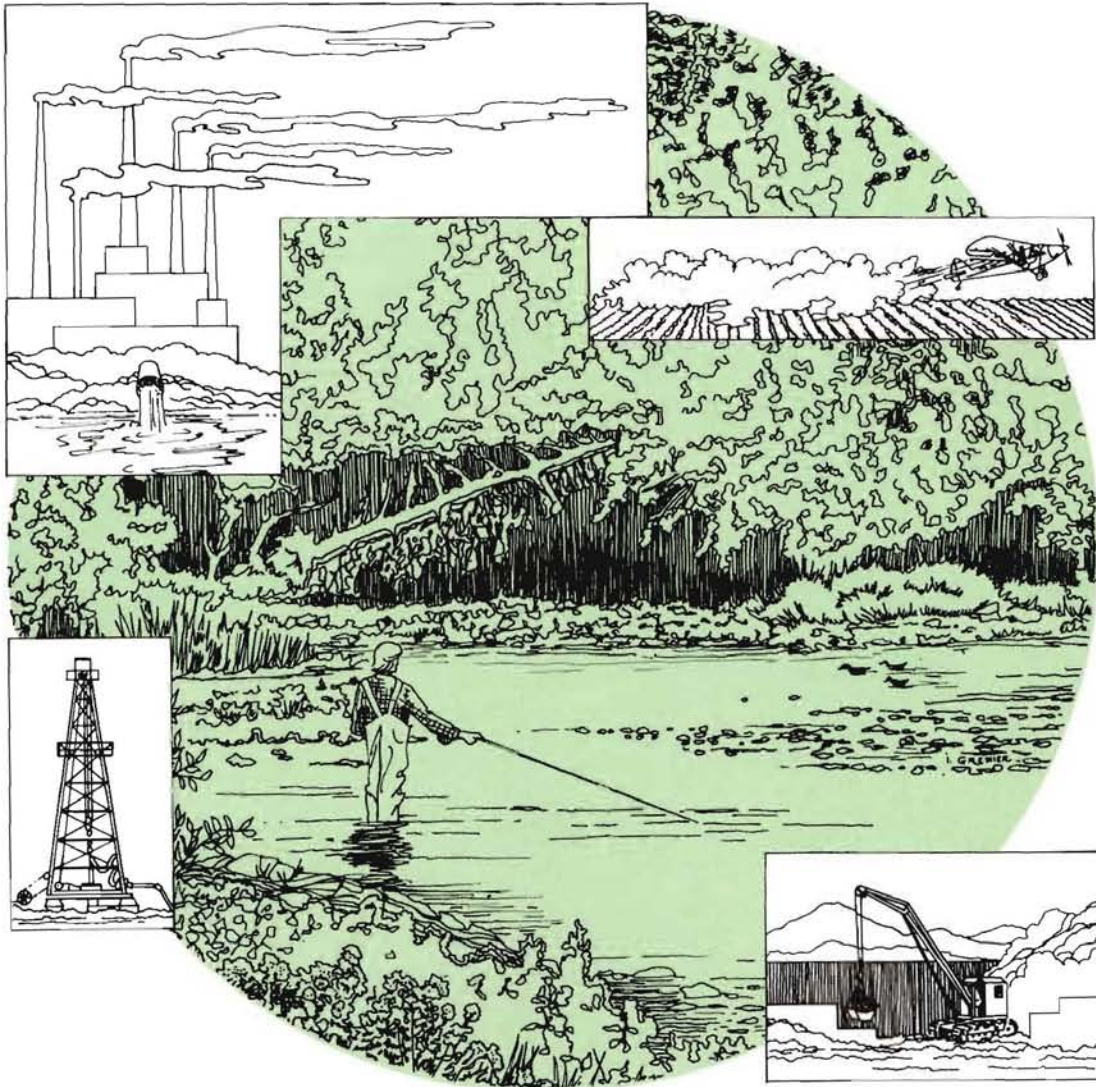


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HANDBOOK OF ACUTE TOXICITY OF CHEMICALS TO FISH AND AQUATIC INVERTEBRATES

Summaries of Toxicity Tests Conducted at Columbia
National Fisheries Research Laboratory, 1965-78

By

WAYNON W. JOHNSON

MACK T. FINLEY



UNITED STATES DEPARTMENT OF THE INTERIOR
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Preface

This Handbook is a compilation of results of toxicity tests on fish and aquatic invertebrates conducted at the Columbia National Fisheries Research Laboratory in 1965-78. These studies, which were initiated under former Laboratory Director Oliver B. Cope, include 1,587 acute toxicity tests on 271 chemicals against 28 species of fish and 30 species of invertebrates. Many scientists and technicians have contributed significantly in one way or another to the Handbook. However, the authors deserve the major credit. Their work spanned several years and included countless evenings of meticulous effort in reviewing and recalculating raw data, judging the quality of findings, editing and compiling summary tables, and preparing the manuscript. Although a number of acute toxicity tests were judged inadequate for inclusion in the Handbook, results of more intensive research were summarized and added for selected chemicals.

The Handbook was produced as (1) a reference source for scientists and resource managers and (2) a contribution to the data base essential to establishing water quality criteria and to estimating potential environmental impacts of chemicals.

To better understand the relative value and use of acute toxicity data, one can group problem chemical contaminants of the Nation into the following three categories: (1) potential future contaminants accompanying development, such as new pesticides, new industrial chemicals, new processes, energy extraction and processing, changing land uses, and population changes; (2) contaminants that exist in aquatic habitats, but are as yet unidentified or are poorly characterized; and (3) the general assemblage of contaminants that have been known to exist in aquatic environments for some time. Laboratory toxicological assessments, including acute toxicity measurements at an early stage, are most appropriate for chemical contaminants in the first two categories. Toxicologists are well aware of the virtues and limitations inherent in the use of the acute toxicity measure, yet there are probably few measurements that have been as misunderstood in evaluating hazard or safety of a chemical to aquatic life as the LC50 (concentration lethal to 50% of the test organisms during a specified exposure period). Users of this Handbook, or users of any acute toxicity data, must bear in mind that the LC50 measures only one biological response—death. Its main value is to provide a relative starting point for evaluation, along with other measurements (e.g., water solubility of the chemical, its partition coefficient, and its degradation rate) of the environmental hazard. In addition, the acute toxicity test provides a rapid, cost efficient way to measure the relative toxicity of different forms and formulations of a chemical in different types of water (acidic, basic, hard, cold, warm) and to organisms representing different trophic levels.

In the early stages of evaluation, where acute measurements are most useful, the LC50 has little more than academic value unless scientists or resource managers can estimate the expected environmental concentration (EEC). At present, procedures for making such estimates are far from precise, and range from "armchair" calculations (based on estimates of volumes or flow rates of water, discharges, application rates, etc.) to estimates based on physical-chemical properties of the chemical and actual analyses of chemical residues present in the abiotic environment.

In general, comparisons of several LC50 values for fish and other aquatic organisms with the EEC should be viewed as a "first cut" in assessing the potential threat of new or little known chemical contaminants. When LC50's are three to four orders of magnitude above the EEC, the long-term effect of a chemical on aquatic life is likely to be small. However, that generalization may not hold for a nontoxic material that physically disrupts, modifies, or destroys aquatic habitat or causes behavioral changes. As the difference between LC50 and EEC declines, consideration must be given to more definitive investigations of bioaccumulation and degradation rates and products, to long-term toxicologic tests, or to integrated laboratory and field ecological studies.

Although the acute toxicity test has been rightly criticized for a variety of technical reasons that are beyond the scope of the present discussion, the principal criticism probably stems from inferential uses of acute toxicity data beyond their limitations, and out of context from other measures necessary for hazard evaluation. Unfortunately, that is the way things are in the real world, because acute toxicity measurements may be the only aquatic effects data available for many chemicals, and then for only a fraction of the thousands of chemicals that have been identified as having potential for escape into the environment. Ideally, evaluators of potential chemical hazards to the environment would prefer a plethora of additional measurements concerning possible effects on growth, reproduction, pathology, biochemistry, populations of aquatic organisms, and ecological relationships. Frankly, the U.S. scientific community does not have the time, research facilities, trained personnel, experimental animals, nor financial resources to provide the additional data needed for "comfortable" predictions of the possible environmental effects of a broad spectrum of chemical contaminants. What is needed is a strategy for concentrating limited scientific resources on those chemicals most likely to have adverse impacts on aquatic systems. Similarly, a chemical-analytical strategy is needed for a more comprehensive approach to the detection, identification, and analysis of a broader spectrum of chemicals in selected environmental compartments. Such strategies would probably not be foolproof and would be different for aquatic ecosystems than for terrestrial ecosystems.

On the brighter side, where rationales exist for targeting research priorities on specific chemicals, toxicological evaluations beyond the acute test are being emphasized. Strategies are being developed to improve quality control in test methods, and to develop schemes for deciding depth of environmental effects testing, particularly under the aegis of the American Society of Testing and Materials and the American Institute of Biological Sciences. It is interesting to note, however, that nearly all such strategies and methods include acute toxicity measurements in the early phases of evaluating effects of pesticides and other potentially toxic materials on aquatic organisms. Unless other techniques can be shown to be equally or more meaningful to aquatic toxicologists, the acute toxicity test is here to stay. For a broader discussion of the methods, uses, and limitations of acute toxicity tests and data, the reader is advised to examine three review papers by Sprague (1969, 1970, 1971), and documents prepared by two groups: the Committee on Methods for Toxicity Tests with Aquatic Organisms (1975); and the Aquatic Hazards of Pesticides Task Group (American Institute of Biological Sciences 1978b).

Richard A. Schoettger, *Director*
Columbia National Fisheries
Research Laboratory

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Numerous scientists and technicians have made major contributions to this Handbook. Under the former Director, Oliver B. Cope, and the present Director, Richard A. Schoettger, funds were provided to support the acute toxicity testing program. Appreciation goes to F. L. Mayer, Jr., for suggestions regarding the selection of chemicals for testing, design of the Handbook format, and for critical review of the manuscript. D. L. Livingston and J. L. Brauhn provided the high-quality organisms needed for testing. Other Federal and State agencies also provided test organisms. Special thanks go to the many chemical companies who provided the compounds for testing.

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Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates

Summaries of toxicity tests conducted at
Columbia National Fisheries Research Laboratory, 1965-78

By

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Introduction

Acute toxicity is a major subject of research at Columbia National Fisheries Research Laboratory for evaluating the impact of toxic chemicals on fishery resources. The Laboratory has played a leading role in developing research technology for toxicity testing and data interpretation. In 1965-78, more than 400 chemicals were tested against a variety of invertebrates and fish species representative of both cold- and warm-water habitats.

The use of acute toxicity tests for assessing the potential hazard of chemical contaminants to aquatic organisms is well documented (Boyd 1957; Henderson et al. 1960; Sanders and Cope 1966; Macek and McAllister 1970). Static acute toxicity tests provide rapid and (within limits) reproducible concentration-response curves for estimating toxic effects of chemicals on aquatic organisms. These tests provide a data base for determining relative toxicity of a large number of chemicals to a variety of species and for estimating acute effects of chemical spills on natural aquatic systems; they also assist in determining priority and design of additional toxicity studies.

Acute toxicity tests usually provide estimates of the exposure concentration causing 50% mortality (LC50) to test organisms during a specified period of time. For certain invertebrates, the effective concentration is based on immobilization, or some other identifiable endpoint, rather than on lethality. The application of the LC50 has gained acceptance among toxicologists and is generally the most highly rated test for assessing potential adverse effects of chemical contaminants to aquatic life (Brungs and Mount 1978; American Institute for Biological Sciences 1978a).

The literature contains numerous papers dealing with the acute toxicity of chemicals to freshwater organisms. However, there is a tremendous need for a concise compendium of toxicity data covering a large variety of chemicals and test species. This Handbook is a compilation of a large volume of acute toxicity data from the Columbia Laboratory and its field laboratories. It presents definitive acute toxicity data on 271 chemicals tested against a variety of freshwater invertebrates and fishes. The chemicals represent all major groups of pesticides, as well as numerous industrial chemicals. This compilation should serve as a useful data base for the many agencies and organizations dealing with research and management programs concerned with the impact of chemicals on aquatic resources.

The Columbia Laboratory has played a major role in developing currently used standard methodology for static acute toxicity testing. The use of standardized methodology greatly reduces variation in results. The data presented here have been carefully scrutinized to eliminate tests that failed to follow acceptable procedures. Handling of test organisms and procedures for static toxicity tests followed those described by Lennon and Walker (1964) and Macek and McAllister (1970), and conform well with those recommended by Brauhn and Schoettger (1975) and the Committee on Methods for Toxicity Tests with Aquatic Organisms (1975).

The species of fish and invertebrates that were tested are listed in phylogenetic order in Tables 1 and 2. Fish were obtained from Federal and State hatcheries as either eggs or fry. Original stocks of invertebrates were collected and cultured from wild populations with no known source of contamination; these populations were replenished regularly. The invertebrates were cultured in the Laboratory by methods similar to those described by Sanders and Cope (1966).

Test chemicals usually consisted of technical or analytical grade samples of known purity. Formulations

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of the chemicals were also tested when available. When purity of test chemicals was known, all calculated concentrations were based on percent active ingredients. Stock solutions were prepared immediately before each test, with commercial grade acetone as the carrier solvent. Occasionally, ethanol or dimethylformamide was substituted. Solvent concentrations did not exceed 0.5 mL/L in final dilution water.

Test water (dilution water) was reconstituted from deionized water of at least 10^6 ohms resistivity by the addition of appropriate reagent grade chemicals (Marking 1969). Water was buffered to maintain a pH of 7.2 to 7.5, an alkalinity of 30 to 35 mg/L, and a hardness of 40 to 50 mg/L as CaCO_3 . Test water was mixed thoroughly and aerated before transfer into test chambers. Fish were acclimated to dilution water by gradually changing the water in acclimation tanks from 100% well water to 100% reconstituted water over a 1- to 3-day period at the desired testing temperature. Invertebrates were acclimated from well water to dilution water over a 4- to 6-h period. Toxicity tests were conducted under static conditions without aeration, and the organisms were not fed during acclimation or testing. Temperature of test solutions was maintained within $\pm 1^\circ\text{C}$ of that required for a given test.

Toxicity tests with fish were conducted in 18.9-liter (5-gal) wide-mouthed jars containing 15 liters of test solution. Fingerling fish weighing 0.2 to 1.5 g were tested at each concentration. Caution was taken not to exceed 0.8 g of test organisms per liter of solution. Duplicate test chambers were used to accommodate larger fish. Test chambers varied in size for invertebrates, depending on the species used; volume of test solution ranged from 0.25 to 4 liters. At least 10 organisms were exposed to each concentration for all definitive tests. At least six concentrations were used per toxicity test.

The tests began upon initial exposure to the toxicant and continued for 96 h. Immobilization tests with invertebrates were conducted for only 48 h. The number of dead or affected organisms in each test chamber was recorded and the dead organisms were removed every 24 h; general observations on the condition of test organisms were also recorded at these times.

Toxicity data were analyzed by a statistical method described by Litchfield and Wilcoxon (1949) to determine LC50 (theoretical estimate of the concentration lethal to 50% of the test animals) and 95% confidence intervals. This method is recommended by the American Public Health Association (1971) and by Sprague (1969) for determining median lethal concentrations. The procedure is easily modified for computing a single LC50 when replicate tests are performed.

Arrangement of Data

In the section on toxicological data, acute toxicity data are summarized separately for each of the 197 chemicals arranged alphabetically by common name in Table 3. Results of tests with an additional group of 74 chemicals, for which only limited data were available, are summarized in Table 4 (p. 81).

The EC50 and LC50 values and their 95% confidence intervals are expressed as either mg/L (ppm) or $\mu\text{g/L}$ (ppb). The standard 96-h LC50 is presented for fish and most invertebrates; 48-h EC50 values are given for daphnids and midges. Exceptions to this form of data presentation fall into one of three categories: (1) when confidence intervals could not be calculated, only the LC50 is reported; (2) when the LC50 could not be calculated because of heterogeneity of the data, range values are presented, usually at 0.5 to 1.0 logarithmic interval; (3) when the LC50 was not calculated but was outside the limits of the test concentrations the values are expressed as "greater than" ($>$) or "less than" ($<$).

For many of the chemicals tested, a NOTE section following the summary of acute toxicity highlights additional toxicity data, when available. Results are given for acute toxicity tests in which different pH's, temperatures, or hardnesses, or aged test solutions (chemical deactivation) were used. Also, variations in sensitivity due to size or developmental life stage of the test organisms are included. Time-independent LC50 (TILC50) values—mathematically derived toxicant concentrations at which 50% of the test animals would be expected to survive indefinitely—are summarized for some chemicals. Organisms are exposed to toxicants under flow-through conditions for up to 30 days, and the TILC50's are calculated by the method of Green (1965), as modified by the additional requirements recommended by Johnson and Julin (1980). The cumulative action of a test chemical can be estimated by computing the ratio of the 96-h LC50 to the TILC50. This ratio or the "cumulative toxicity index" serves as an estimate of the cumulative action of a toxicant (Hayes 1967; Tucker and Crabtree 1970). Chemicals with an index of less than 11 are not considered highly cumulative. We have also added summaries of the results from chronic toxicity studies concerning effects on survival, growth, reproduction, residue dynamics, physiology and biochemistry, or histopathology.

A glossary of terms is given in Appendix I, a cross-index of chemical equivalent names in Appendix II, and a list of publications originating from the Columbia Laboratory that contain toxicity data on any chemicals covered in this Handbook, in Appendix III.

Table 1. Common and scientific names of invertebrates used for acute toxicity testing.^a

Order, genus, and species	Common name
Anostraca	Fairy shrimps
<i>Streptocephalus seali</i>	
Cladocera	Daphnids
<i>Simocephalus serrulatus</i>	
<i>Daphnia magna</i>	
<i>Daphnia pulex</i>	
Ostracoda	Seed shrimps
<i>Cypridopsis vidua</i>	
Isopoda	Sowbugs
<i>Asellus brevicaudus</i>	
Amphipoda	Scuds
<i>Gammarus pseudolimnaeus</i>	
<i>Gammarus lacustris</i>	
<i>Gammarus fasciatus</i>	
Decapoda	
<i>Orconectes nais</i>	Crayfish
<i>Procambarus</i> sp.	Crayfish
<i>Palaemonetes kadiakensis</i>	Glass shrimp
Plecoptera	Stoneflies
<i>Pteronarcella badia</i>	
<i>Pteronarcys californica</i>	
<i>Acroneuria</i> sp.	
<i>Claassenia sabulosa</i>	
<i>Isoperla</i> sp.	
<i>Skwala</i> sp.	
Ephemeroptera	Mayflies
<i>Hexagenia bilineata</i>	
<i>Baetis</i> sp.	
Odonata	
<i>Macromia</i> sp.	Dragonflies
<i>Ischnura venticularis</i>	Damselfly
<i>Lestes congener</i>	Damselfly
Trichoptera	Caddisflies
<i>Hydropsyche</i> sp.	
<i>Limnephilus</i> sp.	
Diptera	
<i>Tipula</i> sp.	Crane flies
<i>Chaoborus</i> sp.	Phantom midges
<i>Pentaneura</i> sp.	Midges
<i>Chironomus plumosus</i>	Midge
<i>Atherix variegata</i>	Snipe fly

^aThe following life stages of invertebrates were tested: daphnids—first instar; crayfish—early instar; stonefly—first year class (1-20 mm long), second year class (20-40 mm long); and midge—fourth instar. All other invertebrates were designated as naiad, juvenile, or mature.

Table 2. Common and scientific names of fish used for acute toxicity testing.

Family, genus, and species	Common name
Polyodontidae	
<i>Polyodon spathula</i>	Paddlefish
Salmonidae	
<i>Oncorhynchus kisutch</i>	Coho salmon
<i>Oncorhynchus tshawytscha</i>	Chinook salmon
<i>Salmo clarki</i>	Cutthroat trout
<i>Salmo gairdneri</i>	Rainbow (steelhead) trout
<i>Salmo salar</i>	Atlantic salmon
<i>Salmo trutta</i>	Brown trout
<i>Salvelinus fontinalis</i>	Brook trout
<i>Salvelinus namaycush</i>	Lake trout
Esocidae	
<i>Esox lucius</i>	Northern pike
Cyprinidae	
<i>Carassius auratus</i>	Goldfish
<i>Cyprinus carpio</i>	Carp
<i>Pimephales promelas</i>	Fathead minnow
Catostomidae	
<i>Catostomus commersoni</i>	Longnose sucker
<i>Catostomus commersoni</i>	White sucker
Ictaluridae	
<i>Ictalurus melas</i>	Black bullhead
<i>Ictalurus punctatus</i>	Channel catfish
Clariidae	
<i>Clarias batrachus</i>	Walking catfish
Poeciliidae	
<i>Gambusia affinis</i>	Mosquitofish
Centrarchidae	
<i>Lepomis cyanellus</i>	Green sunfish
<i>Lepomis macrochirus</i>	Bluegill
<i>Lepomis microlophus</i>	Redear sunfish
<i>Micropterus dolomieu</i>	Smallmouth bass
<i>Micropterus salmoides</i>	Largemouth bass
<i>Pomoxis annularis</i>	White crappie
<i>Pomoxis nigromaculatus</i>	Black crappie
Percidae	
<i>Perca flavescens</i>	Yellow perch
<i>Stizostedion vitreum vitreum</i>	Walleye

Table 3. List of chemicals included in this handbook.^a

Common name	Chemical name
Acephate	0,S-dimethyl N-acetylphosphoramidothioate
Acetone*	2-propanone
Akton	0,0-diethyl 0-[2-chloro-1-(2,5-dichlorophenyl)] vinyl phosphorothioate
Alachlor	2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide
Aldicarb*	2-methyl-2-(methylthio) propionaldehyde-0-(methylcarbamoyl) oxime
Aldrin	1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4-endo-exo-5,8-dimethanonaphthalene
Allethrin	d1-2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one ester of d1 cis/trans-2,2-dimethyl-3-(2-methyl-propenyl)-cyclopropanecarboxylic acid
Ametryn*	2-(ethylamino)-4-(isopropylamino)-6(methylthio)-1,3,5-triazine
Aminocarb	4-(dimethylamino)-m-tolyl methylcarbamate
Amitrol*	3-amino-s-triazole
Antimycin A	Antimycin antibiotic (isolated from <i>Streptomyces</i>)
Aramite	2-(p-tert-butylphenoxy)-1-methylethyl-2-chloroethyl sulfite
Azide	potassium or sodium azide
Azinphos ethyl	0,0-diethyl S-[(4-oxo-1,2,3-benzotriazin-3(4H)-yl)methyl] phosphorodithioate
Azinphos methyl	0,0-dimethyl S-[(4-oxo-1,2,3-benzotriazin-3(4H)-yl)methyl] phosphorodithioate
Azodrin	dimethyl phosphate of 3-hydroxy-N-methyl-cis-crotonamide
Bayluscide	2',5-dichloro-4'-nitrosalicylamide, 2-aminoethanolsalt
Benefin*	N-butyl-N-ethyl- α,α,α -trifluoro-2,6-dinitro-p-toluidine
Benomyl	methyl 1-(butyl carbamoyl)-2-benzimidazolecarbamate
Bensulide*	0,0-diisopropyl phosphorodithioate S-ester of N-(2-mercaptoethyl) benzenesulfonamide
Benzene*	benzene (C ₆ H ₆)
Benzene hexachloride	1,2,3,4,5,6-hexachlorocyclohexane
Binapacryl	2-sec-butyl-4,6,-dinitrophenyl-3-methyl-2-butenolate
Bufencarb*	m-(1-ethylpropyl) phenyl methylcarbamate and m-(1-methylbutyl) phenyl methylcarbamate mixture
Butylate*	S-ethyl-N,N-diisobutylthiocarbamate
Captafol	cis-N-(1,1,2,2-tetrachloroethylthio)-4-cyclohexene-1,2-dicarboximide
Captan	N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide
Carbaryl	1-naphthyl N-methylcarbamate
Carbofuran	2,3-dihydro-2,2-dimethyl-7-benzofuranyl methyl carbamate
Carbophenothion	S-(p-chlorophenyl methylthio)0,0-diethyl phosphorodithioate
Chlorbromuron*	3-(4-bromo-3-chlorophenyl)-1-methoxy-1-methylurea
Chlordane	1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene
Chlordane HCS-3260	1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene
Chlordimeform*	N'-(4-chloro-o-tolyl)-N,N-dimethylforamidine
Chlorendate	dibutyl and dimethyl esters of 1,4,5,6,7,7-hexachloro-(2.2.1)-bicyclo-5-heptene-2,3-dicarboxylic acid
Chlorfenethol*	1,1-bis(4-chlorophenyl) ethanol
Chlorobenzilate*	ethyl-4,4'-dichlorobenzilate
Chloronitropropane*	1-chloro-2-nitropropane
Chlorowax	chlorinated n-paraffin of C ₁₀ -C ₃₀
Chloroxuron*	3-[p-(p-chlorophenoxy)phenyl]-1,1-dimethylurea
Chlorpyrifos	0,0-diethyl 0-(3,5,6-trichloro-2-pyridyl) phosphorothioate
Copper count	copper ammonium sulfate
Copper sulfate	copper sulfate pentahydrate
Coumaphos	0,0-diethyl 0-(3-chloro-4-methyl-2-oxy(2H)-1-benzopyran-7-yl) phosphorothioate
Crotoxphos	dimethyl cis-1-methyl-2-(1-phenylethoxycarbonyl) vinyl phosphate
Crufomate*	4-tert-butyl-2-chlorophenyl methyl methylphosphoramidate
Cryolite	sodium fluoaluminate
Cyanazine	2-[[4-chloro-6-(ethylamino)-S-triazin-2-yl]amino]-2-methyl-propionitrile
Cyclohexamide*	3-[2-(3,5-dimethyl-2-oxycyclohexyl)-2-hydroxyethyl]glutarimide
Cycocel*	(2-chloroethyl)trimethyl ammonium chloride
Cytrol amitrole-T	mixture of aminotriazole and ammonium thiocyanate
Dalapon	2,2-dichloropropionic acid
D-D soil fumigant	mixture of 1,3-dichloropropane, 1,3-dichloropene, and related C ₃ compounds
DDD	dichloro diphenyl dichloroethane
DDE	dichloro diphenyl dichloroethylene

Table 3. Continued

Common name	Chemical name
DDT	dichloro diphenyl trichloroethane
Deet*	N,N-diethyl-meta-toluamide
DEF	S,S,S-tributyl phosphorotrithioate
Demeton	0,0-diethyl 0-[2-(ethylthio)ethyl] phosphorothioate and 0,0-diethyl S-[2-(ethylthio)ethyl] phosphorothioate
Diazinon	0,0-diethyl 0-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate
Dicamba	2-methoxy-3,6-dichlorobenzoic acid
Dichlobenil	2,6-dichlorobenzonitrile
Dichlofenthion	0,0-diethyl 0-(2,4-dichlorophenyl) phosphorothioate
Dichlormate*	mixture of 3,4- and 2,3-dichlorobenzyl N-methylcarbamate
Dichloropropene	1,3-dichloropropene
Dichlorvos	2,2-dichlorovinyl dimethyl phosphate
Dicofol	1,1-bis (4-chlorophenyl)-2,2,2-trichloroethanol
Dicrotophos	dimethyl cis-2-dimethyl-carbamoyl-1-methylvinyl phosphate
Dieldrin	1,2,3,4,10,10-hexachloro-exo-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo-exo-5,8-dimethanonaphthalene
Diflubenzuron	N-[[[4-chlorophenyl]amino]carbonyl]-2,6-difluorobenzamide
Dilan*	mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis (p-chlorophenyl)-2-nitrobutane
Dimethoate	0,0-dimethyl S-(N-methylcarbamoylmethyl) phosphorodithioate
Dimethrin	2,4-dimethylbenzyl-2,2-dimethyl-3-(2-methylpropenyl) cyclopropanecarboxylate
Dimethylformamide*	N,N-dimethylformamide
Dimethyl sulfoxide*	dimethyl sulfoxide
Dinitramine	N ³ ,N ³ -diethyl-2,4-dinitro-6-(trifluoromethyl)-1,3-phenylenediamine
Dinitrocresol	4,6-dinitro-o-cresol
Dinocap	2,4-dinitro-6-octyl phenyl crotonate (reaction mixture)
Dinoseb	2-(sec-butyl)-4,6-dinitrophenol
Dioxathion	2,3-p-dioxanedithiol S,S-bis (0,0-diethyl phosphorodithioate)
Diphenamid	N,N-dimethyl-2,2-diphenylacetamide
Diquat	6,7-dihydrodipyrido [1,2-a:2',1'-c] pyrazinediium dibromide, monohydrate
Disulfoton	0,0-diethyl S-[2-(ethylthio)ethyl] phosphorodithioate
Diuron	3-(3,4-dichlorophenyl)-1,1-dimethylurea
Dodine*	n-dodecylguanidine acetate
d-trans Allethrin	d1-2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one ester of d-trans chrysanthemum monocarboxylic acid
Du-ter	triphenyltin hydroxide
Dyrene	2,4-dichloro-6-(o-chloroanilino)-s-triazine
Emcol AD-410*	calcium salt of dodecyl benzene sulfonic acid and polyoxyethylene ethers
Endosulfan	6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide
Endothall	7-oxabicyclo(2.2.1) heptane-2,3-dicarboxylic acid
Endrin	1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo, endo-5,8-dimethanonaphthalene
EPN	0-ethyl-0-(p-nitrophenyl) phenyl phosphonothioate
EPTC	S-ethyl dipropylthiocarbamate
Ethanol*	ethyl alcohol
Ethion	0,0,0',0'-tetraethyl S,S'-methylene bisphosphorodithioate
Ethofumesate	2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate
Ethyl benzene*	ethyl benzene
Ethylene dichloride*	1,2-dichloroethane
Ethylene glycol*	1,2-ethanediol
Monomethyl ether*	2-methoxyethanol
Fenac	2,3,6-trichlorophenyl acetic acid
Fenamiosulf	p-(dimethylamino) benzenediazo sodium sulfonate
Fenitrothion	0,0-dimethyl 0-(4-nitro-m-tolyl) phosphorothioate
Fenson*	p-chlorophenyl benzenesulfonate
Fensulfothion*	0,0-diethyl 0-[p-(methylsulfinyl) phenyl] phosphorothioate
Fenthion	0,0-dimethyl 0-[4-(methylthio)-m-tolyl] phosphorothioate
Fire-Trol 100	ammonium sulfate plus, additives
Fire-Trol 931	ammonium polyphosphate, plus additives

Table 3. Continued

Common name	Chemical name
Fluometuron*	1,1-dimethyl-3-3-(trifluoromethylphenyl) urea
Folpet	N-(trichloromethylthio) phthalimide
Fonofos*	O-ethyl-S-phenylethyl phosphonodithioate
Garlon 3A*	3,5,6-trichloro-2-pyridinyloxyacetic acid
Geranol*	4-ethylphenyl-6,7-epoxygeranyl ether
Glycerol*	1,2,3-propanetriol
Glyphosate	N-(phosphonomethyl) glycine
Gophacide*	0,0-bis(p-chlorophenyl) acetimidoylphosphoramidodithioate
Halowax 1099*	mixture of trichloro- and tetrachloronaphthalene
Heptachlor	1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene
Hexachlorobenzene	hexachlorobenzene
Houghto-Safe 1120	mixture of tri-aryl phosphate esters
Jodfenphos*	0,0-dimethyl-0-(2,5-dichloro-4-iododophenyl) phosphorothioate
Kepone	decachlorooctahydro-1,3,4-metheno-2H-cyclobuta [cd]pentalen-2-one
Kling-Tite 800*	potassium 1-naphthaleneacetate
Landrin*	mixture of 3,4,5-methylphenyl and 2,3,5-methylphenyl methylcarbamate
Lead arsenate*	diplumbic hydrogen arsenate
Leptophos	0-(4-bromo-2,5-dichlorophenyl) 0-methylphenylphosphonothioate
Lethane 384*	2-(2-butoxyethoxy)ethyl thiocyanate
Lignasan	methyl 2-benzimidazolecarbamate phosphate
Lime sulfur	calcium polysulfide
Lindane	gamma isomer of 1,2,3,4,5,6-hexachlorocyclohexane
Malathion	0,0-dimethyl S-(1,2-dicarbethoxyethyl) phosphorodithioate
Merphos*	tributyl phosphorotrithioite
Methanol*	methyl alcohol
Methidathion*	0,0-dimethyl phosphorodithioate, S-ester with 4-(mercaptomethyl)-2-methoxy-1,3,4-thiadiazolin-5-one
Methiocarb*	4-(methylthio)-3,5-xylol methylcarbamate
Methomyl	S-methyl-N-[(methylcarbamoyl)oxy]thioacetimide
Methoprene	isopropyl (2E,4E)-11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate
Methoprotryne*	2-(isopropylamino)-4-[(3-methylpropyl)amino]-6-(methylthio)-s-triazine
Methoxychlor	2,2-bis(p-methoxyphenyl)-1,1-trichloroethane
Methyl-Demeton*	0,0-dimethyl S-(and O)-[2-(ethylthio)ethyl] phosphorothioate
Methyl trithion	S-(((p-chlorophenyl)thio)methyl) 0,0-dimethyl phosphorodithioate
Mevinphos	dimethyl phosphate of methyl-3-hydroxy-cis-crotonate
Mexacarbate	4-(dimethylamino)-3,5-xylol methylcarbamate
Mirex	dodecachlorooctahydro-1,3,4-metheno-2H-cyclobuta(cd)pentalene
Molinate	S-ethyl hexahydro-1 H-azepine-1-carbothioate
MON-0818	unknown
Monoethanolamine*	2-aminoethanol
Morsodren*	cyano(methylmercuri)guanidine
MSMA	monosodium methanearsonate
Naled	1,2-dibromo-2,2-dichloroethyl dimethyl phosphate
Niclosamide*	5-chloro-N(2-chloro-4-nitrophenyl)-2-hydroxybenzamide 2-amino ethanol salt
Nitralin	4-(methylsulfonyl)-2,6-dinitro-N N-dipropylaniline
Nitrofen*	2,4-dichlorophenyl-p-nitrophenyl ether
Norea*	3-(hexahydro-4,7-methanoindan-5-yl)-1,1-dimethylurea
N-Serve*	2-chloro-6-(trichloromethyl)pyridine
Ortho-11775	3-(2-butyl)phenyl-N-methyl-N-(phenylsulfonyl) carbamate
Oryzalin*	3,5-dinitro-N,N'-dipropylsulfanilamide
Oxydemeton-methyl	S-[2-(ethylsulfinyl)ethyl] 0,0-dimethyl phosphorothioate
Paraquat	1,1-demethyl-4,4'-bipyridinium ion (dichloride and bis (methylsulfate) salt
Parathion ethyl	0,0-diethyl 0-p-nitrophenyl phosphorothioate
Parathion methyl	0,0-dimethyl-0-p-nitrophenyl phosphorothioate
Pentachlorophenol	pentachlorophenol
Sodium salt	sodium pentachlorophenolate
Permethrin	3-(phenoxyphenyl)methyl(1-cis,trans-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropane-carboxylate

Table 3. Continued

Common name	Chemical name
Perthane*	1,1-dichloro-2,2-bis(4-ethylphenyl)ethane
Phenoxy herbicides	
2,4-D's	2,4-dichlorophenoxyacetic acid
2,4,5-T's	2,4,5-trichlorophenoxyacetic acid
2,4-D/2,4,5-T	mixtures of derivatives of 2,4-D and 2,4,5-T
Phorate	0,0-diethyl S-[(ethylthio)methyl] phosphorodithioate
Phosalone	0,0-diethyl S-[6-chloro-3-(mercaptomethyl)-2-benzoxazolinone] phosphorodithioate
Phos-Chek	diammonium phosphate, plus additives
Phosmet	N-(mercaptomethyl)phthalimide S-(0,0-dimethyl phosphorodithioate)
Phosphamidon	2-chloro-N,N-diethyl-3-(dimethoxyphosphinyloxy) crotonamide
Phoxim	phenylglyoxylonitrile oxime 0,0-diethyl phosphorothioate
Phthalic acid esters	
DBP	n-butyl ester of phthalic acid
DEHP	di-2-ethylhexyl ester of phthalic acid
Phygon XL	2,3-dichloro-1,4-naphthoquinone
Phytar 560	sodium salt of cacodylic acid
Picloram	4-amino-3,5,6-trichloropicolinic acid
Piperonyl butoxide	α -[2-(2-butoxyethoxy)ethoxyl]-4,5-metholenedioxy-2-propyltoluene
Pipron*	3-(2-methylpiperidino)propyl-3,4-dichlorobenzoate
Plictran	tricyclohexyltin hydroxide
Polychlorinated phenyls	
biphenyls	1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, 1268
terphenyls	4465, 5442, 5460
Propanil*	3',4'-dichlorophenylpropionanilide
Propham	isopropyl N-phenylcarbamate
Propoxur	0-isopropoxyphenyl N-methylcarbamate
Purifloc C-31	synthetic organic polyelectrolyte
Pydraul 50E	mixture of tri-aryl phosphate esters
Pydraul 115E	mixture of tri-aryl phosphate esters
Pyrethrum	mixture of natural pyrethrins
Reldan*	0,0-dimethyl 0-(3,5,6-trichloro-2-pyridyl)phosphorothioate
Resmethrin	(5-benzyl-3-furyl)methyl 2,2-dimethyl-3-(2-methyl propenyl) cyclopropanecarboxylate
Roccal*	alkyl dimethyl benzylammonium chloride
Ronnel	0,0-dimethyl 0-(2,4,5-trichlorophenyl) phosphorothioate
Rotenone	1,2,12,12a-tetrahydro-2-isopropenyl-8,9-dimethoxy[1] benzopyrano[3,4-b]furo[2,3-b][1]benzopyran-6(6aH)-one
RU-11679	(5-benzyl-3-furyl) methyl 1R, 2R-2-(cyclopentylidene) methyl-3,3-dimethylcyclopropane carboxylate
Ryania	powdered stemwood of <i>Ryania speciosa</i>
S-bioallethrin	d-trans-chrysanthemum monocarboxylic acid ester of d-2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one
SD-14114	distannoxane, hexakis (beta,beta-dimethyl-phenethyl)
SD-17250	N-[(methylcarbamoyl)oxy]thioacetimidic acid ester with 3-mercaptopropionitrile
Simazine	2-chloro-4,6-bis(ethylamino)-s-triazine
Sodium arsenite	sodium arsenite
Stabilene*	polypropylene glycol monobutylether
Stirofos*	2-chloro-1-(2,4,5-trichlorophenyl)vinyl dimethyl phosphate
Strobane	polychlorinates of camphene, pinene, and related terpenes
Suffix	ethyl N-benzoyl-N-(3,4-dichlorophenyl)-2-aminopropionate
2,3,6-TBA*	2,3,6-trichlorobenzoic acid
Temephos	0,0,0',0'-tetramethyl 0,0'-(thiodi-p-phenylene) phosphorothioate
Tepa*	tris(1-aziridinyl)phosphine oxide
TEPP	tetraethyl diphosphate
Terbutryn*	2-(tert-butylamino)-4-(ethylamino)-6-(methylthio)-s-triazine
Tetradifon	4-chlorophenyl 2,4,5-trichlorophenyl sulfone, (2,4,5,4'-tetrachlorodiphenyl sulfone)
Tetramine	tetramethylene disulfotetramine
TFM	3-trifluoromethyl-4-nitrophenol, sodium salt
Thanite	isobornyl thiocynoacetate

Table 3. Continued

Common name	Chemical name
Thiobencarb	5-(4-chlorobenzyl)N,N-diethylthiolcarbamate
Thynon	5,10-dihydro-5,10-dioxonaphtho(2,3b)-p-dithiin-2,3-dicarbonitrile
Toluene*	toluene
Toxaphene	chlorinated camphene (67-69% chlorine) mixture
Tranid*	exo-3-chloro-endo-6-cyano-2-norbornanone 0-(methylcarbamoyl)oxime
Trefmid*	mixture of diphenamid and trifluralin
Tretolite	unknown
Trichlorfon	dimethyl(2,2,2-trichloro-1-hydroxyethyl) phosphonate
Trichloronat*	0-ethyl 0-(2,4,5-trichlorophenyl)ethyl phosphonothioate
Tricresyl phosphate	tricresyl phosphate
Trifluralin	4,4,4-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine
Ureabor	mixture of sodium metaborate tetrahydrate, sodium chlorate, and bromacil
Velpar*	3-cyclohexyl-6-(dimethylamino)-1-methyl-S-triazine-2,4(1H,3H)-dione
Vernolate	S-propyl N,N-dipropylthiocarbamate
Warfarin*	3(a-acetonylbenzyl)-4-hydroxycoumarin
Xylene*	dimethyl benzene

*Chemicals are listed alphabetically by common or generic names proposed by organizations such as the Weed Science Society of America and the Entomological Society of America. Common names followed by an asterisk designate chemicals subjected to limited toxicity testing, which are summarized in Table 4 (p. 81).

Toxicological Data

Summary tables of toxicity data are arranged separately for each chemical tested. Chemicals are arranged alphabetically by common name, along with the generic chemical name, any known trade names and synonyms, principal use, and purity of test samples. In chemical names occupying two or more lines, an equal sign (=) at the end of a line indicates that the name is continuous (to be written solid, not spaced or hyphenated). If the chemical name is not shown, the chemical composition of the commercial compound has not been made available by the manufacturer. If no principal use is given, none is known. Where the sample description includes more than one formulation, each is followed by a superscript number that identifies (by the same superscript number) the organisms in the table against which the formulation was tested. Toxicity data for technical grade material are listed first, followed by data for different formulations. Species tested are listed phylogenetically for each formulation. Included with all toxicity values are the weights or development stages of the test organisms and the testing temperature. Except where otherwise indicated, toxicity values are expressed as either mg/L (ppm) or $\mu\text{g/L}$ (ppb).

The following abbreviations are used throughout the summary tables: Fish—YSF = yolk sac fry; SUF=swim-up fry; J=juvenile; F=fingerling. Invertebrates—*G*=*Gammarus*; *I*₁=first instar; *I*₂=early instar; *I*₄=fourth instar; *YC*₁=first year class; *YC*₂=second year class; N=naiad; J=juvenile; and M=mature.

ACEPHATE

Chemical Name: 0,S-Dimethyl N-acetylphos=phoramidothioate

Alternate Names: ENT-27822, Orthene, Ortho 12420, Ortran, RE 12420

Principal Use: Herbicide

Sample Description: Technical material, 94%¹; soluble powder, 75%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. pseudolimnaeus</i> ¹	M	12	> 50
<i>Pteronarcella</i> ¹	N	12	9.5 7.3-12.3
<i>Skwala</i> ¹	N	7	12 8.7-16
<i>Chironomus</i> ¹	I ₄	20	> 1,000
Cutthroat trout ¹	0.7	12	> 100
Rainbow trout ¹	1.5	10	1,100 775-1,561
Brook trout ¹	0.2	12	> 100

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Fathead minnow ¹	1.0	20	> 1,000
Channel catfish ¹	2.0	22	> 1,000
Bluegill ¹	0.4	20	> 1,000
Yellow perch ¹	2.0	12	> 50
<i>Skwala</i> ²	N	7	12 8.0-18
Cutthroat trout ²	0.9	12	> 100
Rainbow trout ²	1.2	10	730 580-920
Fathead minnow ²	1.0	20	> 1,000
Channel catfish ²	0.5	22	560-1,000
Bluegill ²	0.4	20	> 1,000
Yellow perch ²	1.8	12	> 100

NOTE: Alterations in temperature (7°-20°C), pH (6.5-9.5), and hardness (12-300 ppm) did not alter toxicity to trout, bluegills, or yellow perch. An increase in pH from 6.5 to 8.5 increased 96-h LC50's in stonefly naiads (*Pteronarcella*) from 6.4 to 21 mg/L. Aging of test solutions for 7 days did not alter the toxicity to midge larvae (*Chironomus*).

AKTON

Chemical Name: 0,0-Diethyl 0-[2-chloro-1-(2,5-dichlorophenyl)] vinyl phosphorothioate

Alternate Names: Axiom, CAS-1757-18-2, ENT-27102, SD-9098

Principal Use: Non-systemic soil insecticide

Sample Description: Technical material, 80%¹; emulsifiable concentrate, 2 lb/gal²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
Channel catfish ¹	0.7	18	400 295-542
Bluegill ¹	1.1	18	0.17 0.10-0.27

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
Redear sunfish ¹	2.5	18	0.38 0.17-0.85
Rainbow trout ²	1.2	12	1,200 1,080-1,370
Fathead minnow ²	—	12	270

ALACLOR

Chemical Name: 2-Chloro-2'-diethyl-N-methoxy-methyl) acetanilide

Alternate Names: Lasso, WSSA, MAF, CP50144, Lazo

Principal Use: Herbicide

Sample Description: Technical material, 100%¹; liquid, 43%²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ¹	0.8	12	2.4 1.8-3.1
Bluegill ¹	1.0	22	4.3 3.5-5.5
Rainbow trout ²	0.8	12	1.4 1.1-1.8
Bluegill ²	1.0	22	3.2 2.3-4.5

ALDRIN

Chemical name: 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4-endo-exo-5,8-dimethanonaphthalene

Alternate Names: Aldrine, Aldrite, Aldrosol, CAS-309-00-2, Compound 118, ENT-15949, HHDN, Octalene, Seedrin

Principal Use: Insecticide

Sample Description: Technical material, 90%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i>	I ₁	15	23 ^a 17-30
<i>Simocephalus</i>	I ₁	21	32 ^a 22-36
<i>Daphnia pulex</i>	I ₁	15	28 ^a 20-39
<i>Cypridopsis</i>	M	21	18 ^a 15-21
<i>G. fasciatus</i>	M	21	4,300 3,500-5,300
<i>Palaemonetes</i>	M	21	50 38-65
<i>Pteronarcys</i>	YC ₂	15	1.3 0.8-2.2
Chinook salmon	0.8	15	14.3
Rainbow trout	0.6	13	2.6 2.3-2.9
Fathead minnow	0.6	18	8.2
Black bullhead	1.5	24	19
Channel catfish	5.2	18	53
Bluegill	0.7	18	6.2 5.2-7.7
Largemouth bass	2.5	18	5

^a48-h EC50.

NOTE: Toxicity to fish was not appreciably changed by variations in temperature or water hardness. Temperature variations from 2° to 18°C gave a 96-h LC50 range of 3.4 to 2.6 µg/L for rainbow trout and a variation of 7° to 24°C gave a range of 9.7 to 5.6 µg/L for bluegills. Variations in hardness from 40 to 135 ppm did not change LC50 values for rainbow trout or bluegills. Invertebrates accumulated significant residues when exposed to C¹⁴-labeled aldrin. In *Daphnia magna*, exposure for 3 days to a water concentration of 16 ng/L resulted in a 100,000-fold bioaccumulation. Similarly, *Hexagenia bilineata* and *Chironomus* sp. accumulated residues of 34,000- and 22,800-fold, respectively, when exposed to concentrations of 21 ng/L.

ALLETHRIN

Chemical Name: d1-2-Allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one ester of d1 cis/trans 2,2-dimethyl-3-(2-methylpropenyl)-cyclopropanecarboxylic acid

Alternate Names: Allyl hemolog of cinerin I, CAS-MX8018-12-0, cinerin, cinerolone, ENT-17510, Pallethrine, Pynamin, Pyresyn, Pyrocode, Synthetic Pyrethrin

Principal Use: Insecticide

Sample Description: Technical material, 90%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i>	I ₁	15	56.0 ^a 40.0-78.0
<i>Daphnia pulex</i>	I ₁	15	21.0 ^a 19.0-35.0
<i>G. fasciatus</i>	M	21	11.0 8.0-15.0
<i>Pteronarcys</i>	YC ₂	15	5.6 4.9-6.4
Rainbow trout	0.9	13	19.0
Bluegill	0.9	24	56.0

^a48-h EC50.

AMINOCARB

Chemical Name: 4-(Dimethylamino)-m-tolyl methyl=carbamate

Alternate Names: A-363, Aminocarbe, Bay 44646, CAS-2032-59-9, ENT-25784, Matacil, Metacil

Principal Use: Insecticide

Sample Description: Technical material, 98%¹; liquid formulation, 17%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i> ¹	M	21	12 8.2-18

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
Cutthroat trout ¹	0.8	10	31,000 ^b 18,000-52,400
Rainbow trout ¹	1.5	12	13,500 11,300-16,200
Atlantic salmon ¹	0.4	12	7,600 5,880-9,820
Brown trout ¹	0.5	12	15,000 11,500-19,500
Brook trout ¹	1.0	12	16,000 12,700-20,100
Fathead minnow ¹	0.7	20	8,500 6,500-11,100
Channel catfish ¹	0.6	20	10,000 6,970-14,330
Bluegill ¹	0.6	20	3,100 1,900-5,100
Largemouth bass ¹	0.7	18	3,150 ^b 2,840-3,490 ^b
Yellow perch ¹	0.6	12	6,400 ^b 5,300-7,730
Walleye ¹	0.8	18	880 755-1,030
<i>Daphnia magna</i> ²	I ₁	21	10-100 ^a
<i>G. pseudolimnaeus</i> ²	M	10	> 50 ^b
<i>Chironomus</i> ²	I ₄	20	270 ^a 187-389
Cutthroat trout ²	1.0	10	64 ^b 31-134
Rainbow trout ²	1.5	10	130 103-164
Fathead minnow ²	0.7	20	75 63-90
Channel catfish ²	4.5	20	130 105-160
Bluegill ²	0.6	20	100 68-148

^a48-h EC50.^bTested in hard water.

NOTE: Eyed rainbow trout eggs were not sensitive to the 17% formulation of aminocarb; the 96-h LC50 exceeded 32,000 $\mu\text{g/L}$. A 1.5- to 3.5-fold increase in toxicity was noted when test temperatures were raised from 7° to 17°C for trout and 12° to 27°C for bluegills. A 5- to 15-fold increase in the toxicity of technical aminocarb to fish was noted when the pH was increased from 6.5 to 9.5. Most of the change occurred between pH 8.5 and 9.5; the increase was only twofold or less when variations ranged from 6.5 to 8.5. Aging of test solutions for 4 weeks appeared to have little effect on the toxicity to fish. Brown trout showed a twofold increase in toxicity after 1 week of aging but no further change occurred after 2 additional weeks. Time-independent LC50's for rainbow trout and bluegills were 22 and 41 $\mu\text{g/L}$, respectively. Little cumulative toxicity was indicated; cumulative toxicity indices were 2.5 and 2.4, respectively.

ANTIMYCIN A

Chemical Name: Antibiotic isolated from the bacterium *Streptomyces*

Alternate Names: Antimycin, Fintrol

Principal Use: Piscicide

Sample Description: Technical material, 95.5%

SUMMARY OF ACUTE TOXICITY^a

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (ng/l)
<i>Daphnia magna</i>	I ₁	21	5,000-10,000 ^b
<i>Asellus</i>	M	15	> 1,000
<i>G. fasciatus</i>	M	15	8.0 5.8-11
<i>Palaemonetes</i>	M	21	3,000-6,000
Paddlefish	YSF	15	1.0 0.4-3.0
Coho salmon	0.9	12	18 12-28
Cutthroat trout	1.1	9	78 60-99
Rainbow trout	1.3	13	12 7-23
Lake trout	F	12	53 ^c 45-63

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (ng/L)
Goldfish	0.9	18	180 99-348
Fathead minnow	0.5	17	40 21-77
Black bullhead	1.2	18	7,500 4,300-13,100
Channel catfish	2.3	17	4,230 2,830-6,340
Walking catfish	3.8	25	15,000
Mosquitofish	0.6	17	192 114-324
Green sunfish	1.1	18	220 128-416
Bluegill	1.2	17	38 19-75
Largemouth bass	0.6	17	237 159-354
White crappie	1.5	17	340 273-424
Yellow perch	0.7	12	40 31-52

^aLC50 and EC50 values are presented as ng/L (nanograms per liter).

^b48-h EC50.

^c24-h LC50.

ARAMITE

Chemical Name: 2-(p-tert-Butylphenoxy)-1-methylethyl-2-chloroethyl sulfite

Alternate Names: Aracide, CAS-140-57-8, ENT-16519, Niagaramite, 88-R

Principal Use: Acaricide

Sample Description: Technical material, 90%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i>	I ₁	15	230 ^a 140-390

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Daphnia magna</i>	I ₁	15	160 ^a 113-225
<i>G. fasciatus</i>	M	21	60 43-84
<i>Pteronarcys</i>	YC ₂	15	> 1,000
Rainbow trout	0.9	13	320 265-387
Bluegill	0.7	24	350

^a48-h EC50.

AZIDE

Chemical Name: Potassium or sodium azide

Alternate Names: CAS-12136-44-6, Kazoe, Smite

Principal Use: Herbicide

Sample Description: Technical material: potassium azide, 98%¹; sodium azide, 98%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Simocephalus</i> ¹	I ₁	15	8.4 ^a 6.1-12.2
<i>Daphnia pulex</i> ¹	I ₁	15	7.5 ^a 6.3-9.1
<i>G. fasciatus</i> ¹	M	21	6.4 4.6-8.9
<i>Pteronarcys</i> ¹	YC ₂	15	8.0 5.7-11.0
Rainbow trout ¹	1.4	13	1.6
Bluegill ¹	0.4	18	0.8
<i>Simocephalus</i> ²	I ₁	15	6.4 ^a 4.6-8.9
<i>Daphnia pulex</i> ²	I ₁	15	4.2 ^a 2.8-6.2
<i>G. fasciatus</i> ²	I ₁	21	5.0 3.7-6.8

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Pteronarcys</i> ²	YC ₂	15	9.0 6.4-13
Rainbow trout ²	1.4	13	0.8
Bluegill ²	0.6	18	0.7

^a48-h EC50.

AZINPHOS ETHYL

Chemical Name: 0,0-Diethyl S-[(4-oxo-1,2,3-benzo=triazin-3(4H)-yl) methyl] phosphorodithioate

Alternate Names: Bay 16259, CAS-2642-71-9, Cotnion-Ethyl, ENT-22014, Ethyl Guthion, Gusathion A, R-1513, Triazotion

Principal Use: Insecticide

Sample Description: Technical material, 88%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>Simocephalus</i>	I ₁	15	4.2 ^a 2.9-6.1
<i>Daphnia pulex</i>	I ₁	15	3.2 ^a 1.8-5.8
<i>Pteronarcys</i>	YC ₂	15	1.5 0.8-2.7
Rainbow trout	1.4	13	20 17-22
Bluegill	0.8	24	1.1 0.9-1.2

^a48-h EC50.

AZINPHOS METHYL

Chemical Name: 0,0-Dimethyl S-[(4-oxo-1,2,3-benzo=triazin-3(4H)-yl) methyl] phosphorodithioate

Alternate Names: Bay 9027, Bay 17147, Carfene, CAS 85-50-0, Cotnion-Methyl, DBD, ENT-23233, Gusa=thion M, Guthion, Metiltriastion, R-1582

Principal Use: Insecticide

Sample Description: Technical material, 88-100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>Asellus</i>	M	15	21 15-28
<i>G. fasciatus</i>	M	21	0.15 0.11-0.20
<i>Procambarus</i>	M	12	56 41-77
<i>Palaemonetes</i>	M	21	0.13 ^a 0.11-0.16
<i>Pteronarcys</i>	YC ₂	15	1.9 1.5-2.4
Coho salmon	0.7	12	6.1 5.0-7.4
Rainbow trout	1.0	12	4.3 3.0-6.4
Atlantic salmon	0.5	12	2.1 1.7-2.6
Brown trout	1.5	12	4.6 3.5-6.1
Northern pike	YSF	12	0.36 0.27-0.48
Goldfish	0.9	18	4,270 3,030-6,010
Carp	0.6	18	695 410-1,280
Fathead minnows	1.2	18	235 135-410
Black bullhead	1.2	18	3,500 2,920-4,950
Channel catfish	1.5	18	3,290 2,490-4,340
Green sunfish	1.1	18	52 28-94
Bluegill	1.5	18	22 20-25

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
Largemouth bass	0.9	18	4.8 3.1-7.4
Black crappie	1.0	18	3.0 2.3-3.8
Yellow perch	1.4	18	15 11-19

^aTested in hard water, 272 ppm CaCO_3 .

NOTE: Variations in test temperatures from 2° to 18°C for rainbow trout and 12° to 22°C for bluegills produced no change in toxicity at the lower temperatures and a twofold increase at the highest temperature. Yellow perch became substantially more susceptible with an increase in temperature; 96-h LC50's decreased from 40 to 2.4 $\mu\text{g/L}$ when temperature was increased from 7° to 22°C. Variations in water hardness from 12 to 300 ppm produced no change in toxicity to scuds or fish. Alkaline solutions (pH 8.5 to 9.0) were slightly less toxic to fish than more acidic solutions (pH 6.5 to 7.5). One to 3 weeks of aqueous degradation produced a 1.3- to 2-fold increase in 96-h LC50's for Atlantic salmon and yellow perch. Atlantic salmon eggs were highly tolerant to poisoning (11-day LC50 greater than 50 mg/L). Susceptibility of yolk-sac fry equaled that of fingerlings. Time-independent LC50's were 0.23, 0.29, and 0.32 $\mu\text{g/L}$ for Atlantic salmon, bluegill, and yellow perch, respectively. Cumulative toxicity indices varied from 10.9 to 20.5, indicating a moderate to high degree of cumulative action (for an organophosphate).

AZODRIN

Chemical Name: Dimethyl phosphate of 3-hydroxy-N-methyl-cis-crotonamide

Alternate Names: CAS-141-66-2, Ciba 1414, ENT-27129, Monocron, Monocrotophos, Nuracron, SD-9129

Principal Use: Insecticide

Sample Description: Technical material, 100%¹; dispersible liquid, 3.2 lb/gal²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/l)
<i>G. fasciatus</i> ¹	M	15	0.3

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Fathead minnow ¹	0.9	18	> 50
Bluegill ¹	1.0	18	12.1 7.2-10.1
Rainbow trout ²	0.5	13	5.2
Channel catfish ²	1.4	18	4.93 2.58-9.43

BAYLUSCIDE

Chemical Name: 2',5-Dichloro-4'-nitrosalicylamide, 2-aminoethanolsalt

Alternate Names: Bay 73, Bay 25648, Bayer 73, CAS 1420-04-8, Clonitralid

Principal Use: Molluscicide

Sample Description: Wettable powder, 70%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>Daphnia magna</i>	I ₁	21	190 ^{ab} 140-270
<i>G. pseudolimnaeus</i>	M	21	2,400 ^b 1,800-3,100
<i>Orconectes</i>	I _E	21	25,000 ^b 19,000-33,000
<i>Palaemonetes</i>	M	21	10,000 ^b 7,000-15,000
<i>Pteronarcys</i>	YC ₂	15	200 130-300
<i>Chironomus</i>	I ₄	21	1,600 ^{ab} 1,100-2,200
Rainbow trout	1.4	13	340 289-399

^a48-h EC50.

^bTested in hard water, 272 ppm CaCO_3 .

NOTE: Whole body residues were low in invertebrates exposed to C¹⁴-Bayluscide (1 $\mu\text{g/L}$). Within 48 h, invertebrates (daphnids, sowbugs, scuds, glass shrimp,

crayfish, damselfly larvae, and midge larvae) reached plateaus which were 4 to 87 times that of the concentration to which they were exposed. A 50% reduction in these residues occurred within 24 h after the organisms were transferred to fresh water. In flow-through tests, daphnids showed a 21-day LC50 of 0.65 mg/L, and a concentration of 0.38 mg/L caused a 50% decrease in reproduction.

BENOMYL

Chemical Name: Methyl 1-(butyl carbamoyl)-2-benzimidazolecarbamate

Alternate Names: Benlate, Tersan

Principal Use: Fungicide

Sample Description: Technical material, 99%¹; wettable powder, 50%²; methyl-2-benzimidazole=carbamate, 99% (MBC metabolite)³

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Rainbow trout ¹	1.2	12	170 120-230
Fathead minnow ¹	0.9	22	2,200 1,590-3,040
Channel catfish ¹	1.2	22	29 22-37
Bluegill ¹	0.9	22	850 550-1,300
Rainbow trout ²	1.0	12	310 250-390
Fathead minnow ²	0.5	22	1,900 1,430-2,530
Channel catfish ²	1.2	22	28 21-34
Bluegill ²	0.6	22	1,200 900-1,590
Rainbow trout ³	0.2	12	370 268-510
Channel catfish ³	0.8	22	16 11-23

NOTE: The toxicity of benomyl was altered by water hardness and pH and by life stage of the fish tested.

Temperature had no appreciable effect on toxicity. Variations in pH altered toxicity more than any other test condition. Benomyl was about 5 times more toxic to rainbow trout and bluegills at pH's 6.5 or 7.5 than at 8.5. Benomyl was equally toxic to all life stages of rainbow trout; 96-h LC50's ranged from 120 to 280 µg/L. However, fry of channel catfish were considerably more sensitive to benomyl than were fingerlings. The 96-h LC50's for yolk-sac fry, swim-up fry, and fingerlings were 5.6, 12, and 29 µg/L, respectively. Toxicity of the MBC metabolite was very similar to that of technical grade benomyl for all life stages of rainbow trout and channel catfish tested.

BENZENE HEXACHLORIDE

Chemical Name: 1,2,3,4,5,6-hexachlorocyclohexane

Alternate Names: Benzahex, Benzex, BHC, Dol, Dolmix, FBHC, HCCH, HCH, Hexachlor, Hexachloran, Hexafor, Hexaclan, Soprocid

Principal Use: Insecticide

Sample Description: Technical material, 41.5%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Daphnia pulex</i>	I ₁	16	680 ^a
<i>G. lacustris</i>	M	21	78 54-113
<i>Pteronarcys</i>	YC ₂	15	<18
Cutthroat trout	1.0	13	9 8-10
Rainbow trout	1.0	13	18 15-20
Goldfish	1.0	18	348 261-466
Fathead minnow	1.0	18	125 96-164
Channel catfish	1.1	18	105 85-129
Bluegill	1.5	18	67 51-96
Largemouth bass	0.8	18	41 36-47

^a48-h EC50.

BINAPACRYL

Chemical Name: 2-sec-Butyl-4,6-dinitrophenyl-3-methyl-2-butenate

Alternate Names: Acricid, Ambox, CAS 485-31-4, Dinoseb methacrylate, Endosan, ENT-25793, FMC 9044, Hoe 2784, Morocide, NIA 9044

Principal Use: Acaricide

Sample Description: Technical material, 99.9%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Asellus</i>	M	16	29
Rainbow trout	1.1	13	50 46-55
Channel catfish	1.4	18	15
Green sunfish	0.8	18	43 37-50
Bluegill	1.3	18	40 34-47

CAPTAFOFOL

Chemical Name: cis-N-(1,1,2,2-Tetrachloroethylthio)-4-cyclohexene-1,2-dicarboximide

Alternate Names: CAS 2425-06-1, Difolatan, Folcid, Sanspor, Sulfenimide

Principal Use: Fungicide

Sample Description: Wettable powder, 80%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. lacustris</i>	M	21	800 500-1,300
<i>Pteronarcys</i>	YC ₂	15	40 20-60
Rainbow trout	1.0	13	21 13-32

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Goldfish	0.9	18	178 146-217
Channel catfish	1.0	18	28
Bluegill	1.1	18	59 49-70

NOTE: The toxicity of captafol to rainbow trout, goldfish, and bluegills was reduced about 50% in tests conducted in hard water (272 ppm CaCO₃).

CAPTAN

Chemical Name: N-(Trichloromethylthio)4-cyclohexene-1,2-dicarboximide

Alternate Names: Captane, CAS 133-06-2, Merpan, Orthocide, Vondcaptan

Principal Use: Fungicide

Sample Description: Technical material, 90-100%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Coho salmon	0.8	12	138 118-161
Chinook salmon	F	12	56.5 52.3-61.0
Cutthroat trout	0.4	12	56.4 42.2-75.4
Rainbow trout	1.0	12	73.2 66.6-80.4
Brown trout	0.7	12	80.0 63.8-100
Lake trout	0.4	12	49.0 40.1-59.9
Fathead minnow	0.3	12	200 168-238
Channel catfish	1.2	20	77.5 70.5-85.2

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Bluegill	1.1	17	141 119-167
Yellow perch	1.0	17	120 ^a 97-147

^aFlow-through toxicity test.

CARBARYL

Chemical Name: 1-Naphthyl N-methylcarbamate

Alternate Names: Carpolin, CAS 63-25-2, Cenapon, Dicarbam, ENT-23969, Hexavin, Karbaspray, Nac, Ravion, Ravyon, Septene, Sevin, SOK, Tricarnam

Principal Use: Insecticide

Sample Description: Technical material, 99.5%¹; Oil dispersion, 49%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i> ¹	I ₁	16	7.6 ^a 6.2-9.3
<i>Daphnia pulex</i> ¹	I ₁	16	6.4 ^a 4.5-8.9
<i>Cypridopsis</i> ¹	M	21	115 ^a 74-179
<i>Asellus</i> ¹	M	18	280 214-367
<i>G. lacustris</i> ¹	M	21	22 16-30
<i>G. fasciatus</i> ¹	M	21	26 16-39
<i>Procambarus</i> ¹	I _E	12	1,900 1,160-3,110
<i>Palaemonetes</i> ¹	M	21	5.6 3.6-8.3
<i>Pteronarcella</i> ¹	N	16	1.7 1.4-2.4
<i>Pteronarcys</i> ¹	YC ₂	16	4.8 3.0-7.7

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Claassenia</i> ¹	YC ₂	16	5.6 3.9-8.1
<i>Skwala</i> ¹	N	12	3.6 2.4-5.5
Coho salmon ¹	1.0	13	4,340 3,310-5,690
Chinook salmon ¹	F	12	2,400 ^b 1,620-3,550
Cutthroat trout ¹	0.5	12	7,100 5,240-9,620
Rainbow trout ¹	1.5	12	1,950 1,450-2,630
Atlantic salmon ¹	0.4	12	4,500 3,820-5,310
Brown trout ¹	0.6	12	6,300 5,520-7,190
Brook trout ¹	0.8	12	2,100 1,680-2,620
Lake trout ¹	1.7	12	690 520-910
Goldfish ¹	0.9	18	13,200 8,310-20,800
Carp ¹	0.6	18	5,280 4,620-6,050
Fathead minnow ¹	0.8	18	14,600 11,700-19,800
Black bullhead ¹	1.2	18	20,000 18,000-24,000
Channel catfish ¹	1.5	18	15,800 13,900-18,000
Green sunfish ¹	1.1	18	11,200 8,140-15,500
Bluegill ¹	1.2	18	6,760 5,220-8,760
Largemouth bass ¹	0.9	18	6,400 4,400-9,200
Black crappie ¹	1.0	18	2,600 1,180-5,700

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Yellow perch ¹	0.6	12	5,100 4,520-5,760
<i>Skwala</i> ²	YC ₁	7	9.2 7.4-12.0
Brook trout ²	1.3	12	4,500 3,948-5,066
Bluegill ²	0.7	17	39,000 29,732-51,157

^a48-h EC50.^bFlow-through test.

NOTE: Little or no alteration in toxicity resulted when temperatures were increased from 10° to 21°C for daphnids or from 7° to 17°C for cutthroat trout and Atlantic salmon. Conversely, toxicity to brook trout and yellow perch was significantly increased (4- to 11-fold) by similar temperature increases. Increases in the pH of test solutions from 6.5 to 8.5 decreased toxicity to stoneflies by one-half. However, alkaline test solutions (pH 8.5 to 9.0) were 1.4 to 11.4 times more toxic to trout, salmon, and yellow perch than were test solutions with lower pH (6.5 to 7.5). Variations in hardness (12 to 300 ppm) did not appreciably alter toxicity to scuds, trout, or yellow perch. Test solutions aged for 3 weeks were less toxic to stonefly naiads, yet more toxic to cutthroat trout. Exposures of channel catfish for 28 days to ¹⁴C-labeled carbaryl in the diet (2.8 mg/kg) or by bath (0.25 mg/L) produced whole body residues of 9 and 11 ng/g, respectively. Within 28 days, 78% of these residues were eliminated by the diet-exposed fish but only 11% by the bath-exposed fish.

CARBOFURAN

Chemical Name: 2,3-Dihydro-2,2-dimethyl-7-benzofuranyl methyl carbamate

Alternate Names: Bay 70142, CAS 1563-66-2, Curaterr, D-1221, ENT-27164, FMC 10242, Furadan, NIA-10242

Principal Use: Insecticide

Sample Description: Technical material, 99%¹; wettable powder, 50%²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Coho salmon ¹	0.6	12	530 432-650
Rainbow trout ¹	1.5	12	380 272-531
Brown trout ¹	0.5	12	560 475-660
Lake trout ¹	0.5	12	164 ^a 119-226
Fathead minnow ¹	1.3	17	872 479-1,590
Channel catfish ¹	1.0	20	248 94-649
Yellow perch ¹	0.6	12	147 115-188
Bluegill ²	0.8	18	240 186-310

^aFlow-through toxicity test.

CARBOPHENOTHION

Chemical Name: S-(p-Chlorophenyl) methylthio 0,0-diethyl phosphorodithioate

Alternate Names: Acarithion, CAS 786-19-6, Dagadip, ENT-23709, Garrathion, Lethox, Nephocarp, R-1303, Trithion

Principal Use: Insecticide

Sample Description: Technical material, 95.3%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. lacustris</i>	M	21	5.2 4.1-6.5
<i>G. fasciatus</i>	M	16	10-100
<i>Palaemonetes</i>	M	21	1.2 0.8-1.4
Channel catfish	1.1	18	6,000 5,740-6,270

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Green sunfish	0.8	18	280 186-422
Bluegill	1.1	18	13 10-16

CHLORDANE

Chemical Name: 1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene

Alternate Names: Aspon, Belt, CAS 57-75-9, Chlor= dan, Chlor-Kill, Corodane, ENT-9932, Krypclor, Octachlor, Ortho-Klor, Synklor, Topiclor 20, Velsicol 1068

Principal Use: Insecticide

Sample Description: Technical material, 100% (contains 60% chlordane isomers and 40% related compounds)

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i>	I ₁	15	20 ^a 12-32
<i>Daphnia pulex</i>	I ₁	15	24 ^a 20-28
<i>G. fasciatus</i>	M	21	40 21-60
<i>Pteronarcys</i>	YC ₂	15	15 9-24
Coho salmon	0.6	12	14 11-17
Cutthroat trout	1.0	12	27 24-31
Rainbow trout	1.0	12	42 37-48
Brown trout	0.6	12	11.1 9.3-13.1
Fathead minnow	0.7	17	115 62-214

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Channel catfish	1.9	17	6.7 3.1-14.5
Bluegill	1.4	17	57 40-81
Largemouth bass	0.1	17	3.0 2.2-4.2

^a48-h EC50.

NOTE: In flow-through tests, crayfish (*Orconectes*) were the least sensitive invertebrate; the 96-h LC50 was 50 µg/L and the 35-day LC50 was 31.6 µg/L. Diet quality was found to significantly alter toxicity for rainbow trout; 96-h LC50's ranged from 8.2 to 47 µg/L in fish fed different commercial and synthetic diets. Bluegills were slightly more sensitive at 13°C than at 24°C; 96-h LC50's were 83 and 93 µg/L, respectively. Toxicity of *cis*-chlordane to bluegills was about 8 times that of *trans*-chlordane; 96-h LC50 values were 7.1 and 50.5 µg/L, respectively. Residues of *cis*-chlordane were preferentially stored and magnified over *trans*-chlordane by bluegills and invertebrates in ponds treated with technical chlordane at concentrations ranging from 0.37 to 1.14 µg/L. The *cis* isomer, with a residue half-life estimated to be 46 days, persisted longer after treatment than did the *trans* isomer. The *trans* isomer was not detectable after 56 days. Invertebrate populations were significantly depressed in treated ponds—mayflies the most and midges the least.

CHLORDANE HCS-3260

Chemical Name: 1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene

Alternate Names: Experimental chlordane, HCS-3260

Principal Use: Insecticide

Sample Description: Technical material, 100%^{1a}; emulsifiable concentrate, 45%²; granular, 33.3%³

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Rainbow trout ¹	1.5	12	24.9 16.1-38.5
Fathead minnow ¹	0.7	17	24.8

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Channel catfish ¹	1.8	17	45.8
Bluegill ¹	1.3	17	29.3
Rainbow trout ²	1.5	12	24.9 16.1-38.5
Bluegill ²	1.5	17	23.4
Rainbow trout ³	1.5	12	20.0
Bluegill ³	1.5	17	19.1

^aTechnical material contains 95% chlordane isomers and 5% related compounds.

CHLORENDATE

Chemical Name: Dibutyl and dimethyl esters of 1,4,5,6,7,7-hexachloro-(2.2.1)-bicyclo-5-heptene-2,3-dicarboxylic acid

Alternate Names: Not known

Principal Use: Industrial chemical: plasticizer

Sample Description: Commercial formulation, 100%: Dibutyl chlorendate¹, Dimethyl chlorendate²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ¹	1.0	6	170 132-210
Fathead minnows ¹	0.7	20	> 100
Channel catfish ¹	1.0	20	> 100
Bluegill ¹	1.4	20	> 100
Rainbow trout ²	1.0	11	1.4 1.0-1.9
Fathead minnow ²	1.0	20	1.7 1.3-2.3
Channel catfish ²	1.0	20	2.0 1.6-2.5
Bluegill ²	1.4	20	2.2 1.8-2.7

NOTE: The toxicity of dimethyl chlorendate to rainbow trout was not altered by temperature variations between 6° and 16°C. Time-independent LC50's for the four species ranged from 0.2 to 1.3 mg/L and cumulative toxicity indices were from 1.8 to 2.6, indicating a low degree of accumulative action. Flow-through tests produced a sharp increase in toxicity for dibutyl chlorendate, yielding a 30-day LC50 of 6 µg/L for rainbow trout. Although mortality did not reach time-independence during this period, a high degree of accumulative action is indicated.

CHLOROWAX

Chemical Name: Chlorinated n-paraffin of C₁₀-C₃₀ chain length and average chlorine content of 35-65%

Alternate Names: Chlorinated paraffin

Principal Use: Industrial chemical: plasticizer, oil additive, flame retardant

Sample Description: Commercial formulations, 100%: Chlorowax 40¹, Chlorowax 50², Chlorowax 70³, Chlorowax 500C⁴, Chlorowax LV⁵

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ¹	0.7	10	> 300
Bluegill ¹	0.5	20	> 300
Rainbow trout ²	0.7	10	> 300
Bluegill ²	0.5	20	> 300
Rainbow trout ³	0.7	10	> 300
Bluegill ³	0.5	20	> 300
Rainbow trout ⁴	0.5	10	> 300
Fathead minnow ⁴	0.8	20	> 100
Channel catfish ⁴	1.1	20	> 300
Bluegill ⁴	0.7	20	> 300
Rainbow trout ⁵	0.7	10	> 300
Bluegill ⁵	0.5	20	> 300

NOTE: Variations in test temperature between 5° and 25°C did not reduce the static toxicity of Chlorowax 500C below a 96-h LC50 value of 300 mg/L. Sublethal effects were noted in flow-through tests with rainbow

trout in concentrations as low as 40 µg/L. These effects primarily involved a progressive loss of motor function to the point of immobilization after 15 and 20 days of exposure. Death, when it occurred, resulted from debilitation and other secondary effects. These sublethal effects were not present or only slightly expressed in bluegills and channel catfish. Tests with rainbow trout revealed no significant differences in susceptibility among yolk-sac fry, swim-up fry, and fingerlings. Fingerling rainbow trout fed a diet fortified with 10 ppm chlorowax 500C for 82 days showed no gross pathological effects, although they accumulated a whole body residue level of 1.1 ppm. However, growth of the treated fish was reduced.

CHLORPYRIFOS

Chemical Name: 0,0-Diethyl 0-(3,5,6-trichloro-2-pyridyl) phosphorothioate

Alternate Names: CAS 2921-88-2, Dowco 179, Dursban, Lorsban

Principal Use: Insecticide

Sample Description: Technical material, 97%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. lacustris</i>	M	20	0.11 0.07-0.17
<i>Pteronarcys</i>	YC ₂	15	10 7-13
<i>Claassenia</i>	YC ₂	15	0.57 0.40-0.80
Cutthroat trout	1.4	10	18 16-22
Rainbow trout	1.4	13	7.1 6.0-8.4
Lake trout	2.3	12	98 54-180
Channel catfish	0.8	18	280 206-381
Bluegill	0.6	18	2.4 1.1-5.1

NOTE: Variations in temperature from 2° to 18°C for rainbow trout and 13° to 29°C for bluegills increased

the toxicity by 2- to 15-fold. Toxicity to cutthroat trout was increased threefold when the pH was increased from 7.5 to 9.0. A similar effect was not noted in lake trout, which were much less sensitive to chlorpyrifos than were other species of fish. The TILC50 for lake trout was 45µg/L and the cumulative toxicity index was 5.5, indicating only slight cumulative toxic action.

COPPER COUNT

Chemical Name: Copper ammonium sulfate with and without sulfur

Alternate Names: Oxy-Cop-8L, Oxy-Cop-8LS

Principal Use: Fungicide

Sample Description: Spray concentrate: Copper Count S, 13%¹; Copper Count N, 8%²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Rainbow trout ¹	1.0	12	121 90-164
Fathead minnow ¹	1.1	17	154 92-255
Bluegill ¹	1.2	17	13,700 9,360-20,400
Rainbow trout ²	1.0	12	20.4 14.8-28.2
Fathead minnow ²	1.0	17	35.9 26.3-48.9
Bluegill ²	1.2	17	3,280 1,860-5,750

COPPER SULFATE

Chemical Name: Copper sulfate pentahydrate

Alternate Names: Blue copperas, Bluestone, Blue vitriol, CAS 1344-73-6

Principal Use: Algicide, fungicide

Sample Description: Technical material, 100% (about 25% elemental copper)

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Rainbow trout	1.6	13	135
Goldfish	0.9	18	1,380 ^a 989-1,930
Fathead minnow	1.2	18	838 ^a 623-1,000
Green sunfish	1.1	18	3,510 2,570-4,800
Bluegill	1.5	18	884 707-1,100

^aTested in hard water, 272 ppm CaCO₃.

COUMAPHOS

Chemical Name: 0,0-Diethyl 0-(3-chloro-4-methyl-2-oxy(2H)1-benzopyran-7-yl) phosphorothioate

Alternate Names: Asuntol, Bay 21/199, Baymix, CAS 6012-87-9, Co-Ral, ENT-17957, Meldane, Muscatox, Rasitox

Principal Use: Insecticide

Sample Description: Technical material, 95-97%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i>	I ₁	15	0.10 ^a
<i>G. fasciatus</i>	M	21	0.074 0.059-0.092
Cutthroat trout	0.3	12	862 645-1,150
Rainbow trout	1.2	12	890
Lake trout	2.1	12	593 416-846
Channel catfish	1.0	18	840 620-1,140
Largemouth bass	0.9	18	1,100 1,000-1,200

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Bluegill	1.3	18	340
Walleye	0.8	18	780 645-943

^a48-h EC50.

CROTOXYPHOS

Chemical Name: Dimethyl cis-1-methyl-2-(1-phenyl=ethoxycarbonyl) vinyl phosphate

Alternate Names: CAS 7700-17-6, Ciodrin, ENT-24717, SD-4294

Principal Use: Insecticide

Sample Description: Technical material, 80%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. lacustris</i>	M	15	49.0 ^a 36.0-67.0
<i>Pteronarcys</i>	YC ₂	15	2.2 ^b
Cutthroat trout	1.0	12	51.0 28.0-91.0
Rainbow trout	1.0	17	72.4 60.0-87.4
Fathead minnow	1.0	17	11,900 9,830-14,400
Channel catfish	1.1	18	2,600 2,240-3,020
Largemouth bass	0.7	18	1,100
Bluegill	1.1	17	152 126-183

^a24-h LC50.

^b72-h LC50.

CRYOLITE

Chemical Name: Sodium fluoaluminate

Alternate Names: CAS 1344-75-8, ENT-24984, Kryocide

Principal Use: Insecticide**Sample Description:** Technical material, 96%**SUMMARY OF ACUTE TOXICITY**

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Simocephalus</i>	I ₁	15	5.0 ^a 3.6-6.8
<i>Daphnia pulex</i>	I ₁	15	10.0 ^a 7.6-13.0
Rainbow trout	1.8	12	47.0
Bluegill	0.8	24	> 400

^a48-h EC50.**CYANAZINE****Chemical Name:** 2-[[4-Chloro-6-(ethylamino)-S-triazin-2-yl] amino]-2-methyl-propionitrile**Alternate Names:** Bladex, Payze, SD 15418, WL 19805**Principal Use:** Herbicide**Sample Description:** Technical material, 100%¹; Bladex dispersible liquid, 4 lb/gal²; Bladex wettable powder, 80%³**SUMMARY OF ACUTE TOXICITY**

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. fasciatus</i> ¹	M	15	2.0
Fathead minnow ¹	0.9	18	16.3 14.2-18.0
Channel catfish ¹	1.6	18	17.4 12.2-24.8
Fathead minnow ²	1.2	18	17.5 15.7-19.7
Channel catfish ²	1.6	18	11.3 9.9-12.9
Rainbow trout ³	1.0	13	9.0 5.6-14.6
Fathead minnow ³	1.2	18	21.3 16.5-27.4

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Channel catfish ³	1.6	18	10.4 7.7-14.0
Bluegill ³	1.1	18	22.5

NOTE: Toxicity to fathead minnows and bluegills was not altered by a sixfold increase in water hardness.

CYTROL AMITROLE-T**Chemical Name:** Mixture of aminotriazole and ammonium thiocyanate**Alternate Names:** Amitril-TL, Amitrole-T**Principal Use:** Herbicide**Sample Description:** Liquid, 21.1%**SUMMARY OF ACUTE TOXICITY**

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Daphnia magna</i>	I ₁	21	18.0-56.0 ^a
<i>Asellus</i>	M	15	> 100
Channel catfish	1.8	18	> 160
Bluegill	1.1	18	> 280

^a48-h EC50.

NOTE: Water hardness variations from 44 to 272 ppm did not produce an observable change in toxicity to bluegills or channel catfish.

DALAPON**Chemical Name:** 2,2-Dichloropropionic acid**Alternate Names:** Basapon, CAS 75-99-0, Ded-Weed, Dowpon, Gramevin, Radapon, Unipon**Principal Use:** Herbicide**Sample Description:** Technical material, 75.6%¹; sodium salt formulation, 86.5%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Daphnia pulex</i> ¹	I ₁	15	11.0 ^a 8.2-14.7
<i>Pteronarcys</i> ¹	YC ₁	15	> 1,000
Bluegill ¹	1.0	24	105
<i>Simocephalus</i> ²	I ₁	15	16.0 ^a 11.4-22.4

^a48-h EC50.

NOTE: Preliminary data indicate that the LC50 of the sodium salt formulation to bluegills is 500 to 1,000 mg/L. Other tests show that 96-h LC50's for rainbow trout and goldfish exceed 100 mg/L.

D-D SOIL FUMIGANT

Chemical Name: Mixture of 1,3-dichloropropane, 1,3-dichloropene, and related C₃ compounds

Alternate Names: CAS 78-87-5, D-D Mixture, Nemaferene, Nemafer, Vidden D

Principal Use: Nematocide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Cutthroat trout	1.0	12	1.0-10.0
Rainbow trout	1.1	12	5.5 3.6-8.4
Channel catfish	1.1	18	4.4
Largemouth bass	0.9	18	3.4
Bluegill	1.4	18	3.9
Walleye	1.3	18	1.0

DDD

Chemical Name: Dichloro diphenyl dichloroethane

Alternate Names: CAS 72-54-8, ENT-4225, Rothane, TDE

Principal Use: Insecticide

Sample Description: Technical material, 99%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>Simocephalus</i>	I ₁	15	4.5 ^a 3.1-6.6
<i>Daphnia pulex</i>	I ₁	15	3.2 ^a 2.3-4.4
<i>Cyridopsis</i>	M	21	45 ^a
<i>Asellus</i>	M	21	16
<i>G. fasciatus</i>	M	21	0.6 0.1-1.2
<i>Palaemonetes</i>	M	21	2.4
<i>Pteronarcys</i>	YC ₂	15	380 280-520
<i>Ischnura</i>	J	21	34
Rainbow trout	1.0	12	70 57-87
Fathead minnow	1.0	18	4,400 3,470-5,580
Channel catfish	0.8	18	1,500 1,180-1,910
Largemouth bass	0.7	18	42 34-51
Walleye	1.0	18	14 11-19

^a48-h EC50.

DDE

Chemical Name: Dichloro diphenyl dichloroethylene

Alternate Names: None known

Principal Use: Insecticide, degradation product of DDT

Sample Description: Technical material, 99%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
Rainbow trout	0.8	12	32 26-40
Atlantic salmon	0.5	12	96 52-177
Bluegill	0.9	17	240 201-286

DDT

Chemical Name: Dichloro diphenyl trichloroethane

Alternate Names: Anofax, CAS 50-29-3, Chloro=phenothane, Dedelo, Didimac, ENT-1506, Geritox, Gesapon, Gesarex, Gesarol, Gyron, Ixodex, Kopsol, Neocid, Pentachlorin, Rukseam, Zerdane

Principal Use: Insecticide

Sample Description: Technical material, 99%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>Daphnia magna</i>	I ₁	15	4.7 ^a 2.8-5.6
<i>Cypridopsis</i>	M	21	15 ^a
<i>Asellus</i>	M	21	4.0 1.2-6.5
<i>G. lacustris</i>	M	21	1.0 0.7-1.5
<i>Palaemonetes</i>	M	21	2.3 1.3-4.9
<i>Orconectes</i>	J	21	0.18 ^b 0.12-0.30
<i>Pteronarcys</i>	YC ₂	15	7.0 4.9-9.9
<i>Isoperla</i>	J	15	1.2 0.3-4.9
<i>Pentaneura</i>	J	21	1.5
<i>Chaoborus</i>	J	15	7.4

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
Coho salmon	1.0	13	4.0 3.0-6.0
Rainbow trout	1.0	13	8.7 6.8-11.4
Northern pike	0.7	18	2.7
Fathead minnow	1.2	18	12.2 10.0-15.4
Black bullhead	1.2	18	4.8 3.4-6.8
Channel catfish	1.5	18	21.5 17.7-26.1
Bluegill	1.5	18	8.6 6.2-12.0
Largemouth bass	0.8	18	1.5 0.9-2.4
Yellow perch	1.4	18	9.0 7.0-11.0
Walleye	1.4	18	2.9 2.4-3.5

^a48-h EC50.

^bTested in well water.

NOTE: The *p,p'*-isomer appears to be more toxic than the *o,p*-isomer to invertebrates. DDE is one of the primary metabolites of DDT in invertebrates and produces biological effects similar to those of the parent compound. DDT rapidly accumulates in invertebrates to several thousand times the exposure level in concentrations as low as 80 ng/L. The residue half-life was 7 days in *Daphnia*. A 60% reproductive impairment was observed in *Daphnia* at 100 $\mu\text{g/L}$. The 96-h LC50 for 19 species of fish ranged from 1.8 to 22 $\mu\text{g/L}$. Toxicity to bluegills increased slightly when temperatures were increased from 7° to 29°C. No difference in toxicity was noted between hard and soft water. Continuous exposures for as long as 30 days produced TILC50's of 0.6 $\mu\text{g/L}$ for channel catfish and 0.04 $\mu\text{g/L}$ for bluegills. Cumulative toxicity indices were 90 for channel catfish and 215 for bluegills, indicating a high level of accumulative action. Although isomers tested were toxic to rainbow trout sac fry, the more polar compounds appeared more toxic than the less polar ones. DDT detrimentally altered several physiological characteristics, including normal ratios of serum amino acids, thyroid activity, and the ability to with-

stand stress. Food seems to be more important than water as a source of body residues. Although DDT was not observed to affect gonad maturation, the mortality of fry produced by treated parents was high, especially during the terminal stages of yolk absorption.

DEF

Chemical Name: S,S,S,-Tributyl phosphorotrithioate

Alternate Names: CAS 78-48-8, De-Green, E-Z-OffD, Fos-Fall "A," Ortho Phosphate Defoliant

Principal Use: Defoliant herbicide

Sample Description: Technical material, 95%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	21	100 68-150
<i>Pteronarcys</i>	YC ₂	15	2,100 1,500-2,900
Rainbow trout	0.6	13	660 560-750
Bluegill	0.6	18	620 390-975

DEMETON

Chemical Name: Mixture of 0,0-diethyl 0-[2-(ethyl=thio)ethyl] phosphorothioate and 0,0-diethyl S-[2-ethylthio)ethyl] phosphorothioate

Alternate Names: Systox

Principal Use: Systemic insecticide-acaricide

Sample Description: Technical material, 94%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Daphnia pulex</i>	I ₁	15	14.0 ^a 10.4-18.7

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	15	78 42-140
Rainbow trout	1.4	12	600 483-745
Channel catfish	1.2	18	3,700 3,410-4,020
Largemouth bass	0.7	18	148 ^b 136-162
Walleye	1.3	18	230 ^b 203-260

^a48-h EC50.

^bTested in hard water, 272 ppm CaCO₃.

DIAZINON

Chemical Name: 0,0-Diethyl 0-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate

Alternate Names: AG-500, Alfa-tox, Basudin, CAS 333-41-5, Dazzel, Diazajet, Diazide, Diazol, ENT-19507, Gardentox, Neocidol, Nucidol

Principal Use: Insecticide

Sample Description: Technical material, 89%¹, 92%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i> ¹	I ₁	15	1.4 ^a 1.2-1.6
<i>Daphnia pulex</i> ¹	I ₁	15	0.8 ^a 0.6-1.1
<i>G. fasciatus</i> ¹	M	21	0.20 0.15-0.28
<i>Pteronarcys</i> ¹	YC ₂	15	25 20-30
Rainbow trout ¹	1.2	13	90
Cutthroat trout ²	2.0	12	1,700 ^b 1,390-2,090
Lake trout ²	3.2	12	602 ^b 400-906

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Bluegill ²	1.0	18	168 120-220

^a48-h EC50.^bTested in hard water, 162 ppm CaCO₃.

DICAMBIA

Chemical Name: 2-Methoxy-3,6-dichlorobenzoic acid**Alternate Names:** Banex, Banvel, CAS 1918-00-9, Dianet, Mediben**Principal Use:** Herbicide**Sample Description:** Technical material, 88%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Daphnia magna</i>	I ₁	21	> 100 ^{a,b}
<i>Asellus</i>	M	15	> 100 ^b
<i>G. fasciatus</i>	M	15	> 100 ^b
<i>Palaemonetes</i>	M	21	> 56 ^b
Rainbow trout	0.8	12	28
Bluegill	0.9	12	> 50

^a48-h EC50.^bTested in hard water, 272 ppm CaCO₃.

DICHLOBENIL

Chemical Name: 2,6-Dichlorobenzonitrile**Alternate Names:** CAS 1194-65-6, Casoron, 2,6-DBN, DU-SPREX, ENT-26665, NIA 5996.**Principal Use:** Herbicide**Sample Description:** Technical material, 98.9%¹; wettable powder, 50%²; metabolite (2,6-Dichloro=benzoic acid), technical material, 100%³

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ¹	1.0	13	6.3 4.7-8.4
Goldfish ¹	0.9	18	7.8 4.8-12.6
Fathead minnow ¹	0.8	18	6.0 4.0-9.1
Green sunfish ¹	1.1	18	5.7 3.6-8.9
Bluegill ¹	1.5	18	8.3 6.0-11.6
<i>Simocephalus</i> ²	I ₁	15	5.8 ^a 4.8-8.4
<i>Daphnia pulex</i> ²	I ₁	15	3.7 3.3-4.2
<i>Asellus</i> ²	M	15	35
<i>G. lacustris</i> ²	M	21	11 8-15
<i>Pteronarcys</i> ²	YC ₂	15	7.0 5.5-9.0
Rainbow trout ³	2.6	12	140
Bluegill ³	1.0	24	120

^a48-h EC50.

NOTE: Variations in water hardness from 44 to 272 ppm did not alter the toxicity to fish. In the metabolite, 2,6-dichlorobenzoic acid, 96-h LC50 values exceeded 100 mg/L for rainbow trout and bluegills.

DICHLOFENTHION

Chemical Name: 0,0-Diethyl 0-(2,4 dichlorophenyl) phosphorothioate**Alternate Names:** CAS 97-17-6, dichlorofenthion, ENT-17470, Hexa-Nema, Mobilawn, Nemacide, Tri-VC 13, VC 13, V-C 1-13**Principal Use:** Nematocide, insecticide**Sample Description:** Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>G. fasciatus</i>	M	15	110 80-150
<i>G. lacustris</i>	M	15	56 40-78
<i>Pteronarcys</i>	YC ₂	15	4.1 3.4-5.0
Cutthroat trout	1.0	13	640 550-740
Rainbow trout	0.9	13	1,250 1,040-1,500
Channel catfish	1.1	18	4,800 4,400-5,240
Bluegill	1.3	18	1,230 1,070-1,390
Largemouth bass	0.7	18	840 ^a
Walleye	1.3	18	800 ^a 730-880

^aTested in hard water, 272 ppm CaCO₃.

NOTE: Variations in water hardness from 44 to 272 ppm did not alter the toxicity to scuds or rainbow trout.

DICHLOROPROPENE

Chemical Name: 1,3-Dichloropropene

Alternate Names: Telone

Principal Use: Nematocide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>Daphnia magna</i>	I ₁	21	90 ^a 63-129
Fathead minnow	0.9	18	4,100 3,390-4,970

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
Largemouth bass	1.0	18	3,650 ^b 3,520-3,780
Walleye	1.3	18	1,080 990-1,180

^a48-h EC50.

^bTested in hard water, 272 ppm CaCO₃.

DICHLORVOS

Chemical Name: 2,2-Dichlorovinyl dimethyl phosphate

Alternate Names: CAS 62-73-7, DDVF, DDVP, Dederap, Dichlorphos, Divipan, ENT-20738, Herkol, Mafu, Marvex, Nogos, No-Pest, Nuvan, Oko, Phosvit, Vapona

Principal Use: Insecticide

Sample Description: Technical material, 100%¹, 93%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>Simocephalus</i> ¹	I ₁	21	0.28 ^a 0.16-0.47
<i>Daphnia pulex</i> ¹	I ₁	15	0.07 ^a 0.05-0.09
<i>G. lacustris</i> ¹	M	21	0.50 0.37-0.68
<i>Pteronarcys</i> ¹	YC ₂	15	0.10 0.07-0.15
Cutthroat trout ¹	2.5	12	170 143-203
Lake trout ¹	0.3	12	187 ^b 110-320
Mosquitofish ¹	0.2	17	5,270 2,660-10,400
Bluegill ¹	1.5	18	869 700-1,080
Fathead minnow ²	0.7	17	11,600 7,830-17,200

^a48-h EC50.

^bTested in hard water, 162 ppm CaCO₃.

NOTE: Variations in water hardness from 44 to 162 ppm and pH from 6.0 to 9.0 did not alter the toxicity to cutthroat or lake trout.

DICOFOL

Chemical Name: 1,1-Bis(4-chlorophenyl)-2,2,2-tri-chloroethanol

Alternate Names: Acarin, CAS 115-32-2, ENT-23648, FW-293, Mitigan, Kelthane

Principal Use: Acaricide

Sample Description: Technical material, 100%¹; 74.4%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Pteronarcys</i> ¹	YC ₂	15	650 280-1,360
Channel catfish ¹	0.8	18	360 290-447
Bluegill ¹	1.0	18	520 42-642
Largemouth bass ¹	0.8	18	395
Cutthroat trout ²	0.1	12	53 41-68
Lake trout ²	1.2	12	87 53-142

DICROTAPHOS

Chemical Name: Dimethyl cis-2-dimethyl-carbamoyl-1-methylvinyl phosphate

Alternate Names: Bidrin, Carbicron, CAS 141-66-2, CIBA 709, Ektafos, ENT-24482, SD 3562

Principal Use: Insecticide

Sample Description: Technical material: 80%¹, 90%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Simocephalus</i> ¹	I ₁	15	0.27 ^a 0.21-0.32
<i>G. fasciatus</i> ¹	M	21	2.6 2.1-3.2
<i>G. lacustris</i> ¹	M	21	0.54 0.40-0.73
<i>Pteronarcys</i> ¹	YC ₂	15	0.43 0.34-0.54
Bluegill ¹	1.0	20	24.2 14.3-41.1
Rainbow trout ²	1.0	13	6.3
Channel catfish ²	1.4	18	7.7 4.0-13.8

^a48-h EC50.

DIELDRIN

Chemical Name: 1,2,3,4,10,10-Hexachloro-exo-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo-exo-5,8-dimethanonaphthalene

Alternate Names: Alvit, CAS 60-57-1, Compound 47, Dieldrine, Dieldrite, ENT-16225, HEOD, Octalox, Panoram D-31

Principal Use: Insecticide

Sample Description: Technical material, 85% HEOD¹; photo-dieldrin 98%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i> ¹	I ₁	15	240 ^a 200-280
<i>Daphnia pulex</i> ¹	I ₁	15	190 ^a 170-210
<i>Asellus</i> ¹	M	21	5.0 3.2-10.0
<i>G. fasciatus</i> ¹	M	21	640 460-880

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Orconectes</i> ¹	M	21	740 680-1,200
<i>Pteronarcys</i> ¹	YC ₂	15	0.5 0.4-0.7
<i>Pteronarcella</i> ¹	YC ₁	15	0.5 0.4-0.7
<i>Claassenia</i> ¹	YC ₂	15	0.6 0.4-0.8
<i>Ischnura</i> ¹	J	24	12
Cutthroat trout ¹	1.1	9	6.0 ^b 4.6-8.0
Rainbow trout ¹	1.4	13	1.2 0.9-1.7
Goldfish ¹	1.0	18	1.8 1.2-2.8
Fathead minnow ¹	0.6	18	3.8 3.1-4.6
Channel catfish ¹	1.4	18	4.5 2.5-7.9
Bluegill ¹	1.3	18	3.1 2.1-4.6
Largemouth bass ¹	2.5	18	3.5 ^b 2.7-4.5
Cutthroat trout ²	1.3	8	12 ^b 11-14
Channel catfish ²	1.4	18	19 13-27
Bluegill ²	1.4	18	11 9.3-13

^a48-h EC50.

^bTested in hard water, 162 ppm CaCO₃.

NOTE: Dieldrin rapidly accumulates in invertebrates from a few hundred to several thousand times the exposure level in concentrations as low as 50 ng/L. Plateau levels were reached within 3 days in *Daphnia* and the residue half-life was 2.5 days. Although concentrations of 560 µg/L were not acutely toxic, midge larvae were unable to survive beyond 14 days in concentrations of 180 µg/L, and less than half were able to complete metamorphosis at 5.6 µg/L. The tox-

icity of dieldrin approximately doubled for rainbow trout and bluegills when temperatures were increased from 2° to 13°C and from 7° to 29°C, respectively. Water hardness did not appear to affect toxicity to fish or invertebrates. Dietary dieldrin significantly altered several physiological and biochemical factors, including serum amino acid composition, adrenal and thyroid function, ammonia detoxification, and phenyl-keto acid metabolism. The ability to withstand stress was significantly reduced. Whole body residues in treated fish were similar to those in wild fish.

DIFLUBENZURON

Chemical Name: N-[[[4-Chlorophenyl]amino] carbonyl]-2,6-difluorobenzamide

Alternate Names: Dimilin, TH-6040, PH-6040, OMS 1804, ENT-29054

Principal Use: Insecticide

Sample Description: Technical material, 95%¹; wettable powder, 25%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. pseudolimnaeus</i> ¹	M	12	0.030 0.021-0.043
Rainbow trout ¹	1.0	10	> 100
Brook trout ¹	0.6	7	> 50
Channel catfish ¹	2.0	22	> 100
Bluegill ¹	0.3	20	> 100
Yellow perch ¹	0.6	12	> 25
<i>Daphnia magna</i> ²	I ₁	22	0.016 ^a 0.012-0.020
<i>G. pseudolimnaeus</i> ²	M	12	0.025 0.016-0.040
<i>Chironomus</i> ²	I ₄	22	0.56 ^a 0.47-0.67
Cutthroat trout ²	1.0	12	57 48-67
Rainbow trout ²	1.5	10	240 201-286

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Fathead minnow ²	0.9	20	> 100
Channel catfish ²	2.2	22	> 100
Bluegill ²	0.5	20	> 100

^a48-h EC50.

NOTE: Alterations in test conditions such as pH, temperature, and hardness did not affect the toxicity of diflubenzuron. No adverse effects were observed when eyed eggs and fingerlings of rainbow trout were exposed in a flow-through system for 30 days to concentrations of technical grade diflubenzuron of 0.029 to 0.30 mg/L.

DIMETHOATE

Chemical Name: 0,0-Dimethyl S-(N-methylcarbamoylmethyl) phosphorodithioate

Alternate Names: AC-12880, Asthoate, CAS 60-51-5, Cygon, Daphene, De-Fend, Demos-L40, Dimetho=gen, Diostop, ENT-24650, Fosfamid, Fosthion MM, L-395, Le-Kuo, Perfekthion, Rebelate, Rogor, Roxion, Trimethion

Principal Use: Insecticide, acaricide

Sample Description: Technical material, 97.4%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. lacustris</i>	M	21	0.20 0.15-0.27
<i>Pteronarcys</i>	YC ₂	21	0.043 0.036-0.051
Rainbow trout	1.5	13	6.2 4.1-9.3
Bluegill	0.3	24	6.0

NOTE: Variation in water hardness did not affect the toxicity to rainbow trout.

DIMETHRIN

Chemical Name: 2,4-Dimethylbenzyl-2,2-dimethyl-3-(2-methylpropenyl) cyclopropanecarboxylate.

Alternate Names: CAS 70-38-2, Dimethrine, ENT-21170.

Principal Use: Insecticide (synthetic pyrethroid)

Sample Description: Technical material, 100%.

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
Fathead minnow	1.4	13	62 ^a 51-76
Channel catfish	F	12	1,140 1,018-1,275
Bluegill	0.5	12	38 28-50
Yellow perch	1.4	12	28 22-37

^aFlow-through toxicity test.

NOTE: Toxicity to bluegills did not change significantly with variations in pH from 6.5 to 9.5 or with water hardness from 12 to 300 ppm. A temperature increase from 12° to 22°C decreased the toxicity to bluegills and increased the 96-h LC50 from 21 μg/L to 85 μg/L. No change in toxicity was noted in 1-week aqueous degradation tests at pH 6.5, 7.5, and 9.5.

DINITRAMINE

Chemical Name: N, ³N³-Diethyl-2,4-dinitro-6-(trifluoromethyl)-1,3-phenylenediamine

Alternate Names: Cobex, Cobexo, USB-3584

Principal Use: Herbicide

Sample Description: Technical material, 99.2%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
Coho salmon	0.9	12	600 503-715

DINOCAP

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Rainbow trout	0.3	12	820 625-1,075
Brown trout	0.7	12	590 510-682
Lake trout	0.6	12	920 776-1,090
Carp	1.0	12	1,180 1,020-1,360
Fathead minnow	0.8	12	1,440 1,070-1,930
Channel catfish	0.8	12	1,370 1,040-1,810
Bluegill	1.4	12	1,520 1,140-2,020
Yellow perch	0.8	12	1,000 870-1,150

DINITROCRESOL

Chemical Name: 4,6-Dinitro-o-cresol

Alternate Names: CAS 534-52-1, DNC, Elgetol 30, Nitrador, Selinon, Trifocide, DNOC

Principal Use: Insecticide, fungicide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Daphnia pulex</i>	I ₁	21	145 ^a 100-210
<i>G. fasciatus</i>	M	21	1,100 730-1,600
<i>Pteronarcys</i>	YC ₂	15	320 230-450
Rainbow trout	1.2	13	66 37-117
Bluegill	1.0	18	360 331-392

^a48-h EC50.

Chemical Name: 2,4-Dinitro-6-octyl phenyl crotonate; 2,6-dinitro-4-octyl phenyl crotonate and nitrooctyl=phenols. (A mixture of 1-methylheptyl, 1-ethylhexyl, and 1-propylpentyl isomers of the octyl 8-carbon chain.)

Alternate Names: Arathane, CAS 131-72-6, Croto=thane, ENT-24727, Iscothane, Karathane, Mildex

Principal Use: Fungicide, acaricide

Sample Description: Technical material, 78%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	15	75 ^a 57-99
Rainbow trout	1.1	13	15 14-16
Goldfish	1.0	18	33 25-43
Bluegill	0.9	18	20 19-21

^aTested in hard water, 272 ppm CaCO₃.

NOTE: A sixfold increase in water hardness did not appreciably alter the toxicity to rainbow trout or bluegills.

DINOSEB

Chemical Name: 2-(Sec-butyl)-4,6-dinitrophenol

Alternate Names: Basanite, CAS 88-85-7, Chemox, Dinitrobutylphenol, DN-289, DNBP, Dow General Weed Killer, Elgetol 318, ENT-1122, Kiloseb, Nitropone C, Premerge, Subitex

Principal Use: Herbicide

Sample Description: Technical material, 95.8%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Cutthroat trout	0.3	10	67 56-81
Lake trout	0.3	10	44 38-51

NOTE: A decrease in temperature from 10° to 5°C produced no change in toxicity to cutthroat trout; however, LC50's were 3 times higher for lake trout. A temperature increase from 10° to 15°C produced no substantial change in toxicity to either species. An increase in pH from 6.5 to 8.5 increased LC50 values by as much as 30-fold. Aging of test solutions caused a twofold increase in LC50 values after 1 week but no change in toxicity was observed in solutions aged 4 weeks. Flow-through tests produced TILC50's of 54 µg/L for lake trout and 102 µg/L for cutthroat trout. Cumulative toxicity indices were 1.5 for both species, indicating little cumulative toxic action.

DIOXATHION

Chemical Name: 2,3-p-Dioxanedithiol S,S-bis(0,0-diethyl phosphorodithioate)

Alternate Names: CAS 78-34-2, Delnav, ENT-22897, Hercules AC528, Navadel, Ruphos

Principal Use: Insecticide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Daphnia magna</i>	I ₁	2	0.35 ^a 0.25-0.49
<i>G. fasciatus</i>	M	15	8.6 5.4-13.8
Cutthroat trout	1.0	13	110 ^b 98-120
Rainbow trout	1.4	13	69 ^b 59-81
Largemouth bass	1.3	18	22 ^b 20-25

^a48-h EC50.

^bTested in hard water, 272 ppm CaCO₃.

DIPHENAMID

Chemical Name: N,N-Dimethyl-2,2-diphenylacetamide

Alternate Names: CAS 957-51-7, Dymid, Enide, ENT-28567

Principal Use: Herbicide

Sample Description: Technical material, 100%¹

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Daphnia magna</i>	I ₁	21	58 ^a 43-79
<i>C. vidua</i>	M	21	51 ^a 37-71
<i>Asellus</i>	M	15	> 100
<i>G. fasciatus</i>	M	15	> 100
<i>Palaemonetes</i>	M	21	32 29-35
Goldfish	1.0	18	53 42-68
Fathead minnow	0.9	18	48 38-60

^a48-h EC50.

DIQUAT

Chemical Name: 6,7-Dihydrodipyrido [1,2-a:2',1'-c] pyrazinediium dibromide, monohydrate

Alternate Names: Aquacide, CAS 85-00-7, Deiquat, Dextrone, FB12, Reglon, Reglone

Principal Use: Herbicide

Sample Description: Liquid formulation, 35.3%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. fasciatus</i>	M	15	> 100 ^a
Black bullhead	0.8	12	170 113-255

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Bluegill	1.3	12	245 175-342
Yellow perch	0.6	12	60 39-93

^aTested in hard water, 272 ppm CaCO₃.

NOTE: Variations in temperature from 7° to 22°C did not alter the toxicity to bluegills. A change in pH to 9.5 increased toxicity twofold, whereas an increase in hardness from 40 to 300 ppm decreased toxicity by one-half to one-third. Similar pH effects were noted in black bullheads and yellow perch.

DISULFOTON

Chemical Name: 0,0'Diethyl S-[2-(ethylthio) ethyl] phosphorodithioate

Alternate Names: Bay 19639, CAS 298-04-4; Di-Syston, Dithiodemeton, Dithiosystox, ENT-23427, Frumin AL, M-74, Solvirex, Thiodemeton

Principal Use: Insecticide, acaricide

Sample Description: Technical material, 98%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	15	52 49-58
<i>Palaemonetes</i>	M	21	3.9 ^a 2.7-5.7
<i>Pteronarcys</i>	YC ₂	15	5.0 3.7-6.7
Rainbow trout	1.2	13	1,850
Fathead minnow	1.0	18	4,300
Channel catfish	0.8	18	4,700
Bluegill	0.3	24	300
Largemouth bass	0.7	18	60

^aTested in hard water, 272 ppm CaCO₃.

DIURON

Chemical Name: 3-(3,4-Dichlorophenyl)-1,1-dimethyl-urea

Alternate Names: CAS 330-54-1, Dichlorofenidim, DCMU, Di-on, Diurex, DMU, Karmex, Marmer, Urox D, Vonduron

Principal Use: Herbicide

Sample Description: Technical material, 95%¹; wettable powder, 80%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Simocephalus</i> ¹	I ₁	15	2.0 ^a 1.4-2.8
<i>Daphnia pulex</i> ¹	I ₁	15	1.4 ^a 1.0-1.9
<i>Asellus</i> ¹	M	15	15.5 7.2-33.4
<i>G. fasciatus</i> ¹	M	21	0.16 0.13-0.19
<i>Pteronarcys</i> ¹	YC ₂	15	1.2 0.9-1.7
Cutthroat trout ¹	0.3	10	1.4 1.1-1.9
Rainbow trout ¹	0.8	13	4.9 4.1-5.9
Lake trout ¹	1.5	10	2.7 2.4-3.0
Bluegill ¹	0.8	18	8.2 7.4-9.1
Rainbow trout ²	1.2	13	16 11-23

^a48-h EC50.

NOTE: Increases in temperature from 2° to 18°C for trout and 7° to 24°C for bluegills had little effect on acute toxicity. Changes in pH from 6.5 to 8.5 and hardness from 44 to 300 ppm did not alter toxicity to trout or bluegills. A substantial decrease in toxicity was noted in test solutions aged from 1 to 4 weeks; LC50 values were as much as ninefold higher. The largest change seemed to occur between 2 and 3 weeks of

aging. Flow-through tests produced TILC50's of 0.14 mg/L for rainbow trout and 0.50 mg/L for cutthroat trout. Cumulative toxicity indices were 12.3 and 3.7, respectively, indicating a moderate degree of cumulative toxic action in rainbow trout.

d-TRANS ALLETHRIN

Chemical Name: d1-2-Allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one ester of d-trans chrysanthemum monocarboxylic acid

Alternate Names: Allyl homolog of cinerin I, Bio=allethrin

Principal Use: Insecticide (synthetic pyrethroid)

Sample Description: Technical material, 90%

SUMMARY OF ACUTE TOXICITY^a

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Coho salmon	1.0	12	2.6 1.8-3.5
Steelhead	0.2	12	9.7 8.0-11.6
Lake trout	F	12	16.0 14.3-17.8
Northern pike	F	12	3.3 3.0-3.6
Fathead minnow	0.8	12	48.0 34.9-66.0
White sucker	F	12	12.4 10.5-14.6
Channel catfish	0.9	12	> 30.0
Bluegill	0.8	12	22.5 20.5-24.7
Smallmouth bass	F	12	7.7 5.8-10.2
Largemouth bass	F	12	> 12.0
Yellow perch	F	12	9.9 9.2-10.7

^aAll data from flow-through toxicity tests.

NOTE: Variations in test conditions did not substantially alter toxicity to bluegills. When temperature

was increased from 12° to 22°C, pH from 6.5 to 9.5, and hardness from 12 to 300 ppm in static tests, 96-h LC50 values ranged from 35 to 60 µg/L. After aqueous degradation for 1 week at pH 6.5, 7.5, and 9.5, 96-h LC50 values were 40, 34, and 74 µg/L, indicating loss of toxicity at the highest pH.

DU-TER

Chemical Name: Triphenyltin hydroxide

Alternate Names: CAS 76-87-9, ENT-28009, Fenoloro, Fentin hydroxide, TPTH, TPTOH

Principal Use: Fungicide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	15	66 42-103
Rainbow trout	0.8	13	< 28
Goldfish	1.0	18	62 49-75
Fathead minnow	0.9	18	20 9-42
Bluegill	0.5	24	23 19-28

DYRENE

Chemical Name: 2,4-Dichloro-6-(o-chloroanilino)-s-triazine

Alternate Names: Anilazine, CAS 101-05-3, Direz, Kemate, Triasyn

Principal Use: Fungicide

Sample Description: Technical material, 95.5%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	15	0.27 0.21-0.35

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Rainbow trout	1.5	13	140 122-161
Channel catfish	0.7	18	240 110-550
Bluegill	1.1	18	320 142-735
Redear sunfish	2.5	18	< 140

ENDOSULFAN

Chemical Name: 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide

Alternate Names: CAS 115-29-7, Chlorothiepin, Cyclo-dan, ENT-23979, FMC-5462, HOE-2671, Insectophene, Kop-Thiodan, Malix, Thifor, Thimul, Thiodan, Thionex

Principal Use: Insecticide

Sample Description: Technical material, 96%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. lacustris</i>	M	21	5.8 4.1-8.1
<i>Pteronarcys</i>	YC ₂	15	2.3 1.6-3.3
Rainbow trout	1.3	13	1.4 1.2-1.6
Fathead minnow	0.7	18	1.5 1.1-2.0
Channel catfish	1.7	18	1.5 1.3-1.7
Bluegill	1.0	18	1.2 0.9-1.7

ENDOTHALL

Chemical Name: 7-Oxabicyclo (2.2.1) heptane-2,3-dicarboxylic acid

Alternate Names: Accelerate, Aquathol, CAS 129-67-9, Des-i-cate, Endothal, Herbicide 272, Herbicide 273, Herbicide 282, Herbicide 283, Hydout, Hydrothol, Niagrathal, Tri-Endothal

Principal Use: Herbicide

Sample Description: Aquathol K, 40.3%¹; copper endothall, 25%²; Des-i-cate, 5.5%³; Herbicide 282, 67.9%⁴; Hydrathol 47, 66.7%⁵; Hydrothol 191, 53%⁶; potassium endothall, 40.3%⁷

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Coho salmon ¹	1.4	13	> 100
Rainbow trout ¹	1.2	13	230 187-283
Channel catfish ¹	0.4	12	> 150
Bluegill ¹	1.3	22	343 308-383
Rainbow trout ²	1.2	13	0.14 0.08-0.24
Green sunfish ²	1.1	18	1.3 1.00-1.80
Bluegill ²	1.2	18	3.33 2.51-4.40
Rainbow trout ³	2.0	13	0.31
Rainbow trout ⁴	1.2	13	0.98
Bluegill ⁴	0.5	24	1.20
<i>G. fasciatus</i> ⁵	M	15	0.51 0.28-0.95
<i>G. lacustris</i> ⁶	M	21	0.50 0.37-0.67
<i>Palaemonetes</i> ⁶	M	21	0.05 0.02-0.12
<i>Pteronarcys</i> ⁶	YC ₂	15	3.25 ^a
Cutthroat trout ⁶	1.0	10	0.18 0.12-0.27
Rainbow trout ⁶	1.2	13	0.56
Fathead minnow ⁶	0.6	18	0.75

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Channel catfish ^a	0.3	18	0.49
Bluegill ^a	0.5	24	0.94
<i>G. fasciatus</i> ⁷	M	21	313
Rainbow trout ⁷	1.2	13	450
Bluegill ⁷	0.3	24	440

^a48-h LC50.

NOTE: Toxicity of Aquathol K increased with increases in test temperatures; the 96-h LC50 decreased from 1,740 mg/L to 343 mg/L when the temperature was increased from 7° to 22°C. However, no change in toxicity was observed when pH varied between 6.5 and 9.5. Copper endosulfan was slightly more toxic to green sunfish in soft water than in hard water; 96-h LC50's were 1.3 and 4.3 mg/L, respectively.

ENDRIN

Chemical Name: 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo,endo-5,8-dimethanonaphthalene

Alternate Names: CAS 72-20-8, Compound 269, ENT-17251, Hexadrin, Mendrin

Principal Use: Insecticide

Sample Description: Technical material, 99%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>Simocephalus</i>	I ₁	21	45 ^a 35-58
<i>Daphnia magna</i>	I ₁	21	4.2 ^a
<i>Daphnia pulex</i>	I ₁	15	20 ^a 13-30
<i>Cypridopsis</i>	M	21	1.8 ^a
<i>Asellus</i>	M	15	1.5 0.9-3.7

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>G. lacustris</i>	M	21	3.0 2.0-4.5
<i>G. fasciatus</i>	M	21	4.3 3.5-5.2
<i>Orconectes</i>	I _E	21	3.2 ^b 1.6-7.5
<i>Palaemonetes</i>	M	21	3.2 ^b 1.8-5.8
<i>Pteronarcella</i>	N	15	0.54 0.40-0.72
<i>Pteronarcys</i>	YC ₂	15	0.25 0.20-0.31
<i>Claassenia</i>	YC ₂	15	0.08 0.06-0.09
<i>Acroeneuria</i>	YC ₂	15	> 0.18
<i>Hexagenia</i>	I ₁	15	62 41-95
<i>Baetis</i>	J	15	0.90 0.57-1.4
<i>Ischnura</i>	J	21	2.4 1.5-3.8
<i>Tipula</i>	J	15	12 7.3-18
<i>Atherix</i>	J	15	4.6 3.1-6.8
Rainbow trout	1.0	13	0.75 0.64-0.88
Goldfish	F	12	0.44 ^c 0.29-0.66
Carp	F	12	0.32 ^c 0.25-0.41
Fathead minnow	1.2	18	1.8 1.0-3.0
Black bullhead	1.5	24	1.1 1.0-1.3
Channel catfish	1.4	24	0.32 0.29-0.35
Mosquitofish	0.6	17	1.1 0.4-3.4

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Bluegill	1.5	18	0.61 0.50-0.74
Largemouth bass	2.5	18	0.31 0.25-0.39
Yellow perch	F	12	0.15 ^c 0.12-0.18

^a48-h EC50.

^bTested in hard water, 272 ppm CaCO₃.

^cFlow-through toxicity test.

NOTE: A wide variation in 96-h LC50's was observed in 18 species of invertebrates tested, ranging from 7 parts per trillion for *Tipula* to 320 ppb for mature crayfish. Most values ranged from 0.5 to 10 ppb. Comparatively, endrin was more toxic to fish than to invertebrates and showed less variation in LC50's. Effects of pH and water hardness on toxicity were not appreciable, and increases in temperature from 2° to 29°C only doubled the toxicity to rainbow trout and bluegills. Endrin residues accumulated rapidly in fish exposed by diet or bath, reaching levels of 400 to 2,000 times the exposure level. Mortality occurred in channel catfish when whole body residues exceeded 0.5 ppm. Several physiological and biochemical variables were altered by endrin, including growth and reproductive development, adrenal and thyroid function, serum electrolyte balance and osmoregulation, glycogen metabolism, serum protein composition, resistance to stress, and behavioral patterns.

EPN

Chemical Name: O-Ethyl-O-(p-nitrophenyl) phenyl phosphonothioate

Alternate Names: CAS 2104-64-5, ENT-17798

Principal Use: Acaricide, insecticide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	15	6.8 3.5-13.3
<i>Palaemonetes</i>	M	21	0.6 ^a 0.4-0.8

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Pteronarcys</i>	YC ₂	15	7.4 5.5-10.0
Cutthroat trout	1.0	13	160 150-170
Rainbow trout	1.0	13	210 ^a 192-230
Channel catfish	1.1	18	420 351-502
Bluegill	1.0	18	110 85-141
Largemouth bass	1.0	18	380 ^a 346-417
Walleye	0.8	18	350 ^a 333-368

^aTested in hard water, 272 ppm CaCO₃.

EPTC

Chemical Name: S-Ethyl dipropylthiocarbamate

Alternate Names: CAS 759-94-4, Eptam, Eradicane, R-1608

Principal Use: Herbicide

Sample Description: Technical material, 98%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Asellus</i>	M	15	23 ^a 15-36
<i>G. fasciatus</i>	M	15	66 ^a
Cutthroat trout	1.0	10	17 15-19
Lake trout	0.9	10	16.2 14.8-17.7

^aTested in hard water, 272 ppm CaCO₃.

NOTE: Variations in temperature (5° to 15°C), pH (6.5 to 8.5), or water hardness (44 to 300 ppm) did not alter the toxicity to cutthroat trout or lake trout, except for a slight increase in toxicity to cutthroat trout at pH

6.5. The TILC50 for cutthroat trout was 7.2 mg/L and the cumulative toxicity index was 3.2, indicating only slight cumulative toxic action.

ETHION

Chemical Name: 0,0,0',0'-Tetraethyl S,S'-methylene biphosphorodithioate

Alternate Names: CAS 563-12-2, Diethion, ENT-24105, NIA-1240, Nialate

Principal Use: Acaricide, insecticide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i>	I ₁	15	4.7 ^a 3.2-6.9
<i>Daphnia magna</i>	I ₁	21	0.056 ^a 0.038-0.082
<i>Daphnia pulex</i>	I ₁	15	2.8 ^a 1.5-5.3
<i>G. fasciatus</i>	M	21	1.8 1.3-2.4
<i>Palaemonetes</i>	M	15	5.6 ^b 3.2-9.8
<i>Pteronarcys</i>	YC ₂	15	2.8 1.8-4.2
Cutthroat trout	1.0	13	720 580-900
Rainbow trout	1.0	13	500 ^b 355-705
Fathead minnow	F	18	720
Channel catfish	1.2	18	7,600 6,390-9,030
Bluegill	0.8	18	210 141-313
Largemouth bass	2.8	18	173 ^b 158-190

^a48-h EC50.

^bTested in hard water, 272 ppm CaCO₃.

NOTE: Variations in water hardness (44 to 272 ppm) did not alter toxicity to cutthroat trout.

ETHOFUMESATE

Chemical Name: 2-Ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate

Alternate Names: Fluoromidine, NC-4780, Nortron

Principal Use: Herbicide

Sample Description: Technical material, 96%¹; Formulation, 25%²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ¹	1.0	12	0.8 0.5-1.0
Bluegill ¹	1.5	18	2.5 1.0-5.0
Rainbow trout ²	1.0	12	0.5 0.1-1.0
Bluegill ²	1.5	18	6.5 3.5-9.0

FENAC

Chemical Name: 2,3,6-Trichlorophenyl acetic acid

Alternate Names: CAS 85-34-7, Chlorfenac, Kanepar, 2,3,6-TCA, Tri-fen, Trifene

Principal Use: Herbicide

Sample Description: Technical material, 50%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Simocephalus</i>	I ₁	15	6.6 ^a 4.5-9.6
<i>Daphnia pulex</i>	I ₁	15	4.5 ^a 3.2-6.3
<i>G. fasciatus</i>	M	15	> 100

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Pteronarcys</i>	YC ₂	15	60 50-70
Rainbow trout	1.6	13	11
Bluegill	0.9	24	41
Redear sunfish	3.0	24	> 12

^a48-h EC50.

FENAMINOSULF

Chemical Name: p-(Dimethylamino) benzenediazo sodium sulfonate

Alternate Names: Bay 6027, Bay 22555, CAS 140-56-7, Dexon, Diazoben, ENT-16841

Principal Use: Fungicide

Sample Description: Technical material, 89%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. fasciatus</i>	M	21	3.7 2.7-5.0
<i>Pteronarcys</i>	YC ₂	15	24 20-28
Coho salmon	1.4	13	> 100
Rainbow trout	1.5	13	> 60
Bluegill	0.5	18	85.0 72.7-99.3

FENITROTHION

Chemical Name: 0,0-Dimethyl 0-(4-nitro-m-tolyl) phosphorothioate

Alternate Names: Accothion, Agrothion, Bay 41831, CAS 122-14-5, ENT-25715, Folithion, MEP, Methyl-nitrophos, Novathion, Nuvanol, Sumithion, Cytel, S-5660

Principal Use: Insecticide

Sample Description: Technical material, 95%¹; liquid concentrate, 87.3%²; wettable powder, 40%³

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Daphnia magna</i> ¹	I ₁	21	0.011 ^a 0.005-0.021
<i>G. fasciatus</i> ¹	M	15	0.003 ^b
<i>Pteronarcys</i> ¹	YC ₁	15	0.004 0.003-0.006
Coho salmon ¹	0.6	12	5.0 4.1-6.1
Cutthroat trout ¹	0.7	10	3.6 ^b 2.7-4.9
Rainbow trout ¹	1.5	10	2.4 2.0-2.9
Goldfish ¹	1.0	18	2.8 1.6-4.7
Fathead minnow ¹	1.0	20	3.2 2.4-4.2
Channel catfish ¹	4.7	20	4.3 3.6-5.1
Green sunfish ¹	0.8	18	4.1 2.9-5.9
Bluegill ¹	0.7	20	3.8 3.2-4.5
Cutthroat trout ²	0.8	10	3.3 ^b 2.7-3.9
Rainbow trout ²	1.5	10	2.4 2.0-2.9
Fathead minnow ²	1.0	20	4.8 3.8-6.1
Channel catfish ²	4.7	20	4.8 3.7-6.2
Bluegill ²	0.7	20	3.8 3.2-4.5
Atlantic salmon ³	0.4	12	1.7 1.5-2.0
Brown trout ³	1.0	12	2.2 2.0-2.5
Brook trout ³	0.4	12	2.0 1.6-2.5

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Carp ^a	1.1	12	12.0 10.2-14.2
Bluegill ^a	0.5	12	4.3 3.2-5.0

^a48-h EC50.^bTested in hard water, 272 ppm CaCO₃.

NOTE: Variations in temperature (7° to 17°C), pH (6.5 to 9.0), or water hardness (12 to 300 ppm) did not effectively alter the toxicity to fish. Toxicity to brown trout did not change after periods of up to 3 weeks of aqueous degradation.

FENTHION

Chemical Name: 0,0-Dimethyl 0-[4-(methylthio)-m-tolyl] phosphorothioate

Alternate Names: Bay 29493, Baytex, CAS 55-38-9, DMPT, ENT-25540, Entex, Lebaycid, Quelatox, S-1752, Tiguron

Principal Use: Insecticide

Sample Description: Technical material, 97%¹; Baytex spray concentrate, 46%²; Baytex spray concentrate, 47.5%³

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>Simocephalus</i> ¹	I ₁	21	0.62 ^a 0.44-0.87
<i>Daphnia pulex</i> ¹	I ₁	15	0.80 ^a 0.56-1.20
<i>Asellus</i> ¹	M	21	1,800 1,100-4,900
<i>G. lacustris</i> ¹	M	21	8.4 5.0-12.0
<i>Orconectes</i> ¹	I _E	21	50 ^{b,c} 35-90
<i>Pteronarcys</i> ¹	YC ₂	15	4.5 3.3-6.7

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
Cutthroat trout ¹	1.2	10	1,580 1,290-1,930
Lake trout ¹	2.0	10	1,900 1,700-2,020
<i>Cypridopsis</i> ²	M	21	18 ^a
<i>Palaemonetes</i> ²	M	21	10 ^c 7.1-14.0
Coho salmon ²	0.4	13	1,320 1,020-1,680
Rainbow trout ²	1.0	13	930 750-1,150
Brown trout ²	1.1	13	1,330 966-1,820
Carp ²	0.5	18	1,160 532-2,550
Fathead minnow ²	0.9	18	2,440 1,830-3,270
Black bullhead ²	1.2	18	1,350 1,020-1,800
Channel catfish ²	1.1	18	1,600 1,250-2,060
Green sunfish ²	1.1	18	2,340 1,750-3,130
Yellow perch ²	1.4	18	1,650 1,350-2,020
Goldfish ³	0.9	18	3,404 1,775-6,536
Bluegill ³	1.5	18	1,380 1,080-1,770
Largemouth bass ³	0.9	18	1,540 1,430-1,660

^a48-h EC50.^bFive-day LC50.^cHard water, 272 ppm CaCO₃.

NOTE: Toxicity to fish did not change within a pH range of 6.0 to 9.0 or a water hardness range of 44 to 272 ppm. The time-independent LC50 for cutthroat trout was 460 μg/L. The cumulative toxicity index of 2.5 indicated a low level of cumulative toxicity.

FIRE-TROL 100

Chemical Name: Ammonium sulfate plus thickening, coloring, and anti-corrosion additives

Alternate Names: None known

Principal Use: Forest fire retardant

Sample Description: Commercial formulation, 62%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. pseudolimnaeus</i>	M	18	62 ^a 50-85
Coho salmon	1.0	11	> 1,500
Rainbow trout	0.8	11	> 1,000
Fathead minnow	0.7	21	> 1,500
Bluegill	1.0	21	> 1,500
Largemouth bass	0.5	21	> 1,500

^aTested in hard water, 272 ppm CaCO₃.

NOTE: Early life stages of coho salmon and rainbow trout were more sensitive than fingerlings. The 96-h LC50's of yolk-sac and swim-up fry were 90 and 920 mg/L, respectively, for coho salmon and 150 and 780 mg/L for rainbow trout. Fingerlings were more sensitive at 6°C than at 11°C; 96-h LC50's at 6°C were 780 µg/L for coho salmon and 1,000 µg/L for rainbow trout. Time-independent LC50's were 70 µg/L for coho salmon and 43 mg/L for rainbow trout; cumulative toxicity indices were 4.0 and > 2.3, respectively.

FIRE-TROL 931

Chemical Name: Ammonium polyphosphate plus thickening, coloring, and anti-corrosion additives.

Alternate Names: None known

Principal Use: Forest fire retardant

Sample Description: Commercial formulation, 93%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. pseudolimnaeus</i>	M	18	55 ^a 48-62
Coho salmon	1.0	11	1,000 943-1,060
Rainbow trout	0.8	11	940 796-1,110
Fathead minnow	0.7	21	> 1,500
Bluegill	1.0	21	> 1,500
Largemouth bass	0.5	21	1,160 1,050-1,280

^aTested in hard water, 272 ppm CaCO₃.

NOTE: Yolk-sac fry were somewhat more sensitive than fingerlings in coho salmon and rainbow trout; 96-h LC50's for yolk-sac fry were 580 mg/L for coho salmon and 700 mg/L for rainbow trout. A decrease in test temperature from 11° to 6°C did not appreciably alter the toxicity to either species.

FOLPET

Chemical Name: N-(Trichloromethylthio) phthalimide

Alternate Names: CAS 133-07-3, ENT-26539, Folpan, Phaltan, Thiopal

Principal Use: Fungicide

Sample Description: Technical material, 88-93%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	15	2,500 1,994-3,134
Coho salmon	1.0	12	106 82-137
Rainbow trout	1.5	12	39 18-85
Brown trout	0.6	12	66 56-78

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Lake trout	0.5	12	87 68-110
Fathead minnow	0.3	12	298 207-430
Channel catfish	1.2	20	108 59-201
Bluegill	0.6	20	72 58-89
Smallmouth bass	F	12	91 73-113
Yellow perch	0.6	12	177 149-210

GLYPHOSATE

Chemical Name: N-(Phosphonomethyl) glycine

Alternate Names: Roundup, MON-2139

Principal Use: Herbicide

Sample Description: Technical material, 96.7%¹; liquid, 41%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ¹	0.8	12	130 108-156
Fathead minnow ¹	0.6	20	97 79-120
Channel catfish ¹	2.2	22	130 108-156
Bluegill ¹	0.9	22	135 113-162
<i>Daphnia magna</i> ²	I ₁	22	3.0 ^a 2.6-3.4
<i>G. pseudolimnaeus</i> ²	M	12	43 28-66
<i>Chironomus</i> ²	I ₄	22	55 ^a 31-97

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ²	1.0	12	8.3 7.0-9.9
Fathead minnow ²	0.6	22	2.3 1.9-2.8
Channel catfish ²	0.6	22	13 11-16
Bluegill ²	0.7	22	5.6 4.2-7.5

^a48-h EC50.

NOTE: Test conditions and size of fish altered the toxicity of glyphosate. Toxicity increased with increasing temperature; glyphosate was twice as toxic to rainbow trout at 17°C than at 7°C and to bluegills at 27°C than at 17°C. Toxicity was 2 to 4 times greater to bluegills and rainbow trout at pH 7.5 to 9.5 than at pH 6.5. Toxicity of Roundup (41% liquid) to midge larvae, rainbow trout, or bluegills did not change when test solutions were aged from 1 to 7 days. The egg stage was the least sensitive early life stage for both rainbow trout and channel catfish. Tests with sac fry and swim-up fry yielded 96-h LC50's ranging from 2.4 to 4.3 mg/L. Fingerlings yielded 96-h LC50's of 8.3 mg/L for rainbow trout and 13 mg/L for channel catfish. Overall, the Roundup formulation was 3 to 42 times more toxic than the technical grade material.

HEPTACHLOR

Chemical Name: 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene

Alternate Names: CAS 76-48-8, E-3314, ENT-15152, H-34, Heptachlore, Heptagran, Heptamul, Velsicol 104

Principal Use: Insecticide

Sample Description: Technical material, 99%¹; heptachlor epoxide²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i> ¹	I ₁	15	47 ^a 32-68

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>Daphnia pulex</i> ¹	I ₁	15	42 ^a 21-63
<i>G. fasciatus</i> ¹	M	15	56 33-78
<i>G. lacustris</i> ¹	M	21	29 18-48
<i>Palaemonetes</i> ¹	M	21	1.8 1.4-2.4
<i>Orconectes</i> ¹	I _E	21	0.5 0.3-1.8
<i>Pteronarcys</i> ¹	YC ₂	15	1.1 0.9-1.4
<i>Pteronarcella</i> ¹	N	15	0.9 0.6-1.3
<i>Claassenia</i> ¹	YC ₂	15	2.8 2.1-3.7
Rainbow trout ¹	0.8	13	7.4 6.7-8.2
Northern pike ¹	0.7	18	6.2
Fathead minnow ¹	1.3	18	23
Black bullhead ¹	0.9	24	63 46-86
Channel catfish ¹	1.0	18	25 17-36
Bluegill ¹	1.0	17	13 9-19
Redear sunfish ¹	1.1	24	17 15-19
Largemouth bass ¹	0.8	18	10 7.4-14
Rainbow trout ²	1.2	13	20 16-25
Bluegill ²	0.5	24	5.3 3.9-7.2

^a48-h EC50.

NOTE: Test temperatures ranging from 2° to 18°C did not alter the toxicity to rainbow trout; however, a 4.8-fold increase was noted in redear sunfish when tem-

perature was incrementally increased from 7° to 29°C. No change in toxicity to rainbow trout was noted at water hardnesses between 44 and 272 ppm. Significant toxic effects were noted in the two high treatment levels in ponds treated with 12.5, 25, 37.5, and 50 $\mu\text{g/L}$ of heptachlor. Mortalities for bluegills and aquatic invertebrates were 90 and 100%, respectively, within 7 days after treatment. However, invertebrates showed nearly complete recovery within 28 days. Bluegills accumulated peak whole body residues ranging from 11 to 57 ppm within 2 weeks after treatment; residues were reduced about 50% after 28 days and were undetectable after 84 days. Severe degenerative liver lesions that developed within 14 days after treatment were maintained through 56 days post-treatment. A gradual return to normal occurred thereafter. No differences in growth or spawning success were noted between treated and untreated ponds. Bluegills fed diets containing 5 to 25 ppm heptachlor showed toxic responses similar to those of fish in treated ponds.

HEXACHLOROBENZENE

Chemical Name: Hexachlorobenzene

Alternate Names: Anticarie, Bunt Cure, Bunt-No-More, CAS-118-74-1, ENT-1719, HCB, Hexa C.B., No Bunt, Sanocide, Smut-Go.

Principal Use: Fungicide, Industrial intermediate

Sample Description: Technical material, 80-96%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Coho salmon	0.5	7	> 50
Fathead minnow	0.7	20	22
Channel catfish	0.8	20	14 11-16
Bluegill	1.0	20	12 ^a
Largemouth bass	0.5	21	12 ^a

^aTested in hard water.

NOTE: In channel catfish the 96-h LC50 for yolk-sac fry was about half the value for fingerlings. Rainbow trout accumulated residues 3,800 to 8,900 times the exposure level of 0.1 to 2.0 $\mu\text{g/L}$ within 28 days, and *Daphnia* accumulated residues near 900 times the exposure level of 0.05 to 0.15 $\mu\text{g/L}$ within 48 h. The

residue half-life in *Daphnia* was 44 h; however, neither trout nor *Daphnia* appeared to degrade HCB significantly. Preliminary food chain studies indicated that bluegills accumulated HCB to a level 1 to 2 times that observed for DDT when they were fed *Daphnia* containing residues of 50 ng/g. In comparison, bluegills accumulated residues about half that of DDT in water exposure at concentrations of only 0.05 to 0.15 µg/L. After 5 days of incubation, both aerobically and anaerobically, hydrosol samples inoculated with ring labeled HCB showed an 80 to 90% loss of material. Although phenolic volatilization may be responsible for some of this loss, degradation products were revealed, one of which has been tentatively identified as pentachlorophenol.

HOUGHTO-SAFE 1120

Chemical Name: Mixture of tri-aryl phosphate esters containing phenyl, tolyl (cresyl), xylyl, and ethyl substituted benzene groups

Alternate Names: Tri-aryl phosphate ester

Principal Use: Hydraulic fluids

Sample Description: Commercial formulations, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. pseudolimnaeus</i>	M	20	0.70 ^a 0.53-0.92
Coho salmon	0.4	12	1.2 ^b 0.9-1.5
Rainbow trout	1.4	12	1.7 1.2-2.5
Brook trout	4.0	12	3.6 ^b 3.1-4.2
Fathead minnow	1.2	17	35 24-49
Channel catfish	1.6	21	43 31-59
Bluegill	0.6	20	12 8-19
Yellow perch	7.2	12	0.54 ^{a,b} 0.42-0.70

^aTested in hard water.

^bFlow-through toxicity test.

NOTE: Flow-through toxicity tests produced TILC50's ranging from 0.54 mg/L for rainbow trout to 6.60 mg/L for fathead minnows. Cumulative toxicity indices ranged only from 1.20 to 3.14, indicating little or no cumulative toxic action. Sublethal effects were prominent in flow-through tests at concentrations considerably below acutely lethal levels. Such effects included early cessation of feeding, hypersensitivity, and erratic swimming, followed by a loss of motor function, hemorrhage in the dorsal fin region, and occurrence of a characteristic "broken back" syndrome. This condition remained for extended periods until terminated by death from secondary causes.

KEPONE

Chemical Name: Decachlorooctahydro-1,3,4-metheno-2H-cyclobuta [cd] pentalen-2-one

Alternate Names: CAS 143-50-0, ENT-16391, GC-1899, Chlordecone

Principal Use: Insecticide

Sample Description: Technical material, 90.7%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Daphnia magna</i>	I ₁	17	260 ^a 200-345
<i>G. pseudolimnaeus</i>	M	17	180 110-290
<i>Chironomus</i>	I ₄	22	320 ^a 220-450
Rainbow trout	1.1	12	30 24-38
Channel catfish	1.6	18	225
Bluegill	2-5	24	72
Redear sunfish	1.0	24	44 41-47

^a48-h EC50.

NOTE: Variation in water hardness from 44 to 272 ppm did not alter toxicity to rainbow trout. An increase in temperature from 7° to 29°C produced a 4.8-fold increase in toxicity.

LEPTOPHOS

Chemical Name: 0-(4-Bromo-2,5-dichlorophenyl) 0-methylphenylphosphonothioate

Alternate Names: Abar, Lepton, MBCP, Phosvel, VCS 5-d, VDS-506

Principal Use: Insecticide

Sample Description: Technical material, 87.2%¹; emulsifiable concentrate, 2.7%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Procambarus</i> ¹	I _E	12	> 7,000
Cutthroat trout ¹	0.6	10	5.3 4.2-6.8
Rainbow trout ¹	1.0	12	20 12-32
Lake trout ¹	2.2	12	30 21-43
Fathead minnow ¹	0.5	5	> 30,000
Bluegill ¹	1.4	5	22 14-35
Rainbow trout ²	0.6	12	35 29-42

NOTE: Alterations in pH and hardness did not appreciably affect the toxicity to fish. Aging of test solutions for 7 to 21 days lowered toxicity by about one-half.

LIGNASAN

Chemical Name: Methyl 2-benzimidazolecarbamate phosphate

Alternate Names: Correx, Lignasan BLP

Principal Use: Fungicide

Sample Description: Technical material, 98.1%¹; liquid, 0.7%²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ¹	0.9	12	1.6 1.2-2.1
Fathead minnow ¹	0.9	22	> 100
Channel catfish ¹	0.8	22	0.022 0.014-0.034
Bluegill ¹	0.9	22	> 100
Rainbow trout ²	1.0	12	0.56 0.42-0.74
Channel catfish ²	0.8	22	0.019 0.013-0.028
Bluegill ²	0.6	22	14.0 9.4-21.0

LIME SULFUR

Chemical Name: Calcium polysulfide

Alternate Names: Eau Grison, Orthorix

Principal Use: Fungicide, acaricide

Sample Description: Liquid concentrate, 29%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Simocephalus</i>	I ₁	15	11 ^a 9-14
<i>Daphnia pulex</i>	I ₁	15	10 ^a 7-15
Rainbow trout	0.8	12	8
Fathead minnow	1.2	18	32 ^b 24-42
Bluegill	1.0	18	49 44-53

^a48-h EC50.

^bTested in hard water, 272 ppm CaCO₃.

LINDANE

Chemical Name: Gamma isomer of 1,2,3,4,5,6-hexa=chlorocyclohexane

Alternate Names: Benesan, CAS 58-89-9, ENT-7796, Forlin, Gamaphex, Gamma BHC, Gammafog, Gammalin, Gammex, Gammexane, Isotox, Lindafor, Lindagam, Lindamul, Lintox, Novigam, Oko, Silvanol.

Principal Use: Insecticide

Sample Description: Technical material, 99%.

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i>	I ₁	15	520 ^a 340-790
<i>Daphnia pulex</i>	I ₁	15	460 ^a 386-547
<i>Cypridopsis</i>	M	21	3.2 2.2-4.6
<i>Asellus</i>	M	15	10 7-14
<i>G. fasciatus</i>	M	15	10 7-14
<i>G. lacustris</i>	M	21	88 57-136
<i>Pteronarcys</i>	YC ₂	15	4.5 3.6-5.7
Coho salmon	0.6	12	23 19-28
Rainbow trout	1.0	12	27 20-36
Brown trout	1.7	13	1.7 1.2-2.4
Lake trout	0.7	12	32 24-42
Goldfish	0.9	18	131 92-187

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Carp	0.6	18	90 75-120
Fathead minnow	1.2	18	87 69-101
Black bullhead	1.2	18	64 49-81
Channel catfish	1.5	18	44 37-52
Green sunfish	1.1	18	83 47-149
Bluegill	1.5	18	68 60-78
Largemouth bass	0.9	18	32 27-38
Yellow perch	1.4	18	68 60-76

^a48-h EC50.

NOTE: Stonefly nymphs of the first-year class were 4.5 times more susceptible to lindane than were those of the second-year class. Variations in water hardness from 44 to 272 ppm did not alter the toxicity to fish or invertebrates. An increase in temperature from 2° to 18°C caused a 2.3-fold decrease in toxicity to rainbow trout; an increase from 7° to 29°C caused a 2.6-fold increase in toxicity to bluegills. Sublethal exposure of fish to lindane produced focal necrotic lesions in the liver and damage to the convoluted tubules in kidney glomeruli.

MALATHION

Chemical Name: 0,0-Dimethyl S-(1,2-dicarbethoxy=ethyl) phosphorodithioate

Alternate Names: AC-4049, Carbofos, Carbophos, CAS 121-75-5, Chemathion, Cythion, Emmatos, ENT-17034, For-Mal, Fyfanon, Karbofos, Kop-Thion, Kypfos, Malamar, Malaphos, Malaspray, Malathon, MLT, Mercaptothion, Mor-Mal, Zithiol

Principal Use: Insecticide

Sample Description: Technical material, 95%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)	Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>Simocephalus</i>	I ₁	15	3.5 ^a 2.6-4.8	Brown trout	1.1	12	101 84-115
<i>Daphnia magna</i>	I ₁	15	1.0 ^a 0.7-1.4	Lake trout	0.3	12	76 ^b 47-123
<i>Daphnia pulex</i>	I ₁	15	1.8 ^a 1.4-2.4	Goldfish	0.9	18	10,700 8,340-13,800
<i>Cypridopsis</i>	M	21	47 ^a 32-69	Carp	0.6	18	6,590 4,920-8,820
<i>Asellus</i>	M	21	3,000 1,500-8,500	Fathead minnow	0.9	18	8,650 6,450-11,500
<i>G. fasciatus</i>	M	21	0.76 0.63-0.92	Black bullhead	1.2	18	12,900 10,700-15,600
<i>Orconectes</i>	I _E	15	180 ^b 140-230	Channel catfish	1.5	18	8,970 6,780-12,000
<i>Palaemonetes</i>	M	21	90 ^b 67-120	Green sunfish	1.1	18	175 134-228
<i>Pteronarcys</i>	YC ₂	15	10 7.0-13	Bluegill	1.5	18	103 87-122
<i>Pteronarcella</i>	N	15	1.1 0.8-1.5	Redear sunfish	3.2	24	62 58-67
<i>Claassenia</i>	YC ₂	15	2.8 1.4-4.3	Largemouth bass	0.9	18	285 254-320
<i>Isoperla</i>	YC ₁	15	0.69 0.20-2.4	Yellow perch	1.4	18	263 205-338
<i>Lestes</i>	J	15	10 6.5-15	Walleye	1.3	18	64 59-70
<i>Hydropsyche</i>	J	15	5.0 2.9-8.6	^a 48-h EC50. ^b Tested in hard water (162-272 ppm CaCO ₃).			
<i>Limnephilus</i>	J	15	1.3 0.8-2.0	NOTE: In lake trout, fry (0.3 g) were twice as sensitive as fingerlings (4.5 g) to malathion. An increase in temperature from 10° to 21°C caused an 11-fold decrease in toxicity to the daphnid <i>Simocephalus</i> ; however, an increase from 7° to 29°C caused a fourfold increase in toxicity to bluegills. Variations in water hardness did not appreciably alter the toxicity to fish or invertebrates. Mixtures of malathion with Baytex, parathion, EPN, Perthane, or carbaryl were synergistic in their toxicity to rainbow trout and bluegills. Combinations of malathion with DDT or toxaphene were			
<i>Atherix</i>	J	15	385 246-602				
Coho salmon	0.9	12	170 160-180				
Cutthroat trout	1.0	12	280 270-310				
Rainbow trout	1.4	12	200 160-240				

only additive. Salmonids exposed to 120 to 300 µg/L malathion showed acetylcholinesterase (AChE) inhibition of 70 to 80%, and activity indices were reduced by 50 to 70% of that of unexposed fish. Goldfish exposed to sublethal levels showed a significantly reduced frequency of avoidance response at levels below that causing a reduced AChE activity. One-hour bath exposures of rainbow trout to sublethal levels of malathion caused severe tissue damage to the gills and minor nonspecific liver lesions. Ponds given four semi-monthly treatments during May-July at levels up to 0.02 mg/L produced no discernible effects on resident bluegill and channel catfish populations. Aquatic insect populations were significantly depressed at the high treatment level but not at the lower levels.

METHOMYL

Chemical Name: S-Methyl-N-[(methylcarbamoyl)oxy]thioacetimidate

Alternate Names: CAS 16752-77-5, Dupont 1179, Lannate, Nudrin

Principal Use: Insecticide-nematocide

Sample Description: Technical material, 95-98%¹; liquid concentrate, 24%²; liquid formulation, 29%³

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Daphnia magna</i> ¹	I ₁	21	8.8 ^{a,b} 4.1-19
<i>Pteronarcella</i> ¹	N	7	69 34-143
<i>Skwala</i> ¹	N	7	34 27-44
Cutthroat trout ¹	1.0	10	6,800 2,180-7,530
Rainbow trout ¹	1.1	12	1,600 1,190-2,150
Fathead minnow ¹	0.8	17	2,800 1,820-4,310
Atlantic salmon ¹	0.5	12	1,120 930-1,350
Brook trout ¹	1.2	12	1,500 1,230-1,830

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Channel catfish ¹	1.0	22	530 375-748
Bluegill ¹	0.9	20	1,050 859-1,280
Largemouth bass ¹	3.0	22	1,250 971-1,610
<i>Daphnia magna</i> ²	I ₁	20	3,200 ^{a,b} 1,990-5,130
<i>G. pseudolimnaeus</i> ²	M	12	1,050 ^b 424-2,600
<i>Pteronarcella</i> ²	N	7	60 50-80
<i>Skwala</i> ²	N	7	29 21-41
<i>Chironomus</i> ²	I ₄	20	32 ^c 13-80
Rainbow trout ²	1.0	12	1,200 1,100-1,400
Atlantic salmon ²	0.3	12	1,400 1,250-1,570
Brook trout ²	1.2	12	2,200 1,600-3,010
Fathead minnow ²	0.2	22	1,800 1,200-2,700
Channel catfish ²	0.5	22	300 200-430
Bluegill ²	0.9	20	710 561-898
Largemouth bass ²	3.0	22	760 589-979
Rainbow trout ³	0.6	12	1,200 764-1,880
Fathead minnow ³	0.8	17	1,500 890-2,540
Atlantic salmon ³	0.3	12	1,200 1,050-1,380
Brook trout ³	1.2	12	1,220 860-1,730

Test organism	Stage or wt (g)	Temp (C)	96-h LC50
			95% CI ($\mu\text{g/L}$)
Channel catfish ^a	0.8	17	320 275-371
Bluegill ^a	0.8	17	670 428-1,048

^a48-h EC50.^bTested in hard water, 272 ppm CaCO₃.^c48-h LC50.

NOTE: Eyed eggs of rainbow trout, with a 96-h LC50 of 32,000 $\mu\text{g/L}$, were much less sensitive than fingerlings to methomyl. Yolk-sac fry, with a 96-h LC50 of 3,200 $\mu\text{g/L}$, were about twice as tolerant as were fingerlings. Swim-up fry and fingerlings were equally susceptible. No changes in toxicity were noted at test temperatures between 12° and 17°C for rainbow trout and 17° and 27°C for bluegills. Variations in pH from 6.5 to 8.5 did not alter toxicity to either rainbow trout or bluegills. Aging of test solutions for 7 days increased the toxicity to scuds (*G. pseudolimnaeus*) threefold but did not alter the toxicity to rainbow trout.

METHOPRENE

Chemical Name: Isopropyl (2E,4E)-11-methoxy-3,7,11-trimethyl-2,4,-dodecadienoate

Alternate Names: Altosid, ZR-515

Principal Use: Insecticide

Sample Description: Technical material, 68.9%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50
			95% CI (mg/L)
Rainbow trout	0.6	12	1.6 1.0-2.4
Fathead minnow	0.7	20	> 10.0
Channel catfish	1.2	20	> 100
Bluegill	0.6	20	2.9 1.9-4.5

METHOXYCHLOR

Chemical Name: 2,2-Bis(p-methoxyphenyl)-1,1,1-tri-chloroethane

Alternate Names: CAS 72-43-5, Dimethoxy-DT, DMDT, ENT-1716, Marlate, Methoxo, Methoxy-DDT

Principal Use: Insecticide

Sample Description: Technical material, 89.5%¹; granular, 50%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50
			95% CI ($\mu\text{g/L}$)
<i>Simocephalus</i> ¹	I ₁	15	5.0 ^a 3.8-6.6
<i>Daphnia pulex</i> ¹	I ₁	15	0.78 ^a 0.57-1.07
<i>Cypridopsis</i> ¹	M	21	32 ^a 23-45
<i>Asellus</i> ¹	M	18	34 25-47
<i>G. fasciatus</i> ¹	M	15	1.9 1.2-3.1
<i>G. lacustris</i> ¹	M	21	0.80 0.56-1.14
<i>Orconectes</i> ¹	I _E	21	0.50 0.25-1.80
<i>Palaemonetes</i> ¹	M	21	1.05 0.76-1.46
<i>Pteronarcella</i> ¹	N	10	5.0 3.9-6.3
<i>Pteronarcys</i> ¹	YC ₂	15	1.4 1.1-1.8
Cutthroat trout ¹	0.5	12	15 14-17
Rainbow trout ¹	1.2	12	62 55-69
Atlantic salmon ¹	0.6	12	16.4 13.8-19.5
Brook trout ¹	1.2	12	19.0 16.4-22.0

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Lake trout ¹	3.0	12	17 13-24 ^b
Northern pike ¹	0.7	18	12 ^b
Goldfish ¹	1.0	18	42 33-52
Fathead minnow ¹	1.0	18	39 31-49
Channel catfish ¹	1.2	18	52 38-71
Bluegill ¹	1.2	17	32 20-49
Largemouth bass ¹	0.8	18	16 13-18 ^b
Yellow perch ¹	1.0	12	30.0 22.8-39.4
Atlantic salmon ²	0.6	12	1.7 1.1-2.8
Brook trout ²	0.7	12	11.7 9.3-14.8
Yellow perch ²	1.0	12	17.5 13.3-23.1

^a48-h EC50.

^bTested in hard water, 162-272 ppm CaCO₃.

NOTE: Variations in temperature from 15° to 21°C did not alter toxicity to daphnids. A slight decrease in toxicity was noted when temperatures increased from 2° to 18°C for rainbow trout and from 12° to 24°C for bluegills. Brook trout were equally susceptible to test solutions of pH 6.5, 7.5, and 8.5. Variations in hardness from 42 to 300 mg/L did not alter toxicity to cutthroat trout, brook trout, or bluegills. No difference in susceptibility was noted between species of trout; 96-h LC50's ranged from 9 to 25 µg/L. Yolk-sac fry and eyed eggs of brook trout were highly tolerant of methoxychlor; 96-h LC50's exceeded 400 µg/L for fry and 50,000 µg/L for eyed eggs. The TL50's for cutthroat trout and brook trout were 1.5 and 4.1 µg/L, respectively. The cumulative toxicity indices were 3.0 and 4.1, indicating slight cumulative toxicity. The major degradation product of hydrosol microorganisms was methoxychlor olefin (MDE); degradation occurred only under aerobic conditions. No evidence of metabolism by daphnids, mayflies, or rainbow trout was observed; however, in vitro preparations of liver microsomes of

channel catfish produced olefin as a major degradation product. Compared with the parent molecule, MDE was about 0.001 as toxic to crustacea and aquatic insect larvae and 0.03 as toxic to bluegills. Microorganisms rapidly accumulated ¹⁴C-methoxychlor to levels 1,000 to 3,000 times the exposure levels of 0.1 to 5.0 µg/L. Uptake appeared to be a passive process. *Daphnia*, mayfly larvae, and rainbow trout fry exposed to a concentration of 50 ng/L had accumulation factors similar to these values. However, neither mosquito larvae nor damselfly naiads appeared to accumulate residues. No magnification of residues between trophic levels was observed when *Daphnia* were fed bacteria containing residues of 0.1 µg/g, or when fingerling largemouth bass were fed *Daphnia* containing residues up to 0.06 µg/g. At concentrations of 1 µg/L of methoxychlor or MDE, *Daphnia* exposed for three generations grew and reproduced normally, but the emergence of mayfly nymphs was drastically reduced. In ponds treated with 10 to 40 µg/L, the total number of benthic organisms increased and species composition changed, chironomids becoming the dominant species. Neither survival nor growth of bluegills in the treated ponds was affected; however, most of the fish examined showed nonspecific liver degeneration and an accumulation of a muco- or glyco-proteinaceous material inside the major blood vessels. Regression of these effects had occurred by 56 days after treatment.

METHYL TRITHION

Chemical Name: S-(((p-Chlorophenyl)thio)methyl) 0,0-dimethyl phosphorodithioate

Alternate Names: CAS 953-17-3, ENT-25586, Stauffer R-1492, TRI-ME

Principal Use: Insecticide

Sample Description: Technical material, 91.4%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	21	11 8-15
<i>Pteronarcys</i>	YC ₂	15	6.2
Cutthroat trout	1.0	12	1,200 1,100-1,400
Rainbow trout	1.2	12	760 605-95

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Channel catfish	1.1	18	2,800 2,330-3,365
Bluegill	1.1	18	960 743-1,240
Largemouth bass	0.7	18	610 ^a 442-841

^aTested in hard water, 272 ppm CaCO₃.

NOTE: Toxicity to bluegills was not altered when water hardness varied from 44 to 272 ppm.

MEVINPHOS

Chemical Name: Dimethyl phosphate of methyl-3-hydroxy-cis-crotonate

Alternate Names: Phosdrin, OS-2046, Phosfene, Menite

Principal Use: Systemic insecticide-acaricide

Sample Description: Technical material, 60%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i>	I ₁	15	0.42 ^a 0.32-0.56
<i>Daphnia pulex</i>	I ₁	15	0.18 ^a 0.13-0.25
<i>Asellus</i>	J	15	61 39-95
<i>G. fasciatus</i>	J	15	3.5 3.1-3.9
<i>Pteronarcys</i>	YC ₁	15	5.0 3.6-6.9
Rainbow trout	0.9	12	11.9 10.7-13.2
Bluegill	0.9	24	22.5 19.6-25.8

^a48-h EC50.

MEXACARBATE

Chemical Name: 4-(Dimethylamino)-3,5-xylyl methyl= carbamate

Alternate Names: CAS 315-18-4, Dowco 139, ENT-25766, Zectran

Principal Use: Insecticide

Sample Description: Technical material, 90-95%¹; metabolites (analytical grade 99%): 4-dimethyl= amino-3,5-xylenol²; 4-amino-3,5-xylenol³

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Simocephalus</i> ¹	I ₁	15	0.013 ^a 0.011-0.016
<i>Daphnia pulex</i> ¹	I ₁	15	0.010 ^a 0.007-0.015
<i>G. fasciatus</i> ¹	M	21	0.04 0.03-0.06
<i>Procambarus</i> ¹	I _E	12	1.2
<i>Pteronarcys</i> ¹	YC ₂	15	0.010 0.007-0.014
Coho salmon ¹	0.5	12	23.0 19.7-26.9
Cutthroat trout ¹	0.8	10	15.8 15.1-16.5
Rainbow trout ¹	1.0	11	12.0 10.3-14.0
Atlantic salmon ¹	0.5	12	22.3 19.2-25.9
Lake trout ¹	1.0	12	8.2 3.7-18.0
Carp ¹	0.6	18	13.4 11.3-16.0
Fathead minnow ¹	1.0	18	17.0 15.7-18.2
Channel catfish ¹	1.4	18	11.4 8.3-15.9
Green sunfish ¹	1.1	18	16.7 14.5-19.3

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Bluegill ¹	0.7	12	22.9 21.3-24.6
Largemouth bass ¹	0.9	18	14.7 13.8-15.8
Yellow perch ¹	0.4	12	16.2 13.8-19.0
<i>Daphnia magna</i> ²	I ₁	21	0.10-0.32 ^{a,b}
Bluegill ²	0.5	12	7.2 5.6-9.2
Bluegill ³	0.5	12	0.32 0.23-0.44

^a48-h EC50.^bTested in hard water, 272 ppm CaCO₃.

NOTE: Variations of species, temperature, or water hardness did not produce 96-h LC50's outside the range of 10-25 mg/L for 17 species of fish tested. Although pH did not alter the toxicity to crayfish, an increase in pH from 6.5 to 9.5 increased the toxicity to fish up to 40 times. Similar increases in toxicity were noted in test solutions aged up to 3 weeks at different pH's, but solutions aged 4 weeks showed reduced toxicity; the early increases can be attributed to the instability of mexacarbate and the increased toxicity of the degradation products, 4-dimethylamino-3,5-xyleneol and 4-amino-3,5-xyleneol, particularly at alkaline pH's. Cumulative toxicity indices ranged between 1 and 4 for three species of fish, indicating only slight cumulative toxicity.

MIREX

Chemical Name: Dodecachlorooctahydro-1,3,4-metheno-2H-cyclobuta(cd)pentalene

Alternate Names: Dechlorane, GC-1283

Principal Use: Stomach insecticide

Sample Description: Technical material, 98%¹; wettable powder, 50%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Simocephalus</i> ¹	I ₁	16	> 0.100 ^a

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Daphnia pulex</i> ¹	I ₁	16	> 0.100 ^a
<i>Daphnia magna</i> ¹	I ₁	17	> 1.0 ^a
<i>G. pseudolimnaeus</i> ¹	M	17	> 1.0
<i>Chironomus</i> ¹	I ₄	22	> 1.0 ^a
Rainbow trout ¹	1.0	12	> 100
Yellow perch ¹	2.6	15	> 100
Fathead minnow ²	1.3	18	> 100
Bluegill ²	1.1	18	> 100
Walleye ²	1.4	18	> 100

^a48-h EC50.

MOLINATE

Chemical Name: S-Ethyl hexahydro-1 H-azepine-1-carbothioate

Alternate Names: Ordram, Hydram

Principal Use: Selective herbicide

Sample Description: Technical material, 98.6%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. fasciatus</i>	M	21	4.5 3.5-5.8
<i>Pteronarcys</i>	M	15	0.34 0.24-0.47
Rainbow trout	1.6	12	0.21 0.16-0.29
Bluegill	1.0	24	0.32 0.19-0.53

MON-0818

Chemical Name: Not known

Alternate Names: Not known

Principal Use: Surfactant for MON-2139 (Glyphosate)

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Chironomus</i>	I ₄	22	13.0 ^a 7.1-24
Rainbow trout	0.8	12	2.0 1.5-2.7
Fathead minnow	0.6	22	1.4 1.2-1.7
Channel catfish	0.6	22	13.0 9.9-16.9
Bluegill	0.8	22	3.0 2.5-3.7

^a48-h EC50.

NOTE: The toxicity of the technical grade surfactant alone was similar to that of the Roundup formulation of glyphosate. This surfactant alone is primarily responsible for the toxicity of the commercial product Roundup; it does not merely enhance the biological availability of glyphosate.

MSMA

Chemical Name: Monosodium methanearsonate

Alternate Names: CAS 2163-80-6, Arsar 529, Daconate

Principal Use: Herbicide

Sample Description: Liquid formulations, 34.8%¹; plus surfactant, 37.7%²

SUMMARY OF ACUTE TOXICITY^a

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. fasciatus</i> ¹	M	15	> 100
Cutthroat trout ¹	0.6	10	> 100
Goldfish ¹	0.9	18	31.1 24.4-38.8

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Fathead minnow ¹	0.9	18	13.3 5.1-35.8
Bluegill ¹	0.9	18	12
Channel catfish ²	2.1	17	26.8 20.0-35.9
Bluegill ²	1.0	17	49.2 25.3-95.8

^aComputations based on total material.

NALED

Chemical Name: 1,2-Dibromo-2,2-dichloroethyl dimethyl phosphate

Alternate Names: Bromchlophos, Bromex, CAS 300-76-5, Dibrom, ENT-24988, RE-4355

Principal Use: Insecticide, acaricide

Sample Description: Technical material, 90%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>Simocephalus</i>	I ₁	15	1.1 ^a 1.0-1.2
<i>Daphnia pulex</i>	I ₁	15	0.4 ^a 0.2-0.8
<i>Asellus</i>	M	15	41
<i>G. fasciatus</i>	M	15	18 16-20
<i>Palaemonetes</i>	M	15	92 ^b
<i>Pteronarcys</i>	YC ₂	15	8 6-11
Cutthroat trout	2.3	12	127 ^b 115-139
Rainbow trout	1.5	13	195 126-302
Lake trout	0.3	12	87 53-142

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Fathead minnow	1.3	18	3,300
Channel catfish	5.2	18	710
Bluegill	1.4	18	2,200 ^b
Largemouth bass	0.7	18	1,900 ^b

^a48-h EC50.

^bTested in hard water, 162-272 ppm CaCO₃.

NOTE: Naled was about twice as toxic to rainbow trout at 13°C as at 2°C. Toxicity was not affected by variations in water hardness.

NITRALIN

Chemical Name: 4-(Methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline

Alternate Names: Planavin, SD 11831

Principal Use: Selective pre-emergence herbicide

Sample Description: Wettable powder, 75%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Daphnia magna</i>	I ₁	21	0.004 ^{a,b} 0.002-0.008
<i>G. fasciatus</i>	M	15	1.3 ^b 0.8-2.2
Rainbow trout	0.6	12	30.0 22.0-40.8
Bluegill	0.8	24	62 51-76

^a48-h EC50.

^bTested in hard water, 272 ppm CaCO₃.

ORTHO 11775

Chemical Name: 3-(2-Butyl) phenyl-N-methyl-N-(phenylsulfonyl) carbamate

Alternate Names: Not known

Principal Use: Insecticide

Sample Description: Technical material, 46%¹; liquid formulation, 22.9%²; granular formulation, 10%³

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Fathead minnow ¹	0.5	17	61 42-88
Bluegill ¹	1.3	17	16 6.7-36
Rainbow trout ²	0.7	12	7
Fathead minnow ²	0.5	17	25 15-42
Rainbow trout ³	0.7	12	11
Channel catfish ³	2.6	17	23 13-40

OXYDEMETON-METHYL

Chemical Name: S-[2-(Ethylsulfinyl) ethyl] 0,0-dimethyl phosphorothioate

Alternate Names: Bay 21097, CAS 301-12-2, Demeton-S-methyl sulfoxid, Metasystemox, Metasystox-R, Metilmercaptosoksod, R 2170

Principal Use: Insecticide

Sample Description: Liquid concentrate, 50%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Asellus</i>	M	15	1.4
<i>G. fasciatus</i>	M	15	1.0 0.6-1.7
Rainbow trout	1.1	12	6.4 4.4-9.2
Channel catfish	1.4	18	< 18
Bluegill	1.0	18	13.0 ^a 10.6-16.7

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Largemouth bass	0.7	18	31.5 ^a 27.4-36.2
Walleye	1.4	18	18.0 15.6-20.8

^aTested in hard water, 272 ppm CaCO₃.

PARAQUAT

Chemical Name: 1,1-Demethyl-4,4'-bipyridinium ion (dichloride and bis(methylsulfate) salt)

Alternate Names: Dichloride salt: CAS 1910-42-5, Dextrone X, Gramoxone, Ortho Paraquat CL, Paraquat Chloride, PP 148, Preeglone, Weedol. Bis(methylsulfate) salt: Aerial Gramoxone, Dual Paraquat, PP 910.

Principal Use: Herbicide

Sample Description: Technical material, 42% (cation)¹; soluble concentrate, 2 lb (cation)/gal²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Channel catfish ¹	1.4	18	> 100
<i>Simocephalus</i> ²	I ₁	16	3.7 ^a 2.8-4.8
<i>Daphnia pulex</i> ¹	I ₁	16	4.0 ^a 2.7-6.0
<i>G. fasciatus</i> ²	M	21	11 8.1-15
<i>Pteronarcys</i> ²	YC ₂	16	> 100
Rainbow trout ²	0.5	13	15 11-19
Bluegill ²	0.9	24	13.0 8.5-19.0

^a48-h EC50.

PARATHION ETHYL

Chemical Name: 0,0-Diethyl 0-p-nitrophenyl phos=phorothioate

Alternate Names: AAT, AC 3422, Alkron, Alleron, Aphonite, Bladan, CAS 56-38-2, Corothion, DNTP, E-605, ENT-15108, Ethyl parathion, Ethilon, Folidol E-605, Fosferno 50, Nitrothymine, Orthophos, Panthion, Paramar, Paraphos, Parathene, Parawet, Phoskil, Rhodiatox, SNP, Soprathion, Stathion, Thiophos

Principal Use: Insecticide

Sample Description: Technical material, 98.7%¹; thioate analogue, 100% technical grade²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>Simocephalus</i> ¹	I ₁	21	0.47 ^a 0.34-0.66
<i>Daphnia pulex</i> ¹	I ₁	15	0.60 ^a 0.45-0.79
<i>Asellus</i> ¹	M	15	2,130 1,450-3,120
<i>G. lacustris</i> ¹	M	21	3.5 2.6-4.8
<i>G. fasciatus</i> ¹	M	21	1.3 0.60-1.9
<i>Orconectes</i> ¹	I _E	21	0.04 0.01-0.20
<i>Procambarus</i> ¹	M	12	< 250
<i>Palaemonetes</i> ¹	M	21	1.5 0.82-2.7
<i>Pteronarcys</i> ¹	YC ₂	15	5.4 4.7-6.2
<i>Pteronarcella</i> ¹	N	15	4.2 3.4-5.2
<i>Claassenia</i> ¹	YC ₂	15	1.5 1.0-2.2
<i>Hexagenia</i> ¹	J	24	15
<i>Ischnura</i> ¹	J	24	0.64
Cutthroat trout ¹	0.3	12	1,560 ^b 985-2,470
Rainbow trout ¹	1.0	12	1,430 962-2,110

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Lake trout ¹	0.7	12	1,920 ^b 1,750-2,100
Goldfish ¹	0.9	18	1,830 1,350-2,470
Fathead minnow ¹	0.8	18	2,350 1,760-3,120
Channel catfish ¹	1.4	18	2,650 2,160-3,260
Mosquitofish ¹	0.6	17	320 156-647
Green sunfish ¹	1.1	18	930 675-1,282
Bluegill ¹	1.0	18	400 295-543
Largemouth bass ¹	0.7	18	620 ^b 462-830
Rainbow trout ²	1.5	12	750 520-1,100
Channel catfish ²	1.4	18	3,300 3,090-3,520
Bluegill ²	1.4	18	24 15-38

^a48-h EC50.

^bTested in hard water, 162-272 ppm CaCO₃.

NOTE: Early instar crayfish (*Orconectes*) were much more susceptible than adults. No change in susceptibility was noted among trout weighing 0.3 to 4.5 g. Increases in toxicity ranging from 3- to 10-fold were produced when temperatures were increased from 15° to 21 °C for sowbugs and from 7° to 29 °C for bluegills. Toxicity to invertebrates and fish was generally unaffected by water hardness; however, toxicity to green sunfish increased slightly when hardness was increased from 44 to 272 ppm. Acute exposures of bluegills for periods up to 2 weeks produced pathological changes in gills, liver, and kidneys. Paraoxon, a primary metabolite of parathion, was found to be a potent brain acetylcholinesterase inhibitor in cutthroat trout, channel catfish, and bluegills.

PARATHION METHYL

Chemical Name: 0,0-Dimethyl-0-p-nitrophenyl phosphorothioate

Alternate Names: CAS 298-00-0, Dalf, Dimethyl parathion, E601, ENT-17292, Folidol M, Fosferno M50, Gearphos, Metacide, Metaphos, Methyl Niran, Metron, Nitrox 80, Parathion methyl, Partron M, Pencap-M, Tekwaia, Wofatox

Principal Use: Insecticide

Sample Description: Technical material, 80-99%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i>	I ₁	15	0.37 ^a 0.23-0.57
<i>Daphnia magna</i>	I ₁	21	0.14 ^a 0.09-0.20
<i>G. fasciatus</i>	M	15	3.8 2.6-5.5
<i>Orconectes</i>	M	15	15 ^b
<i>Ischnura</i>	J	15	33 ^b
Coho salmon	1.0	12	5,300 4,900-5,600
Cutthroat trout	0.2	12	1,850 ^b 1,390-2,470
Rainbow trout	1.1	12	3,700 3,130-4,380
Brown trout	1.1	12	4,700 3,900-5,750
Lake trout	0.5	12	3,780 2,810-5,090
Goldfish	0.9	18	9,000 8,100-9,900
Carp	0.6	18	7,130 6,440-7,870
Fathead minnow	1.2	18	8,900 7,780-10,200
Black bullhead	1.2	18	6,640 4,970-8,880
Channel catfish	1.4	18	5,240 4,270-6,440
Green sunfish	0.8	18	6,860 5,590-8,420

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Bluegill	1.0	17	4,380 3,480-5,510
Largemouth bass	0.9	18	5,220 4,320-6,310
Yellow perch	1.4	18	3,060 2,530-3,700

^a48-h EC50.

^bTested in hard water, 162 to 272 ppm CaCO₃.

NOTE: Changes in water hardness from 44 to 272 ppm did not appreciably alter the toxicity to daphnids, scuds, rainbow trout, fathead minnows, green sunfish, or bluegills.

PENTACHLOROPHENOL

Chemical Name: Pentachlorophenol

Alternate Names: Dowicide-7, penchlorol, Pentacon, Penwar, Weedone, Sinituho

Principal Use: Herbicide, wood preservative, defoliant, molluscicide

Sample Description: Technical material, 96%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (c)	96-h LC50 95% CI (µg/L)
Chinook salmon	1.0	10	68 48-95
Rainbow trout	1.0	11	52 48-56
Fathead minnow	1.1	20	205 179-234
Channel catfish	0.8	20	68 58-80
Bluegill	0.4	15	32 23-44

PENTACHLOROPHENOL SODIUM SALT

Chemical Name: Sodium pentachlorophenate

Alternate Names: Dowicide G, Santobrite, Weedbeads

Principal Use: Contact and pre-emergence herbicide

Sample Description: Liquid, 90%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Chinook salmon	1.0	10	68 48-95
Rainbow trout	1.0	12	55 47-64
Channel catfish	0.8	20	77 61-98
Bluegill	0.4	15	44 25-78

NOTE: Flow-through tests with chinook salmon and rainbow trout produced TILC50 values of 170 and 104 µg/L and cumulative toxicity indices of 1.0 and 1.2, respectively.

PERMETHRIN

Chemical Name: 3-(Phenoxyphenyl)methyl(I)-cis, trans-3-(2,2-dichloroethenyl)-2,2-dimethylcyclo=propanecarboxylate

Alternate Names: Pounce, Ambush, SBP-1513, NRDC-143

Principal Use: Insecticide (synthetic pyrethroid)

Sample Description: Technical material 92.5%¹; liquid 5.7%²; emulsifiable concentrate 13.3%³

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Brook trout ¹	1.2	12	3.2 2.2-4.8
Brook trout ²	1.2	12	5.2 3.5-7.9
Brook trout ³	1.2	12	2.3 1.4-3.7

PHENOXY HERBICIDES^a: 2,4-D

Chemical Name: 2,4-Dichlorophenoxyacetic Acid
(derivatives shown in sample description)

Alternate Names: (Superscript numbers refer to superscripts in sample description and summary table)
2,4-D, CAS 94-75-7, Weedar¹; 2,4-DB, Butyrac, Embutox²; Esteron 76-BE, CAS 90-80-4³; Esteron-99⁴; DED-WEED LV-69⁵; 2,4-D DMA, Weedar 64, Floratox⁶; Dacamine 4-D⁸; Emulsamine E-3⁹; Emulsavert D¹⁰; Diclofop, HOE-23408, HOE-Grass, Illoxan, Hoelon¹¹

Principal Use: Herbicide

Sample Description: 2,4-Dichlorophenoxyacetic acid, granular 100%¹; 4-(2,4-Dichlorophenoxy) butyric acid, technical grade 100%²; butyl ester of 2,4-D, liquid 98.4%³; propylene glycol butyl ether ester of 2,4-D, liquid 100%⁴; butoxy ethanol ester of 2,4-D, technical 62.5%⁵; isooctyl (2-ethylhexyl) ester of 2,4-D, 67%⁶; dimethyl amine salt (DMA) of 2,4-D, liquid 49%⁷; N-oleyl-1,3-propylenediamine salt of 2,4-D, commercial 57%⁸; dodecyl (50.7%)/tetradodecyl (12.7%) amine of 2,4-D, oil soluble liquid 63.4%⁹; N,N-dimethyl-2,4-Dichlorophenoxy-acetamide, technical 99%¹⁰; methyl 2- 4-(2,4-Dichlorophenoxy)-phenoxy proanoate, technical 95%¹¹

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Cutthroat trout ¹	0.3	10	64 57-72
Lake trout ¹	0.3	10	45 35-56
<i>Pteronarcys</i> ²	J	15	15 10-22
Rainbow trout ²	0.8	12	2.0 1.2-3.2
Fathead minnow ²	0.5	17	18 13-25
Bluegill ²	1.4	17	7.5 5.5-10.5
<i>Pteronarcella</i> ³	N	10	1.5 1.2-1.9
Cutthroat trout ³	0.8	10	0.9 0.7-1.0

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Lake trout ³	0.6	10	0.9 0.8-1.0
<i>Simocephalus</i> ⁴	I ₁	15	4.9 4.0-6.7
<i>Daphnia magna</i> ⁴	I ₁	21	1.2 ^{b,c} 0.7-2.0
<i>Cypridopsis</i> ⁴	M	21	0.4 ^b 0.3-0.7
<i>G. fasciatus</i> ⁴	M	15	2.9 1.7-4.7
<i>Palaemonetes</i> ⁴	M	21	0.4 ^c 0.09-1.4
<i>Pteronarcys</i> ⁴	YC ₂	10	2.6 ^c 1.8-3.8
<i>Pteronarcella</i> ⁴	N	10	2.4 1.9-3.2
Cutthroat trout ⁴	1.0	10	1.0 0.9-1.2
Rainbow trout ⁴	1.5	15	1.0 0.8-1.1
Lake trout ⁴	0.6	10	1.1 1.0-1.2
Bluegill ⁴	1.0	18	0.6 0.4-0.7
<i>Daphnia magna</i> ⁵	I ₁	21	6.4 4.5-9.1
<i>Cypridopsis</i> ⁵	M	21	2.2 ^{b,c} 1.5-3.3
<i>Asellus</i> ⁵	M	15	2.6 1.3-5.3
<i>G. fasciatus</i> ⁵	M	15	6.1 ^c 4.5-8.3
Fathead minnow ⁵	0.9	18	3.3 2.5-4.2
Bluegill ⁶	1.4	18	1.2 1.1-1.3
<i>G. fasciatus</i> ⁶	M	21	2.4 1.9-3.0

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Daphnia magna</i> ⁷	I ₁	21	4.0 ^{b,c} 3.4-4.9
<i>Cypridopsis</i> ⁷	M	21	8.0 ^{b,c} 5.9-10.8
<i>G. fasciatus</i> ⁷	M	15	> 100 ^c
<i>Palaemonetes</i> ⁷	M	21	0.15 ^b 0.11-0.20
Chinook salmon ⁷	1.0	10	> 100
Rainbow trout ⁷	1.4	10	> 100
Fathead minnow ⁷	0.8	17	335 245-458
Channel catfish ⁷	1.9	18	155 142-169
Bluegill ⁷	1.1	18	168 123-230
Smallmouth bass ⁷	0.4	10	236 185-300
Channel catfish ⁸	1.9	18	0.3 0.2-0.5
Bluegill ⁸	1.1	18	0.8 0.6-0.9
Chinook salmon ⁸	1.0	10	4.8 4.0-5.8
Rainbow trout ⁸	1.4	10	3.1 2.2-4.3
Fathead minnow ⁸	0.9	20	2.7 1.8-4.0
Channel catfish ⁸	0.8	20	7.0 5.6-8.7
Bluegill ⁸	1.4	20	7.4 6.1-9.0
Smallmouth bass ⁸	0.4	20	3.1 2.6-3.7
Bluegill ¹⁰	1.3	18	816 635-1,050
Rainbow trout ¹¹	0.6	12	0.25 0.19-0.33

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Bluegill ¹¹	0.8	22	0.54 0.38-0.78

^aSeparate summaries of acute toxicity data are given for four groups of phenoxy herbicides: 2,4-D; 2,4,5-T; mixtures of 2,4-D and 2,4,5-T; and others.

^b48-h EC50.

^cTested in hard water, 272 ppm CaCO₃.

NOTE: (Superscript numbers refer to equivalent numbers shown in sample description) Alterations in water hardness (44 to 300 ppm) did not appreciably change the toxicity of 2,4-D or any of its derivatives tested. Variations in pH from 6.5 to 8.5 did affect toxicity of some 2,4-D test chemicals. The 2,4-D acid,¹ a butyl ester,³ and a dimethyl amine salt⁷ of 2,4-D were about half as toxic to fish at pH 8.5 as at pH 6.5. However, the dodecyl/tetradodecyl amine⁹ was nearly 4 times more toxic to fathead minnows at pH 8.5 than at 6.5; 96-h LC50's increased from 2.4 to 8.4 mg/L as pH decreased. Aging of test solutions for up to 21 days also altered toxicity of certain 2,4-D compounds. Toxicity of the butyl ester³ and the propylene glycol butyl ether ester⁴ was halved by the aging of test solutions for 21 days. The toxicities of two amine salts^{7,9} to fathead minnows did not change after test solutions were aged for 21 days. Fry and fingerlings were considerably more sensitive than eggs to two amine salts of 2,4-D: in fathead minnows, tests with the dimethyl amine of 2,4-D⁷ yielded 96-h LC50's from 320 to 630 mg/L for fingerlings and swim-up fry, compared with over 1,400 mg/L for the egg stage; in rainbow trout, tests with dodecyl/tetradodecyl amine⁹ against several early life stages yielded LC50's (mg/L) of 3.2 for fingerlings, 1.4 for swim-up fry, 7.6 for yolk-sac fry, and 47 for eggs.

Flow-through tests with a propylene glycol butyl ester of 2,4-D⁴ produced a TILC50 of 313 µg/L and a cumulative toxicity index of 1.05 µg/L in cutthroat trout. Tests with dodecyl/tetradodecyl amine⁹ against rainbow trout and bluegills produced TILC50's of 497 and 1,093 µg/L and cumulative toxicity indices of 2.0 and 4.2, respectively.

PHENOXY HERBICIDES: 2,4,5-T

Chemical Name: 2,4,5-Trichlorophenoxyacetic acid (derivatives shown in sample description)

Alternate Names: (Superscript numbers refer to superscripts in sample description and summary table) 2,4,5-T, Silvex, Kurosai, Silvi-Rhap¹; Weedone 2,4,5-TP⁴; Kuron, Visko-Rhap 2TP⁸

Principal Use: Herbicide

Sample Description: 2-(2,4,5-Trichlorophenoxy) propionic acid, liquid 65.2%¹; triethyl amine of 2,4,5-T, technical 56.7%²; butoxy ethanol ester of 2,4,5-Trichlorophenoxyacetic acid, liquid 58.3%³; butoxy ethanol ester of 2-(2,4,5-Trichlorophenoxy) propionic acid, technical 58.9%⁴; propylene glycol butyl ether ester of 2-(2,4,5-Trichlorophenoxy) propionic acid, liquid 69.2%⁵

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Asellus</i> ¹	M	18	> 32
<i>G. fasciatus</i> ¹	M	21	> 100
Coho salmon ¹	1.4	12	0.6 0.5-0.8
Rainbow trout ¹	1.1	12	17.2 14.0-21.0
Channel catfish ¹	1.6	17	19.4 15.9-23.7
Bluegill ¹	0.7	17	10.4 8.5-12.6
Fathead minnow ²	0.8	17	> 100
Channel catfish ²	2.0	17	> 100
Bluegill ²	1.1	18	> 100
<i>Asellus</i> ³	M	15	> 3.2 ^a
<i>G. fasciatus</i> ³	M	15	0.12 0.08-0.18
<i>Palaemonetes</i> ³	M	21	2.7 ^a 1.9-3.9
<i>Cypridopsis</i> ⁴	M	21	4.6 ^{a,b} 3.7-5.8
<i>Asellus</i> ⁴	M	15	88 57-136
Goldfish ⁴	0.8	18	62 48-78
Bluegill ⁴	1.0	18	45 42-47
Rainbow trout ⁵	1.5	12	0.64 0.53-0.77

^aTested in hard water, 272 ppm CaCO₃.^b48-h EC50.

PHENOXY HERBICIDES MIXTURES OF 2,4-D AND 2,4,5-T

Chemical Name: Mixture of 2,4-dichlorophenoxy acetic acid/2,4,5-trichlorophenoxy acetic acid (see sample description)

Alternate Names: (Superscript numbers refer to superscripts in sample description and summary table) Brush Rhap¹; Veon²; Brush Killer^{3,4}; Weed and Brush-Off 400⁵

Principal Use: Herbicide

Sample Description: 2,4-Dichlorophenoxyacetic acid dimethylamine salt/2,4,5-Trichlorophenoxyacetic acid triethylamine salt mixture, liquid 53.3% (20.5% 2,4-D and 20.5% 2,4,5-T)¹; as above, liquid 52.5% (20.2% 2,4-D and 20.2% 2,4,5-T)²; 2,4-Dichlorophenoxyacetic acid (34.4%)/2,4,5-Trichlorophenoxyacetic acid (16.9%) dimethylamine salt, liquid 51.3% (28.5% 2,4-D and 14.3% 2,4,5-T)³; 2,4-Dichlorophenoxyacetic acid (29.7%)/2,4,5-Trichlorophenoxyacetic acid (28.5%) triethylamine salt, liquid (20.3% 2,4-D and 20.3% 2,4,5-T)⁴; 2,4-Dichlorophenoxyacetic acid (17.5%)/2,4,5-trichlorophenoxyacetic acid (8.8%), diethylethanamine salt, liquid (12.1% 2,4-D and 6.1% 2,4,5-T)⁵

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Channel catfish ¹	1.5	18	> 100
Bluegill ¹	1.3	18	> 100
Rainbow trout ²	1.0	12	51 38-68
Bluegill ²	1.1	18	41 32-52
Bluegill ³	1.1	18	> 100
Rainbow trout ⁴	1.0	12	24 18-31
Bluegill ⁴	1.1	18	23 16-32
Bluegill ⁵	0.6	18	0.16 0.08-0.29

PHENOXY HERBICIDES: OTHERS

Chemical Name: See sample description.

Alternate Names: (Superscript numbers refer to superscripts in sample description and summary table.) MCPB Acid, Can-Trol¹; MCPA-DMA, Agroxone, Chiptox, Hormotuh, Kilsem, Mephanac, Phenoxylene, Rhonox, Zelan²

Principal Use: Herbicide

Sample Description: 4-(2-methyl-4-chlorophenoxy) butyric acid, technical 90.5%¹; 2 methyl-4-chloro=phenoxyacetic acid, liquid concentrate 27.6%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ¹	1.1	12	< 0.07
Fathead minnow ¹	0.5	17	12.5 8.8-17.5
Bluegill ¹	0.8	17	3.3 2.0-5.6
Bluegill ²	F	24	> 10

PHORATE

Chemical Name: 0,0-Diethyl S-[(ethylthio) methyl] phosphorodithioate

Alternate Names: Timet, Thimet, Rampart, Vegfru

Principal Use: Insecticide

Sample Description: Technical material, 100%¹, 91%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>G. fasciatus</i> ¹	M	15	4 2-7
<i>Pteronarcys</i> ¹	YC ₂	15	4 2-6
Rainbow trout ¹	1.2	12	13 11-16
Northern pike ¹	0.7	15	110 ^a 90-130
Cutthroat trout ²	1.0	12	6.0 5.2-6.8

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
Largemouth bass ²	0.9	15	5.0 ^a 4.7-5.4
Bluegill ²	1.0	15	2.0 1.5-2.5
Channel catfish ²	1.0	15	280 115-680

^aTested in hard water, 272 ppm CaCO₃.

PHOSALONE

Chemical Name: 0,0-Diethyl S-[6-chloro-3-(mercapto=methyl)-2-benzoxazolinone] phosphorodithioate

Alternate Names: Azofene, Benzphos, CAS 2310-17-01, ENT-27163, NIA-9241, RP-11974, Rubitox, Zolone

Principal Use: Insecticide-acaricide

Sample Description: Wettable powder, 25%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
Rainbow trout	1.1	12	150 70-330
Fathead minnow	0.5	18	320 190-540
Bluegill	0.8	18	100 70-140

PHOS-CHEK

Chemical Name: Diammonium phosphate plus thickening, coloring, and anti-corrosion additives

Alternate Names: None known

Principal Use: Forest fire retardant

Sample Description: Commercial formulation, 89%; Phos-Chek 202¹; Phos-Chek 259²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. pseudolimnaeus</i> ¹	M	18	52 48-68
Coho salmon ¹	1.0	11	320 279-367
Rainbow trout ¹	0.8	11	230 204-259
Fathead minnow ¹	0.7	21	650 497-851
Bluegill ¹	1.0	21	840 753-937
Largemouth bass ¹	0.5	21	840 753-937
<i>G. pseudolimnaeus</i> ²	M	18	40 32-46
Coho salmon ²	1.0	11	245 216-277
Rainbow trout ²	0.8	11	160 150-171
Fathead minnow ²	0.7	21	300 265-340
Bluegill ²	1.0	21	350 300-404
Largemouth bass ²	0.5	21	450 402-504

NOTE: Yolk-sac fry were more sensitive than fingerlings in both coho salmon and rainbow trout. A decrease in test temperature from 11° to 6°C did not appreciably alter toxicity for either species.

PHOSMET

Chemical Name: N-(Mercaptomethyl)phthalimide S-(0,0-dimethyl phosphorodithioate)

Alternate Names: CAS 732-11-6, ENT-25705, Imidan, Phthalophos, Prolate, R-1504

Principal Use: Insecticide

Sample Description: Technical material, 95.3%¹; wettable powder, 50%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Streptocephalus</i> ¹	M	21	170 ^a 145-220
<i>Daphnia magna</i> ¹	I ₁	21	5.6 ^b 4.2-8.4
<i>Asellus</i> ¹	M	20	90 62-130
<i>G. fasciatus</i> ¹	M	15	2.0 1.4-2.8
<i>Chironomus</i> ¹	I ₄	20	3,150 ^b 2,370-4,190
Chinook salmon ¹	1.0	10	150 112-200
Rainbow trout ¹	0.8	10	300 213-423
Fathead minnow ¹	0.1	20	7,300 4,700-11,400
Channel catfish ¹	0.4	20	10,600 8,400-13,400
Bluegill ¹	0.5	20	200 150-270
Smallmouth bass ¹	0.4	20	150 100-224
Largemouth bass ¹	0.5	20	160 105-244
<i>Daphnia magna</i> ²	I ₁	21	11 ^{b,c} 9-14
<i>Chironomus</i> ²	I ₄	20	3,400 ^b 2,470-4,680
Rainbow trout ²	0.2	10	500 318-785
Fathead minnow ²	0.1	20	9,000 6,200-13,200
Channel catfish ²	0.4	20	7,500 6,300-8,900
Bluegill ²	0.5	20	160 120-220

^a48-h LC50.

^b48-h EC50.

^cTested in hard water.

NOTE: An increase in temperature from 10° to 25°C produced a ninefold increase in toxicity to bluegills; however, rainbow trout were slightly more sensitive at 5°C than at 10°C. The toxicity of phosmet at pH 8.5 was 0.03 that at pH 6.5. Toxicity was unaffected by water hardness. Eyed eggs and yolk-sac fry were considerably less sensitive than swim-up fry or fingerlings. After 3 to 4 days of aging in aqueous solution, toxicity to midge larvae and bluegills was reduced to 0.04 that of fresh solution. Aqueous degradation appeared to be slower at pH 6.3 than at 7.4. Fish and invertebrates continuously exposed to 1.2 µg/L accumulated residues 2 to 9 times greater than the water concentration. After 10 days of exposure in flow-through tests, LC50 values ranged from 44 µg/L for aquatic sowbugs to 78 µg/L for rainbow trout. Prominent sublethal effects were noted in trout in concentrations down to 35 µg/L.

PHOSPHAMIDON

Chemical Name: 2-Chloro-N,N-diethyl-3-(dimethoxyphosphinyloxy) crotonamide

Alternate Names: Dimecron, Dixon, C570

Principal Use: Systemic and contact insecticide-acaricide

Sample Description: Technical material, 80%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Simocephalus</i>	I ₁	15	0.012 ^a 0.0079-0.018
<i>Daphnia pulex</i>	I ₁	15	0.010 ^a 0.0067-0.015
<i>G. fasciatus</i>	M	15	0.013 0.006-0.028
<i>Pteronarcys</i>	YC ₂	15	1.5 0.77-2.92
Rainbow trout	0.8	15	7.8 6.2-9.8
Fathead minnow	1.0	18	100 91-110
Channel catfish	0.8	18	70 67-74

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Bluegill	0.5	24	3.4 2.4-4.9

^a48-h EC50.

PHOXIM

Chemical Name: Phenylglyoxylonitrile oxime 0,0-diethyl phosphorothioate

Alternate Names: Bay 5621, Bay 77488, Bayer 77488, Baythion, ENT-27488, Phoxime, Valexon, Volaton

Principal Use: Insecticide

Sample Description: Technical material, 89%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Procambarus</i>	I _E	12	6.5 4.3-9.7
Coho salmon	0.5	12	407 327-507
Rainbow trout	0.2	12	180 ^a 119-272
Atlantic salmon	0.5	12	380 311-465
Brown trout	0.6	12	<300
Brook trout	1.5	12	432 371-503
Northern pike	F	12	165 ^{a,b} 123-221
Fathead minnow	0.3	12	2,900 2,260-3,721
Channel catfish	F	12	1,210 1,009-1,451
Bluegill	1.1	22	82 61-110

^aTested in hard water, 314 ppm CaCO₃.

^bFlow-through test.

NOTE: Increases in toxicity ranging from twofold to fivefold occurred when temperatures were increased from 7° to 17°C for coho salmon and from 12° to 22°C for bluegills. Variations in pH (6.5 to 9.5) or water hardness (12 to 300 ppm) did not alter toxicity to coho salmon or bluegills. Prolonged exposure of coho salmon, brook trout, northern pike, bluegills, and yellow perch produced TILC50's ranging from 21 µg/L for northern pike to 309 µg/L for coho salmon. Cumulative toxicity indices ranged from 1.2 to 7.9, indicating only a slight cumulative toxic effect.

PHTHALIC ACID ESTERS

Chemical Name: n-Butyl and di-2-ethylhexyl esters of phthalic acid

Alternate Names: PAE, DBP, DEHP

Principal Use: Industrial chemical; plasticizer

Sample Description: Commercial formulation, 100%: di-n-butyl phthalate¹, di-2-ethylhexyl phthalate²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. pseudolimnaeus</i> ¹	M	21	2.1 ^a
<i>Orconectes</i> ¹	I _E	21	> 10.0 ^a
Rainbow trout ¹	1.5	12	2.6 1.2-5.3
Fathead minnow ¹	0.8	17	1.3 0.3-5.5
Channel catfish ¹	1.4	17	2.9 1.4-6.1
Bluegill ¹	1.3	17	0.7 0.4-1.3
<i>G. pseudolimnaeus</i> ²	J	21	> 32
Coho salmon ²	1.5	16	> 100
Rainbow trout ²	1.5	12	> 100
Channel catfish ²	1.5	20	> 100
Bluegill ²	0.6	17	> 100

^aTested in hard water, 272 ppm CaCO₃.

NOTE: Variation in water hardness from 44 to 272 ppm or pH from 6.5 to 9.0 did not alter toxicity of

DBP. In channel catfish, yolk-sac fry were slightly more sensitive than fingerlings. Fathead minnows accumulated equilibrium levels of DEHP 1,380 times the water concentration of 2.5 µg/L after 28 days. Residue half-life was 7 days. Invertebrates accumulated DBP and DEHP up to 6,700 and 13,400 times, respectively, when exposed to water concentrations ranging from 0.08 to 0.3 µg/L. Over 90% of the residues were lost within 10 days in clean water. DEHP reduced reproduction in *Daphnia magna* and increased abortion and fry mortality in guppies (*Poecilia* sp.) DBP was metabolized 16 times faster than DEHP by hepatic microsomes of channel catfish. The monoester was the predominant metabolite. The TILC50's for rainbow trout, fathead minnows, bluegills, and yellow perch ranged from 0.2 to 4.0 µg/L; cumulative toxicity indices between 1.0 and 1.8 indicated little or no cumulative toxic effect.

PHYGON XL

Chemical Name: 2,3-Dichloro-1,4-naphthoquinone

Alternate Names: Phygon, Seed Protectant, dichlone

Principal Use: Fungicide

Sample Description: Wettable powder, 50%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Cypridopsis</i>	M	21	32 ^a 20-50
<i>G. fasciatus</i>	M	21	1,100 802-1,507
Rainbow trout	0.5	12	49 41-58
Bluegill	1.5	18	148 107-205

^a48-h EC50, tested in hard water, 272 ppm CaCO₃.

PHYTAR 560

Chemical Name: Sodium salt of cacodylic acid

Alternate Names: Rad-E-Cate 25, sodium cacodylate

Principal Use: Herbicide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. fasciatus</i>	M	15	> 100
<i>Palaemonetes</i>	M	21	28 ^a 14-58
Bluegill	0.8	18	17 15-19

^aTested in hard water, 272 ppm CaCO₃.

PICLORAM

Chemical Name: 4-Amino-3,5,6-trichloropicolinic acid

Alternate Names: Amdon, Borolin, CAS 1918-02-1, M-3179, Tordon

Principal Use: Herbicide

Sample Description: Technical material, 90-100%¹; isooctylester, 90%²; potassium salt, 24.9%³

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. fasciatus</i> ¹	M	21	0.027 0.020-0.037
<i>Pteronarcella</i> ¹	N	10	> 10.0
<i>Pteronarcys</i> ¹	YC ₂	15	0.048 0.037-0.062
Cutthroat trout ¹	0.4	12	4.8 3.8-6.2
Rainbow trout ¹	0.8	12	12.5 9.5-16.5
Lake trout ¹	0.3	10	4.3 4.0-4.5
Channel catfish ¹	1.4	18	6.3 3.6-11.1
Channel catfish ¹	1.0	22	15.5 11.4-20.9
Bluegill ¹	0.9	22	23.0 17.8-29.9
Rainbow trout ²	1.1	12	4.0 2.8-5.9

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Channel catfish ²	1.4	18	1.4 0.7-2.5
Cutthroat trout ³	0.9	10	1.5 0.8-3.0
Bluegill ³	0.9	18	26.8 22.9-31.3

NOTE: Toxicity to cutthroat trout or lake trout was not substantially altered by variations in temperature or water hardness, or by aqueous degradation for 4 weeks. Toxicity was reduced by 50% by a decrease in pH from 7.5 to 6.5 but was not altered by an increase to pH 8.6. No cumulative toxic action was indicated in flow-through tests; cumulative toxicity indices were 1.6 or less and TILC50's were 1.5 mg/L for cutthroat trout and 1.2 mg/L for lake trout. Toxicity to fry of rainbow trout and channel catfish did not differ appreciably from that of fingerlings; 96-h LC50's ranged from 5.8 to 8.0 mg/L for yolk-sac and swim-up fry. In chronic toxicity studies, the rate of yolk sac absorption and growth of lake trout fry was reduced at concentrations as low as 35 µg/L. The no-effect concentration of picloram for lake trout is apparently below this value.

PIPERONYL BUTOXIDE

Chemical Name: a-[2-(2-Butoxyethoxy)ethoxy]-4,5-methylenedioxy-2-propyltoluene

Alternate Names: FMC-5273, Butacide

Principal Use: Synergist with pyrethrins, tetra = methrin, and rotenone

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Asellus</i>	M	15	12 ^a 7-22
Rainbow trout	0.6	12	3.4 2.7-4.3
Bluegill	0.7	18	4.2 3.8-4.6

^aTested in hard water, 272 ppm CaCO₃.

PLICTRAN

Chemical Name: Tricyclohexyltin hydroxide

Alternate Names: CAS 13121-70-5, Cyhexatin, Dowco 213, M-3180

Principal Use: Acaricide

Sample Description: Technical material, 96.8%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>Daphnia magna</i>	I ₁	21	0.17 ^a 0.12-0.26
<i>G. fasciatus</i>	M	15	5
Bluegill	1.1	18	6.7 5.8-7.7
Largemouth bass	0.8	18	2.1 ^b 1.9-2.3

^a48-h EC50.

^bTested in hard water, 272 ppm CaCO₃.

POLYCHLORINATED BIPHENYLS AND TERPHENYLS

Chemical Name: See Aroclor numbers

Alternate Names: Aroclor, PCB

Principal Use: Industrial chemical: plasticizer, dielectric fluid

Sample Description: Commercial formulations, 100%: Aroclors 1016¹, 1221², 1232³, 1242⁴, 1248⁵, 1254⁶, 1260⁷, 1262⁸, 1268⁹, 4465¹⁰, 5442¹¹, 5460¹²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>Pteronarcella</i> ¹	N	10	610 ^a 424-878
Rainbow trout ¹	0.5	12	135 114-159
Atlantic salmon ¹	5.6	12	134 ^b 113-159

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
Brown trout ¹	4.6	12	138 ^b 109-175
Brook trout ¹	3.0	12	> 800 ^b
Lake trout ¹	YSF	10	890 ^a 686-1,154
Lake trout ¹	SUF	10	480 ^a 386-596
Longnose sucker ¹	F	12	330 ^b 222-490
White sucker ¹	1.9	12	435 ^b 325-582
Channel catfish ¹	YSF	25	440 340-560
Bluegill ¹	0.9	12	460 ^b 390-540
Yellow perch ¹	0.8	12	240 153-376
Cutthroat trout ²	2.7	9	1,170 957-1,430
Cutthroat trout ³	2.2	9	2,500 1,720-3,080
<i>G. pseudolimnaeus</i> ⁴	M	15	10 ^b
<i>Orconectes</i> ⁴	I _E	21	30 ^c
<i>Macromia</i> ⁴	J	21	800 ^c
<i>Ischnura</i> ⁴	J	15	400 ^b
Cutthroat trout ⁴	F	9	5,420 3,820-7,680
Rainbow trout ⁴	1.8	17	67 ^{b,d}
Channel catfish ⁴	2.8	17	> 100 ^b
Bluegill ⁴	2.2	17	125 ^{b,d}
Yellow perch ⁴	1.2	17	> 150 ^{a,b}
<i>G. fasciatus</i> ⁵	M	21	52
Cutthroat trout ⁵	2.5	9	5,750 5,100-6,480
Rainbow trout ⁵	1.8	17	54 ^{b,d}

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
Channel catfish ^a	2.8	22	> 100 ^b
Bluegill ^a	0.8	18	690 480-990
Yellow perch ^a	1.1	17	> 100 ^b
<i>G. fasciatus</i> ^a	M	21	2,400
<i>Orconectes</i> ^a	I _E	21	100 ^a
<i>Procambarus</i> ^a	I _E	12	> 550
<i>Palaemonetes</i> ^a	M	15	3.0 ^{b,c}
<i>Macromia</i> ^a	J	21	800 ^c
<i>Ischnura</i> ^a	J	15	200 ^b
Cutthroat trout ^a	2.5	9	42,500 38,700-46,700
Rainbow trout ^a	1.8	17	142 ^{b,d}
Channel catfish ^a	2.8	22	> 200 ^b
Bluegill ^a	0.8	18	2,740 1,294-5,810
Yellow perch ^a	1.0	17	> 150 ^b
Cutthroat trout ⁷	2.6	9	60,900 55,400-67,000
Rainbow trout ⁷	1.8	17	> 232 ^b
Channel catfish ⁷	2.8	22	> 400 ^b
Bluegill ⁷	2.2	22	> 400 ^b
Yellow perch ⁷	1.2	17	> 200 ^b
Cutthroat trout ^a	F	9	> 50,000
Cutthroat trout ⁹	F	9	> 50,000
Cutthroat trout ¹⁰	F	9	> 65,000
Cutthroat trout ¹¹	F	9	> 50,000
Cutthroat trout ¹²	F	9	> 50,000

^aTested in hard water, 162-272 ppm CaCO₃.

^bFlow-through test.

^cSeven-day LC50.

^dFive-day LC50.

NOTE: The LC50's for fish in flow-through tests of 25 to 30 days ranged from 3 to 433 $\mu\text{g/L}$ and those for invertebrates in 5- to 10-day exposures ranged from 0.6 to 80 $\mu\text{g/L}$. TILC50's ranged from 33 to 80 $\mu\text{g/L}$ for fish; however, mortality did not reach time-independence within 30 days in most tests. Cumulative toxicity indices ranged from 2 to 15, indicating a low to moderate degree of accumulative action. Biological magnification of Aroclors 1248 and 1254 by channel catfish was 56,370 to 60,190 times the levels in water after 60 days. Invertebrates showed a magnification of Aroclor 1254 up to 6,300 times within 21 days. Chronic dietary exposures of Aroclor 1254 produced no observable toxicosis or effects on growth in coho salmon or channel catfish within a 260-day exposure, although thyroid activity was stimulated. In other chronic toxicity studies, growth decreased in brook trout fry after 48 days of exposure to concentrations of Aroclor 1254 of 1.5 $\mu\text{g/L}$ or greater. As judged by decreased hydroxyproline concentration in collagen isolated from the backbone of brook trout, 0.43 $\mu\text{g/L}$ was considered the no-effect concentration for Aroclor 1254.

PROPHAM

Chemical Name: Isopropyl N-phenylcarbamate

Alternate Names: CAS 122-42-9, Chem-hoe, IFC, IFK, INPC, IPC, IPPC, Iso-PPC, Triherbide-IPC, Tuberite, Y-2

Principal Use: Herbicide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Simocephalus</i>	I ₁	15	10 ^a 7-15
<i>Daphnia pulex</i>	I ₁	15	8 ^a 5-13
<i>G. fasciatus</i>	M	15	19 ^{a,b} 10-34
Rainbow trout	0.8	12	38 34-43
Bluegill	0.3	24	29

^a48-h EC50.

^bTested in hard water, 272 ppm CaCO₃.

PROPOXUR

Chemical Name: o-Isopropoxyphenyl N-methyl= carbamate

Alternate Names: Aprocarb, Bay 9010, Bay 39007, Blattanex, CAS 114-26-1, ENT-25671, Baygon, Sendran, Suncide, Tendex, Tugon Fliegankugel, Unden

Principal Use: Insecticide

Sample Description: Technical material, 88%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>G. lacustris</i>	M	21	34 29-39
<i>Pteronarcys</i>	YC ₂	15	18
Rainbow trout	1.2	13	8,200
Fathead minnow	0.6	18	25,000
Bluegill	0.8	24	4,800

PURIFLOC C-31

Chemical Name: High molecular weight, cationic, water soluble, synthetic organic polyelectrolyte

Alternate Names: None known

Principal Use: Flocculant

Sample Description: Commercial formulation, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
Chinook salmon	YSF	10	357 251-507
Rainbow trout	1.3	11	446 310-640
Fathead minnow	1.2	17	490 419-596
Channel catfish	1.5	20	680 539-858

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
Bluegill	0.6	20	1,470 1,250-1,730

NOTE: The TILC50 is 128 $\mu\text{g/L}$ for rainbow trout and 871 $\mu\text{g/L}$ for bluegills. Cumulative toxicity indices of 1.5 and 1.4, respectively, indicate little or no cumulative action.

PYDRAUL 50E

Chemical Name: Mixture of tri-aryl phosphate esters containing phenol, tolyl (cresyl), xylyl, and ethyl substituted benzene groups

Alternate Names: Tri-aryl phosphate ester

Principal Use: Hydraulic fluid

Sample Description: Commercial formulation, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. pseudolimnaeus</i>	M	20	0.56 ^a 0.40-0.78
<i>Orconectes</i>	M	16	> 1.5 ^{a,b}
<i>Pteronarcella</i>	N	10	12.5 8.7-17.9
Coho salmon	0.5	12	0.1
Rainbow trout	1.3	10	0.7 0.5-1.0
Brook trout	4.0	12	1.4 ^b 1.2-1.7
Fathead minnow	1.0	20	1.3 0.5-3.2
Channel catfish	1.6	21	3.0 2.2-4.1
Bluegill	0.6	20	2.2 1.5-3.2
Lake trout	YSF	10	2.8 2.1-3.7

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Lake trout	SUF	10	2.9 2.4-3.4
Lake trout	0.8	10	1.5 ^a 1.1-1.9

^aTested in hard water, 170-272 ppm CaCO₃.

^bFlow-through toxicity test.

NOTE: Green eggs of brown trout were much less sensitive than fingerlings, for which the 96-h LC50 was 11 mg/L. Variations in water hardness from 44 to 300 ppm did not alter toxicity to eggs. The TILC50's ranged from 0.25 mg/L for rainbow trout to 2.09 mg/L for channel catfish. Cumulative toxicity indices varied from 1.1 to 2.7, indicating little or no cumulative toxic action. Sublethal effects were prominent in flow-through tests at concentrations considerably below acutely lethal levels. Effects included early cessation of feeding, hypersensitivity, and erratic swimming. Those effects were followed by a loss of motor function, associated with hemorrhage in the dorsal fin region and occurrence of a characteristic "broken back" syndrome. This condition remained for extended periods, and death usually resulted from secondary causes. Opacity of the eye lens of rainbow trout was a characteristic lesion after 90-day exposures to concentrations greater than 2.1 µg/L.

PYDRAUL 115E

Chemical Name: Mixture of tri-aryl phosphate esters containing phenol, tolyl (cresyl), xylyl, and ethyl substituted benzene groups

Alternate Names: Tri-aryl phosphates

Principal Use: Hydraulic fluid

Sample Description: Commercial formulation, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout	1.0	12	45 34-60
Rainbow trout	0.6	12	10 5.7-17.4
Channel catfish	1.3	20	> 100

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Bluegill	0.6	20	> 100

NOTE: Sublethal effects were similar to those of Pydraul 50E.

PYRETHRUM

Chemical Name: Mixture of Pyrethrin I, Pyrethrin II, Cinerin I, Cinerin II, Jasmolin I, and Jasmolin II

Alternate Names: Pyrethrins (natural)

Principal Use: Botanical insecticide

Sample Description: Liquid, 20% active

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	15	1.4 0.9-2.1
Coho salmon	0.7	12	42 35-50
Coho salmon	F	12	28 ^a 18-30
Atlantic salmon	0.2	7	40 30-53
Brown trout	0.6	12	50 44-57
Lake trout	0.5	12	37 32-44
Channel catfish	0.7	18	9.0 6.7-12.0
Channel catfish	0.7	18	13 ^b 8-23
Bluegill	0.8	22	58 52-65

^aFlow-through test, hard water (314 ppm CaCO₃).

^bn-Propyl isomer, a pyrethrin synergist (dipropyl-5,6,7,8-tetrahydro-7-methylnaphtho (2,3-d)-1,3-dioxole-5,6-dicarboxylate).

NOTE: Temperature and pH of test solutions affected the biological activity of natural pyrethrins. Toxicity

to channel catfish was 12-fold higher at 18°C than at 12°C. Toxicity increased in acid water; the 96-h LC50 for bluegills was 41 µg/L at pH 6.5 and 87 µg/L at pH 9.5. Water hardness (44-314 ppm) had little influence on toxicity.

RESMETHRIN

Chemical Name: (5-Benzyl-3-furyl)methyl 2,2-dimethyl-3-(2-methyl propenyl) cyclopropane=carboxylate

Alternate Names: Chryson, benzofuroline, NRDC 104, SBP-1382

Principal Use: Insecticide (synthetic pyrethroid)

Sample Description: Technical material, 84.5%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Coho salmon	0.5	18	1.8 ^a 0.55-5.6
Lake trout	0.7	12	1.7 1.1-2.5
Fathead minnow	0.7	17	3.0 0.89-9.9
Channel catfish	0.7	18	16.6 9.6-28.6
Bluegill	0.6	18	1.7 0.31-9.3

^aTested in hard water, 262 ppm CaCO₃.

RONNEL

Chemical Name: 0,0-Dimethyl 0-(2,4,5-trichlorophenyl) phosphorothioate

Alternate Names: Fenclorophos, Ectoral, Etrolene, Nankor, Korlan, Trolene, Viozene

Principal Use: Insecticide

Sample Description: Technical material, 95%¹, crystal, 98.4%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i> ¹	M	15	4,300 ^a 3,400-5,400
Rainbow trout ¹	1.1	12	550 410-730
Channel catfish ¹	1.1	18	1,600 1,480-1,730
Bluegill ¹	1.0	18	1,300 1,180-1,430
Cutthroat trout ²	2.2	12	555 415-742
Lake trout ²	1.2	12	490 ^a 395-608

^aTested in hard water, 267 ppm CaCO₃.

ROTENONE

Chemical Name: 1,2,12,12a-Tetrahydro-2-isopropenyl-8,9-dimethoxy[1]benzopyrano [3,4-b]furo[2,3-b] [1] benzopyran-6(6aH)-one

Alternate Names: Derrin, Nicouline, Tubatoxin, Noxfish

Principal Use: Insecticide, piscicide

Sample Description: Technical material, 44%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i>	I ₁	15	310 ^a 239-402
<i>Daphnia pulex</i>	I ₁	15	100,000 ^a 74,000-134,000
<i>G. fasciatus</i>	M	21	2,600 2,100-3,200
Rainbow trout	0.3	12	31 27-36
Channel catfish	0.5	24	2.6 2.1-3.2

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Bluegill	0.6	24	23 20-25

*48-h EC50.

RU-11679

Chemical Name: (5-Benzyl-3-furyl) methyl 1R, 2R-2-[(cyclopentylidene) methyl]-3,3-dimethylcyclopropane carboxylate

Alternate Names: NIA 24110, ENT 27985-B; Roussel-Uclaf 11679, K-Othrine

Principal Use: Insecticide (synthetic pyrethroid)

Sample Description: Technical material, 96%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Coho salmon	1.1	12	0.63 0.58-0.69
Atlantic salmon	0.6	12	0.41 0.35-0.49
Lake trout	0.4	12	0.17 0.14-0.20
Fathead minnow	0.7	12	0.8 0.7-1.0
White sucker	0.7	12	10.0 3.6-28.0
Bluegill	F	12	0.3 0.2-0.5

NOTE: RU-11679 was deactivated considerably at all pH's tested (6.5-9.5). In flow-through tests, toxicity to channel catfish stabilized after 15 to 20 days of exposure, yielding a TILC50 of 0.19 µg/L.

RYANIA

Chemical Name: Powdered stemwood of *Ryania speciosa*

Alternate Names: Ryanicide

Principal Use: Insecticide

Sample Description: Powdered stems, 100%; powdered stems, 22%²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ¹	1.1	12	3.2 2.9-3.5
Bluegill ¹	1.0	18	18.5 16.1-21.2
Channel catfish ²	0.7	18	20.0 16.4-24.4

S-BIOALLETHRIN

Chemical Name: d-trans-Chrysanthemum mono-carboxylic acid ester of d-2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one

Alternate Names: None known

Principal Use: Insecticide (synthetic pyrethroid)

Sample Description: Technical material, 98%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Fathead minnow	0.7	12	80 66-97
Channel catfish	0.9	12	15 ^a 10-21
Bluegill	0.8	12	24 19-30
Yellow perch	1.5	12	7.8 6.5-9.4

^aFlow-through test.

NOTE: When test temperature was varied from 12° to 22°C, pH from 6.5 to 9.5, and hardness from 12 to 300 ppm, the 96-h LC50 for bluegills remained within the range of 24-39 µg/L.

SD-14114

Chemical Name: Distannoxane, hexakis (beta, beta-dimethyl-phenethyl)

Alternate Names: Vendex, Torque

Principal Use: Acaricide

Sample Description: Technical material, 100%¹; wettable powder, 50%²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Rainbow trout ¹	1.0	12	1.7 1.3-2.4
Fathead minnow ¹	0.7	17	1.9 1.0-3.5
Bluegill ¹	1.2	17	4.8 2.5-9.3
Channel catfish ²	1.0	17	1.5 0.9-2.7

SD-17250

Chemical Name: N-[(Methylcarbamoyl) oxy] thio=acetimidic acid, ester with 3-mercaptopropionitrile

Alternate Names: None known

Principal Use: Insecticide

Sample Description: Technical material, 100%¹; wettable powder, 75%²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Coho salmon ¹	1.4	12	3.1 2.3-4.1
Rainbow trout ¹	0.8	12	1.5 1.0-2.2
Bluegill ¹	0.5	18	5.7 3.4-9.5
Bluegill ²	0.5	18	1.1 0.9-1.4

SIMAZINE

Chemical Name: 2-Chloro-4,6-bis(ethylamino)-s-triazine

Alternate Names: Princep, Aquazine, Simadex, Primatol

Principal Use: Herbicide

Sample Description: Technical material, 98.1%¹; wettable powder, 80%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Daphnia magna</i> ¹	I ₁	21	1.1 ^a 0.56-2.2
<i>Cypridopsis</i> ¹	M	21	3.7 ^a 2.6-5.3
<i>G. fasciatus</i> ¹	M	15	> 100
<i>Pteronarcys</i> ¹	YC ₂	15	1.9 0.9-4.0
Rainbow trout ¹	1.2	12	> 100
Fathead minnow ¹	0.7	25	> 100
Bluegill ²	1.0	24	100 90-110

^a48-h EC50, water hardness 272 ppm CaCO₃.

SODIUM ARSENITE

Chemical Name: Sodium meta-arsenite

Alternate Names: Atlas "A," Chem Pels C, Kill-All, Penite

Principal Use: Herbicide, insecticide

Sample Description: Liquid, 99%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Daphnia pulex</i>	I ₁	15	3.0 ^a 2.2-4.1

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Pteronarcys</i>	YC ₂	15	38 30-48
Rainbow trout	2.6	12	23 14-39
Bluegill	1.0	24	30 21-42

^a48-h EC50.

STROBANE

Chemical Name: Polychlorinates of camphene, pinene, and related terpenes (65% chlorine)

Alternate Names: Terpene polychlorinates

Principal Use: Insecticide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>Pteronarcys</i>	YC ₂	15	7 ^a 4.4-11
Rainbow trout	1.0	12	12 9-14
Bluegill	0.9	24	8.7 7.4-10.2

^a48-h LC50.

SUFFIX

Chemical Name: Ethyl N-benzoyl-N-(3,4-dichlorophenyl)-2-aminopropionate

Alternate Names: Suffix 25, WL 17731, SD30053

Principal Use: Selective herbicide

Sample Description: Technical material, 100%¹; emulsified concentrate: 1.6 lb/gal²; 2.0 lb/gal³; 17.6%⁴; 22.2%⁵

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
Fathead minnow ¹	0.5	17	860 660-1,120
Bluegill ¹	0.8	17	1,200 1,073-1,341
Bluegill ²	0.8	17	1,000 808-1,238
Bluegill ³	0.8	17	720 564-919
Fathead minnow ⁴	0.5	17	460 330-640
Fathead minnow ⁵	0.5	17	760 525-1,100

TEMEPHOS

Chemical Name: 0,0,0',0'-Tetramethyl 0,0'-(thiodi-p-phenylene) phosphorothioate

Alternate Names: AC-5216, Bathion, CAS-3383-96-8, ENT-27165, Difenthos, Abate, Nimitox

Principal Use: Insecticide

Sample Description: Technical material 86-90%¹; emulsifiable concentrate (4-E), 46%²; wettable powder, 50%³

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. lacustris</i> ¹	M	21	0.08 0.03-0.21
<i>Pteronarcella</i> ¹	N	10	0.031 0.023-0.041
<i>Pteronarcys</i> ¹	YC ₂	17	0.010 0.007-0.015
Cutthroat trout ¹	0.2	12	1.27 0.87-1.86
Rainbow trout ¹	1.3	12	3.49 2.33-5.23

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Atlantic salmon ¹	0.5	12	21.0 17.5-25.0
Brook trout ¹	1.2	12	12.8 9.75-16.80
Lake trout ¹	2.3	10	3.65 2.70-4.92
Fathead minnow ¹	0.7	17	34.1 19.7-59.2
Channel catfish ¹	1.0	17	> 10.0
Bluegill ¹	1.0	17	21.8 15.6-30.5
Coho salmon ²	0.9	12	0.35 0.23-0.33
Rainbow trout ²	1.2	12	0.16 0.10-0.24
Channel catfish ²	1.9	17	3.23 1.71-6.67
Bluegill ²	1.4	17	1.14 0.80-1.53
Largemouth bass ²	0.9	17	1.44 0.92-2.25
Atlantic salmon ³	0.5	12	6.70 5.66-7.94
Brook trout ³	1.2	12	5.00 3.69-6.77

NOTE: Test conditions and size did not appreciably change the toxicity of temephos to fish. Variations in pH from 6.0 to 9.0, hardness from 40 to 162 ppm, or size from 1 to 20 g gave a range of less than 4 mg/L in 96-h LC50 values. Flow-through tests for up to 15 days with cutthroat trout and lake trout produced TILC50 values of 0.20 and 1.05 mg/L and cumulative toxicity indices of 5.0 and 1.0, respectively.

TEPP

Chemical Name: Tetraethyl diphosphate

Alternate Names: Kilmit 40, Tetron, Vapotone, Nifos

Principal Use: Insecticide

Sample Description: Formulation, 40%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>G. fasciatus</i>	M	21	39 27-57
Rainbow trout	1.0	12	700 500-980
Fathead minnow	0.6	18	240 144-401
Bluegill	0.8	24	640 537-762

TETRADIFON

Chemical Name: 4-Chlorophenyl 2,4,5-trichlorophenyl sulfone; (2,4,5,4'-tetrachlorodiphenyl sulfone)

Alternate Names: Tedion, Nia-5488

Principal Use: Acaricide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>G. fasciatus</i>	M	21	111 82-150
Rainbow trout	1.1	12	1,200 949-1,600
Channel catfish	0.3	18	2,100 1,150-3,830
Bluegill	0.8	24	880 664-1,166

TETRAMINE

Chemical Name: Tetramethylene disulfotetramine

Alternate Names: TEM

Principal Use: Rodenticide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>G. fasciatus</i>	M	21	18 12-26
<i>Pteronarcys</i>	YC ₂	15	> 1,000
Rainbow trout	2.0	12	56 51-62
Bluegill	1.3	18	89 78-101

TFM

Chemical Name: 3-Trifluoromethyl-4-nitrophenol, sodium salt

Alternate Names: TFN, Hoe-02770, Lampricide

Principal Use: Lampricide

Sample Description: Technical material, 95%¹; field grade, 35.7%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage	Temp (C)	96-h LC50 95% CI (mg/L)
<i>G. pseudolimnaeus</i> ¹	M	21	22.3 ^a 16.0-31.4
<i>Orconectes</i>	I _E	21	17.8 14.9-21.2
<i>G. pseudolimnaeus</i> ²	M	21	57 ^a 47-69

^aTested in hard water, 272 ppm CaCO₃.

THANITE

Chemical Name: Isobornyl thiocyanacetate, 82%; other related terpenes, 18%

Alternate Names: None known

Principal Use: Contact insecticide

Sample Description: Liquid, 82%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Daphnia magna</i>	I ₁	—	115 ^a 79-168
<i>G. fasciatus</i>	M	15	740 451-1,214
Cutthroat trout	0.3	12	160 ^b 142-180
Lake trout	0.3	12	109 90-132

^a48-h EC50.

^bTested in hard water, 162 ppm CaCO₃.

THIOBENCARB

Chemical Name: S-(4-Chlorobenzyl) N,N-diethylthiol= carbamate

Alternate Names: None known

Principal Use: No known uses

Sample Description: Liquid 95.5%¹, 85.2%²

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Rainbow trout ¹	0.6	12	1.2 0.74-1.8
Channel catfish ¹	1.2	20	2.3 1.2-4.4
Bluegill ¹	0.6	20	2.5 1.7-3.7
Rainbow trout ²	0.6	12	1.2 0.7-1.6
Channel catfish ²	1.2	20	2.3 1.2-4.4
Bluegill ²	0.6	20	1.7 1.2-2.3

THYNON

Chemical Name: 5,10-Dihydro-5,10-dioxonaphtho-(2,3b)-p-dithiin-2,3-dicarbonitrile

Alternate Names: Dithianon, Delan, Delan-Col

Principal Use: Fungicide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
Goldfish	1.0	18	150 66-330
Fathead minnow	0.9	18	165 123-223
Channel catfish	1.6	18	130 120-140

TOXAPHENE

Chemical Name: Chlorinated camphene mixture (content of combined chlorine, 67-69%)

Alternate Names: polychlorocamphene, camphechlor (common names) Clor Chem T-590, Cristoxo, Motox, Phenacide, Phenatox, Strobane-T, Toxakil, Toxon 63

Principal Use: Insecticide

Sample Description: Technical material, 100%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>Simocephalus</i>	I ₁	15	19 ^a 12.2-29.5
<i>Daphnia magna</i>	I ₁	21	10 ^a 6.8-14.2
<i>Daphnia pulex</i>	I ₁	15	14.2 ^a 10.5-19.1
<i>G. fasciatus</i>	M	21	26 18.9-35.7
<i>Pteronarcys</i>	YC ₂	15	2.3 1.3-4.0
<i>Tipula</i>	J	15	18.0 12.8-25.4

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI ($\mu\text{g/L}$)
<i>Chironomus</i>	J	15	30 ^a 16.0-56.4
<i>Claassenia</i>	J	15	1.3 1.0-1.6
<i>Atherix</i>	J	15	40 27-60
Coho salmon	1.0	12	8 6-10
Rainbow trout	1.4	12	10.6 7.9-12.7
Brown trout	1.7	12	3.1 2.1-4.7
Goldfish	1.0	18	14 11-19
Carp	0.6	18	3.7 2.8-4.7
Fathead minnow	1.1	20	18 12-27
Black bullhead	0.9	24	5.8 5.1-6.6
Channel catfish	1.5	18	13.1 9.8-17.5
Green sunfish	1.1	18	13 8-17
Bluegill	0.8	24	2.4 2.0-2.8
Largemouth bass	0.9	18	2.0 1.3-3.2
Yellow perch	1.4	18	12 9-14

^a48-h EC50.

NOTE: Alterations in pH and water hardness did not change the toxicity of toxaphene to fish. In channel catfish, swim-up fry were more sensitive than other life stages tested; 96-h LC50's ($\mu\text{g/L}$) were 8.0 for yolk-sac fry, 0.8 for swim-up fry, and 2.0 for fingerlings. Flow-through tests with channel catfish and bluegills produced TL50's of 1.82 and 1.04 $\mu\text{g/L}$ and cumulative toxicity indices of 3.9 and 1.0 $\mu\text{g/L}$, respectively. Continuous exposures of catfish fry for 90 days to concen-

trations of toxaphene ranging from 72 to 630 ng/L caused significant reductions in collagen and increases in calcium in the backbone; this decrease in organic matrix and increase in mineral content increased the fragility of the backbone.

TRETOLITE

Chemical Name: Not known

Alternate Names: None known

Principal Use: Oil demulsifier

Sample Description: Technical material, 100%; J-146¹, JW-8226², and JN9045³

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Pteronarcella</i> ¹	N	10	61 37-102
Cutthroat trout ¹	0.6	10	1.4 1.1-1.9
Cutthroat trout ²	0.5	10	0.36 0.26-0.49
Cutthroat trout ³	0.5	10	0.36 0.26-0.50

NOTE: Tests with tretolite JW-8226 in hard water against cutthroat trout yielded 96-h LC50's of 0.048 mg/L for eyed eggs and 2.9 mg/L for yolk-sac fry.

TRICHLORFON

Chemical Name: Dimethyl (2,2,2-trichloro-1-hydroxyethyl) phosphonate

Alternate Names: Anthon, Bay 13/59, Bayer 15922, Bayer L 13/59, Bovinox, Briton, CAS 52-68-6, Cekufon, Chlorofos, Cicloxom, Clorofos, Danex, Dipterex, Diptetes, Dylox, ENT-19739, Equino-Acid, Masoten, Neguvon, Proxol, Trichlorphon, Trinex, Tugon

Principal Use: Insecticide

Sample Description: Technical material, 98%¹; soluble powder, 80%²; liquid, 40%³

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (μg/L)
<i>Simocephalus</i> ¹	I ₁	16	0.70 ^a 0.56-0.87
<i>Daphnia pulex</i> ¹	I ₁	16	0.18 ^a 0.13-0.25
<i>G. lacustris</i> ¹	M	21	40 26-60
<i>Procambarus</i> ¹	M	12	7,800 6,520-9,330
<i>Pteronarcella</i> ¹	N	16	11 7.6-16
<i>Pteronarcys</i> ¹	YC ₂	16	35 22-55
<i>Claassenia</i> ¹	YC ₁	16	22 16-29
<i>Skwala</i> ¹	N	7	24 17-32
Cutthroat trout ¹	0.6	12	2,700 1,920-3,800
Rainbow trout ¹	0.5	12	1,750 1,250-2,460
Atlantic salmon ¹	0.5	12	1,400 1,130-1,730
Brown trout ¹	4.6	12	3,500 2,490-4,910
Brook trout ¹	0.8	12	2,500 2,180-2,860
Lake trout ¹	2.3	12	550 354-854
Fathead minnow ¹	0.9	18	7,900 6,740-9,260
Channel catfish ¹	1.6	18	880 766-1,010
Bluegill ¹	1.0	18	3,170 2,680-3,750
Largemouth bass ¹	0.8	18	3,450 ^b 3,030-3,930
<i>Skwala</i> ²	N	7	12 8.9-15

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Cutthroat trout ^a	0.9	12	3,250 2,740-3,860
Rainbow trout ²	1.0	12	700 500-969
Brook trout ²	0.7	12	9,200 6,740-12,500
Bluegill ²	0.8	18	940 645-1,360
Rainbow trout ³	0.6	12	1,400 1,050-1,850

^a48-h EC50.^bTested in hard water, 272 ppm CaCO₃.

NOTE: Variations in temperature and pH significantly altered the toxicity of trichlorfon to test animals. Naiads of the stonefly *Pteronarcella badia* were 19 times more susceptible at pH 8.5 than at pH 6.5. In tests with trout and bluegills, increases in temperature (7° to 17°C) and pH (6.5 to 9.0) were marked by increases in toxicity ranging from 3.4- to 11-fold and 5- to 35-fold, respectively. The increase in toxicity was greatest as pH increased from 7.5 to 8.5; the increase between pH 8.5 and 9.5 was small. Water hardness variations (12 to 300 ppm) did not alter toxicity to cutthroat trout but were accompanied by a fourfold increase in toxicity to brook trout. Toxicity to brook trout increased 10-fold after solutions were aged for 2 weeks but only 5-fold after the solutions were aged for 3 weeks. Small trout (0.6 to 2 g) were 2 to 3 times more susceptible than larger fish (3.2 to 4.4 g). The TILC50 for coho salmon was 3.5 mg/L and the cumulative toxicity index was less than 1.2, indicating no significant cumulative toxic action. Bluegills and channel catfish from ponds given four successive treatments of trichlorfon (0.25 or 1.0 mg/L) at 7-day intervals showed severe acetylcholinesterase inhibition; cumulative mortalities were as high as 29% in channel catfish and 83% in bluegills.

TRICRESYL PHOSPHATE

Chemical Name: Tricresyl phosphate

Alternate Names: TCP

Principal Use: Industrial chemical: flame-retardant plasticizer

Sample Description: Commercial formulation, 100%

SUMMARY OF ACUTE TOXICITY^a

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Rainbow trout	0.2	12	260 210-322
Channel catfish	1.3	12	803 672-959
Bluegill	0.6	12	150 102-220
Yellow perch	0.7	12	502 384-656

^aAll data are for flow-through tests.

TRIFLURALIN

Chemical Name: *a,a,a*-Trifluoro-2,6-dinitro-*N,N*,-dipropyl-*p*-toluidine

Alternate Names: Treflan, Elancolan, Ipersan, Trefanocide, Triflurex

Principal Use: Selective, pre-emergence herbicide

Sample Description: Technical material, 95.9%¹; emulsifiable concentrate, 46%²

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
<i>Simocephalus</i> ¹	I ₁	15	900 ^a 651-1,245
<i>Daphnia magna</i> ¹	I ₁	21	560 ^{a,b} 320-1,000
<i>Daphnia pulex</i> ¹	I ₁	15	625 ^a 446-876
<i>G. fasciatus</i> ¹	M	21	2,200 1,400-3,400
<i>Pteronarcys</i> ¹	YC ₂	15	2,800 2,100-3,700
Rainbow trout ¹	0.8	12	41 26-62
Fathead minnow ¹	0.8	18	105 83-134
Channel catfish ¹	0.8	22	2,200 1,420-3,410

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (µg/L)
Bluegill ¹	0.8	22	58 47-70
Largemouth bass ¹	0.7	18	75 ^b 65-87
Goldfish ²	1.0	18	145 108-195

^a48-h EC50.^bTested in hard water, 272 ppm CaCO₃.

NOTE: Variations in test conditions such as temperature, pH, and water hardness did not appreciably alter the toxicity of trifluralin to fish. However, size of fish did affect toxicity; in rainbow trout, trifluralin was 20 times more toxic to swim-up fry and fingerlings than to yolk-sac fry. In channel catfish, yolk-sac and swim-up fry were 4 to 5 times more sensitive than fingerlings.

UREABOR

Chemical Name: Sodium metaborate tetrahydrate (66.5%), sodium chlorate (30.0%), bromacil (1.5%)

Alternate Names: None known

Principal Use: Herbicide

Sample Description: Dry granule formulation, 98%

SUMMARY OF ACUTE TOXICITY

Test organism	Wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
Chinook salmon	1.0	10	352 289-428
Rainbow trout	1.1	10	640 387-1,057
Fathead minnow	0.7	17	> 100
Channel catfish	0.9	20	> 100
Bluegill	0.9	20	> 100

VERNOLATE

Chemical Name: S-Propyl N,N-dipropylthiocarbamate

Alternate Names: Vernam

Principal Use: Selective herbicide

Sample Description: Technical material, 97.7%

SUMMARY OF ACUTE TOXICITY

Test organism	Stage or wt (g)	Temp (C)	96-h LC50 95% CI (mg/L)
<i>Cypridopsis</i>	M	21	0.25 ^{a,b} 0.15-0.42
<i>Asellus</i>	M	15	0.23 ^b 0.16-0.33
<i>G. fasciatus</i>	M	15	14.0 9.6-20.0
<i>Palaemonetes</i>	J	2.1	0.53 ^b 0.14-2.0
Rainbow trout	1.3	12	4.3 3.9-4.7
Bluegill	1.2	24	2.5 1.7-3.7

^a48-h EC50.^bTested in hard water, 272 ppm CaCO₃.

Table 4. Summary of Acute Toxicity Data for Chemicals that Received only Limited Testing.^a

Compound and test organism	Stage or wt (g)	Temp (C)	96-h LC50 (mg/L)	95% CI
Acetone				
Rainbow trout	1.0	12	5,540	4,740-6,330
Aldicarb				
Rainbow trout	0.5	12	0.56	0.39-0.80
Bluegill	1.3	24	0.05	0.03-0.08
Ametryn				
Rainbow trout	1.2	13	3.2	—
Bluegill	0.8	24	3.7	—
Amitrol				
<i>G. fasciatus</i>	—	18	> 10	—
Fathead minnow	1.2	18	> 100	—
Channel catfish	1.8	18	> 160	—
Benefin				
<i>G. fasciatus</i>	M	15	1.1	0.6-1.9
Goldfish	1.0	18	0.8	0.7-1.0
Fathead minnow	0.9	18	< 1.0	—
Bensulide				
<i>G. fasciatus</i>	M	15	1.4	0.4-5.1
Rainbow trout	1.6	13	0.7	—
Bluegill	0.2	24	0.8	—
Benzene				
Rainbow trout	2.4	12	9.2	7.2-11.7
Channel catfish	0.1	22	425	357-505
Bluegill	0.2	22	100	70-142
Bufencarb				
<i>G. fasciatus</i>	M	15	0.001	0.0006-0.002
<i>Palaemonetes</i>	M	21	0.001	—
Goldfish	1.0	18	0.29	0.22-0.39
Butylate				
<i>G. fasciatus</i>	M	15	11	8-16
Chlorbromuron				
Rainbow trout	0.7	12	1.4	0.7-3.1
Channel catfish	0.7	18	10.2	8.4-12.4
Chlordimeform				
Rainbow trout	0.7	12	13.2	8.1-21.3
Channel catfish	0.7	18	20.2	14.8-27.6
Chlorfenethol				
Fathead minnow	1.2	18	1.4	1.0-2.1
Channel catfish	1.4	18	0.9	0.7-1.2

Table 4. Continued

Compound and Test Organism	Stage or wt (g)	Temp (C)	95-h LC50 (mg/L)	95% CI
Chlorobenzilate				
<i>Simocephalus</i>	I ₁	15	0.6 ^b	0.5-0.7
<i>Daphnia pulex</i>	I ₁	15	0.9 ^b	0.7-1.1
Rainbow trout	0.8	13	0.7	—
Chloronitropropane				
<i>G. lacustris</i>	M	21	0.64	0.50-0.90
Rainbow trout	1.5	12	0.11	0.09-0.13
Bluegill	1.1	18	0.15	0.14-0.16
Chloroxuron				
Rainbow trout	0.7	12	0.43	0.36-0.51
Channel catfish	1.3	18	0.45	0.16-1.24
Crufomate				
<i>G. fasciatus</i>	M	15	3.7	3.4-4.1
Bluegill	1.0	18	1.8	1.3-2.4
Cycloheximide				
Rainbow trout	3.5	12	1.4	—
Cycocel				
Rainbow trout	1.4	12	> 100	—
Fathead minnow	1.5	17	> 100	—
Channel catfish	1.5	17	> 100	—
Bluegill	1.5	17	> 100	—
Deet				
<i>G. fasciatus</i>	M	15	> 100	—
Dichlormate				
Rainbow trout	0.8	12	4.9	3.8-6.4
Dilan				
<i>G. lacustris</i>	M	13	0.350	0.30-0.40
Rainbow trout	1.1	13	0.034	0.032-0.036
Dimethylformamide				
Rainbow trout	0.8	12	12,000	10,000-13,000
Dimethyl sulfoxide				
Rainbow trout	0.7	12	35,000	33,000-37,000
Bluegill	1.0	24	> 400,000	—
Dodine				
<i>G. fasciatus</i>	M	15	1.1	—
Emcol AD-410				
Rainbow trout	0.9	12	9.0	6.7-12.2
Bluegill	0.9	12	16.5	14.2-19.1
Ethanol				
<i>Palaemonetes</i>	M	21	> 250	—
Rainbow trout	0.8	12	13,000	12,000-16,000

Table 4. Continued

Compound and test organism	Stage or wt (g)	Temp (C)	96-h LC50 (mg/L)	95% CI
Ethyl Benzene				
Rainbow trout	2.4	12	14	11-18
Channel catfish	0.1	22	210	134-330
Bluegill	0.2	17	88	63-122
Ethylene Dichloride				
<i>G. fasciatus</i>	M	21	> 100	—
<i>Pteronarcys</i>	YC ₂	15	> 100	—
Rainbow trout	1.8	13	225	—
Ethylene Glycol				
Rainbow trout	0.7	12	41,000	36,000-47,000
Ethylene Glycol (monomethyl ether)				
Rainbow trout	1.1	12	16,000	14,000-18,000
Fenson				
Rainbow trout	0.7	13	6.6	5.5-8.0
Bluegill	0.5	24	5.1	3.6-7.3
Fensulfothion				
<i>G. fasciatus</i>	M	15	0.01	0.007-0.014
Fluometuron				
Rainbow trout	0.7	12	3.0	2.0-4.5
Channel catfish	0.8	18	0.6	0.3-1.3
Fonofos				
Rainbow trout	1.7	13	0.020	0.016-0.025
Bluegill	1.0	24	0.007	0.005-0.009
Garlon 3A				
Rainbow trout	0.9	12	> 100	—
Bluegill	0.8	22	> 100	—
Geranol				
Rainbow trout	F	12	3.7	3.3-4.1
Brown trout	0.8	12	2.6	2.3-3.0
Fathead minnow	0.5	12	5.0	4.1-6.1
Fathead minnow	0.8	17	3.2	2.7-3.8
Glycerol				
Rainbow trout	0.9	12	54,000	51,000-57,000
Gophacide				
Rainbow trout	1.4	13	0.44	0.39-0.50
Halowax 1099				
Fathead minnow	0.7	20	> 100	—
Channel catfish	0.8	20	> 100	—
Jodfenphos				
Rainbow trout	0.7	12	0.016	0.012-0.023
Channel catfish	0.8	18	0.390	0.300-0.490

Table 4. Continued

Compound and test organism	Stage or wt (g)	Temp (C)	96-h LC50 (mg/L)	95% CI
Kling-Tite 800 Coho salmon	1.4	12	76	47-117
Landrin Rainbow trout	1.2	12	1.0	0.8-1.3
Bluegill	0.9	18	11.6	10.6-12.7
Lead arsenate Channel catfish	1.6	18	> 100	—
Lethane 384 <i>G. fasciatus</i>	M	15	4.8	3.7-6.1
Cutthroat trout	0.6	12	6.5	4.9-8.7
Lake trout	1.2	12	3.9	3.4-4.5
Merphos Rainbow trout	0.6	12	33	20-53
Rainbow trout ^c	0.6	12	10	7-14
Methanol Rainbow trout	0.8	12	19,000	18,000-20,000
Methidathion Rainbow trout	0.8	12	0.014	0.009-0.022
Bluegill	0.7	24	0.009	0.006-0.013
Methiocarb <i>Pteronarcys</i>	YC ₂	15	0.005	0.004-0.006
Rainbow trout	1.3	12	0.80	0.63-0.89
Bluegill	1.0	24	0.21	0.12-0.36
Methorprotryne Bluegill	0.9	18	15.5	13.9-17.2
Methyl-Demeton <i>G. lacustris</i>	M	21	0.190	0.170-0.210
<i>Pteronarcys</i>	YC ₂	15	0.035	0.030-0.039
Monoethanolamine Rainbow trout	YSF	10	150	114-196
Bluegill	0.3	20	> 300	—
Morsodren Rainbow trout	1.0	12	0.06	0.03-0.10
Niclosamide <i>Cypridopsis</i>	M	21	0.31 ^b	0.23-0.42
<i>G. fasciatus</i>	M	15	0.36	0.22-0.59
Nitrofen <i>G. fasciatus</i>	M	15	3.1	1.7-5.6
Norea Goldfish	1.0	18	37	28-50
Fathead minnow	0.9	18	32	23-44
Bluegill	0.4	24	13	11-16

Table 4. Continued

Compound and test organism	Stage or wt (g)	Temp (C)	96-h LC50 (mg/L)	95% CI
N-serve				
Rainbow trout	1.1	12	7.5	6.9-8.2
Fathead minnow	1.2	18	10.2	8.8-11.7
Channel catfish	1.5	18	5.8	4.6-7.3
Oryzalin				
<i>Asellus</i>	M	18	0.40	0.19-0.84
<i>G. fasciatus</i>	M	18	0.19	0.14-0.26
Perthane				
Rainbow trout	0.7	12	0.004	0.003-0.006
Bluegill	0.9	24	0.020	0.016-0.025
Pipron				
Goldfish	1.0	18	2.0	1.5-2.6
Propanil				
<i>G. fasciatus</i>	M	15	16	9-32
Reldan				
Brook trout	1.2	12	0.20	0.14-0.28
Roccal				
Rainbow trout	1.8	12	1.20	0.8-1.6
Bluegill	0.3	24	0.32	0.22-0.46
Stabilene				
<i>G. fasciatus</i>	M	15	17	7.1-40.9
Stirofos				
Rainbow trout	0.8	13	0.43	0.33-0.56
Channel catfish ^d	2.0	18	> 0.50	—
Bluegill ^d	1.0	18	0.53	0.36-0.77
2,3,6-TBA				
Fathead minnow	0.9	18	0.009	0.007-0.011
Tepa				
Rainbow trout	0.8	12	> 100	—
Terbutryn				
Rainbow trout	0.8	13	0.82	0.56-1.20
Bluegill	1.3	18	2.70	1.40-5.30
Toluene				
Rainbow trout	2.4	12	24	17.6-32.6
Channel catfish	0.1	22	240	187-309
Bluegill	0.1	17	170	139-208
Tranid				
Rainbow trout	1.0	12	13	11-16
Bluegill	1.3	24	4.2	2.8-6.4
Trefmid				
Rainbow trout	1.3	12	0.13	0.09-0.18
Bluegill	1.0	24	0.35	0.28-0.40

Table 4. Continued

Compound test organism	Stage or wt (g)	Temp (C)	96-h LC50 (mg/L)	95% CI
Trichloronat				
<i>Pteronarcys</i>	YC ₂	16	0.0001	0.00009-0.00012
Rainbow trout	1.4	12	0.14	0.11-0.18
Bluegill	0.8	24	0.22	0.15-0.33
Velpar				
Rainbow trout	0.7	12	> 100	—
Bluegill	0.8	22	> 100	—
Warfarin				
Channel catfish	0.8	18	34.3	28.1-42.0
Xylene				
Rainbow trout	0.6	12	8.2	6.7-10.0
Bluegill	0.9	12	13.5	12.1-15.0

^aSee Table 3 for chemical names. Abbreviations are as follows: G. = *Gammarus*; YSF = yolk-sac fry; F = fingerling; M = mature; I₁ = first instar; YC₂ = second year class.

^b48-h EC50.

^cLiquid material, 72%.

^dWettable powder, 75%.

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APPENDIX I

Glossary

- acute** A condition or test in which the stimulus applied is severe enough to elicit a biological response; the response is usually death or immobilization of the test organism within 96 h.
- chronic** A condition or test in which exposure to a stimulus continues for an extended time and typically induces sublethal biological response. Aquatic toxicity tests usually involve a portion of an organism's life cycle (partial or embryo-larval chronic toxicity tests). Full chronic toxicity tests cover one complete life cycle.
- conditional toxicity tests** Tests additional to the standard acute toxicity tests recommended by the U.S. Environmental Protection Agency for registration of chemicals. Conditional tests are acute toxicity tests conducted in the laboratory under controlled conditions that reflect the effects on chemical toxicity of such natural environmental variables as pH, temperature, water hardness, deactivation (aging of test solutions), and different life stages of organisms, or other water quality tests.
- cumulative toxicity index** Numerical ratio of the 96-h LC50 to the TILC50 for a chemical. This ratio can serve as an estimate of the cumulative action of a toxicant. For example, ratio or index of 2 suggests little cumulative action, whereas an index of 50 suggests high cumulative action.
- deactivation tests** Conditional toxicity tests not included in routine standard toxicity testing. Organisms are exposed to a series of test solutions that have been prepared and allowed to age for a predetermined period, usually 1 to 4 weeks. A deactivation index is calculated by dividing the LC50 of the aged solution by the LC50 of the fresh solution.
- EC50 (effective concentration)** A statistical estimate of the concentration of a test material necessary to produce a particular effect (usually immobilization) in 50% of a test population within a given time (often 48 h).
- flow-through toxicity tests** Exposures of test organisms to a series of toxicant concentrations in which both the toxicant and the dilution water are continuously renewed. Organisms are exposed to toxicants in flow-through diluter systems for 4 days or longer.
- instar** Growth stage or period of growth occurring between any two successive molts, as in insects and crustaceans.
- LC50 (median lethal concentration)** A statistical estimate of the concentration of a test material necessary to cause death to 50% of a test population within a given time (often 96 h).
- naïad** Any of the immature or nymphal stages of certain aquatic insects (e.g., stoneflies, dragonflies, and damselflies).
- reconstituted water** Recommended dilution water for standard acute toxicity tests. This water is reconstituted from deionized water by adding known amounts of specified reagent grade chemicals. Freshwater organisms are tested in reconstituted water of pH 7.4, alkalinity 35 mg/L, and hardness of 40 mg/L as CaCO₃.
- standard toxicity tests** The group of initial tests that the U.S. Environmental Protection Agency recommends be included to support applications for pesticide registration. These tests are routinely used to determine the relative toxicity of a chemical. The toxicity data presented in this Handbook are a product of standard toxicity testing; basic tests are run on a chemical (both technical and formulated materials) against one or more representative species of invertebrates and fish. The 96-h LC50's are determined by following standardized test procedures.
- static toxicity tests** Acute toxicity tests in which test organisms are exposed to the toxicant throughout the duration of the testing period, without renewal of the test solution.
- subacute** Condition or tests involving a stimulus that is less severe than an acute stimulus; the response is produced over a longer period. Test conditions may approach those in chronic toxicity tests.
- sublethal** Usually refers to a stimulus that causes biological responses less severe than death of the test organisms.
- TILC50 (time-independent LC50)** Statistical estimate of the toxicant concentration at which 50% of the test population would be expected to survive indefinitely.
- toxicity** Property of a chemical substance that causes a measurable adverse biological response.
- toxicology** Study of the effects of chemicals on living systems, including the mechanisms of these effects and the conditions under which they occur.

APPENDIX II

Cross-index to Chemicals

<i>Alternate Name</i>	<i>Common Name</i>	<i>Alternate Name</i>	<i>Common Name</i>
Abar	Leptophos	Atlas A	Sodium Arsenite
Abate	Temephos	Axiom	Akton
Acaraben	Chlorobenzilate	Azide	Azide
Acarin	Dicofol	Azinphos ethyl	Azinphos ethyl
Acarithion	Carbophenothion	Azinphos methyl	Azinphos methyl
Accelerate	Endothall	Azodrin	Azodrin
Accothion	Fenitrothion	Azofene	Phosalone
Acephate	Acephate		
Acetone	Acetone	Balan	Benefin
Acricid	Binapacryl	Balfin	Benefin
Actidione	Cycloheximide	Banex	Dicambia
Aerial gramoxone	Paraquat	Banvel	Dicambia
Agritox	Trichloronat	Baraquat	Roccal
Agrothion	Fenitrothion	Basanite	Dinoseb
Agroxone	Phenoxy herbicides	Basapon	Dalapon
Akton	Akton	Basudin	Diazinon
Alaclor	Alaclor	Bathion	Temephos
Aldicarb	Aldicarb	Bay 2352	Niclosamide
Aldrin	Aldrin	Bay 25141	Fensulfothion
Aldrite	Aldrin	Bay 30130	Propanil
Aldrosol	Aldrin	Bay 37344	Methiocarb
Alfacron	Jodfenphos	Bay 38819	Gophacide
Alfa-tox	Diazinon	Bay 68138	Perthane
Alkron	Parathion ethyl	Bayer L13/59	Trichlorfon
Alleron	Parathion ethyl	Bayer 73	Bayluscide
Allethrin	Allethrin	Bayer 15922	Trichlorfon
Altosid	Methoprene	Bayer 77488	Phoxim
Alvit	Dieldrin	Baygon	Propoxur
Ambox	Binapacryl	Bayluscide	Bayluscide
Ambush	Permethrin	Baymix	Coumaphos
Amdon	Picloram	Baytex	Fenthion
Ametryn	Ametryn	Baythion	Phoxim
Aminocarb	Aminocarb	Belt	Chlordane
Aminocarbe	Aminocarb	Benefin	Benefin
Amitril-TL	Cytrol Amitrole-T	Benesan	Lindane
Amitrol	Amitrol	Benlate	Benomyl
Amitrole-T	Cytrol Amitrol-T	Benofuroline	Resmethrin
Anilazine	Dyrene	Benomyl	Benomyl
Anofax	DDT	Bensulide	Bensulide
Ansar 529	MSMA	Benzac	2,3,6-TBA
Anthon	Trichlorfon	Benzahex	Benzene Hexachloride
Anticarie	Hexachlorobenzene	Benzalkonium chloride	Roccal
Antimycin	Antimycin A	Benzene	Benzene
Aphamite	Parathion Ethyl	Benzene Hexachloride	Benzene Hexachloride
Aphoxide	TEPA	Benzex	Benzene Hexachloride
APO	TEPA	Benzphos	Phosalone
Aquacide	Diquat	Betasan	Bensulide
Aquathol	Endothall	BHC	Benzene Hexachloride
Aquazine	Simazine	Bidrin	Dicrotophos
Aracide	Aramite	Binapacryl	Binapacryl
Aramite	Aramite	Bioallethrin	Trans Allethrin
Arathane	Dinocap	Bladan	Parathion ethyl
Aracors	Polychlorinated biphenyls	Bladex	Cyanazine
Aspon	Chlordane	Blattane	Propoxur
Asthoate	Dimethoate	Blue Copperas	Copper sulfate
Asuntol	Coumaphos	Bluestone	Copper sulfate

<i>Alternate Name</i>	<i>Common Name</i>	<i>Alternate Name</i>	<i>Common Name</i>
Blue vitriol	Copper sulfate	Cinerin	Allethrin
Borolin	Picloram	Cinerolone	Allethrin
Bovinox	Trichlorfon	Ciodrin	Crotoxyphos
Briton	Trichlorfon	Clonitralid	Bayluscide
Bromchlophos	Naled	Clorofos	Trichlorfon
Bromex	Chlorbromuron	Cobex	Dinitramine
Brush killer	Phenoxy herbicides	Cobexo	Dinitramine
Brush rhap	Phenoxy herbicides	Copper count	Copper count
BTC	Roccal	Copper sulfate	Copper sulfate
Bufencarb	Bufencarb	Co-Ral	Coumaphos
Bulan	Dilan	Corodane	Chlordane
Butacide	Piperonyl butoxide	Corothion	Parathion ethyl
Butylate	Butylate	Correx	Lignasan
Butyrac	Phenoxy herbicides: 2,4-D	Cotnion-Ethyl	Azinphos ethyl
Bux	Bufencarb	Cotnion-Methyl	Azinphos methyl
		Cotoran	Fluometuron
Camphechlor	Toxaphene	Coumaphos	Coumaphos
Can-Trol	Phenoxy herbicides	Cristoxo	Toxaphene
Captafol	Captafol	Crotothane	Dinocap
Captan	Captan	Crotoxyphos	Crotoxyphos
Carbaryl	Carbaryl	Cruformate	Cruformate
Carbicon	Dicrotophos	Cryolite	Cryolite
Carbinol	Methanol	Curaterr	Carbofuran
Carbofos	Malathion	Curitan	Dodine
Carbofuran	Carbofuran	Cyanazine	Cyanazine
Carbophenothion	Carbophenothion	Cyclodan	Endosulfan
Carbophos	Malathion	Cycloheximide	Cycloheximide
Carfene	Azinphos ethyl	Cycocel	Cycocel
Carpene	Dodine	Cygon	Dimethoate
Carpolin	Carbaryl	Cyhexatin	Plictran
Casoron	Dichlobenil	Cyprex	Dodine
Cekufon	Trichlorfon	Cytel	Fenitrothion
Cenapon	Carbaryl	Cythion	Malathion
Chemathion	Malathion	Cytrol	Amitrol
Chemox	Dinoseb	Cytrol amitrole-T	Cytrol amitrole-T
Chem Pels C	Sodium Arsenite		
Chem Rice	Propanil	Dacamine 4-D	Phenoxy herbicides-2,4-D
Chiptox	Phenoxy herbicides	Daconate	MSMA
Chlorbromuron	Chlorbromuron	Dagadip	Carbophenothion
Chlordan	Chlordane	Dalapon	Dalapon
Chlordane	Chlordane	Danex	Trichlorfon
Chlordane, HCS-3260	Chlordane, HCS-3260	Daphene	Dimethoate
Chlordecone	Kepone	Dasanit	Fensulfathion
Chlordimeform	Chlordimeform	Dazzel	Diazinon
Chlorendate	Chlorendate	DBP	Phthalic acid ester
Chlorfenac	Fenac	D-D soil fumigant	D-D soil fumigant
Chlorfenethol	Chlorfenethol	DDD	DDD
Chlorinated paraffin	Chlorowax	DDE	DDE
Chlor-Kill	Chlordane	DDT	DDT
Chlorobenzilate	Chlorobenzilate	DDVF	Dichlorvos
Chlorofos	Trichlorfon	DDVP	Dichlorvos
Chloronitropropane	Chloronitropropane	Dechlorane	Mirex
Chlorophenothane	DDT	Dedelo	DDT
Chlorothiepin	Endosulfan	Dederap	Dichlorvos
Chlorowax	Chlorowax	Ded-Weed	Dalapon
Chloroxuron	Chloroxuron	Ded-Weed LV-69	Phenoxy herbicides-2,4-D
Chlorpyrifos	Chlorpyrifos	Deet	Deet
Chryson	Resmethrin	DEF	DEF
Cicloxom	Trichlorfon	De Fend	Dimethoate

<i>Alternate Name</i>	<i>Common Name</i>	<i>Alternate Name</i>	<i>Common Name</i>
De-Green	DEF	Dimite	Chlorfenethol
DEHP	Phthalic acid ester	Dinitramine	Dinitramine
Deiquat	Diquat	Dinitrobutylphenol	Dinoseb
Delan	Thynon	Dinitrocresol	Dinitrocresol
Delan-Col	Thynon	Dinocap	Dinocap
Delnav	Dioxathion	Dinoseb	Dinoseb
Delphene	Deet	Dinoseb methacrylate	Binapacryl
Demaso	Dimethyl sulfoxide	DI-ON	Diuron
Demasorb	Dimethyl sulfoxide	Diostop	Dimethoate
Demavet	Dimethyl sulfoxide	Dioxathion	Dioxathion
Demeton	Demeton	Diphenamid	Diphenamid
Demeton-Methyl	Methyl-Demeton	Diquat	Diquat
Demeton-S-Methyl sulfoxid	Oxydemeton-Methyl	Dipterex	Trichlorfon
Demo-L40		Diptetes	Trichlorfon
Dedrin	Dimethoate	Direz	Dyrene
DET	Rotenone	Disulfoton	Disulfoton
Detamide	Deet	Di-Syston	Disulfoton
Dexon	Deet	Dithianon	Thynon
Dextrone	Fenaminosulf	Dithiodemeton	Disulfoton
Dextrone X	Diquat	Dithiosystox	Disulfoton
Dianet	Paraquat	Diurex	Diuron
Diazajet	Dicambia	Diuron	Diuron
Diazide	Diazinon	Divipan	Dichlorvos
Diazinon	Diazinon	Dixon	Phosphamidon
Diazoben	Diazinon	DMF	Dimethylformamide
Diazol	Fenaminosulf	DMFA	Dimethylformamide
Dibrom	Diazinon	DMSO	Dimethyl sulfoxide
Dicambia	Naled	Dodine	Dodine
Dicarbam	Dicambia	Dolmix	Benzene hexachloride
Dichlobenil	Carbaryl	Dowcide-G	Pentachlorophenol (sodium salt)
Dichlofenthion	Dichlobenil		Pentachlorophenol
Dichlone	Dichlofenthion	Dowcide-7	Dalapon
Dichlormate	Phygon XL	Dowpon	Propanil
Dichlorofenidim	Dichlormate	DPA	<i>d-trans</i> -allethrin
Dichlorofenthion	Diuron	<i>d-trans</i> -allethrin	Paraquat
Dichloropropene	Dichlofenthion	Dual paraquat	Chlorpyrifos
Dichlorphos	Dichloropropene	Dursban	Dichlobenil
Dichlorvos	Dichlorvos	Dusprex	Du-ter
Diclofop	Dichlorvos	Du-ter	Fonofos
Dicofol	Phenoxy herbicides-2,4-D	Dyfonate	Trichlorfon
Dicrotophos	Dicofol	Dylox	Diphenamid
Dedimac	Dicrotophos	Dymid	Dyrene
Dieldrin	DDT	Dyrene	Phenoxy herbicides
Dieldrine	Dieldrin	2,4-D	Phenoxy herbicides-2,4-D
Dieldrite	Dieldrin	2,4-DB	Phenoxy herbicides-2,4-D
Diethione	Dieldrin	2,4-D DMA	Phenoxy herbicides-2,4-D
Difenthos	Ethion	2,6,DBN	Dichlobenil
Diflubenzuron	Temephos		
Difolatan	Diflubenzuron	Ectoral	Ronnel
Dilan	Captafol	Ektafos	Dicrotophos
Dimecron	Dilan	Elancolan	Trifluralin
Dimethoate	Phosphamidon	Elgetol 30	Dinitrocresol
Dimethogen	Dimethoate	Elgetol 318	Dinoseb
Dimethoxy-DT	Dimethoate	Embutox	Phenoxy herbicides-2,4-D
Dimethrin	Methoxychlor	Emcol AD-410	Emcol AD-410
Dimethylformamide	Dimethrin	Emmatos	Malathion
Dimethyl parathion	Dimethylformamide	Emulsamine E-3	Phenoxy herbicides-2,4-D
Dimethyl sulfoxide	Parathion methyl	Emulsavert D	Phenoxy herbicides-2,4-D
Dimilin	Dimethyl sulfoxide	Endosan	Binapacryl
	Diflubenzuron	Endosulfan	Endosulfan

<i>Alternate Name</i>	<i>Common Name</i>	<i>Alternate Name</i>	<i>Common Name</i>
Endothall	Endothall	Gamaphex	Lindane
Endrin	Endrin	Gamasol-90	Dimethyl sulfoxide
Enide	Diphenamid	Gamma BHC	Lindane
Entex	Fenthion	Gammafog	Lindane
EPN	EPN	Gammalin	Lindane
Eptam	EPTC	Gammex	Lindane
EPTC	EPTC	Gammexane	Lindane
Equino-Acid	Trichlorfon	Gardona	Stirofos
Eradicane	EPTC	Gardentox	Diazinon
Esteron 76-BE	Phenoxy herbicides-2,4-D	Garlon 3A	Garlon 3A
Esteron-99	Phenoxy herbicides-2,4-D	Garrathion	Carbophenothion
Ethanol	Ethanol	Gearphos	Parathion methyl
Ethilon	Parathion ethyl	Geranol	Geranol
Ethion	Ethion	Geritox	DDT
Ethofumesate	Ethofumesate	Gesapon	DDT
Ethyl Guthion	Azinphos ethyl	Gesaran	Methoprotrotryne
Ethyl Parathion	Parathion ethyl	Gesarex	DDT
Ethylan	Perthane	Gesarol	DDT
Ethyl benzene	Ethyl benzene	Glycerin	Glycerol
Ethylene dichloride	Ethylene dichloride	Glycerol	Glycerol
Ethylene glycol	Ethylene glycol	Glyphosate	Glyphosate
Etolene	Ronnel	Gophacide	Gophacide
Evik	Ametryn	Gramevin	Dalapon
E-Z-Off D	DEF	Gramoxone	Paraquat
		Gusathion A	Azinphos ethyl
		Gusathion M	Azinphos methyl
		Guthion	Azinphos methyl
		Gyron	DDT
Fenac	Fenac		
Fen-All	2,3,6-TBA		
Fenaminosulf	Fenaminosulf		
Fenchlorphos	Ronnel		
Fenitrothion	Fenitrothion	Halowax 1099	Halowax 1099
Fenizon	Fenson	HCB	Hexachlorobenzene
Fenoloro	Du-ter	HCS-3260	Chlordane HCS-3260
Fenson	Fenson	Heptachlor	Heptachlor
Fensulfothion	Fensulfothion	Heptagran	Heptachlor
Fenthion	Fenthion	Heptamul	Heptachlor
Fentin hydroxide	Du-ter	Herban	Norea
Fintrol	Antimycin A	Herkol	Dichlorvos
Fire-Trol 100	Fire-Trol 100	Hexachlor	Benzene hexachloride
Fire-Trol 931	Fire-Trol 931	Hexachloran	Benzene hexachloride
Floratox	Phenoxy herbicides-2,4-D	Hexachlorobenzene	Hexachlorobenzene
Fluometruon	Fluometruon	Hexaclan	Benzene hexachloride
Fluoromidine	Ethofumesate	Hexadrin	Endrin
Folcid	Captafol	Hexafor	Benzene hexachloride
Folex	Merphos	Hexa-Nema	Dichlofenthion
Folidol E605	Parathion ethyl	Hexavin	Carbaryl
Folidol M	Parathion methyl	HOE-23408	Phenoxy herbicides-2,4-D
Folithion	Fenitrothion	HOE-Grass	Phenoxy herbicides-2,4-D
Folpan	Folpet	Hoelon	Phenoxy herbicides-2,4-D
Folpet	Folpet	Hormotuh	Phenoxy herbicides
Fonofos	Fonofos	Houghto-Safe 1120	Houghto-Safe 1120
Forlin	Lindane	Hydout	Endothall
Fos-Fall "A"	DEF	Hydran	Molinate
Fosfamid	Dimethoate	Hydrothol	Endothall
Fosfern M50	Parathion methyl		
Fosferno 50	Parathion ethyl	Igran	Terbutryn
Fosthion MM	Dimethoate	Illoxan	Phenoxy herbicides-2,4-D
Frumin AL	Disulfoton	Imidan	Phosmet
Fundal	Chlordimeform	Insectophene	Endosulfan
Furadan	Carbofuran	Ipersan	Trifluralin
Fyfanon	Malathion	Iscothane	Dinocap
		Isotox	Lindane
		Ixodex	DDT
Galecron	Chlordimeform		

<i>Alternate Name</i>	<i>Common Name</i>	<i>Alternate Name</i>	<i>Common Name</i>
Jodfenphos	Jodfenphos	MCPB acid	Phenoxy herbicides
Kanepar	Fenac	MCPA-DMA	Phenoxy herbicides
Karathane	Dinocap	Mediben	Dicambia
Karbaspray	Carbaryl	Meldane	Coumaphos
Karbofos	Malathion	Melprex	Dodine
Karmex	Diuron	Mendrin	Endrin
Kazoe	Azide	Menite	Mevinphos
Kelthane	Dicofol	Mephanac	Phenoxy herbicides
Kemate	Dyrene	Mercaptothion	Malathion
Kepone	Kepone	Merpan	Captan
Kill-All	Sodium arsenite	Merphos	Merphos
Killmite 40	TEPP	Mesurol	Methiocarb
Kiloseb	Dinoseb	Metacide	Parathion methyl
Kilsem	Phenoxy herbicides	Metacil	Aminocarb
Kling-Tite 800	Kling-Tite 800	Metaphos	Parathion methyl
Kopsol	DDT	Metasystox	Methyl-demeton
Kop-Thiodan	Endosulfan	Meta-Systox	Methyl-demeton
Kop-Thion	Malathion	Metasystemox	Oxydemeton-methyl
Korlan	Ronnel	Metasystox-R	Oxydemeton-methyl
K-Orthrine	RU-11679	Methanol	Methanol
Kryocide	Cryolite	Methidathion	Methidathion
Krypelor	Chlordane	Methiocarb	Methiocarb
Kuron	Phenoxy herbicide-2,4,5-T	Methomyl	Methomyl
Kurosai	Phenoxy herbicide-2,4,5-T	Methoprene	Methoprene
Kypfos	Malathion	Methoprotryne	Methoprotryne
		Methyl-Demeton	Methyl-Demeton
		Methyl trithion	Methyl trithion
		Methoxo	Methoxychlor
		Methoxychlor	Methoxychlor
		Methoxy-DDT	Methoxychlor
		Methyl-niran	Parathion methyl
		Methylnitrophos	Fenitrothion
		Metilmercaptosoksidi	Oxydemeton-methyl
		Metilnazotion	Azinphos methyl
		Metoprotryn	Methoprotryne
		Metron	Parathion methyl
		Mevinphos	Mevinphos
		Mexacarbate	Mexacarbate
		Mildex	Dinocap
		Mirex	Mirex
		Mitigan	Dicofol
		Mobilawn	Dichlofenthion
		Molinate	Molinate
		MON-0818	MON-0818
		MON-2139	Glyphosate
		Monocron	Azodrin
		Monocrotophos	Azodrin
		Monoethanolamine	Monoethanolamine
		Morocide	Binapacryl
		Morsodren	Morsodren
		Motox	Toxaphene
		MSMA	MSMA
		Muscatox	Coumaphos
		Naled	Naled
		Nankor	Ronnel
		Navadel	Dioxathion
		Neguvon	Trichlorfon
		Nemacide	Dichlofenthion
		Nemafene	D-D soil fumigant
		Nemax	D-D soil fumigant
Landrin	Landrin		
Lanex	Fluometuron		
Lannate	Methomyl		
Lasso	Alachlor		
Lazo	Alachlor		
Lead arsenate	Lead arsenate		
Lebaycid	Fenthion		
Lepton	Leptophos		
Leptophos	Leptophos		
Lethane 384	Lethane 384		
Lethox	Carbophenothion		
Lignasan	Lignasan		
Lime sulfur	Lime sulfur		
Lindafor	Lindane		
Linagam	Lindane		
Linamul	Lindane		
Lindane	Lindane		
Lintox	Lindane		
Lorsban	Chlorpyrifos		
Lumeton	Methoprotryne		
MAF	Alachlor		
Mafu	Dichlorvos		
Malamar	Malathion		
Malaphos	Malathion		
Malaspray	Malathion		
Malathion	Malathion		
Malix	Endosulfan		
Maloran	Chlorbromuron		
Marlate	Methoxychlor		
Marmer	Du-ter		
Marvex	Dichlorvos		
Masoten	Trichlorfon		
Matacil	Aminocarb		

<i>Alternate Name</i>	<i>Common Name</i>	<i>Alternate Name</i>	<i>Common Name</i>
Neocid	DDT	Parathion methyl	Parathion methyl
Neocidal	Diazinon	Parawet	Parathion ethyl
Nephocarp	Carbophenothion	Partron M	Parathion methyl
Niagaramite	Aramite	Payze	Cyanazine
Niagrathal	Endothall	PCB	Polychlorinated biphenyls
Nialate	Ethion	Pencap-M	Parathion methyl
Niclosamide	Niclosamide	Penchlorol	Pentachlorophenol
Nicouline	Rotenone	Penite	Sodium arsenite
Nifos	TEPP	Pentachlorin	DDT
Nimitox	Temephos	Pentachlorophenol	Pentachlorophenol
Nitrador	Dinitroresol	Pentacon	Pentachlorophenol
Nitralin	Nitralin	Penwar	Pentachlorophenol
Nitrofen	Nitrofen	Perfekthion	Dimethoate
Nitrophen	Nitrofen	Permethrin	Permethrin
Nitropone	Dinoseb	Perthane	Perthane
Nitrostigmine	Parathion ethyl	PH 6040	Diflubenzuron
Nitrox 80	Parathion methyl	Phaltan	Folpet
Nogos	Dichlorvos	Phenacide	Toxaphene
Norea	Norea	Phenatox	Toxaphene
Norex	Chloroxuron	Phenoxy herbicides	Phenoxy herbicides
Nortron	Ethofumesate	Phenoxylene	Phenoxy herbicides
Noruron	Norea	Phoxime	Phoxim
N-Serve	N-Serve	Phthalophos	Phosmet
Novathion	Fenitrothion	Phorate	Phorate
Novigam	Lindane	Phosalone	Phosalone
Noxfish	Rotenone	Phos-Chek	Phos-Chek
Nudrin	Methomyl	Phosdrin	Mevinphos
Nuracron	Azodrin	Phosfene	Mevinphos
Nuvan	Dichlorvos	Phoskil	Parathion ethyl
Nuanol	Fenitrothion	Phosmet	Phosmet
Nuvanol N	Jodfenphos	Phosphamidon	Phosphamidon
		Phosvel	Leptophos
Octachlor	Chlordane	Phosvit	Dichlorvos
Octalene	Aldrin	Phoxim	Phoxim
Octalox	Dieldrin	Phthalic acid esters	Phthalic acid esters
Ordram	Molinate	Phygon	Phygon XL
Orthene	Acephate	Phytar 560	Phytar 560
Ortho-11775	Ortho-11775	Picloram	Picloram
Orthocide	Captan	Piperalin	Pipron
Ortho-Klor	Chlordane	Piperonyl butoxide	Piperonyl butoxide
Orthophos	Parathion ethyl	Pipron	Pipron
Orthorix	Lime sulfur	Planavin	Nitralin
Ortran	Acephate	Plictran	Plictran
Oryzalin	Oryzalin	Polychlorcamphene	Toxaphene
Oxy-Cop 8LS	Copper count	Polychlorinated	Halowax 1099
Oxydemeton-methyl	Oxydemeton-methyl	naphthalene	
		Polychlorinated phenyls	Polychlorinated phenyls
PAE	Phthalic acid esters	Pounce	Permethrin
Pallethrine	Allethrin	Prebane	Terbutryn
Panodrin	Morsodren	Preeglone	Paraquat
Panogen	Morsodren	Prefar	Bensulide
Panoram D-31	Dieldrin	Primatol	Simazine
Panthion	Parathion ethyl	Princep	Simazine
Paramar	Parathion ethyl	Prolan	Dilan
Paraphos	Parathion ethyl	Prolate	Phosmet
Paraquat	Paraquat	Propanex	Propanil
Paraquat Chloride	Paraquat	Propanil	Propanil
Parathene	Parathion ethyl	Propham	Propham
Parathion ethyl	Parathion ethyl	Propoxur	Propoxur

<i>Alternate Name</i>	<i>Common Name</i>	<i>Alternate Name</i>	<i>Common Name</i>
Proxol	Trichlorfon	Smite	Azide
Purifloc-C31	Purifloc-C31	Sodium arsenite	Sodium arsenite
Pydraul	Pydraul	Sodium Cacodylate	Phytar 560
Pynamin	Allethrin	Solvirex	Disulfoton
Pyresyn	Allethrin	Soprathion	Parathion ethyl
Pyrethrins (Natural)	Pyrethrum	Soprocide	Benzene hexachloride
Pyrethrum	Pyrethrum	Stabilene	Stabilene
Pyrocide	Allethrin	Stathion	Parathion ethyl
		Stirofos	Stirofos
Quelatox	Fenthion	Strobane	Strobane
		Strobane-T	Toxaphene
Rabon	Stirofos	Subitex	Dinoseb
Radapon	Dalapon	Suffix 25	Suffix
Rampart	Phorate	Sulfenimide	Captafol
Rasitox	Coumaphos	Sumithion	Fenitrothion
Ravion	Carbaryl	Suncide	Propoxur
Ravyon	Carbaryl	Surflan	Oryzalin
Rebelate	Dimethoate	Sutan	Butylate
Reglon	Diquat	Synklor	Chlordane
Reldan	Reldan	Systox	Demeton
Resmethrin	Resmethrin		
Rhodiatox	Parathion ethyl	2,3,6-TBA	2,3,6-TBA
Rhonox	Phenoxy herbicides	TBA	2,3,6-TBA
Roccal	Roccal	TCP	Tricresyl phosphate
Rogor	Dimethoate	TDE	DDD
Ronnel	Ronnel	Tedion	Tetradifon
Rotenone	Rotenone	Tekwaisa	Parathion methyl
Rothane	DDD	Telone	Dichloropropene
Roundup	Glyphosate	TEM	Tetramine
Roussel-Uclaf 11679	RU-11679	Temephos	Temephos
Rowmate	Dichlormate	Temik	Aldicarb
Roxion	Dimethoate	Tendex	Propoxur
RU-11679	RU-11679	Tenoran	Chloroxuron
Rubitox	Phosalone	Tepa	Tepa
Ruelene	Cruformate	Terpene polychlorinates	Strobane
Rukseam	DDT	TEPP	TEPP
Ruphos	Dioxathion	Terbutryn	Terbutryn
Ryania	Ryania	Tersan	Benomyl
Ryanicide	Ryania	Tetrachlorvinphos	Stirofos
Ryzelan	Oryzalin	Tetradifon	Tetradifon
		Tetramine	Tetramine
Sanocide	Hexachlorobenzene	TFM	TFM
Sanspor	Captafol	Tetron	TEPP
Santobrite	Pentachlorophenol (sodium salt)	TH-6040	Diiflubenzuron
S-bioallethrin	S-bioallethrin	Thanite	Thanite
SD-14114	SD-14114	Thifor	Endosulfan
SD-17250	SD-17250	Thimet	Phorate
Seed protectant	Phygon X2	Thimul	Endosulfan
Seedrin	Aldrin	Thiobencarb	Thiobencarb
Selinon	Dinoseb	Thiodan	Endosulfan
Sendran	Propoxur	Thiodemeton	Dimethoate
Septene	Carbaryl	Thionex	Dendosulfan
Sevin	Carbaryl	Thiopal	Folpet
Silvanol	Lindane	Thiophos	Parathion ethyl
Silvex	Phenoxy herbicides-2,4,5-T	Thynon	Thynon
Silvi-Rhap	Phenoxy herbicides-2,4,5-T	Timet	Azinphos ethyl
Simadex	Simazine	Tiguron	Fenthion
Simazine	Simazine	Toluene	Toluene
Sirmate	Dichlomite	Topiclor	Chlordane
		Tordon	Picloram

<i>Alternate Name</i>	<i>Common Name</i>	<i>Alternate Name</i>	<i>Common Name</i>
Torque	SD-14114	Valexon	Phoxim
Toxakil	Toxaphene	Vapona	Dichlorvos
Toxaphene	Toxaphene	Vapotone	TEPP
Toxon 63	Toxaphene	Vegfru	Phorate
Tranid	Tranid	Velpar	Velpar
Trefanocide	Trifluralin	Vendex	SD-14114
Treflan	Trifluralin	Veon	Phenoxy herbicides
Trefmid	Trefmid	Vernam	Vernolate
Tretolite	Tretolite	Vernolate	Vernolate
Triasyn	Dyrene	Vidden D	D-D soil fumigant
Triazotion	Azinphos ethyl	Viozene	Ronnel
Tricarnam	Carbaryl	Visko-Rhap 2TP	Phenoxy herbicides-2,4,5-T
Trichlorfon	Trichlorfon	Volaton	Phoxim
Trichloronat	Trichloronat	Vondcaptan	Captan
Tricresyl phosphate	Tricresyl phosphate	Vonduron	Diuron
Tri-Endothal	Endothal		
Trifen	Fenac		
Trifene	Fenac	Warfarin	Warfarin
Trifenson	Fenson	Weedar	Phenoxy herbicides-2,4-D
Trifluralin	Trifluralin	Weedbeads	Pentachlorophenol (sodium salt)
Triflurex	Trifluralin		Phenoxy herbicides
Trifocide	Dinitrocresol	Weed/Brush Off 400	Paraquat
Triherbide-IPC	Propham	Weedol	Pentachlorophenol
Trimethion	Dimethoate	Weedone	Phenoxy herbicides-2,4,5-T
Trinex	Trichlorfon	Weedone 2,4,5-TP	Parathion methyl
Trithion	Carbophenothion	Wofatox	Alachlor
Trolene	Ronnel	WSSA	
Trysben 200	2,3,6-TBA		
Tubatoxin	Rotenone		
Tuberite	Propham	Xylene	Xylene
Tugon fliegankugel	Propoxur	Xylol	Xylene
2,4-D	Phenoxy herbicides		
2,4,5-T	Phenoxy herbicides	Yomesan	Niclosamide
2,3,6-TCA	Fenac		
Ultracide	Methidathion	Zectran	Mexacarbate
Unden	Propoxur	Zelan	Phenoxy herbicides
Unipon	Dalapon	Zephiran	Roccal
Ureabor	Ureabor	Zerdane	DDT
Urox-D	Diuron	Zithiol	Malathion
		Zolone	Phosalone

APPENDIX III

Publications of the Columbia National Fisheries Research Laboratory Containing Toxicity Data on Chemicals Included in this Handbook

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