentration 4 Nom/Meas (µg/L)	NR	Reps: 2 w/5 per
Concentration 5 Nom/Meas (µg/L)	NR	Reps: 2 w/5 per
Control	Solvent	Reps:2 w/5 per
LC50 (95% ci); ug/L	0.80 (0.65-1.00)	Trimmed Spearman-Karber

Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Organisms/rep (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Daphnia magna

Dennis WH Jr, Meier EP, Randall WF, Rosencrance AB, Rosenblatt DH. 1979. Degradation of diazinon by sodium hypochlorite. Chemistry and aquatic toxicity. *Environ Sci Technol* 13: 594-598.

Relevance
Score: 60 (No standard method, purity, controls not described or reported)
Rating: N

Toxicity Data Summary

Daphnia magna

Study 1: Dennis WH Jr, Rosencrance AB, Randall WF, Meier EP. 1980. Acid hydrolysis of military formulations of diazinon. *J Environ Sci Health B* 15: 47-60.

Study 2: Meier EP, Dennis WH, Rosencrance AB, Randall WF, Cooper WJ, Warner MC. 1979. Sulfotepp, a toxic impurity in formulations of diazinon. *Bull Environ Toxicol Chem* 23: 158-164.

These two papers describe the same study with different levels of detail regarding the bioassays. Combined, the details are adequate to allow evaluation.

Relevance
Score: 82.5 (No standard method; Control response NR)
Rating: L

Reliability
Score: 47.5
Rating: N

Dennis *et al.* 1980 and Meier *et al.* 1979		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	NR	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	

Dennis *et al.* 1980 and Meier *et al.* 1979		***D. magna***
Parameter	**Value**	**Comment**
Temperature	NR	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Aerated well water	
pH	7.7 (reported for dilution water); pH measured, but NR during test	
Hardness	192 mg/L as $CaCO_3$	
Alkalinity	138 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	Measured, but NR	
Feeding	None	
Purity of test substance	88.1%	
Concentrations measured?	Cannot determine; apparently not	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Acetone used, but concentration NR	
Concentration 1 Nom/Meas (µg/L)	At least 5 concentrations; levels NR	Reps: NR
Control	Well water	Reps: NR
LC50; µg/L	2.0	Litchfield & Wilcoxon (1949)

Reliability points taken off for:
Documentation: Organism source (5), Organism age (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organism size (3), Prior contamination (4), Organisms randomized (1), Organisms/rep (2), Feeding (3), Organism acclimation (1), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Daphnia magna

Study: Devillers J, Neunier T, Chambon P. 1985. Usefulness of the dosage- effect-time relation in ecotoxicology for determination of different chemical classes of toxicants. Techniques et Sciences Municipales 80: 329-334 (in French with English abstract)

Article is in French. Without translation, many details cannot be determined. USEPA (2000) did not use these data in the final diazinon criteria document, describing it as a study "conducted without controls, with unacceptable control survival, or with too few test organisms." The study did not report precise EC50 values; rather ranges of values were reported. Thus, it is not useful for criteria derivation. Since many other *Daphnia magna* studies are available, this one was not pursued further.

Relevance
Score: $\leq$ 85
Rating: N, per explanation above

Toxicity Data Summary

Daphnia magna

Study: Fort DJ, Stover EL, Burks SL, Atherton RA, Blankemeyer JT. 1996. Utilizing biomarker techniques: cellular membrane potential as a biomarker of subchronic toxicity. *Environmental Toxicology and Risk Assessment: Biomarkers and Risk Assessment—Fifth Volume, ASMT STP 1306*, Bengtson DA, Henshel DS, eds. American Society for Testing and Materials. pp. 177-187.

Relevance
Score: 75 (No standard method; Endpoint not linked to survival, growth, reproduction)
Rating: L

Reliability
Score: 58.5
Rating: N

Fort *et al.* 1996		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	Culture: USEPA 1991; Bioassay: no standard method cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	NR	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	30 min	
Data for multiple times?	No	
Effect 1	Cellular membrane potential	
Control response 1	Baseline	
Temperature	NR	
Test type	Static	
Photoperiod/light intensity	NA for 30 min test	

Fort *et al.* 1996		***D. magna***
Parameter	**Value**	**Comment**
Dilution water	Synthetic hard water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	Optimum grade	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L)	Number and levels NR	Reps: 1 w/20 per; test replicated 3x
Control	Dilution water	Reps: 1 w/20 per; test replicated 3x
IC50; µg/L	0.45	Trimmed Spearman-Karber
NOEC; µg/L	0.23	Method: Dunnett's or Steel's Many-One Rank p: 0.05 MSD: NR
LOEC; µg/L	0.37	
MATC; µg/L; (GeoMean NOEC,LOEC)	0.29	
% control at NOEC	NC; raw data not shown	
% of control LOEC	NC; raw data not shown	

Reliability points taken off for:
Documentation: Organism age (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Minimum significant difference (2), % control of NOEC/LOEC (2).
Acceptability: No standard method (5), Appropriate duration (2), Measured concentrations within 20% of nominal (4), Organism size (3), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Daphnia magna

Shigehisa H, Sugaya Y. 1989. A freshwater shrimp (*Paratya compressa imporvisa*) as a sensitive test organism to pesticides. *Environ Pollut* 59: 325-336.

Relevance	Reliability
Score: 75 (no std. method, controls not described or response reported)	Score: 47.5
Rating: L	Rating: N

Shigehisa & Sugaya 1989		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	36 $\pm$ 12 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	23 $\pm$ 1^{o}C	
Test type	Static	
Photoperiod/light intensity	12L:12D	
Dilution water	Artificial soft water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	99%	

Shigehisa & Sugaya 1989		***D. magna***
Parameter	**Value**	**Comment**
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	0.1% (1mL/L)	
Concentration 1 Nom/Meas (mg/L)	Number and levels NR	Reps: 1 w/8 per; experiment repeated 3x
Control	Not described	Reps and # per (cell density for single
LC50; mg/L	~ 0.01 (read from Fig. 1)	Method NR

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Feeding (3), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Number of concentrations (3), Random design (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Daphnia magna

Study: Hong LCD, Becker-Van Slooten, K, Tarradellas J. 2004. Tropical ecotoxicity testing with *Ceriodaphnia cornuta*. WileyInterScience online.

Relevance
Score: 85 (Controls not described or response reported)
Rating: L

Reliability
Score: 42.5
Rating: N

Hong *et al.* 2004		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	OECD 202 (1984)	Full reference below
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Immobilization	
Control response 1	NR	
Temperature	Cultures at 22 $\pm$ 2^{o}C; test temperature NR	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Not clear; probably M4 medium	
pH	NR	

Hong *et al.* 2004		***D. magna***
Parameter	**Value**	**Comment**
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	95%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	DMSO used, but concentration NR	
Concentration 1 Nom (µg/L)	Number and level NR	Reps: 4 w/5 per; test repeated 4x
Control	Not described	Not described
EC50 (95% ci); µg/L	24.35 (13.39-45.96)	Non-linear regression

OECD. 1984. Test guideline 202: *Daphnia* sp., acute immobilization test and reproduction test. Organization for Economic Co-operation and Development, Paris.

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Feeding (3), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Daphnia magna

Study: Lee SK, Freitag D, Steinberg C, Kettrup A, Kim YH. 1993. Effects of dissolved humic materials on acute toxicity of some organic chemicals to aquatic organisms. Wat Res 27: 199-204.

Relevance
Score: 75 (No standard method; Controls not described or reported)
Rating: L

Reliability
Score: 45.5
Rating: N

Lee *et al.* 1993		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	NR	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	20 $\pm$ 1^{o}C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Not clearly described	
pH	NR	
Hardness	NR	

Lee *et al.* 1993		***D. magna***
Parameter	**Value**	**Comment**
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	95.4%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	DMSO plus hydrated castor oil used, but concentration NR	
Concentration 1 Nom (µg/L)	Number and levels NR	Reps: 4-5 w/10 per
Control	Not described	Not described
LC50; µg/L	0 TOC: 0.85 0.5 mg/L TOC: 0.9 5.0 mg/L TOC: 1.0 50 mg/L TOC: 1.7	Moving average angle; values estimated from figure 1

Reliability points taken off for:
Documentation: Control type (8), Organism source (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Feeding (3), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Daphnia magna

Olmstead AW, LeBlanc GA. 2005. Toxicity assessment of environmentally relevant pollutant mixtures using a heuristic model. *Integrated Environmental Assessment and Management* 1: 114-122.

Relevance (Lifespan endpoint)
Score: 75 (no std. method, purity NR)
Rating: L

Reliability
Score: 48
Rating: N

Relevance (Growth rate and fecundity)
Score: 52.5 (no std. method, purity, not tox values, controls response reported)
Rating: N

Olmstead & LeBlanc 2005		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	3 broods; 17-19 d	
Data for multiple times?	No	
Effect 1	Lifespan	
Control response 1	0% reduction	
Effect 2	Growth rate	
Control response 2	NR	
Effect 3	Fecundity	
Control response 3	NR	
Temperature	20^{o} C (culture; test NR)	
Test type	Static renewal; renewed 3x per week	

Olmstead & LeBlanc 2005		***D. magna***
Parameter	**Value**	**Comment**
Photoperiod/light intensity	16L:8D (culture; test NR)	
Dilution water	Not described	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	2-3x per day	
Purity of test substance	NR	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	≤ 0.01% (≤ 0.1 mL/L)	
Concentration 1 Nom/Meas (µg/L)	50 concentrations; levels NR; dilution factor = 0.9	Reps: 1 w/1 per
Control	solvent	Reps: 10 w/1 per
EC5 (95% ci); µg/L	Lifespan: 0.127 (0.054-0.16) Growth Rate: > 0.55 Fecundity: > 0.26	Curve-fitting (sigmoid)
EC50 (95% ci); µg/L	Lifespan: 0.52 (0.40-0.56) Growth Rate: > 0.55 Fecundity: > 0.26	Curve-fitting (sigmoid)

No NOEC, LOEC values determined; EC5 not usable without supporting studies indicating that a 5% effect represents no effect.

Lifespan - Reliability points taken off for:
Documentation: Chemical purity (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Chemical purity (10), Measured concentrations within 20% of nominal (4), Organisms randomized (1), Organisms/rep (2), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Adequate replicates (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Daphnia magna

Study: Robinson PW. 1999. The toxicity of pesticides and organics to mysid shrimps can be predicted from *Daphnia* spp. toxicity data. *Wat Res* 33:1545-1549.

Explanation:

- Article is a summation of toxicology studies previously conducted, in order to extrapolate the findings of several aquatic species to that of the (mostly saltwater) mysid shrimp
- Does not conduct any actual experiment
- Creates correlations between data wish exists for aquatic species to predict toxicity for mysid shrimp
- Conclusion of article is that mysid shrimps are at least as sensitive to pesticides and organics as are freshwater daphnids.

Notes:

Data Collected from Other Sources (and the citations given):

- 48 hr EC50 for Daphnia spp. = 0.8 ug/L (Reeves, 1994, personal communication)
- Mean EC50 for freshwater fish = 2.7 mg/L (Reeves, 1994, personal communication)

Score: 15

No new freshwater data

Toxicity Data Summary

Daphnia magna

Study: Steinberg CE, Sturm A, Kelbel J, Kyu Lee S, Hertkorn N, Freitag D, Kettrup AA. 1992. Changes of acute toxicity of organic chemicals to *Daphnia magna* in the presence of dissolved humic material (DHM). *Acta Hydrochim Hydrobiol* 20: 236-332.

Relevance	Reliability
Score: 75	Score: 44
Rating: L	Rating: N

Steinberg *et al.* 1992		***D. magna***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*magna*	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	NR	
Have organisms been exposed to contaminants?	NR	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Immobility	
Control response 1	NR	
Temperature	20 $\pm$ 1^{o}C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Not described	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	

Steinberg *et al.* 1992		***D. magna***
Parameter	**Value**	**Comment**
Purity of test substance	95.4%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	NR; DMSO w/hydrated castor oil	
Concentration 1 Nom/Meas (µg/L)	Number and levels NR	Reps: 4-7 w/10 per
Control	Not described	Reps: NR
EC50 (95% ci); µg/L	0.85 (0.7 – 1.0)	Moving average angle; value and ci estimated from Figure 1

Reliability points taken off for:
Documentation: Control type (8), Organism source (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Prior contamination (4), Organisms randomized (1), Feeding (3), Organism acclimation (1), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Number of concentrations (3), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Daphnia magna

Study: Stratton GW, Corke CT. 1981. Interaction of permethrin with *Daphnia magna* in the presence and absence of particulate matter. *Environ Poll* (Series A) 24: 135-144.

Relevance
Score: 60 (No standard method; Diazinon purity NR; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Daphnia pulex

Study: Ankley GT, Dierkes JR, Jensen DA, Peterson GS. 1991. Piperonyl butoxide as a tool in aquatic toxicological research with organophosphate insecticides. Ecotox Environ Saf 21: 266-274.

Relevance
Score: 92.4 (no control response)
Rating: R

Reliability
Score: 55
Rating: N

Ankley *et al.* 1991		***D. pulex***
Parameter	**Value**	**Comment**
Test method cited	None cited, but appears to follows EPA guidance; studies by EPA staff	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Daphnia*	
Species	*pulex*	
Found in	North America	
Age/size at start of test	$\leq$ 48 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	25 ^{o}C	
Test type	Static	
Photoperiod	NR	
Dilution water	10% mineral water in Millipore	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NA	
Dissolved Oxygen	NR	

Ankley *et al.* 1991		***D. pulex***
Parameter	**Value**	**Comment**
Feeding	No	
Purity of test substance	95-99%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	< 1.5% (15 mL/L)	
Concentration 1 Nom/Meas (µg/L)	5 concentrations; levels NR	Reps: 2 w/5 per
Control	Solvent control (< 1.5% methanol)	Reps:2 w/5 per
LC50 (95% ci); ug/L	0.65 (0.53-0.80)	Trimmed Spearman-Karber

Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Organisms/rep (2), Feeding (3), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Daphnia pulex

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating:

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Daphnia pulex

Study: Sanders HO, Cope OB. 1966. Toxicities of several pesticides to two species of cladocerans. Trans Am Fish Soc 95: 165-169.

Relevance
Score: 60 (No standard method; Diazinon purity NR; Controls not described and not reported)
Rating: N

Note: USEPA (2005), CDFG (2000) and Menconi & Cox (1994) all accept this test and include statements regarding purity of diazinon used and controls that are not in the paper. USEPA (2005) indicates that 89% pure technical grade diazinon was used; CDFG (2000) and Menconi & Cox (1994) indicate that technical grade was used, but that the purity was not stated. Careful reading of the paper revealed no mention of diazinon grade or purity. Likewise, CDFG (2000) and Menconi & Cox (1994) report 100% control survival, but no such number is reported in the paper.

Toxicity Data Summary

Daphnia pulex

Study: Stark JD, Vargas RI. 2003. Demographic changes in *Daphnia pulex* (leydig) after exposure to the insecticides spinosad and diazinon. *Ecotox Environ Safety* 56: 334-338.

Relevance
Score: 60 (No standard method; 48% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Desmocaris trispimosa

Ebere AG, Akintonwa A. 1992. Acute toxicity of pesticides to *Gobius* sp., *Palaemonetes africanus,* and *Desmocaris trispimosa*. *Bull Environ Contam Toxicol* 49: 588-592.

Relevance
Score: 60 (no std. method, purity, not tox values)
Rating: N

Toxicity Data Summary

Dugesia tigrina

Study: Phipps GL. 1988. Diazinon acute tests for criteria development. Memorandum to R. Spehar, U.S. EPA, Duluth, MN. April 29.

Relevance
Score: 67.5 (purity not reported, no standard method, control not described)
Rating:N

Toxicity Data Summary

Dugesia tigrina

Villar D, González M, Gualda MJ, Schaeffer DJ. 1994. Effects of organophosphorus insecticides on *Dugesia tigrina*; cholinesterase activity and head regeneration. *Bull Environ Contam Toxicol* 52: 319-324.

Relevance
Score: 60 (no std. method, purity, controls response reported)
Rating: N

Toxicity Data Summary

Gambusia affinis

Study: Mulla MS, Isaak LW, Axelrod H. 1963. Field studies of the effects of insecticides on some aquatic wildlife species. *J Econ Entom* 56: 184-188.

Relevance
Score: 60 (No standard method; Diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Gobius sp.

Ebere AG, Akintonwa A. 1992. Acute toxicity of pesticides to *Gobius* sp., *Palaemonetes africanus,* and *Desmocaris trispimosa*. *Bull Environ Contam Toxicol* 49: 588-592.

Relevance
Score: 60 (no std. method, purity, not tox values)
Rating: N

Toxicity Data Summary

Heteropneustes fossilis

Study: Sastry KV, Malik PV. 1982b. Histopathological and enzymological alterations in the digestive system of a freshwater teleost fish, *Heteropneustes fossilis*, exposed to acutely and chronically to diazinon. *Ecotox Environ Safety* 6: 223-235.

Relevance
Score: 45 (No standard method; Endpoints not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Huso huso

Study: Khoshbavar-Rostami HA, Soltani M, Hassan HMD. 2006. Immune response of great sturgeon (*Huso huso*) subjected to long-term exposure to sublethal concentration of the organophosphate, diazinon. *Aquaculture* 256: 88-94.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated
Rating: N

Toxicity Data Summary

Hydropsyche spp.

Study: Fredeen. 1972. Reactions of the larvae of three rheophilic species of Trichoptera to selected insecticides. *Can Ent* 104: 945-953.

Relevance
Score: 52.5 (No standard method; Diazinon purity NR; No toxicity values calculated/calculable; Control response NR)
Rating: N

Toxicity Data Summary

Hyla versicolor

Study: Relyea RA. 2004. Growth and survival of five amphibian species exposed to combinations of pesticides. Environ Toxicol Chem 23: 1737-1742.

Relevance
Score: 60 (No standard method; 22.4% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Ictalurus punctatus

Study: Christensen GM, Tucker JH. 1976. Effects of selected water toxicants on the *in vitro* activity of fish carbonic anhydrase. *Chem-Biol Interactions* 13: 181-192.

Relevance
Score: 60 (No standard method; Endpoint not linked to survival, growth, reproduction; No toxicity value reported for diazinon)
Rating: N
In vitro exposure not useful for criteria derivation.

Toxicity Data Summary

Ictalurus punctatus

Study: Hogan JW, Knowles CO. 1972. Metabolism of diazinon by fish liver microsomes. *Bull Environ Contam Toxicol* 8: 61-64.

Metabolism study; no toxicity values.

- Metabolism of diazinon by channel catfish liver (divided into subcellular fractions) into diazoxon and water solubles measured as a result of time
- Shows effects of air, carbon monoxide, and nitrogen on metabolism by channel catfish liver
- Metabolism of diazinon increased throughout 2 hour incubation period, most rapid metabolism during first 30 minutes
- Only slight increase in water soluble diazinon metabolites by glutathione (GSH)
- Results indicate that carbon monoxide is a potent inhibitor of diazinon metabolism, and oxygen is required for metabolism
- Two major polar metabolites in addition to diazoxon found: diethyl phosphorothioic acid, and diethyl phosphoric acid (diethyl phosphorothioic acid: diethyl phosphoric acid = 3:1)
- Microsomal fraction of liver homogenate found to be most active in metabolism

Toxicity Data Summary

Indoplanorbis esustus

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating:

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Jordanella floridae

Allison DT. 1977. Use of exposure units for estimating aquatic toxicity of organophosphate pesticides. EPA-600/3-77-077. Office of Research and Development, US Environmental Protection Agency, Duluth, MN.

Relevance
Score: 67.5 (no std. method, purity, controls not described)
Rating: N

Toxicity Data Summary

Lebistes reticulatus

Study: Chen P-S, Lin Y-N, Chung C-L. 1971. Laboratory studies on the susceptibility of mosquito-eating fish, *Lebistes reticulatus*, and the larvae of *Culex pipiens fatigans* to insecticides. JFMA 70: 28-35.

Relevance	Reliability
Score: 75 (No std method; control not described or response reported)	Score: 46
Rating: L	Rating: N

Chen *et al.* 1971		***L. reticulatus***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyprinodontiformes	
Family	Poeciliidae	
Genus	*Lebistes*	
Species	*reticulates*	
Found in	N. America (invasive)	
Age/size at start of test/growth phase	7 wk	
Source of organisms	BKG/PTG strain: Lab CCG strain: Culverts	
Have organisms been exposed to contaminants?	BKG/PTG: no CCG: probably	
Animals acclimated and disease-free?	BKG/PTG: Yes CCG: No	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	24-30^{o}C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Not described	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	

Chen *et al.* 1971		***L. reticulatus***
Parameter	**Value**	**Comment**
Feeding	NR	
Purity of test substance	Technical	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Ethanol used, but concentration NR	
Concentration 1 Nom (mg/L)	1	Reps: NR w/15-16 per
Concentration 2 Nom (mg/L)	2	Reps: NR w/15-16 per
Concentration 3 Nom (mg/L)	3	Reps: NR w/15-16 per
Concentration 4 Nom (mg/L)	4	Reps: NR w/15-16 per
Concentration 5 Nom (mg/L)	6	Reps: NR w/15-16 per
Concentration 6 Nom (mg/L)	8	Reps: NR w/15-16 per
Control	Not described	
LC50; mg/L	BKG/PTG: 3.8 CCG: 3.7	Logarithmic probability paper
LC05; mg/L	BKG/PTG: 1.1 CCG: 1.5	

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Prior contamination (4), Organisms randomized (1), Feeding (3), Organism acclimation (1), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (3), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Adequate replicates (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Lepomis macrochirus

Study: Beliles RP (1965) Diazinon Safety evaluation on fish and wildlife (bobwhite quail, goldfish, sunfish, and rainbow trout). Woodward Research Corp. EPA doc. 3046-013-02

Relevance
Score: 82.5 (No std method, Control not described)
Rating: R

Reliability
Score: 56
Rating: N

Beliles 1965		***L. macrochirus***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	*Lepomis*	
Species	*macrochirus*	
Family in North America?	Yes	
Age/size at start of test/growth phase	2.5-5 cm	
Source of organisms	Caught locally	
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	mortality	
Control response 1	3/20 (15%)	
Temperature	14-18 C	
Test type	static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted deionized	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	no	
Purity of test substance	91%	

Beliles 1965		***L. macrochirus***
Parameter	**Value**	**Comment**
Concentrations measured?	No	
Measured is what % of nominal?	n/a	
Chemical method documented?	n/a	
Concentration of carrier (if any) in test solutions	4 mL/L	
Concentration 1 Nom/ (μg/L)	320	2 Rep and 5 per jar
Concentration 2 Nom/ (μg/L)	240	2 Rep and 5 per jar
Concentration 3 Nom/ (μg/L)	180	2 Rep and 5 per jar
Concentration 4 Nom/ (μg/L)	100	2 Rep and 5 per jar
Concentration 5 Nom/ (μg/L)	56	2 Rep and 5 per jar
Concentration 5 Nom/ (μg/L)	10	2 Rep and 5 per jar
Control	Not described	2 Rep and 5 per jar
LC50; indicate calculation method	136	Litchfield and Wilcoxon 1949

Other notes:
Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Prior contamination (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (3), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Adequate replicates (2), Hypothesis tests (3).

Toxicity Data Summary

Lepomis macrochirus

Study: Cope OB. 1965. Sport fishery investigations. Effects of pesticides on fish and wildlife; 1964 research findings of the Fish and Wildlife Service. Circular No. 226. pp 51-63.

Relevance
Score: 75 (No standard method; Controls not described or reported)
Rating: L

Reliability
Score: 34
Rating: N

Cope 1965		***L. macrochirus***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	*Lepomis*	
Species	macrochirus	
Found in	N. America	
Age/size at start of test/growth phase	0.87 g	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	NR	
Temperature	23.9^{o}C	
Test type	NR	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	
Hardness	NR	

Cope 1965		***L. macrochirus***
Parameter	**Value**	**Comment**
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	Technical	
Concentrations measured?	NR	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	Number and levels NR	Reps: NR
Control	NR	Reps: NR
LC50; µg/L	24 h: 52 48 h: 30 96 h: 22	Method NR

Reliability points taken off for:
Documentation: Control type (8), Organism source (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Exposure type (5), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Prior contamination (4), Organisms randomized (1), Organisms/rep (2), Feeding (3), Organism acclimation (1), Exposure type (2), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Lepomis macrochirus

Dennis WH Jr, Meier EP, Randall WF, Rosencrance AB, Rosenblatt DH. 1979. Degradation of diazinon by sodium hypochlorite. Chemistry and aquatic toxicity. *Environ Sci Technol* 13: 594-598.

Relevance
Score: 60 (no std. method, purity, controls not described or response reported)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study 1: Dennis WH Jr, Rosencrance AB, Randall WF, Meier EP. 1980. Acid hydrolysis of military formulations of diazinon. J Environ Sci Health B15: 47-60.

Study 2: Meier EP, Dennis WH, Rosencrance AB, Randall WF, Cooper WJ, Warner MC. 1979. Sulfotepp, a toxic impurity in formulations of diazinon. Bull Environ Toxicol Chem 23: 158-164.

These two papers describe the same study with different levels of detail regarding the bioassays. Combined, the details are adequate to allow evaluation.

Relevance
Score: 82.5 (No standard method; Control response NR)
Rating: L

Reliability
Score: 58
Rating: N

Dennis *et al.* 1980 and Meier *et al.* 1979		***L. macrochirus***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	*Lepomis*	
Species	*macrochirus*	
Found in	N. America	
Age/size at start of test/growth phase	Young-of-the-year; 0.8 g	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	$20 \pm 1^{o}C$	

Dennis *et al.* 1980 and Meier *et al.* 1979		***L. macrochirus***
Parameter	**Value**	**Comment**
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Aerated well water	
pH	7.7 (reported for dilution water); pH measured, but NR during test	
Hardness	192 mg/L as $CaCO_3$	
Alkalinity	138 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	Measured, but NR	
Feeding	None	
Purity of test substance	88.1%	
Concentrations measured?	Cannot determine; apparently not	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Acetone used, but concentration NR	
Concentration 1 Nom/Meas (µg/L)	At least 5 concentrations; levels NR	Reps: 3 w/10 per
Control	Well water	Reps: 3 w/10 per
LC50; µg/L	120	Litchfield & Wilcoxon (1949)

Reliability points taken off for:
Documentation: Organism source (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Prior contamination (4), Organisms randomized (1), Feeding (3), Organism acclimation (1), Dissolved oxygen (6), Conductivity (1), pH (2), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Lepomis macrochirus

Study: Dutta H, Marcelino J, Richmonds C. 1992. Brain acetylcholinesterase activity and optomotor behavior in bluegills, *Lepomis macrochirus*, exposed to different concentrations of diazinon. *Arch Intl Physiol Biochim Biophy* 100: 331-334.

Relevance
Score: 60 (No standard method; Endpoint no linked to survival, growth, reproduction; Diazinon purity NR)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study: Dutta HM, Maxwell LB. 2003. Histological examination of sublethal effects of diazinon on ovary of bluegill, *Lepomis macrochirus*. *Environ Poll* 121: 95-102.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated/calculable)
Rating: N

Note: although this study looked at histopathology in reproductive tissue after exposure to diazinon, this endpoint was not been clearly linked to long-term reproductive effects that could lead to population declines; an experiment that includes a recovery period would help establish this link.

Toxicity Data Summary

Lepomis macrochirus

Study: Dutta HM, Meijer HJM. 2003. Sublethal effects of diazinon on the structure of the testis of bluegill, *Lepomis macrochirus*: a microscopic analysis. *Environ Poll* 125: 355-360.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; 25% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Note: although this study looked at histopathology in reproductive tissue after exposure to diazinon, this endpoint was not been clearly linked to long-term reproductive effects that could lead to population declines; an experiment that includes a recovery period would help establish this link.

Toxicity Data Summary

Lepomis macrochirus

Dutta HM, Munshi JSD, Roy PK, Singh NK, Motz L, Adhikari S. 1997. Effects of diazinon on bluegill sunfish, *Lepomis macrochirus*, gills: scanning electron microscope observations. *Exp Biol Online* 2:17.

Relevance
Score: 60 (No standard method; Endpoint no linked to survival, growth, reproduction; Low chemical purity)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study: Dutta HM, Qadri N, Ojha J, Singh K, Adhikari S, Datat Munshi JS, Roy PK. 1997. Effect of diazinon on macrophages of bluegill sunfish, *Lepomis macrochirus*: a cytochemical evaluation. *Bull Environ Contam Toxicol* 58: 135-141.

Relevance
Score: 45 (No standard method; Diazinon purity not stated; Endpoint not linked to survival, growth, reproduction; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study: Dutta HM, Richmonds CR, Zeno T. 1993. Effects of diazinon on the gills of bluegill sunfish *Lepomis macrochirus*. *J Environ Path Toxicol Oncol* 12: 219-227.

Relevance
Score: 30 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study: Hiltibran RC. 1974. Oxygen and phosphate metabolism of bluegill liver mitochondria in the presence of some insecticides. *Trans Ill State Acad Sci* 67: 228-237.

Relevance
Score: 45 (No standard method; Endpoints not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study: Hiltibran RC. 1982. Effects of insecticides on the metal-activated hydrolysis of adenosine triphosphate by bluegill liver mitochondria. *Arch Environ Contam Toxicol* 11:709-717.

- Suspensions of liver mitochondria exposed
- ATP hydrolysis rates measured; not linked to survival, growth, reproduction
- Diazinon increased manganese activated ATP hydrolysis at 430 ug/L, but not at higher concentrations
- Diazinon increased calcium activated hydrolysis at 430 and 1450 ug/L, but not at 720 ug/L

Relevance
Score: 45 (no std. method, endpoint, purity, not tox values) interrupted dose-response
Rating: N

Also has interrupted dose-response

Toxicity Data Summary

Lepomis macrochirus

Macek KJ. 1975. Acute toxicity of pesticide mixtures to bluegills. *Bull Environ Contam Toxicol* 14: 648-652.

Relevance
Score: 67.5 (no std. method, not tox values, controls response reported)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study: Maxwell LB, Dutta HM. 2005. Diazinon-induced endocrine disruption in bluegill sunfish, *Lepomis macrochirus*. *Ecotox Environ Safety* 60: 21-27.

Relevance
Score: 45 (No standard method; Endpoint not linked to reduction in survival, growth, reproduction; Diazinon purity NR; No toxicity values reported)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study: Qadri N, Dutta HM. 1995. Long term effects of low and high concentrations of diazinon on bluegill fish, *Lepomis macrochirus*: a light microscopic study. *Am Zool* 35: 144A (meeting abstract).

Relevance
Score: 30 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated; Controls not described or mentioned)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study: USEPA. 1977. Acute toxicity of diazinon to bluegill sunfish, EPA TN#1122.

Relevance	Reliability
Score: 82.5 (No standard method, control not described)	Score: 43.5
Rating: L	Rating: N

US EPA 1977		***L. macrochirus***
Parameter	**Value**	**Comment**
Test method cited	NR	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	*Lepomis*	
Species	*macrochirus*	
Family in North America?	Yes	
Age/size at start of test/growth phase	0.83 g, 4.51 cm	
Source of organisms	Welaka Natl. Fish Hatchery	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 96 h	
Effect 1	mortality	
Control response 1	0 (in raw data sheets)	
Temperature	NR	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	87%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	

US EPA 1977		***L. macrochirus***
Parameter	**Value**	**Comment**
Chemical method documented?	No	
Concentration of carrier (if any) in test solutions	Acetone, concentration not understood	
Concentration 1 Nom/Meas (µg/L)	650	1 Rep, 10 per rep
Concentration 2 Nom/Meas (µg/L)	420	1 Rep, 10 per rep
Concentration 3 Nom/Meas (µg/L)	280	1 Rep, 10 per rep
Concentration 4 Nom/Meas (µg/L)	180	1 Rep, 10 per rep
Concentration 5 Nom/Meas (µg/L)	120	1 Rep, 10 per rep
	75	1 Rep, 10 per rep
	49	1 Rep, 10 per rep
Control	0	1 Rep, 10 per rep
LC50	91 (µg/L) 123-67 CL	

Other notes:

Report is just data sheets so little info about test conditions.

From OPP database
Data entry states:
Laboratory: Agricultural Research Center, USDA, Beltsville, MD.
EPA Identification: TN 1122

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Measured concentrations (3), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Feeding (3), Organism acclimation (1), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Adequate replicates (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Lepomis macrochirus

Study: Weiss CM. 1959. Stream Pollution; response of fish to sub-lethal exposures of organic phosphorus insecticides. Sewage and Industrial Wastes 31: 580-593.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; No toxicity values calculated; Controls not described or reported)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study: Weiss CM. 1961. Physiological effect of organic phosphorus insecticides on several species of fish. Trans Am Fish Soc 90: 143-152.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Lepomis macrochirus

Study: Weiss CM, Gakstatter JH. 1964. Detection of pesticides in water by biochemical assay. J Wat Poll Cont Fed 36: 240-253.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon grade NR; No toxicity values calculated)
Rating: N

Toxicity Data Summary

Lumbriculus variegatus

Study: Rogge, R.W. and C.D. Drewes. 1993. Assessing Sublethal Neurotoxicity Effects in the Freshwater oligochaete, *Lumbriculus variegates*. *Aquat Toxicol* 26:73-90.

Relevance
Score: 45 (no std. method, endpoint, purity, not tox values)
Rating: N

Toxicity Data Summary

Lumbricus variegatus

Study: Phipps GL. 1988. Diazinon acute tests for criteria development. Memorandum to R. Spehar, U.S. EPA, Duluth, MN. April 29.

Relevance
Score: 68.25 (purity not reported, no standard method, control not described)
Rating:N

Toxicity Data Summary

Metapenaeus ensis

Study: Chu KH, Lau PY. 1994. Effects of diazinon, malathion, and paraquat on the behavioral response of the shrimp *Metapenaeus ensis* to chemoattractants. *Bull Environ Contam Toxicol* 53: 127-133.

Relevance
Score: 15 (No standard method; Endpoints not linked to survival, growth, reproduction; Saltwater; Species no resident in N. America; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Micropterus salmoides

Study: Pan G, Dutta HM. 1998. The inhibition of brain acetylcholinesterase activity of juvenile largemouth bass *Micropterus salmoides* by sublethal concentrations of diazinon. *Environ Res (Sec A)* 79:133-137.

Relevance
Score: 55 (endpoint, purity, not tox values)
Rating: N

Toxicity Data Summary

Micropterus salmoides

Study: Pan G, Dutta H. 2000. Diazinon induced changes in the serum proteins of large mouth bass, *Micropterus salmoides*. *Bull Environ Contam Toxicol* 64: 287-293.

Rating:

Relevance: No standard method; endpoint not linked to survival, growth, reproduction; 25% purity.
score: 60
rating: N

Toxicity Data Summary

Micropterus salmoides

Study: Weiss CM. 1959. Stream Pollution; response of fish to sub-lethal exposures of organic phosphorus insecticides. Sewage and Industrial Wastes 31: 580-593.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; No toxicity values calculated; Controls not described or reported)
Rating: N

Toxicity Data Summary

Micropterus salmoides

Study: Weiss CM. 1961. Physiological effect of organic phosphorus insecticides on several species of fish. Trans Am Fish Soc 90: 143-152.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Misgurnus anguillicaudatus

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating:

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Misgurnus anguillicaudatus

Oh HS, Lee SK, Kim Y-H, Roh JK. 1991. Mechanism of selective toxicity of diazinon to killifish (*Oryzias latipes*) and loach (*Misgurnus anguillicaudatus*). In: *Aquatic Toxicology and Risk Assessment: Fourteenth Edition, ASTM STP 1124*. Mayes MA, Barron MG, eds. American Society for Testing and Materials, Philadelphia, PA, pp. 343-353.

LC50 values are reported, but no test details are given. Following are results of sub-lethal exposures with acetylcholinesterase (AChE) inhibition as the endpoint.

Relevance
Score: 60 (no std. method, endpoint, controls not described or response reported)
Rating: N

Toxicity Data Summary

Moina macrocopa

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating:

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Moina macrocopa

Shigehisa H, Sugaya Y. 1989. A freshwater shrimp (*Paratya compressa imporvisa*) as a sensitive test organism to pesticides. *Environ Pollut* 59: 325-336.

Relevance	Reliability
Score: 75 (no std. method, controls not described or response reported)	Score: 46.5
Rating: L	Rating: N

Shigehisa & Sugaya 1989		***M. macrocopa***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	*Moina*	
Species	*macrocopa*	
Native to	North America	
Age/size at start of test/growth phase	36 ± 12 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	23 ± 1°C	
Test type	Static	
Photoperiod/light intensity	12L:12D	
Dilution water	Artificial soft water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	99%	
Concentrations measured?	No	

Shigehisa & Sugaya 1989		***M. macrocopa***
Parameter	**Value**	**Comment**
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	0.1% (1mL/L)	
Concentration 1 Nom/Meas (mg/L)	Number and levels NR	Reps: 1 w/8 per; experiment repeated 3x
Control	Not described	Reps and # per (cell density for single
LC50; mg/L	~ 0.2 (read from Fig. 1)	Method NR

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Feeding (3), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Mosquito sp.

Study: LeBrecque GC, Noe JR, Gahan JB. 1956. Effectiveness f insecticides on granular clay carriers against mosquito larvae. *Mosq News* 16: 1-3.

Relevance
Score: 45 (No standard method; Diazinon formulation; No toxicity values calculated/calculable; Controls not described or reported)
Rating: N

Toxicity Data Summary

Mosquito spp.

Study: Rettich F. 1977. The susceptibility of mosquito larvae to eighteen insecticides in Czechoslovakia. *Mosq News* 37: 252-257.

Relevance
Score: 75 (No acceptable standard method; Controls not described or reported)
Rating: L

Reliability
Score: 42.5
Rating: N

Rettich 1977		
Parameter	**Value**	**Comment**
Test method cited	WHO 1963	Not an acceptable method
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Culicidae	
Genus	*Aedes* (6 spp.) *Culex* (2 spp.) *Culiseta*	
Species	*Ae. cantans* *Ae. vexans* *Ae. punctor* *Cx. pipiens pipiens* *Cx. pipiens molestus* *Culiseta annulata*	
Found in	Europe; some likely in N. America	
Age/size at start of test/growth phase	4th instar	
Source of organisms	Field collected	
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	No acclimation period	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality	

Rettich 1977		
Parameter	**Value**	**Comment**
Control response 1	NR	
Temperature	20-23^{o}C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Tapwater	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	Technical	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Ethanol used; concentrations NR	
Concentration 1 Nom (µg/L)	5-6 concentrations with 1.5 dilution factor; levels NR	Reps: 3 w/25 per
Control	Not described	Reps: NR
LC50 (range); mg/L	*Ae. cantans*: 0.0356 (0.009-0.0521) *Ae. vexans*: 0.0379 (0.0266-0.0493) *Cx. pipiens pipiens*: 0.0243 (0.0077-0.0657) *Ae. punctor*: 0.0659 *Cx. pipiens molestus*: 0.0308 *C. annulata*: 0.0623	Method NR

Toxicity Data Summary

Mosquito spp.

Study: Rettich F. 1979. Laboratory and field investigations in Czechoslovakia with fenitrothion, pirimiphos-methyl, temephos and other organophosphorous larvicides applied as sprays for control of *Culex pipiens molestus* Forskal and *Aedes cantans* Meigen. *Mosq News* 39: 320-328.

Relevance
Score: 60 (No acceptable standard method; 60% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Notemigonus crysoleucus

Study: Weiss CM. 1959. Stream Pollution; response of fish to sub-lethal exposures of organic phosphorus insecticides. Sewage and Industrial Wastes 31: 580-593.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; No toxicity values calculated; Controls not described or reported)
Rating: N

Toxicity Data Summary

Notemigonus crysoleucus

Study: Weiss CM. 1961. Physiological effect of organic phosphorus insecticides on several species of fish. Trans Am Fish Soc 90: 143-152.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Notemigonus crysoleucus

Study: Weiss CM, Gakstatter JH. 1964. Detection of pesticides in water by biochemical assay. J Wat Poll Cont Fed 36: 240-253.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon grade NR; No toxicity values calculated)
Rating: N

Toxicity Data Summary

Oncorhynchus mykiss

Study: Applegate VC, Howell JH, Hall AE Jr, Smith MA. 1957. Toxicity of 4.346 chemicals to larval lampreys and fishes. US Fish and Wildlife Service Special Scientific Report—Fisheries No. 207. United States Department of the Interior, Washington, DC.

Relevance
Score: 52.5 (No standard method; Diazinon purity NR; No toxicity values calculated/calculable; Control response NR)
Rating: N

Toxicity Data Summary

Oncorhynchus mykiss

Study: Bathe R, Sachsse K, Ullmann L, Hörmann WD, Zak F, Hess R. 1975. The evaluation of fish toxicity in the laboratory. *Proc Eur Soc Toxicol* 16: 113-124.

Relevance
Score: 60 (No standard method; 40% diazinon formulation; Controls not described or reported)
Rating: N

USEPA (2005) criteria document cites this study as giving a 96-h LC50 value of 3200 µg/L for rainbow trout using technical grade diazinon. However, a review of this study revealed that a 40% emulsifiable concentrate was used and a 96-h LC50 of 8000 µg/L was obtained for rainbow trout. This study included tests with 5 other species, but all with the diazinon formulation. It appears that the USEPA reference is incorrect and it is not clear where the value or 3200 µg/L came from.

Toxicity Data Summary

Oncorhynchus mykiss

Beauvais SL, Jones SB, Brewerand SK and Little EE. 2000. Physiological measures of neurotoxicity of diazinon and malathion to larval trout (*Oncorhynchus mykiss*) and their correlation with behavioral measures. *Environ Toxicol Chem* 19:1875-1880.

Swimming etc. endpoint
Notes:

- Diazinon exposure caused significant changes in all four swimming behaviors studied. No linkage to survival/growth/reproduction

Toxicity Data Summary

Oncorhynchus mykiss

Study: Bisson M, Hontela A. 2002. Cytotoxic and endocrine-disrupting potential of atrazine, diazinon, endosulfan, and mancozeb in adrenocortical steroidogenic cells of rainbow trout exposed *in vitro*. *Toxicol Appl Pharm* 180:110-117.

This *in vitro* study is not useful for criteria derivation, or as supporting information, since it does not involve whole-body, water exposure.

Toxicity Data Summary

Oncorhynchus mykiss

Study: Cope OB. 1965. Sport fishery investigations. Effects of pesticides on fish and wildlife; 1964 research findings of the Fish and Wildlife Service. Circular No. 226. pp 51-63.

Relevance
Score: 75 (No standard method; Controls not described or reported)
Rating: L

Reliability
Score: 34
Rating: N

Cope 1965		***O. mykiss***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Oncorhynchus*	
Species	*mykiss*	
Found in	N. America	
Age/size at start of test/growth phase	3.52 g	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	NR	
Temperature	12.8^{o}C	
Test type	NR	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	
Hardness	NR	
Alkalinity	NR	

Cope 1965		***O. mykiss***
Parameter	**Value**	**Comment**
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	Technical	
Concentrations measured?	NR	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	Number and levels NR	Reps: NR
Control	NR	Reps: NR
LC50; µg/L	24 h: 19 48 h: 15 96 h: 13	Method NR

Reliability points taken off for:
Documentation: Control type (8), Organism source (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Exposure type (5), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Prior contamination (4), Organisms randomized (1), Organisms/rep (2), Feeding (3), Organism acclimation (1), Exposure type (2), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Oncorhynchus mykiss

Study 1: Dennis WH Jr, Rosencrance AB, Randall WF, Meier EP. Acid hydrolysis of military formulations of diazinon. J Environ Sci Health B15: 47-60.

Study 2: Meier EP, Dennis WH, Rosencrance AB, Randall WF, Cooper WJ, Warner MC. 1979. Sulfotepp, a toxic impurity in formulations of diazinon. Bull Environ Toxicol Chem 23: 158-164.

These two papers describe the same study with different levels of detail regarding the bioassays. Combined, the details are adequate to allow evaluation.

Relevance
Score: 82.5 (No standard method; Control response NR)
Rating: L

Reliability
Score: 49.5
Rating: N

Dennis *et al.* 1980 and Meier *et al.* 1979		***O. mykiss***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Oncorhynchus*	
Species	*mykiss*	
Found in	California	
Age/size at start of test/growth phase	NR	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	NR	

Dennis *et al.* 1980 and Meier *et al.* 1979		***O. mykiss***
Parameter	**Value**	**Comment**
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Aerated well water	
pH	7.7 (reported for dilution water); pH measured, but NR during test	
Hardness	192 mg/L as $CaCO_3$	
Alkalinity	138 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	Measured, but NR	
Feeding	None	
Purity of test substance	88.1%	
Concentrations measured?	Cannot determine; apparently not	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Acetone used, but concentration NR	
Concentration 1 Nom/Meas (µg/L)	At least 5 concentrations; levels NR	Reps: NR
Control	Well water	Reps: NR
LC50; µg/L	1350	Litchfield & Wilcoxon (1949)

Reliability points taken off for:
Documentation: Organism source (5), Organism age (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Temperature (4), Dissolved oxygen (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organism size (3), Prior contamination (4), Organisms randomized (1), Feeding (3), Organism acclimation (1), Temperature (6), Dissolved oxygen (6), Conductivity (1), pH (2), Random design (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Oncorhynchus mykiss

Study: Kikuchi M, Miyagaki T, Wakabayashi M. 1996. Evaluation of pesticides used in golf links by acute toxicity test on rainbow trout. *Nippon Suisan Gakkaishi* 62: 414-419.

Article is in Japanese with English abstract, tables and figures. Many details of the test cannot be determined. Test was conducted with a formulation, so results are not usable for criteria derivation. Since other rainbow trout data are available, no effort was made to translate this study further.

Relevance
Score: 85
Rating: L

Reliability
Score: Not determined
Rating: Not determined

Kikuchi et al. 1996		
Parameter	**Value**	**Comment**
Test method cited	Cannot determine	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	*Oncorhynchus*	
Species	*mykiss*	
Found in	N. America	
Age/size at start of test/growth phase	5 d sac fry; 41-46 d fry	
Source of organisms	Cannot determine	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	Cannot determine	
Animals randomized?	Cannot determine	
Test vessels randomized?	Cannot determine	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Temperature	Embryo: 10^{o}C fry: 10^{o}C Fry: 10-11^{o}C or 13^{o}C	
Test type	Cannot determine	
Photoperiod/light intensity	Cannot determine	

Kikuchi et al. 1996		
Parameter	**Value**	**Comment**
Dilution water	Cannot determine	
pH	6.8-7.6 over all tests	
Hardness	Cannot determine	
Alkalinity	Cannot determine	
Conductivity	Cannot determine	
Dissolved Oxygen	> 6 - < 10 mg/L over all tests	
Feeding	Cannot determine	
Purity of test substance	40%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Cannot determine	
Concentration 1 Nom/Meas (μg/L)	Levels NR	Reps: cannot determine
Control	Cannot determine	Reps: cannot determine
LC50	5-d sac fry: 6.2 mg/L 41-46-d: 2.3 mg/L	Cannot determine method

Toxicity Data Summary

Oncorhynchus mykiss

Study: Matsuo K, Tamura T. 1970. Laboratory experiments on the effect of insecticides against blackfly larvae (Diptera: Simuliidae) and fishes. *Botyu-Kagaku* 35: 125-130.

Relevance
Score: 60 (No standard method; 10% diazinon; No toxicity value calculated)
Rating: N

Toxicity Data Summary

Oncorhynchus tshawytscha

Study: Scholz NL, Truelove NK, French BL, Berejikian BA, Quinn TP, Casillas E, Collier TK. *Can J Fish Aquat Sci* 57: 1911-1918.

Relevance
Score: 60 (No standard method; Toxicity values not calculated/calculable; Endpoint)
Rating: N

Toxicity Data Summary

Ophiocephalus punctatus (Channa punctatus)

Study: Sastry KV, Sharma K. 1981. Diazinon-induced histopathological and hematological alterations in a freshwater teleost, *Ophiocephalus punctatus*. *Ecotox Environ Safety* 5: 329-340.

Relevance
Score: 45 (No standard method; Endpoints not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Oreochromis niloticus

Study: Durmaz H, Sevgiler Y, Üner N. 2006. Tissue-specific antioxidative and neurotoxic responses to diazinon in *Oreochromis niloticus*. *Pest Bioch Physiol* 84: 215-226.

Relevance
Score: 60 (No standard method; Endpoints not linked to survival, growth, reproduction; 630 g/L diazinon formulation)
Rating: N

Toxicity Data Summary

Oreochromis niloticus

Study: Üner N, Ourc EO, Sevgiler Y, Sahin N, Durmaz H, Usta D. 2006. Effects of diazinon on acetylcholinesterase activity and lipid peroxidation in the brain of *Oreochromis niloticus*. *Environ Toxicol Pharm* 21: 241-245.

Relevance
Score: 60 (No standard method; Endpoint not linked to survival, growth, reproduction; 63% diazinon formulation)
Rating: N

Toxicity Data Summary

Orthetrum albistylum speciosum

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating:

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Oryzias latipes

Study: Hamm JT, Wilson BW, Hinton DE. 1998. Organophosphate-induced acetylcholinesterase inhibition and embryonic retinal cell necrosis *in vivo* in teleost (*Oryzias latipes*). *Neurotoxicol* 19: 853-870.

Relevance
Score: 60 (No standard method; Endpoints not linked to survival, growth, reproduction; Family not in N. America)
Rating: N

Toxicity Data Summary

Oryzias latipes

Study: Hamm JT, Wilson BW, Hinton DE. 2001. Increasing uptake and bioactivation with development positively modulate diazinon toxicity in early life stage medaka (*Oryzias latipes*). *Toxicol Sci* 61: 304-313.

Relevance-mortality
Score: 67.5 (No standard method; Family not in N. America; Control response NR)
Rating: N

Relevance-AChE inhibition
Score: 60 (No standard method; Endpoint not linked to survival, growth, reproduction; Species not in N. America)
Rating: N

Toxicity Data Summary

Oryzias latipes

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating:

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Oryzias latipes

Study: Hidaka H, Hattanda M, Tatsukawa R. 1984. Avoidance of pesticides with medakas (*Oryzias latipes*). *Nippon Nogeikagaku Kaishi* 58: 145-151.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Family not in N. America; No useable toxicity values calculated)
Rating: N

Toxicity Data Summary

Oryzias latipes

Oh HS, Lee SK, Kim Y-H, Roh JK. 1991. Mechanism of selective toxicity of diazinon to killifish (*Oryzias latipes*) and loach (*Misgurnus anguillicaudatus*). In: *Aquatic Toxicology and Risk Assessment: Fourteenth Edition, ASTM STP 1124*. Mayes MA, Barron MG, eds. American Society for Testing and Materials, Philadelphia, PA, pp. 343-353.

LC50 values are reported, but no test details are given. Following are results of sub-lethal exposures with acetylcholinesterase (AChE) inhibition as the endpoint.

Relevance
Score: 60 (no std. method, endpoint, family not in NA, controls not described or response reported)
Rating: N

Toxicity Data Summary

Oryzias latipes

Study: Tsuda T, Kojima M, Nakajima A, Aoki S. 1997a. Acute toxicity, accumulation and excretion of organophosphorous insecticides and their oxidation products in killifish. Chemosphere 35: 939-949.

Relevance
Score: 62.5 (Family not in N. America; Endpoint; Control response NR)
Rating: N

Toxicity Data Summary

Paramecium caudatum

Study: Evtugyn GA, Rizaeva EP, Stoikova EE, Latipova VZ, Budnikov HC.1997. The application of cholinesterase potentiometric biosensor for preliminary screening of the toxicity of waste waters. *Electroanalysis* 9: 1124-1128.

Relevance
Score: 67.5 (No standard method; Diazinon purity no reported; Control response not reported)
Rating: N

Toxicity Data Summary

Paratya compressa improvisa

Shigehisa H, Sugaya Y. 1989. A freshwater shrimp (*Paratya compressa imporvisa*) as a sensitive test organism to pesticides. *Environ Pollut* 59: 325-336.

Relevance
Score: 60 (no std. method, controls not described/ response reported)
Rating: L

Reliability
Score: 47.5
Rating: N

Hatakeyama & Sugaya 1989		***P. compressa***
Parameter	**Value**	**Comment**
Test method cited	None cited	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Decapoda	
Family	Atyidae	
Genus	*Paratya*	
Species	*compressa improvisa*	
Found in	Japan	
Age/size at start of test/growth phase	2 wk; 5.98 $\pm$ 0.49 mm	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	23 $\pm$ 1^{o}C	
Test type	Static	
Photoperiod/light intensity	12L:12D	
Dilution water	Artificial soft water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	99%	

Hatakeyama & Sugaya 1989		***P. compressa***
Parameter	**Value**	**Comment**
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	0.1% (1mL/L)	
Concentration 1 Nom/Meas (mg/L)	Number and levels NR	Reps: 1 w/8 per; experiment repeated 3x
Control	Not described	Reps and # per (cell density for single
LC50; mg/L	~ 0.1 (read from Fig. 1)	Method NR

Reliability points taken off for:
Documentation: Control type (8), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Feeding (3), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Number of concentrations (3), Random design (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Evaluation

Paratya compressa improvisa

Shigehisa H, Shiraishi H. 1998. Biomonitoring with Shrimp to Detect Seasonal Change in River Water Toxicity. *Environ Toxicol Chem* 17:687-694

Relevance
Score: 82.5 (no std. method, control response NR)
Rating: L

Reliability
Score: 58
Rating: N

Shigehisa & Shiraishi 1998		***P. compressa***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Decapoda	
Family	Atyidae	
Genus	*Paratya*	
Species	*compressa improvisa*	
Found in	Japan	
Age/size at start of test	4 wk; 8.27 $\pm$ 1.03 mm	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not, although cultured in lake water	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	22 $\pm$ 1^{o} C	
Test type	Static	
Photoperiod/light intensity	14L: 10D	
Dilution water	Reconstituted soft water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	Analytical grade; 98-99%	

Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	0.1% (1 mL/L) ethanol	
Concentration 1 Nom/Meas (µg/L)	Number and levels NR	Reps: 3 w/ 7 per
Control	Dilution water	Reps: 3 w/ 7 per
LC50; µg/L	2.33	probit

Reliability points taken off for:
Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Feeding (3), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Hypothesis tests (3).

Toxicity Data Summary

Penaeus japonicus

Study: Hirayama K, Tamonoi S. 1980. Acute toxicity of MEP and diazinon (pesticide) to larvae of Kuruma prawn *Penaeus japonicus* and of swimming crab *Portunus trituberculatus*. *Bulletin of the Japanese Society of Scientific Fisheries* 46: 117-123.

Relevance
Score: ≤ 85 (Marine species)
Rating: L

This report is in Japanese with an English abstract. Without translation, it is not possible to score other relevance factors. Since this is a marine species that is not found in N. America, no further effort was made to evaluate this study. It cannot be used for criteria derivation and will not be useful as supporting information.

Toxicity Data Summary

Petromyzon marinus

Study: Applegate VC, Howell JH, Hall AE Jr, Smith MA. 1957. Toxicity of 4.346 chemicals to larval lampreys and fishes. US Fish and Wildlife Service Special Scientific Report—Fisheries No. 207. United States Department of the Interior, Washington, DC.

Relevance
Score: 52.5 (No standard method; Diazinon purity NR; No toxicity values calculated/calculable; Control response NR)
Rating: N

Toxicity Data Summary

Photobacterium phosphoreum

Study: Curtis C, Lima A, Lozano SJ, Veith GD. Evaluation of a bacterial bioluminescence bioassay as a method for predicting acute toxicity of organic chemicals to fish. *Aquatic Toxicology and Hazard Assessment: Fifth Conference. ASTM STP 766*. Pearson JG, Foster RB, Bishop WE, eds. American Society for Testing and Materials. pp. 170-178.

Relevance
Score: 70 (Endpoint not linked to survival, growth, reproduction; Marine bacterium)
Rating: L

This study utilizes the Microtox system to determine EC50 values for organic chemicals. It is not possible to evaluate it against the same set of criteria as typical aquatic toxicity tests. The EC50 for diazinon of 9.8 mg/L (based on nominal concentrations) indicates that *P. phosphoreum* is relatively insensitive to diazinon. The study was not evaluated further as it cannot be used for criteria derivation (relevance rating = L) and will not be useful as supporting data.

Toxicity Data Summary

Physa acuta

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating:

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Phytoplankton

Doggett SM, Rhodes RG. 1991. Effects of a diazinon formulation on unialgal growth rates and phytoplankton diversity. *Bull Environ Contam Toxicol* 47: 36-42.

Relevance
Score: 60 (no std. method, purity, not tox values)
Rating: N

Toxicity Data Summary

Pimephales promelas

Dennis WH Jr, Meier EP, Randall WF, Rosencrance AB, Rosenblatt DH. 1979. Degradation of diazinon by sodium hypochlorite. Chemistry and aquatic toxicity. *Environ Sci Technol* 13: 594-598.

Relevance
Score: 60 (no std. method, purity, controls not described or response reported)
Rating: N

Toxicity Data Summary

Pimephales promelas

Study 1: Dennis WH Jr, Rosencrance AB, Randall WF, Meier EP. Acid hydrolysis of military formulations of diazinon. J Environ Sci Health B15: 47-60.

Study 2: Meier EP, Dennis WH, Rosencrance AB, Randall WF, Cooper WJ, Warner MC. 1979. Sulfotepp, a toxic impurity in formulations of diazinon. Bull Environ Toxicol Chem 23: 158-164.

These two papers describe the same study with different levels of detail regarding the bioassays. Combined, the details are adequate to allow evaluation.

Relevance
Score: 82.5 (No standard method; Control response NR)
Rating: L

Reliability
Score: 47.5
Rating: N

Dennis *et al.* 1980 and Meier *et al.* 1979		***P. promelas***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyriniformes	
Family	Cyprinidae	
Genus	*Pimephales*	
Species	*promelas*	
Found in	N. America	
Age/size at start of test/growth phase	NR	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	

Dennis *et al.* 1980 and Meier *et al.* 1979		***P. promelas***
Parameter	**Value**	**Comment**
Temperature	NR	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Aerated well water	
pH	7.7 (reported for dilution water); pH measured, but NR during test	
Hardness	192 mg/L as $CaCO_3$	
Alkalinity	138 mg/L as $CaCO_3$	
Conductivity	NR	
Dissolved Oxygen	Measured, but NR	
Feeding	None	
Purity of test substance	88.1%	
Concentrations measured?	Cannot determine; apparently not	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	Acetone used, but concentration NR	
Concentration 1 Nom/Meas (µg/L)	At least 5 concentrations; levels NR	Reps: NR
Control	Well water	Reps: NR
LC50; µg/L	10,300	Litchfield & Wilcoxon (1949)

Reliability points taken off for:
Documentation: Organism source (5), Organism age (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organism size (3), Prior contamination (4), Organisms randomized (1), Organisms/rep (2), Feeding (3), Organism acclimation (1), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Random design (2), Adequate replicates (2), Dilution factor (2), Hypothesis tests (3).

Toxicity Data Summary

Pimephales promelas

Study: Dyer SK, Dickson KL, Zimmerman EG. 1993. A laboratory evaluation of the use of stress proteins in fish to detect changes in water quality. *Environmental Toxicology and Risk Assessment, ASTM STP 1179*, Landis WG, Hughes JS, Lewis MA, eds. American Society for Testing and Materials, Philadelphia, PA. pp. 247-261.

Relevance
Score: 60 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR)
Rating: N

Toxicity Data Summary

Pimephales promelas

Study: Hilsenhoff WH. 1959. The evaluation of insecticides of the control of *Tendipes plumosus* (Linnaeus). *J Econ Entom* 52: 331-332.

Relevance
Score: 60 (No standard method; Diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Pimephales promelas

Study: Weiss CM. 1961. Physiological effect of organic phosphorus insecticides on several species of fish. Trans Am Fish Soc 90: 143-152.

Relevance
Score: 45 (No standard method; Endpoint not linked to survival, growth, reproduction; Diazinon purity NR; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Plecoglossus altivelis

Study: Matsuo K, Tamura T. 1970. Laboratory experiments on the effect of insecticides against blackfly larvae (Diptera: Simuliidae) and fishes. Botyu-Kagaku 35: 125-130.

Relevance
Score: 60 (No standard method; 10% diazinon; No toxicity value calculated)
Rating: N

Toxicity Data Evaluation

Plectonema boryanum

Singh PK. 1973. Effect of Pesticides on Blue-Green Algae. *Arch Mikrobiol* 89:317-320.

Relevance
Score: 60 (no std. method, purity, not tox values)
Rating: N

Toxicity Data Summary

Poecilia reticulata

Study: Keizer J, D'Agostino G, Nagel R, Gramenzi F, Vittozzi L. 1993. Comparative diazinon toxicity in guppy and zebra fish: different role of oxidative metabolism. Environ Toxicol Chem 12: 1243-1250.

Relevance
Score: 82.5 (No standard method, control response NR)
Rating: R

Reliability
Score: 51
Rating: N

Keizer *et al.* 1993		***P. reticulata***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Osteichthyes	
Order	Actinopterygii	
Family	Poeciliidae	
Genus	*Poecilia*	Formerly *Lebistes*
Species	*reticulata*	Formerly *reticulatus*
Found in	Invasive in California	
Age/size at start of test/growth phase	Adults; 0.4 $\pm$ 0.05 g	
Source of organisms	Commercial supplier	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	Measured, but NR	
Test type	Static renewal; daily	
Photoperiod/light intensity	12L:12D (culture); measured, but NR in test	
Dilution water	Dechlorinated tapwater	
pH	7.6 (culture); measured, but NR in test	

Keizer *et al.* 1993		***P. reticulata***
Parameter	**Value**	**Comment**
Hardness	NR	
Alkalinity	NR	
Conductivity	0.6 mS (sic; culture); NR in test	
Dissolved Oxygen	Measured, but NR	
Feeding	None	
Purity of test substance	98%	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	50 µL/L	
Concentration 1 Meas (µg/L)	Five concentrations; levels NR	Reps: ≥ 2 w/10 per
Control	Solvent	Reps: ≥ 2 w/10 per
LC50 (95% ci); µM	2.3 (1.9-3.2) in mg/L: 0.7 (0.6-1.0)	

BCF: static-renewal system; exposure at 350 µg/L.

48 h: 59
144 h (steady-state reached): 188

Reliability points taken off for:
Documentation: Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Random design (2), Adequate replicates (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Poecilia reticulata

Rongsriyam Y, Prownebon S, Hirakoso S. 1965. Effects of insecticides on the feeding activity of the guppy, a mosquito-eating fish, in Thailand. *Bull WHO* 39: 977-980.

Relevance -mortality
Score: 60 (no std. method, purity, controls not described or response reported)
Rating: N

Relevance -activity
Score: 60 (endpoint, no std. method, purity,)
Rating: N

Toxicity Data Summary

Portunus trituberculatus

Study: Hirayama K, Tamonoi S. 1980. Acute toxicity of MEP and diazinon (pesticide) to larvae of Kuruma prawn *Penaeus japonicus* and of swimming crab *Portunus trituberculatus*. Bulletin of the Japanese Society of Scientific Fisheries 46: 117-123.

Relevance
Score: ≤ 85 (Marine species)
Rating: L

This report is in Japanese with an English abstract. Without translation, it is not possible to score other relevance factors. Since this is a marine species that is not found in N. America, no further effort was made to evaluate this study. It cannot be used for criteria derivation and will not be useful as supporting information.

Toxicity Data Summary

Pteronarcys californica

Study: Cope OB. 1965. Sport fishery investigations. Effects of pesticides on fish and wildlife; 1964 research findings of the Fish and Wildlife Service. Circular No. 226. pp 51-63.

Relevance
Score: 75 (No standard method; Controls not described or reported)
Rating: L

Reliability
Score: 32
Rating: N

Appears to be the same study reported in Johnson & Finley 1980.

Cope 1965		***P. californica***
Parameter	**Value**	**Comment**
Test method cited	No standard method cited	
Phylum	Arthropoda	
Class	Insecta	
Order	Plecoptera	
Family	Pteronarcyidae	
Genus	*Pteronarcys*	
Species	*californica*	
Found in	N. America	
Age/size at start of test/growth phase	Nymph	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	NR	
Temperature	15.6^{o}C	
Test type	NR	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	

Cope 1965		***P. californica***
Parameter	**Value**	**Comment**
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	Technical	
Concentrations measured?	NR	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	Number and levels NR	Reps: NR
Control	NR	Reps: NR
LC50; µg/L	24 h: 150 48 h: 74 96 h: 25	Method NR

Reliability points taken off for:
Documentation: Control type (8), Organism source (5), Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Exposure type (5), Dilution water (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Photoperiod (3), Statistical methods (5), Hypothesis tests (8).
Acceptability: No standard method (5), Control description (6), Control response (9), Measured concentrations within 20% of nominal (4), Concentrations exceed 2x water solubility (4), Carrier solvent (4), Prior contamination (4), Organisms randomized (1), Organisms/rep (2), Feeding (3), Organism acclimation (1), Exposure type (2), Dilution water (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Dilution factor (2), Statistical method (2), Hypothesis tests (3).

Toxicity Data Summary

Puntius javanicus Bleeker

Study: Kok LT. 1972. Toxicity of insecticides used for Asiatic rice borer control to tropical fish in rice paddies. In: *The Careless Technology: Ecology and International Development*. Farvar MT, Milton JP, eds. The Natural History Press, Garden City, NY. pp. 489-498.

Relevance
Score: 45 (No standard method; Diazinon purity NR; No toxicity values calculated; Controls not described or reported)
Rating: N

Toxicity Data Summary

Rana boylii

Sparling DW, Fellers G. 2006. Comparative toxicity of chlorpyrifos, diazinon, malathion and their oxon derivatives to larval *Rana boylii. Environ Pollut* 147(3): 535 -539.

Relevance
Score: 82.5 (No Std. Method, No Control Response)
Rating: L

Reliability
Score: 55.5
Rating: N

Sparling & Fellers 2006		***R. boylii***
Parameter	**Value**	**Comment**
Test method cited	ASTM	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Ranidae	
Genus	*Rana*	
Species	*boylii*	foothill yellow-legged frog
Family in North America?	Yes	
Age/size at start of test/growth phase	Gosner 32 to Gosner 44	
Source of organisms	Coast Range stream, Fort Bragg, CA	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes, Weeks acc	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	yes	
Effect 1	mortality	
Control response 1	NR	
Effect 2	acetylcholinesterase inhibition	
Control response 2	100%	
Temperature	NR	
Test type	NR	
Photoperiod/light intensity	NR	
Dilution water	medium soft reconstituted water ASTM	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	On first day	

Sparling & Fellers 2006		***R. boylii***
Parameter	**Value**	**Comment**
Purity of test substance	99%	
Concentrations measured?	no	
Concentration of carrier (if any) in test solutions	Acetone 0.29 ml/L	
Concentration 1 Nom/Meas (µg/L)	1,250	1 Rep and 9 per rep
Concentration 2 Nom/Meas (µg/L)	2,500	1 Rep and 9 per rep
Concentration 3 Nom/Meas (µg/L)	5,000	1 Rep and 9 per rep
Concentration 4 Nom/Meas (µg/L)	10,000	1 Rep and 7 per rep
Control	Solvent control and water only	
LC50; indicate calculation method	7.488 mg/L	Probit
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	none	Method: ANOVA p: NR MSD: NR
LOEC; indicate calculation method	1,250 ug/L ace inhibition	
MATC (GeoMean NOEC,LOEC)	Can't calculate	
% control at NOEC	Can't calculate	
% of control LOEC	Can't calculate	

Other notes:
For diazinon, normalized cholinesterase values differed between controls and those exposed to 5 mg/L or higher ($p = 0.0125$). Controls had higher values than all other treatments except 0.025 mg/L ($p < 0.0001$).

Fig 1b
ACE inhibition approx - 40% at 1,250 ug/L to 55% at 10,000 ug/L

In this study the oxon derivatives of chlorpyrifos, malathion and diazinon were significantly more toxic than their respective parental forms.

Emailed for missing information Jul 2008. The authors mentioned that they did not want to share unpublished information and never sent info.
dsparl@siu.edu (D.W. Sparling)

Reliability points taken off for:
Documentation: Analytical method (4), Measured concentrations (3), Exposure type (5), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Temperature (4), Conductivity (2), pH (3), Photoperiod (3), Significance level (2), Minimum significant difference (2), % control of NOEC/LOEC (2).
Acceptability: Control response (9), Measured concentrations within 20% of nominal (4), Prior contamination (4), Organisms randomized (1), Exposure type (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Temperature (6), Conductivity (1), pH (2), Photoperiod (2), Number of concentrations (3), Random design (2), Adequate replicates (2), Hypothesis tests (3).

Toxicity Data Summary

Rana catesbeiana

Study: Relyea RA. 2004. Growth and survival of five amphibian species exposed to combinations of pesticides. Environ Toxicol Chem 23: 1737-1742.

Relevance
Score: 60 (No standard method; 22.4% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Rana clamitans

Study: Relyea RA. 2004. Growth and survival of five amphibian species exposed to combinations of pesticides. Environ Toxicol Chem 23: 1737-1742.

Relevance
Score: 60 (No standard method; 22.4% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Rana pipiens

Study: Relyea RA. 2004. Growth and survival of five amphibian species exposed to combinations of pesticides. Environ Toxicol Chem 23: 1737-1742.

Relevance
Score: 60 (No standard method; 22.4% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Rasbora heteromorpha

Study: Alabaster JS. 1969. Survival of fish in 164 herbicides, insecticides, fungicides, wetting agents and miscellaneous substances. *Intl Pest Cont* 11:29-35.

Relevance
Score: 60 (Not a std method, Diazinon formulation; Controls not described/reported)
Rating:N

Toxicity Data Summary

Sacco temmincki

Study: Matsuo K, Tamura T. 1970. Laboratory experiments on the effect of insecticides against blackfly larvae (Diptera: Simuliidae) and fishes. Botyu-Kagaku 35: 125-130.

Relevance
Score: 60 (No standard method; 10% diazinon; No toxicity value calculated)
Rating: N

Toxicity Data Summary

Saccobranchus fossilis

Study: Verma SR, Bansal SK, Gupta AK, Pal N, Tyagi AK, Bhathagar MC, Kumar V, Delela RC. 1982. Bioassay trials with twenty three pesticides to a fresh water teleost, *Saccobranchus fossilis*. *Wat Res* 16: 525-529.

Relevance
Score: 52.5 (No standard method; 20% diazinon formulation; Family not in N. America; Control response NR)
Rating: N

Toxicity Data Summary

Salmo salar L.

Study: Lower N, Moore A. 2003. Exposure to insecticides inhibits embryo development and emergence in Atlantic salmon (*Salmo saloa* L.). *Fish Physiol Biochem* 28: 431-432.

Relevance
Score: 45 (No standard method; Diazinon purity NR; No toxicity values calculated/calculable; Controls not described and results NR)
Rating: N

Toxicity Data Summary

Salmo salar L.

Study: Moore A, Waring CP. 1996. Sublethal effects of the pesticide diazinon on olfactory function in mature male Atlantic salmon parr. *J Fish Biol* 48: 758-775.

Relevance
Score: 45-60 (No standard method; Endpoint not adequately linked to survival, growth, reproduction; Diazinon purity NR; Toxicity values not calculated/calculable—except for endpoint of PlasmaGgtH-II levels for which an MATC is calculable)
Rating: N

Toxicity Data Summary

Scenedesmus quadricaudata (Turpin)

Stadnyk L, Campbell RS, Johnson BT. 1971. Pesticide effect on growth and ^{14}C assimilation in a freshwater alga. *Bull Environ Contam Toxicol* 6: 1-8.

Relevance
Score: 60 (no std. method, purity, not tox values)
Rating: N

Toxicity Data Summary

Semisulcospira libertina

Study: Hashimoto Y, Nishiuchi Y. 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms. J Pest Sci 6: 257-264.

Relevance
Score: ≥ 85 (Cannot determine if controls were used/reported)
Rating:

This study was rated of good quality by USEPA (2005), but was not used for criteria derivation because the exposure periods were too short (3 h for daphnids; 48 h for fish, insects, mollusks). This will eliminate values from this study from being used for criteria derivation according to TenBrook & Tjeerdema (2006) as well. Since the study is in Japanese, no further evaluation was done.

Toxicity Data Summary

Simocephalus serrykatys

Study: Sanders HO, Cope OB. 1966. Toxicities of several pesticides to two species of cladocerans. Trans Am Fish Soc 95: 165-169.

Relevance
Score: 60 (No standard method; Diazinon purity NR; Controls not described and not reported)
Rating: N

Note: USEPA (2005), CDFG (2000) and Menconi & Cox (1994) all accept this test and include statements regarding purity of diazinon used and controls that are not in the paper. USEPA (2005) indicates that 89% pure technical grade diazinon was used; CDFG (2000) and Menconi & Cox (1994) indicate that technical grade was used, but that the purity was not stated. Careful reading of the paper revealed no mention of diazinon grade or purity. Likewise, CDFG (2000) and Menconi & Cox (1994) report 100% control survival, but no such number is reported in the paper.

Toxicity Data Summary

Simulium spp.

Study: Matsuo K, Tamura T. 1970. Laboratory experiments on the effect of insecticides against blackfly larvae (Diptera: Simuliidae) and fishes. Botyu-Kagaku 35: 125-130.

Relevance
Score: 60 (No standard method; 10% diazinon; No toxicity value calculated)
Rating: N

Toxicity Data Summary

Simulium sp.

Study: Muirhead-Thomson RC, Merryweather J. 1970. Ovicides in *Simulium* control. *Bull Wld Hlth Org* 42: 174-177.

Relevance
Score: 60 (No standard method; 25% diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Snails

Study: Sinha PK, Pal S, Kumar K, Triar SB, Singh R. 1986. Thiodocarb, an effective molluscicide for grazer snails of blue green algae. *J Entomol Res* 10: 116-118.

Relevance
Score: 52.5 (No standard method; 20% diazinon formulation; No toxicity values calculated/calculable; Control response NR)
Rating: N

Toxicity Data Summary

Stizostedion vitreum

Study: Phillips TA, Summerfelt RC, Wu J, Laird DA. 2003. Toxicity of chlorpyrifos adsorbed on humic colloids to larval walleye (*Stizostedion vitreum*). *Arch Environ Contam Toxicol* 45:258-263.

Relevance
Score: 60 (No standard method; No toxicity values calculated; No water-only control)
Rating: N

Toxicity Data Summary

Tendipes plumosus

Study: Hilsenhoff WH. 1959. The evaluation of insecticides of the control of *Tendipes plumosus* (Linnaeus). J Econ Entom 52: 331-332.

Relevance
Score: 60 (No standard method; Diazinon formulation; No toxicity values calculated/calculable)
Rating: N

Toxicity Data Summary

Tilapia mossambicus

Study: Anjum F, Siddiqui MKJ. 1990. *In vitro* inhibition of fish (*Tilapia mossambicus*) brain Ca^{2+} -ATPase by monocrotophos, dimethoate, diazinon and DDT. *Indian J Exp Biol* 28: 488-489.

Relevance
Score: In vitro study.
Rating: N

Toxicity Data Summary

Tilapia mossambicus

Study: Dutt N, Guha RS. 1988. Toxicity of few organophosphorus insecticides to fingerlings of bound water fishes, *Cyprinus carpio* (Linn.) and *Tilapia mossambicus* Peters.

Relevance
Score: 60 (No standard method; Diazinon purity NR; Controls not described and results not reported)
Rating: N

Toxicity Data Summary

Tilapia mossambicus Peters

Study: Kok LT. 1972. Toxicity of insecticides used for Asiatic rice borer control to tropical fish in rice paddies. In: *The Careless Technology: Ecology and International Development*. Farvar MT, Milton JP, eds. The Natural History Press, Garden City, NY. pp. 489-498.

Relevance
Score: 45 (No standard method; Diazinon purity NR; No toxicity values calculated; Controls not described or reported)
Rating: N

Toxicity Data Summary

Tilapia mossambicus

Study: Mustafa M, Anjum F, Qadri SSH. 1982. A technique to evaluate acute toxicity of insecticide (technical and formulation) to fresh-water fish, *Tilapia mossambicus*. *Int Pest Control* 24, 90.

Relevance-technical grade test
Score: 67.5 (No standard method; No useable toxicity value calculated/calculable; Controls not described)
Rating: N

Toxicity Data Summary

Tilapia mossambicus

Study: Qadri SSH, Sultana H, Anjum F. 1982. Selective toxicity of organophosphorous and carbamate pesticides to honey bee and freshwater fish. *Intl Pest Con* 24: 124-126.

Relevance—technical grade
Score: 60 (No standard method; No useable toxicity values calculated/calculable; Controls not described or reported)
Rating: N

Toxicity Data Summary

Tilapia nilotica

Study: Khalaf-Allah SS. 1999. Effect of pesticide water pollution on some haematological, biochemical and immunological parameters in *Tilapia nilotica* fish. Dtsch. *Tiereärztl. Wschr* 106: 67-71.

Relevance--acute
Score: 62.5 (Diazinon purity NR; Control response NR, No useable tox values [no units])
Rating: N

Relevance—sub-acute
Score: 60 (No standard method; Diazinon purity NR; No toxicity values calculated)
Rating: N

Toxicity Data Summary

Tilapia nilotica

Study: Sakr SA, Gabr SA, El-Saadany MM. 1991. Effect of diazinon on freeze-fracture images of microvilli of intestinal epithelial cells of *Tilapia nilotica*. *Zeitschrift fur Ernahrungswissenschaft* 30:268-275.

Explanation:

- Looks at effects of diazinon on the intramembranous particles (IMPs) of the microvilli after exposure
- Population density of IMPs in microvillus membrane was found lowered in fish exposed to diazinon

Relevance
Score: 45 (no std. method, purity, endpoint, not tox values)
Rating: N

Toxicity Data Evaluation

Tilapia nilotica

Sakr SA, Gabr SA. 1992. Ultrastructural changes induced by diazinon and neopybuthrin in skeletal muscles of *Tilapia nilotica*. *Bull Environ Contam Toxicol* 48:467-473.

Relevance
Score: 52.5 (no std. method, endpoint, purity, not tox values)
Rating: N

Toxicity Data Summary

Umbra limi

Study: Vigfusson NV, Vyse ER, Pernsteiner CA, Dawson RJ. 1983. In vivo induction of sister-chromatid exchange in *Umbra limi* by the insecticides endrin, chlordane, diazinon and guthion. *Mut Res* 118: 61-68.

Relevance
Score: 60 (No standard method; Endpoint no linked to survival, growth, reproduction; 48.72% diazinon formulation)
Rating: N

Toxicity Data Summary

Utterbackia imbecillis

Study: Conners DE, Black MC. 2004. Evaluation of lethality and genotoxicity in the freshwater mussel *Utterbackia imbecillis* (Bivalvia: Unionidae) exposed singly and in combination to chemicals used in lawn care. *Arch Environ Contam Toxicol* 46: 362-371.

Relevance
Score: Mortality: 67.5 (No standard method; 22.4% diazinon formulation, Controls not described);
Genotoxicity: 60 (No standard method; Endpoint not linked to survival, growth, reproduction; 22.4% diazinon formulation)
Rating: Mortality: N; Genotoxicity: N

Toxicity Data Summary

Various insects (family Simuliidae)

Jamnback H, Frempong-Boadu J. 1966. Testing blackfly larvicides in the laboratory and in streams. *Bull Wld Hlth Org* 34: 405-421.

Relevance
Score: 60 (no std. method, purity, not tox values)
Rating: N

Toxicity Data Summary

Various microorganisms (Phyla: Chrysophyta, Cyanophyta, Chlorophyta)

Study: Murray HE, Guthrie RK. 1980. Effects of carbaryl, diazinon, and malathion on native aquatic populations of microorganisms. *Bull Environ Contam Toxicol* 24: 535-542.

Relevance	Reliability
Score: 70 (low purity chemical, no toxicity values)	Score: 42.5
Rating: L	Rating: N

Murray & Guthrie 1980		**Various**
Parameter	**Value**	**Comment**
Test method cited	APHA 1975	
Phylum	Chrysophyta, Cyanophyta, and Chlorophyta	No genus, species identified
Class	NR	
Order	NR	
Family	NR	
Genus	*NR*	
Species	NR	
Found in	N. America	
Age/size at start of test/growth phase	NR	
Source of organisms	Lake Houston	
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	NR	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	14 days	Long for static test
Data for multiple times?	No raw data reported	
Effect 1	Algal cells/mL	$p < 0.05$, significant compared to control
Control response 1	Baseline	
Temperature	21+/- 2 degrees C	Monitored daily during testing
Test type	NR	
Photoperiod/light intensity	12 hour light:dark	
Dilution water	Lake Houston, aerated 1 wk prior to testing	Not sterilized; study looked at effects on bacterial counts, too
pH	NR	

Murray & Guthrie 1980		**Various**
Parameter	**Value**	**Comment**
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	Value not recorded, but monitored daily	
Feeding	NR	
Purity of test substance	NR	
Concentrations measured?	No	Only one concentration used
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration 1 Nom/Meas (mg/L)	5.0; only one concentrations used	3 reps, 10^3 cells/mL
Control	Lake Houston water	1 rep, 10^3 cells/mL

No toxicity values calculated/reported.

Cyanophyta reduced compared to t_0 at 3, 7 and 14 d in treatments and controls.
Total algal cells less than controls at 7 and 14 d.
Chrysophyta numbers reduced at 14 d compared to control at 14 d.

Documentation: Organism age (5), Chemical purity (5), Analytical method (4), Measured concentrations (3), Exposure type (5), Hardness (2), Alkalinity (2), Dissolved oxygen (4), Conductivity (2), pH (3), Statistical methods (5), Hypothesis tests (8), Point estimates (8).
Acceptability: Appropriate duration (2), Chemical purity (10), Measured concentrations within 20% of nominal (4), Carrier solvent (4), Organism size (3), Prior contamination (4), Feeding (3), Organism acclimation (1), Exposure type (2), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Number of concentrations (3), Dilution factor (2), Statistical method (2), Hypothesis tests (3), Point estimates (3).