**DERIVATION OF ACUTE AND CHRONIC TOXICITY CRITERIA**
**FOR PARATHION**
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## EPA SPECIES MEAN ACUTE VALUES

(values from 9/86 EPA AWQC document, EPA 440/5-86-007 and 3/95 GLI Criteria Update, EPA-820-B-95-004)

**Isopod *(Asellus brevicadus)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 600 | S U | Sanders 1972 |
| 2130 | S U | Johnson & Finley 1980 |
| SMAV = 1130.49 | | (2 results) |

**Prawn *(Palaemontes kadiakensis)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 5 | FT U | Sanders 1972 |
| 1.5 | S U | Johnson & Finley 1980 |
| SMAV = 2.74 | | (2 results) |

**Amphipod *(Gammarus fasciatus)*** *immature = most sensitive life stage*

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 0.43 | FT M | Spacie 1976 |
| 0.62 | FT M | Spacie 1976 |
| 0.26 | FT M | Spacie 1976 |
| 0.25 | FT M | Spacie 1976 |
| SMAV = 0.36 | | (4 results) |

**Phantom midge *(Chaoborus* sp.*)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 0.8 | S U | Collins & Shank 1983 |
| 1 | S U | Collins & Shank 1983 |
| SMAV = 0.89 | | (2 results) |

**Midge *(Chironomus riparius)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 1.6 | S U | Collins & Shank 1983 |
| 1.8 | S U | Collins & Shank 1983 |
| SMAV = 1.70 | | (2 results) |

**Midge *(Cloeon dipterum)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 2.5 | S U | Dortland 1980 |
| 2.6 | S U | Dortland 1980 |
| 1.7 | R U | Dortland 1980 |
| SMAV = 2.23 | | (3 results) |

**Rainbow trout *(Onchorhynchus mykiss)*** *smallest as most sensitive life stage*

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 1430 | S U | Johnson & Finley 1980 |
| 1400 | S U | Van Leeuwen et al. 1983 |
| SMAV = 1414.92 | | (2 results) |

**Goldfish *(Carassius auratus)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 2700 | S U | Flowering et al. 1962 |
| 1830 | S U | Johnson & Finley 1980 |
| SMAV = 2222.84 | | (2 results) |

**Fathead minnow *(Pimephales promelas)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 1410 | FT M | Solon et al. 1969 |
| 580 | FT M | Spacie 1976 |
| SMAV = 839.64 | | (2 FT results) |

## SPECIES WITH SINGLE TEST RESULTS:

| Species | VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|---|
| Worm (*Limnodrilus* sp.) | 5230 | S U | Whitten & Goodnight 1966 |
| Worm (*Tubifex* sp.) | 5230 | S U | Whitten & Goodnight 1966 |
| Cladoceran (*Daphnia magna*) | 1.0 | FT M | Spacie 1976 |
| Cladoceran (*Daphnia pulex*) | 0.60 | S U | Johnson & Finley 1980 |
| Cladoceran (*Simocephalus serrulatus*) | 0.47 | S U | Johnson & Finley 1980 |
| Amphipod (*Gammarus lacustris*) | 3.5 | S U | Johnson & Finley 1980 |
| Crayfish (*Orconectes nais*) | 0.04 | S U (early instar) | Sanders 1972 |
| Mayfly (*Hexagenia bilenata*) | 15 | S U | Johnson & Finley 1980 |
| Damselfly (*Ischnura verticalis*) | 0.64 | S U | Johnson & Finley 1980 |
| Damselfly (*Lestes congener*) | 3 | S U | Federle & Collins 1976 |
| Stonefly (*Pteronarcella badia*) | 4.2 | S U | Johnson & Finley 1980 |
| Stonefly (*Pteronarcys californica*) $2^{nd}$ yr | 5.4 | S U | Johnson & Finley 1980 |
| Stonefly (*Acroneuria pacifica*) | 2.9 | S U | Jensen & Gaufin 1964 |
| Stonefly (*Claassenia sabulosa*) | 1.5 | S U | Johnson & Finley 1980 |
| Water beetle (*Peltodytes* sp.) | 7 | S U | Federle & Collins 1976 |
| Chironomid (*Chironomus tentans*) | 31 | FT M | Spacie 1976 |
| Cutthroat trout (*Salmo clarki*) | 1560 | S U | Johnson & Finley 1980 |
| Brown trout (*Salmo trutta*) | 1510 | FT M | Spacie 1976 |
| Brook trout (*Salvelinus fontinalis*) | 1760 | FT M | Spacie 1976 |
| Lake trout (*Salvelinus namaycush*) | 1920 | S U | Johnson & Finley 1980 |
| Channel catfish (*Ictalurus punctatus*) | 2650 | S U | Johnson & Finley 1980 |
| Mosquitofish (*Gambusia affinis*) | 320 | S U | Johnson & Finley 1980 |
| Guppy (*Poecilia reticulata*) | 56 | S U | Pickering et al. 1962 |
| Green sunfish (*Lepomis cyanellus*) | 930 | S U | Johnson & Finley 1980 |
| Bluegill (*Lepomis macrochirus*) | 510 | FT M | Spacie 1976 |
| Largemouth bass (*Micropterus salmoides*) | 620 | S U | Johnson & Finley 1980 |
| Western chorus frog (*Pseudacris triseriata*) | 1000 | S U | Sanders 1970 |
| Crayfish (*Procambarus* sp.) | < 250* | S U | Johnson & Finley 1980 |

* - not used since a “less than” value was reported

MINIMUM DATABASE REQUIREMENT EVALUATION

According to s. NR 105.05(1)(a), acute toxicity criteria can be calculated if data are available on one or more species of freshwater animal in at least 8 different families, provided that of the 8 species:

1. At least one is a salmonid fish in the family Salmonidae in the class Osteichthyes,
2. At least one is a non-salmonid fish from another family in the class Osteichthyes, preferably a commercially or recreationally important species,
3. At least one is a planktonic crustacean (e.g., cladoceran, copepod),
4. At least one is a benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish),
5. At least one is an insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge),
6. At least one is a fish or amphibian from a family in the phylum Chordata not already represented in one of the other subdivisions,
7. At least one is an organism from a family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca), and
8. At least one is an organism from a family in any order of insect or any other phylum not already represented in subds. 1. to 7.

Using the above numbering scheme, the following species are represented in the minimum database requirements for criteria calculation. If any of the 8 categories are not represented in the database, a criterion cannot be calculated under ch. NR 105. Instead, a secondary value must be calculated.

1. Rainbow trout
2. Bluegill
3. Cladoceran *(D. magna)*
4. Amphipod (*G. fasciatus*)
5. Stonefly *(P. californica)*
6. Fathead minnow, family Cyprinidae
7. Worm (*Tubifex*)
8. Channel catfish, family Ictaluridae

CONCLUSION: An acute toxicity criterion can be calculated for parathion according to ch. NR 105.

| GENUS NAME (w/ component species) | GMAV (ug/L) | CLASSIFICATIONS * CW | WW | LFF | LAL |
|---|---|---|---|---|---|
| Chironomus (not used since GMAVs varied by more than 10x) | | | | | |
| Procambarus (not used because a less than value was reported) | | | | | |
| Limnodrilus | 5230 | x | x | x | x |
| Tubifex | 5230 | x | x | x | x |
| Ictalurus | 2650 | x | x | | |
| Carassius | 2223 | x | x | x | |
| Salvelinus | 1838 | x | | | |
| S. fontinalis 1760 | | | | | |
| S. namaycush 1920 | | | | | |
| Salmo | 1535 | x | | | |
| S. clarki 1560 | | | | | |
| S. trutta 1510 | | | | | |
| Onchorhynchus | 1415 | x | | | |
| Asellus | 1130 | x | x | x | x |
| Pseudacris | 1000 | x | x | x | x |
| Pimephales | 839.6 | x | x | x | |
| Lepomis | 688.7 | x | x | | |
| L. cyanellus 930 | | | | | |
| L. macrochirus 510 | | | | | |
| Micropterus | 620 | x | x | | |
| Gambusia | 320 | x | | | |
| Poecilia | 56 | x | | | |
| Hexagenia | 15 | x | x | x | x |
| Peltodytes | 7 | x | x | x | x |
| Pteronarcys | 5.4 | x | x | x | x |
| Pteronarcella | 4.2 | x | x | x | x |
| Lestes | 3 | x | x | x | x |
| Acroneuria | 2.9 | x | x | x | x |
| Palaemontes | 2.74 | x | x | x | x |
| Cloeon | 2.23 | x | x | x | x |
| Claassenia | 1.5 | x | x | x | x |
| Gammarus | 1.13 | x | x | x | x |
| G. fasciatus 0.36 | | | | | |
| G. lacustris 3.5 | | | | | |
| Chaoborus | 0.89 | x | x | x | x |
| Daphnia | 0.77 | x | x | x | x |
| D. magna 1.0 | | | | | |
| D. pulex 0.6 | | | | | |
| Ischnura | 0.64 | x | x | x | x |
| Simocephalus | 0.47 | x | x | x | x |
| Orconectes | 0.04 | x | x | x | x |
| TOTAL NUMBER OF GENERA REPRESENTED: | | 29 | 23 | 20 | 18 |

* - KEY TO CLASSIFICATIONS (an X is listed for species considered in each):

CW = Coldwater community, all genera are considered here.

WW = Warmwater sportfish community, only the coldwater fish are excluded from this database (also includes warmwater forage).

LFF = Limited forage fish community, all sport fish are excluded from this database.

LAL = Limited aquatic life, all fish are excluded from this database.

The four most sensitive genera in each classification are used to calculate the criteria under each classification, pursuant to s. NR 105.05 (2). From this point, the results of the calculation are shown using the variables listed in sub. (2).

**CRITERIA CALCULATION:**

| | **CW** |
|---|---|
| GMAV RANKS | |
| 4 | 0.7746 |
| 3 | 0.64 |
| 2 | 0.47 |
| 1 | 0.04 |
| n | 29 |
| ln GMAV | |
| 4 | -0.255413 |
| 3 | -0.446287 |
| 2 | -0.755023 |
| 1 | -3.218876 |
| (ln GMAV)^2 | |
| 4 | 0.0652357 |
| 3 | 0.1991722 |
| 2 | 0.5700591 |
| 1 | 10.361162 |
| P | |
| 4 | 0.133333 |
| 3 | 0.1 |
| 2 | 0.066667 |
| 1 | 0.033333 |
| sq rt P | |
| 4 | 0.3651484 |
| 3 | 0.3162278 |
| 2 | 0.2581989 |
| 1 | 0.1825742 |
| EV | -4.675598 |
| EW | 11.195629 |
| EP | 0.333333 |
| EPR | 1.1221492 |
| | |
| J | 0.05 |
| S | 17.58604 |
| L | -6.10244 |
| A | -2.170082 |
| FAV | 0.1141683 |
| ATC | 0.0570841 |

The four most sensitive genera are associated with all of the classifications. Since the databases are smaller for WW, LFF, and LAL, the calculated criteria will be lower than CW. Since all the organisms in those classifications are subsets of the CW database, all of the criteria are set equal to CW; no relief is

appropriate for the other classifications.

**Acute toxicity criteria for parathion:**
**ATC = 0.057 ug/L (all)**

## EPA ACUTE-CHRONIC RATIOS:

Not enough data are available to permit the calculation of independent chronic toxicity criteria (see table below). Instead, acute-chronic ratios (ACRs) must be developed such that the chronic criterion equals the final acute value divided by the appropriate ACR. The following table summarizes the calculation procedure for the ACRs using the procedure in s. NR 105.06 (5).

| SPECIES | ACUTE VALUE | CHRONIC VALUE | TEST ACR |
|---|---|---|---|
| Daphnia magna | 1 | 0.099 | 10.10 |
| Fathead minnow | 500 | 6.293 | 79.45 |
| Bluegill | 510 | 0.2404 | 2121.46 |

All data: Reference = Spacie, 1976

Since the daphnid is among the most sensitive organisms and the two fish are not, the Daphnia magna ACR is used alone to calculate the chronic criterion.

## Chronic toxicity criteria for parathion:

CTC = 0.114 / 10.10 = 0.011 ug/L (all classifications)