

STUDY TITLE

Comments on Draft Water Quality Criteria Report for Cypermethrin Issued by the
California Regional Water Quality Control Board, Central Valley

DATA REQUIREMENTS

None

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Executive Summary

A draft water quality criteria report for the pyrethroid insecticide cypermethrin has been issued by the University of California, Davis (UCD) and is being circulated for public comment. Compliance Services International (CSI), Lakewood WA, developed the comments presented herein on behalf of FMC Corporation, the registrant for cypermethrin. These comments address two main areas: data selection for derivation of Acute and Chronic Criteria, and bioavailability.

The data selected by UCD for derivation of the Acute Criterion for cypermethrin omitted several Relevant and Reliable studies. Inclusion of these studies resulted in a recalculated Acute Criterion of 4 ng/L. (UCD's proposed Acute Criterion is 6 ng/L.)

Due to limited data available on chronic toxicity, UCD used an Acute-to-Chronic Ratio (ACR) approach to derive the Chronic Criterion for cypermethrin. The ACRs calculated by UCD were based on several unreliable endpoints. Using acceptable acute and chronic toxicity data, CSI calculated ACRs for 3 species ranging from 4.0 to 16.2. Based on the ACR for the species closest to the acute value, the recalculated Chronic Criterion is 2 ng/L. (UCD's proposed Chronic Criterion is 0.01 ng/L.)

Pyrethroids that are bound to particulate matter or associated with dissolved organic matter are not biologically available to aquatic organisms and do not contribute to toxicity; only freely dissolved pyrethroids are bioavailable and toxic. In laboratory toxicity tests using water with minimal particulate or dissolved organic matter, nearly all the pyrethroid is bioavailable. In ambient water, only a small fraction – a few percent or less – of the total pyrethroid may be bioavailable. To be consistent with the underlying data, compliance with cypermethrin water quality standards should therefore be based on concentrations of freely dissolved cypermethrin, not total cypermethrin. Freely dissolved cypermethrin can be measured directly using solid phase microextraction (SPME) or calculated using an equilibrium partitioning model. Any water quality program should measure or estimate freely dissolved cypermethrin concentrations to ensure appropriate comparison to concentrations calculated as Acute or Chronic Criteria.

1. Introduction

As part of the Central Valley Pesticide TMDL and Basin Plan Amendment Project, draft water quality criteria for the pyrethroid insecticide cypermethrin have been derived by the University of California, Davis (Fojut *et al.* 2011) and are being circulated for public comment. Compliance Services International (CSI), Lakewood WA, developed the comments presented below on behalf of FMC Corporation, the registrant for cypermethrin.

2. Derivation of Acute Criterion

UCD's draft Acute Criterion is based on data for 14 freshwater species, presented in Table 3 of their report. Toxicity values for several of these species require correction, as discussed below. Relevant and reliable data are also available for other species, and these affect the calculated acute value and the Acute Criterion. The aquatic toxicity data used by UCD and those proposed by CSI are summarized in Table 1. Evaluation forms for studies rated by CSI are presented in Appendix A.

2.1 *Baetis rhodani*

UCD did not identify any *B. rhodani* studies to rate before calculating the Acute Criterion for cypermethrin. However, a 96-h LC50 of 0.0123 µg/L is available for a flow-through study (Edwards *et al.* 1980a) rated "Relevant and Reliable" (RR) by CSI. The 96-h LC50 of 0.0123 µg/L should be used in the calculation of the Acute Criterion for cypermethrin.

2.2 *Cloeon dipterum*

UCD derived the Acute Criterion using the *C. dipterum* 24-h LC50 of 0.6 µg/L (Stephenson 1982; the primary source is Stephenson 1980a). Results are also available from one other study rated RR. The additional 96-h LC50 value is 0.02 µg/L (Stephenson 1980b). The latter study is preferred, because it used flow-through exposure and because of the 96-h exposure duration. Therefore, the 96-h LC50 of 0.02 µg/L is the appropriate value to use for this species in deriving an Acute Criterion for cypermethrin.

2.3 *Corixa punctata*

UCD used the 24-h EC50 of 0.7 µg/L for *C. punctata*, from Stephenson 1982. The primary source for this study (Stephenson 1980a) reports a 24-h LC50 of >5 µg/L. The LC50 is more appropriate than the EC50 for derivation of the Acute Criterion.

2.4 *Cyprinus carpio*

UCD did not use a *C. carpio* LC50 to calculate the Acute Criterion for cypermethrin. The two *C. carpio* tests evaluated by UCD (Aydin *et al.* 2005; Stephenson 1982) were rated "Less Relevant, Reliable" (LR) and "Less Relevant, Less Reliable" (LL), respectively, and CSI agrees with those ratings. However, a third *C. carpio* test by Hill (1981) was not evaluated by UCD and was rated RR by CSI. The *C. carpio* LC50 of 1.6 µg/L from Hill (1981) should be used in deriving the Acute Criterion for cypermethrin.

2.5 *Daphnia magna*

UCD derived the Acute Criterion using the *D. magna* 48-h LC50 of 0.147 µg/L (geometric mean of results from Ward and Boeri [1991a] and Wheat and Evans [1994]). Results are also available from three other studies that CSI rated RR. The additional 48-h EC50 values for immobilization range from 0.21 µg/L (Rufli 1989) to 1.25 µg/L (Edwards *et al.* 1980b). However, among all the studies, only Wheat and Evans (1994) used flow-through exposure. Therefore, the LC50 of 0.162 µg/L (Wheat and Evans 1994) is the most appropriate value to use for this species in deriving an Acute Criterion for cypermethrin.

2.6 *Gammarus pulex*

The 24-h LC50 for *G. pulex* is shown as 0.1 µg/L in the publication by Stephenson (1982; the primary source is Stephenson 1980a). However, a 96-h LC50 of 0.009 µg/L is available for a flow-through study (Stephenson 1980b) rated RR by CSI. The 96-h LC50 of 0.009 µg/L should be used in the calculation of the Acute Criterion for cypermethrin because (a) it is from a flow-through study, and (b) the exposure duration is 96 h.

2.7 *Gyrinus natator*

UCD used the 24-h EC50 of 0.07 µg/L for *G. natator*, from Stephenson (1982). The primary source for this study (Stephenson 1980a) reports a 24-h LC50 of >5 µg/L. The LC50 is more appropriate than the EC50 for derivation of the Acute Criterion.

2.8 *Hyaella azteca*

UCD presents LC50 data from two studies with *H. azteca*, including three tests by Weston and Jackson (2009) and one by Hamer (1997). UCD's analysis used the geometric mean of the LC50 values from the four tests (0.0027 µg/L). If the two studies (rather than the four individual tests) were weighted equally in the analysis, the species geometric mean would be 0.0030 µg/L. We believe this value, with the two studies receiving equal weight, should be used in the calculation of Acute Criterion, though we acknowledge that the small difference in this case is unlikely to affect the result.

2.9 *Lepomis macrochirus*

UCD did not identify any *L. macrochirus* studies to rate before calculating the Acute Criterion for cypermethrin. A relevant and reliable study (Hill 1980a) reported a 96-h LC50 of 1.78 µg/L. This LC50 should be used in the calculation of the Acute Criterion for cypermethrin.

2.10 *Oncorhynchus mykiss*

UCD used the 96-h LC50 of 0.90 reported by Vaishnav and Yurk (1990) for *O. mykiss*. Two other relevant and reliable flow-through studies (Davies *et al.* 1994; Hill 1980b) reported 96-h LC50 values of 1.47 and

0.92 µg/L, respectively. Davies *et al.* 1994 was rated LR by UCD since it did not state if a standard method was followed and because the control response was not described. However, sufficient detail is provided in the report to conclude that the methods followed were equivalent to standard methods. Therefore, it should have been rated RR and used in the Species Mean Acute Value (SMAV) determination for *O. mykiss*. The Hill 1980b study was not evaluated by UCD; it was rated RR by CSI. The geometric mean of all three tests, 1.07 µg/L, should be used in the calculation of the Acute Criterion.

2.11 *Orconectes sp.*

UCD did not identify any *Orconectes sp.* studies to rate before calculating the Acute Criterion for cypermethrin. A relevant and reliable study (Jaber 1981a) reported a 96-h LC50 of 0.068 µg/L. This LC50 should be used in the calculation of the Acute Criterion for cypermethrin.

2.12 *Pimephales promelas*

UCD indicated that no acute toxicity data were found for *P. promelas*. Two relevant and reliable studies (Balog 1989a,b) reported 96-h LC50 values of 0.84 µg/L and 1.28 µg/L, respectively. The geometric mean of these two values (1.04 µg/L) should be used in the calculation of the Acute Criterion.

2.13 *Pseudaphritis urvillii*

UCD did not use the 96-h LC50 of 2.19 µg/L available for *P. urvillii* (Davies *et al.* 1994) since they rated it LL. This study was rated poorly since it did not state if a standard method was followed, did not provide a control response, and had a low reliability score. However, sufficient detail is provided in the report to conclude that the methods followed were equivalent to standard methods and that the reliability score should be 77, not 71. Therefore, it should have been rated RR and used in the calculation of the Acute Criterion.

2.14 Calculation of Acute Criterion

The UCD report stated that the ETX 1.3 software program (Aldenbergh 1993) was used to fit the data set to a log-logistic distribution. UCD reported a median HC5 of 0.0126904 µg/L. Using an updated version of the same software (ETX 2.0, Van Vlaardingen *et al.* 2004) and the data shown in UCD's Table 3, CSI obtained a median HC5 value of 0.0130427 µg/L, quite close to UCD's result. UCD's result corresponds to an Acute Criterion (HC5 divided by 2, reported with one significant digit) of 6 ng/L. The result obtained by CSI, though only slightly greater than UCD's, would correspond to an Acute Criterion of 7 ng/L.

As discussed above, CSI proposes additions or corrections to UCD's toxicity values for *B. rhodani*, *C. dipterum*, *C. punctata*, *C. carpio*, *D. magna*, *G. pulex*, *G. natator*, *H. azteca*, *L. macrochirus*, *O. mykiss*, *Orconectes sp.*, *P. promelas*, and *P. urvillii*. These proposed changes are summarized in Table 1. With these revisions, the median HC5 is calculated as 0.007021 µg/L (0.001427-0020919 µg/L). The revised Acute Criterion is 4 ng/L.

Conclusion on Acute Criterion

- UCD's draft Acute Criterion for cypermethrin was 6 ng/L. Using the same data and an updated version of the same software, CSI obtained an Acute Criterion of 7 ng/L.
- CSI proposes additions and corrections to the dataset used for derivation of the Acute Criterion. Based on the revised dataset, the Acute Criterion for cypermethrin is 4 ng/L.

3. Derivation of Chronic Criterion

UCD's draft cypermethrin criteria report discussed chronic toxicity data for *D. magna* and *P. promelas* (Table 1). For *D. magna* UCD used the 21-d Maximum Acceptable Toxicant Concentration (MATC) of 0.0000063 µg/L from a study by Kim *et al.* (2008). While the study is rated RR, this MATC is highly suspect; it is more than 1000 times lower than the lowest chronic endpoint reported for any pyrethroid (a NOEC of 0.00095 µg/L for *D. magna* and bifenthrin; Surprenant and Yarko 1985). Two other available chronic *D. magna* studies were not included in UCD's dataset: Edwards *et al.* (1981) and Garforth (1982). CSI evaluated these studies using the UCD methodology and rated both of them Relevant and Reliable. Edwards *et al.* (1981) reported two separate *D. magna* tests that provided 21-d MATC values of 0.013 and 0.009 µg/L, respectively. The 21-d MATC for Garforth (1982) was 0.17 µg/L. Of the three available *D. magna* studies that are relevant and reliable, only the Edwards *et al.* (1981) studies used flow-through exposures with measured concentrations. Therefore, the geometric mean of the two Edwards *et al.* (1981) 21-d MATC values (0.01 µg/L) should be used as the *D. magna* Species Mean Chronic Value (SMCV).

Relevant and reliable chronic toxicity data were also available for *P. promelas*. UCD used 30-d and 60-d MATC values of 0.11 µg/L from Tapp *et al.* (1988) to derive a SMCV of 0.11 µg/L for *P. promelas*. (Table 6 of the draft criteria report indicates that UCD calculated the geometric mean of these two endpoints. Calculating the geometric mean of 30-d and 60-d endpoints from a single study is not appropriate, and not consistent with the UCD methodology [TenBrook *et al.* 2009]. However, since the endpoints were identical, this had no impact on the criterion derivation.) One other flow-through study was available (Jaber 1981b) and rated relevant and reliable by CSI. The 30-d MATC for survival from the Jaber (1981b) study was 0.21 µg/L. The geometric mean of the *P. promelas* MATC values from the two studies is 0.15 µg/L.

Derivation of a chronic criterion using the SSD approach would have required, in addition to the species listed above, data on chronic toxicity to the family Salmonidae, a benthic crustacean, and an aquatic insect. Because chronic toxicity data for these groups were not available, UCD applied an Acute-to-Chronic Ratio (ACR) approach instead (TenBrook *et al.* 2009).

To derive a Chronic Criterion using the ACR approach, ACRs are required for three species, including a fish and an invertebrate. The UCD methodology is unclear about the requirements for ACR calculation. At first, the methodology states that the acute and chronic data used to calculate an ACR must come from the same study in the same dilution water, but then this requirement is relaxed to allow a different study in the same laboratory under identical conditions, or even in a different laboratory – in other words, only the dilution water must be the same. The rationale for this requirement is unclear, since toxicity values are not presumed to be strongly affected by the source of dilution water.

According to UCD, for *D. magna*, only the study by Kim *et al.* (2008) could be paired with an appropriate acute datum and satisfy the invertebrate data requirement for calculation of an ACR based on measured data. The resulting SMACR that UCD used was 949. As discussed above, a more reliable MATC for *D. magna* is available, which when paired with the *D. magna* SMAV (0.162 µg/L) gives an ACR of 16.2.

UCD calculated an ACR for *O. mykiss* based on data from a 10-d study by Davies *et al.* (1994). The acute study (rated LR by UCD but rated RR by CSI, as discussed in Section 2.10) resulted in a 96-h LC50 of 1.47 µg/L. The chronic results presented by Davies *et al.* (1994) consisted of 10-d responses of plasma glucose, brain acetylcholinesterase (AChE), and liver glutathione-S-transferase (GST). Dose-response trends were inconsistent (not monotonic) for glucose and brain AChE; neither of these endpoints was significantly affected at the highest concentration tested. For GST, the NOEC was 0.49 µg/L and the LOEC was 0.87 µg/L, corresponding to an MATC of 0.65 µg/L. UCD cited an MATC of 0.65 µg/L but listed the endpoint as mortality (Table 9 of the draft criteria report). Actually, none of the endpoints from this study qualify as chronic endpoints under the UCD methodology: the 10-d test involved neither full life-cycle exposure, partial life-cycle exposure, nor early life-stage exposure, and none of the endpoints represented survival, growth, or reproductive effects (TenBrook *et al.* 2009, Section 3-2.1.1). Thus, the ACR generated by UCD for *O. mykiss* is not reliable.

UCD also calculated an ACR for *Acartia tonsa* based on studies by Barata *et al.* (2002). Both the acute and chronic portions of this study were rated as LL by UCD, with a low reliability score. To calculate the ACR, UCD selected a 5-d LC50 for adults (although nauplii were much more sensitive) and a 5-d MATC for adult survival (or perhaps a 2-d MATC for egg survival – the two MATC values were identical). The reasons for those selections are not presented, and different selections would have resulted in quite different ACRs; indeed, had the lowest LC50 (a 4-d LC50 for nauplii) been used, the ACR would have been less than 1. Furthermore, 2-d and 5-d MATC values do not meet the definition of chronic toxicity data presented by TenBrook *et al.* (2009): they do not “take into account the number of young produced” and the exposure durations are too short. Thus, the ACR generated by UCD for *A. tonsa* is not reliable.

Because UCD was unaware of the existing acute data for *P. promelas*, they were unable to develop an ACR for this species. As discussed above, there were two similar relevant and reliable LC50s: 0.84 µg/L (Balog 1989a) and 1.28 µg/L (Balog 1989b), with a geometric mean of 1.04 µg/L. There were also two similar and reliable MATCs: 0.11 µg/L (Tapp *et al.* 1988) and 0.21 µg/L (Jaber 1981b), with a geometric mean of 0.15 µg/L. The consistency of both acute and chronic endpoints supports their validity for deriving an ACR of 6.9.

Reliable acute and chronic data are also available for *Americamysis bahia*. There are two similar reliable LC50 values: 0.005 µg/L (Ward *et al.* 1992) and 0.0049 (Ward and Boeri 1991b), with a geometric mean of 0.005 µg/L. There is also a reliable MATC of 0.00124 µg/L (Wheat 1993). These results support an ACR of 4.0 for *A. bahia*.

Since the *D. magna* ACR was much larger than the other two ACRs of 2.11 for *A. tonsa* (Barata *et al.* 2002) and 2.26 for *O. mykiss* (Davies *et al.* 1994), UCD also calculated an example chronic criterion without using the *D. magna* ACR. In this example, the final ACR was calculated as the geometric mean of

the remaining two ACRs (Barata *et al.* 2002; Davies *et al.* 1994) and one default ACR of 12.4¹, which resulted in an example final ACR of 3.90.

However, as discussed, none of the ACRs used by UCD is valid. Appropriate ACRs for cypermethrin are summarized in Table 2. As discussed in Section 2.14, the acute toxicity value (HC5) derived based on CSI's revised dataset is 0.007021 µg/L. The ACR for the species with SMAV nearest the acute value (*A. bahia*) is 4.0. Applying the ACR of 4.0, the Chronic Criterion is 0.0018 µg/L, or 2 ng/L.

4. Bioavailability of Cypermethrin

The draft criteria report summarizes evidence that pyrethroids bound to particulate matter are not biologically available to aquatic organisms and do not contribute to toxicity; only freely dissolved pyrethroids are bioavailable and toxic. Bound pyrethroids become bioavailable only when they desorb from particles or dissociate from dissolved organic matter.

“As a counterpoint” to the evidence relating cypermethrin toxicity to the freely dissolved fraction, the draft criteria report notes (p. 9) that “equilibrium partitioning would suggest that as organisms take up cypermethrin, more cypermethrin will desorb from particles, so the fraction absorbed to solids is likely not completely unavailable.” This is not a logical inference. In the equilibrium partitioning model, the flux of cypermethrin between phases (freely dissolved, associated with dissolved organic matter, and sorbed to particulate organic matter) is such that concentrations in each phase are constant – fluxes into each phase (e.g., desorption from particles as an input to the freely dissolved phase) are balanced by fluxes in the opposite direction (e.g., sorption of freely dissolved cypermethrin to particles). The fact that cypermethrin molecules can move from one phase to the other does not “counter” the evidence that cypermethrin molecules are bioavailable only when freely dissolved.

The draft criteria report notes the possibility that pyrethroids can be taken up from ingested particles, citing the findings of Mayer *et al.* (2001) as evidence that hydrophobic compounds can be desorbed by digestive juices. The cited study involved uptake of benzo(a)pyrene and zinc by 18 species of benthic marine invertebrates, including 10 species of worms, 5 species of echinoderms, 2 species of mollusks, and a sea anemone. The relevance of these findings to uptake of pyrethroids by sensitive freshwater taxa (such as insects and crustaceans) is unclear. There is no evidence for uptake of pyrethroids by this route, and the UCD report in fact summarizes the evidence to the contrary.

TenBrook *et al.* (2009, Section 3-5.1) state that when a pesticide has only a single bioavailable phase (sorbed to solids, associated with dissolved organic matter, or freely dissolved in water), it is appropriate to evaluate compliance with water quality standards based on concentrations in the bioavailable phase alone. This is the case for cypermethrin and other pyrethroids, of which only the freely dissolved phase is bioavailable.

Pyrethroid concentrations in the freely dissolved phase can be measured using techniques such as solid-phase microextraction (SPME) or calculated based on partitioning coefficients (Equation 3.6, TenBrook

¹ The default ACR (TenBrook *et al.* 2009, Section 3-4.2.3) is the 80th percentile value derived from ACRs for 8 insecticides (chlordane, chlorpyrifos, diazinon, dieldrin, endosulfan, endrin, lindane, and parathion). TenBrook *et al.* (2009) do not explain why these insecticides should be considered representative of pesticides from different chemical groups, or why the 80th percentile should be used as the basis for a default ACR.

et al. 2009, presented as Equation 1 in the draft criteria document for cypermethrin). UCD notes that Equation 1 should not be used unless site-specific data are available for all the terms in the equation. These terms include SS, the concentration of suspended solids in the water, and f_{oc} , the fraction of organic carbon in the suspended sediment. While f_{oc} of suspended sediment is not usually measured directly, the term $[SS]/f_{oc}$ in Equation 1 is equivalent to the concentration of particulate organic carbon (POC), which can be readily determined as the difference between total organic carbon (TOC) and dissolved organic carbon (DOC). Thus, the site-specific data needed for Equation 1 are the total concentration of cypermethrin in water, the concentration of DOC, and the concentration of POC. Values for the other terms in Equation 1, K_{OC} and K_{DOC} , are available in the literature. The suggestion by TenBrook *et al.* (2009) that site-specific K_{OC} and K_{DOC} values must be available is unreasonable: it would prevent all use of the model, because such data are virtually non-existent for any chemical.

5. Conclusions

- The data selected by UCD for derivation of the Acute Criterion for cypermethrin overlooked several Relevant and Reliable studies. Inclusion of these studies resulted in a recalculated Acute Criterion of 4 ng/L. (UCD's recommended Acute Criterion was 6 ng/L.)
- Due to limited data available on chronic toxicity, an ACR approach was used to derive the Chronic Criterion for cypermethrin. The ACRs calculated by UCD were based on several unreliable endpoints. Using acceptable acute and chronic toxicity data, CSI calculated ACRs for 3 species ranging from 4.0 to 16.2. Based on the ACR for the species closest to the acute value, the recalculated Chronic Criterion is 2 ng/L. (UCD's proposed Chronic Criterion was 0.01 ng/L.)
- Pyrethroids bound to particulate matter or associated with dissolved organic matter are not biologically available to aquatic organisms and do not contribute to toxicity; only freely dissolved pyrethroids are bioavailable and toxic. In laboratory toxicity tests using water with minimal particulate or dissolved organic matter, nearly all the pyrethroid is bioavailable. In ambient water, only a small fraction – a few percent or less – of the total pyrethroid may be bioavailable. For consistency with the underlying data, compliance with cypermethrin water quality standards should therefore be based on concentrations of freely dissolved cypermethrin, not total cypermethrin. Freely dissolved cypermethrin can be measured directly using SPME, or estimated using an equilibrium partitioning model such as the one presented by TenBrook *et al.* (2009).

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Table 1. Summary of cypermethrin aquatic toxicity data endpoints used to derive criteria.

Species	Endpoint	UCD Conc (µg/L)	Reference	CSI Proposed	Reference
ACUTE TOXICITY					
<i>Aedes aegypti</i>	24h LC50	1	Stephenson 1982	1	Stephenson 1980a
<i>Asellus aquaticus</i>	24h LC50	0.2	Stephenson 1982	0.2	Stephenson 1980a
<i>Baetis rhodani</i>	96h LC50	—	—	0.0123	Edwards <i>et al.</i> 1980a
<i>Ceriodaphnia dubia</i>	48h EC50	0.683	Wheelock <i>et al.</i> 2004	0.683	Wheelock <i>et al.</i> 2004
<i>Chaoborus crystallinus</i>	24h LC50	0.2	Stephenson 1982	0.2	Stephenson 1980a
<i>Chironomus thummi</i>	24h EC50	0.2	Stephenson 1982	0.2	Stephenson 1980a
<i>Cloeon dipterum</i>	24h LC50	0.6	Stephenson 1982	0.02 (96-h LC50)	Stephenson 1980b
<i>Corixa punctata</i>	24h EC50	0.7	Stephenson 1982	>5 (24-h LC50)	Stephenson 1980a
<i>Cyprinus carpio</i>	96h LC50	—	—	1.6	Hill 1981
<i>Daphnia magna</i>	48h LC50	0.147	Geomean: Ward and Boeri 1991a, Wheat and Evans 1994	0.162	Wheat and Evans 1994
<i>Gammarus pulex</i>	24h LC50	0.1	Stephenson 1982	0.009 (96-h LC50)	Stephenson 1980b
<i>Gyrinus natator</i>	24h EC50	0.07	Stephenson 1982	>5 (24-h LC50)	Stephenson 1980a
<i>Hyaella azteca</i>	96h LC50	0.0027	Geomean: Weston and Jackson 2009, Hamer 1997	0.0030	Geomean: Weston and Jackson 2009, Hamer 1997
<i>Lepomis macrochirus</i>	96h LC50	—	—	1.78	Hill 1980a
<i>Oncorhynchus mykiss</i>	96h LC50	0.90	Vaishnav and Yurk 1990	1.07	Geomean: Davies <i>et al.</i> 1994, Hill 1980b, Vaishnav and Yurk 1990
<i>Orconectes sp.</i>	96h LC50	—	—	0.068	Jaber 1981a
<i>Oreochromis niloticus</i>	96h LC50	2	Stephenson <i>et al.</i> 1984	2	Stephenson <i>et al.</i> 1984
<i>Plmephales promelas</i>	96h LC50	—	—	1.04	Geomean: Balog 1989a b
<i>Piona carnea</i>	24h LC50	0.05	Stephenson 1982	0.05	Stephenson 1980a
<i>Pseudaphritis urvillii</i>	96h LC50	—	—	2.19	Davies <i>et al.</i> 1994

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Species	Endpoint	UCD Conc (µg/L)	Reference	CSI Proposed	Reference
CHRONIC TOXICITY					
<i>Acartia tonsa</i>	5-d MATC	0.0512	Barata et al. 2002	No valid MATC	—
<i>Americamysis bahia</i>	28-d MATC	—	—	0.00124	Wheat 1993
<i>Daphnia magna</i>	21d MATC	0.00000063	Kim et al. 2008	0.01	Geomean: Two tests, Edwards et al. 1981
<i>Oncorhynchus mykiss</i>	10-d MATC	0.65	Davies et al. 1994	No valid MATC	—
<i>Pimephales promelas</i>	30d, 60d MATC	0.11	Tapp et al. 1988	0.15 (30d MATC)	Geomean: Jaber 1981b, Tapp et al. 1988

Table 2. Revised Acute-to-Chronic Ratios (ACRs) for derivation of the cypermethrin chronic criterion.

Species	MATC (µg/L)	Ref	SMAV (µg/L)	Ref	ACR
<i>Americamysis bahia</i>	0.00124	Wheat 1993	0.005	Geomean: Ward et al. 1992; Ward and Boeri 1991b	4.0
<i>Daphnia magna</i>	0.01	Geomean: Two tests, Edwards <i>et al.</i> 1981	0.162	Wheat and Evans 1994	16.2
<i>Pimephales promelas</i>	0.15 (30d MATC)	Geomean: Jaber 1981b, Tapp <i>et al.</i> 1988	1.04	Geomean: Balog 1989a,b	6.9

Appendix A. Study Evaluation Forms

Davies et al. 1994

Toxicity Data Summary Relevance: 92.5

Reliability: 77

Parameter	Davies et al. 1994 Value	<i>Oncorhynchus mykiss</i> Comment
Test method cited	Not cited	Test method is comparable to standard methods
Phylum	Chordata	
Class	Osteichthyes	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>mykiss</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Juveniles (1.1-2.5 g, 45-60 mm or 10-30 g, 100-150 mm)	
Source of organisms	Hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	10 d	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	NR	
Temperature	12-15 °C	UCD subtracted 3 points for acceptability
Test type	Flow through	
Photoperiod/light intensity	NR	
Dilution water	Surface water	
pH	6.5-7	
Hardness	NR	
Alkalinity	NR	
Conductivity	50-120 uS/cm	UCD subtracted 2 points for documentation, 1 point for acceptability
Dissolved Oxygen	>80% saturation	
Feeding	Yes	UCD indicated NR
Purity of test substance	>98%	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Toxicity values calculated based on nominal or measured concentrations?	Measured	

Comments on Draft Cypermethrin Criteria

	Davies et al. 1994	<i>Oncorhynchus mykiss</i>
Parameter	Value	Comment
Chemical method documented?	Yes	GC
Concentration of carrier (if any) in test solutions	2-10 mg/L	UCD indicated NR
Concentration 1 Nom/Meas (µg/L)	NR/0.17	2 reps/10 per rep (UCD indicated 10-15 per rep)
Concentration 2 Nom/Meas (µg/L)	NR/0.33	2 reps/10 per rep
Concentration 3 Nom/Meas (µg/L)	NR/0.49	2 reps/10 per rep
Concentration 4 Nom/Meas (µg/L)	NR/0.87	2 reps/10 per rep
Concentration 5 Nom/Meas (µg/L)	NR/2.52	2 reps/10 per rep
Control (describe type)	Dilution water	2 reps/10 per rep
LC50 (µg/L; indicate calculation method)	12 h: >2.52 96 h: 1.47 (1.20-1.75) 10 d: 1.47 (1.20-1.75)	Method: Probit

Reliability points taken off for:

Documentation:

Nominal concentrations (3), hardness (2), alkalinity (2), photoperiod (3), hypothesis tests (8)

Total 18

UCD also took off points for conductivity (2); only took 2 points off for hypothesis test, based on 10-d hepatic GST activity

Acceptability:

Control response (9), measured concentrations within 20% of nominal (4), organisms randomly assigned (1), feeding (3), hardness (2), alkalinity (2), photoperiod (2), random design (2), hypothesis tests (3)

Total 28

UCD also took off points for standard method (5), carrier solvent (4), temperature (3), conductivity (1), adequate replicates (2); didn't take points off for control response

Davies et al. 1994

Toxicity Data Summary Relevance: 92.5

Reliability: 77

Parameter	Davies et al. 1994 Value	<i>P. urvillii</i> Comment
Test method cited	Not cited	Test method is comparable to standard methods
Phylum	Chordata	
Class	Osteichthyes	
Order	Perciformes	
Family	Pseudaphritidae	
Genus	<i>Pseudaphritis</i>	
Species	<i>urvillii</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Juveniles (6-30 g, 95-160 mm)	
Source of organisms	Collected in field	
Have organisms been exposed to contaminants?	Not likely	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	10 d	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	NR	
Temperature	12-15 °C	UCD subtracted 3 points for acceptability
Test type	Flow through	
Photoperiod/light intensity	NR	
Dilution water	Surface water	
pH	6.5-7	
Hardness	NR	
Alkalinity	NR	
Conductivity	50-120 uS/cm	UCD subtracted 2 points for documentation, 1 point for acceptability
Dissolved Oxygen	>80% saturation	
Feeding	Yes	UCD indicated NR
Purity of test substance	>98%	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Toxicity values calculated based on nominal or measured concentrations?	Measured	
Chemical method documented?	Yes	GC

Comments on Draft Cypermethrin Criteria

	Davies et al. 1994	<i>P. urvillii</i>
Parameter	Value	Comment
Concentration of carrier (if any) in test solutions	2-10 mg/L	UCD indicated NR
Concentration 1 Nom/Meas (µg/L)	NR/0.17	2 reps/10 per rep (UCD indicated 10-15 per rep)
Concentration 2 Nom/Meas (µg/L)	NR/0.33	2 reps/10 per rep
Concentration 3 Nom/Meas (µg/L)	NR/0.49	2 reps/10 per rep
Concentration 4 Nom/Meas (µg/L)	NR/0.87	2 reps/10 per rep
Concentration 5 Nom/Meas (µg/L)	NR/2.52	2 reps/10 per rep
Control (describe type)	Dilution water	2 reps/10 per rep
LC50 (µg/L; indicate calculation method)	12 h: >2.52 96 h: 2.19 (1.80-2.65) 10 d: 1.47 (1.20-1.75)	Method: Probit

Reliability points taken off for:

Documentation:

Nominal concentrations (3), hardness (2), alkalinity (2), photoperiod (3), hypothesis tests (8)

Total 18

UCD also took off points for conductivity (2)

Acceptability:

Control response (9), measured concentrations within 20% of nominal (4), organisms randomly assigned (1), feeding (3), hardness (2), alkalinity (2), photoperiod (2), random design (2), hypothesis tests (3)

Total 28

UCD also took off points for standard method (5), carrier solvent (4), prior contamination (4), temperature (3), conductivity (1), adequate replicates (2); didn't take points off for control response

Davies et al. 1994

Rating of relevance/usability of single-species data for derivation of criteria.

	Davies et al. 1994	<i>Oncorhynchus mykiss</i>; <i>Pseudaphritis urvillii</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	Equivalent; UCD took 10 points off
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	>98%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	NR (-7.5)
Total	100	(-7.5)

Davies et al. 1994

Documentation rating for single-species aquatic laboratory data.

	Davies et al. 1994	<i>Oncorhynchus mykiss</i> ; <i>Pseudaphritis urvillii</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	NR (-3)
Measured concentrations	3	
Exposure type	5	
Dilution water source	3	
Hardness	2	NR (-2)
Alkalinity	2	NR (-2)
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	UCD took 2 points off
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	NR (-3)
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	NR (-2)
Significance level	2	NR (-2)
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	NR (-2)
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-18)

Davies et al. 1994

Acceptability rating for single-species aquatic laboratory data.

	Davies et al. 1994	<i>Oncorhynchus mykiss</i> ; <i>Pseudaphritis urvillii</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	Equivalent; UCD took 5 points off
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	Solvent control not included; preliminary trials showed no solvent effect
Response within test guidance	9	NR (-9); UCD did not take points off
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	NR (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	2-10 mg/L = 0.002-0.01 mL/L; UCD took 4 points off
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	UCD indicated “not likely” but took 4 points off
Organisms randomly assigned to test containers	1	NR (-1)
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	Fed (-3 for 4-d LC50); UCD took 3 points off
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	NR (-2)
Alkalinity within organism tolerance and/or dilution water specifications	2	NR (-2)
Dissolved oxygen ≥60%	6	

Comments on Draft Cypermethrin Criteria

	Davies et al. 1994	<i>Oncorhynchus mykiss</i> ; <i>Pseudaphritis urvillii</i>
Parameter	Value	Comment
Temperature within organism tolerance (3 pts) and/or test guidance and held to $\pm 1^{\circ}\text{C}$ (3 pts)	6	UCD took 3 points off
Conductivity within organism tolerance and/or dilution water specifications	1	UCD took 1 point off
pH within organism tolerance and/or dilution water specifications	2	
Photoperiod and light intensity within organism tolerance and/or test guidance	2	NR (-2)
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	NR (-2)
Adequate replication	2	UCD took 2 points off
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	NR (-1)
LOEC response reasonable compared to control	1	NR (-1)
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	(-25) (-28 for 4-d)
		UCD took total of 38 points off

Hill 1980a

Toxicity Data Summary Relevance: 90 Reliability: 80.5

Parameter	Hill 1980a Value	<i>Lepomis macrochirus</i> Comment
Test method cited	NR	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	<i>Lepomis</i>	
Species	<i>macrochirus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	1.46 g/41.95 mm	
Source of organisms	Dutchland Laboratory Animals, Inc.	Imported from USA
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Survival	
Control response 1	100% survival	
Temperature	21.8-22.6 °C	
Test type	Flow through	
Photoperiod/light intensity	NR	
Dilution water	20,000 g reservoir	
pH	7.25-7.70	
Hardness	34-46 mg/L CaCO ₃	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	7.6-8.9 mg/L	
Feeding	None	
Purity of test substance	91.55%	
Concentrations measured?	Measured	
Measured is what % of nominal?	56.6-79.4%	
Toxicity values calculated based on nominal or measured concentrations?	Measured	
Chemical method documented?	GC/ECD	
Concentration of carrier (if any) in test solutions	DMSO; 10 mg/L	
Concentration 1 Nom/Meas (µg/L)	0.56/0.35	1 rep/20 per rep
Concentration 2 Nom/Meas (µg/L)	1.0/0.71	1 rep/20 per rep
Concentration 3 Nom/Meas (µg/L)	2.4/1.44	1 rep/20 per rep
Concentration 4 Nom/Meas (µg/L)	3.2/1.93	1 rep/20 per rep
Concentration 5 Nom/Meas (µg/L)	4.2/2.38	1 rep/20 per rep

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	Hill 1980a	<i>Lepomis macrochirus</i>
Parameter	Value	Comment
Concentration 6 Nom/Meas (µg/L)	5.6/3.17	1 rep/20 per rep
Concentration 7 Nom/Meas (µg/L)	10/6.66	1 rep/20 per rep
Concentration 8 Nom/Meas (µg/L)	18/14.3	1 rep/20 per rep
Concentration 9 Nom/Meas (µg/L)	24/16.1	1 rep/20 per rep
Concentration 10 Nom/Meas (µg/L)	32/21.6	1 rep/20 per rep
Concentration 11 Nom/Meas (µg/L)	42/32.3	1 rep/20 per rep
Control (describe type)	Solvent and Dilution water	1 rep/20 per rep
LC50 (µg/L; indicate calculation method)	1.78 (1.63-1.95)	Method: Probit

Reliability points taken off for:

Documentation:

Alkalinity (2), conductivity (2), photoperiod (3), hypothesis tests (8)

Total 15

Acceptability:

Acceptable standard (5), measured concentrations within 20% of nominal (4), carrier solvent (4), organisms randomly assigned (1), alkalinity (2), conductivity (1), photoperiod (2), random design (2), hypothesis tests (3)

Total 24

Hill 1980a

Rating of relevance/usability of single-species data for derivation of criteria.

	Hill 1980a	<i>Lepomis macrochirus</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	NR (-10)
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	91.55%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	(-10)

Hill 1980a

Documentation rating for single-species aquatic laboratory data.

	Hill 1980a	<i>Lepomis macrochirus</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	
Measured concentrations	3	
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	NR (-2)
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	NR (-2)
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	NR (-3)
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	NR (-2)
Significance level	2	NR (-2)
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	NR (-2)
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-15)

Hill 1980a

Acceptability rating for single-species aquatic laboratory data.

	Hill 1980a	<i>Lepomis macrochirus</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	NR (-5)
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	No (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	No (-4)
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	NR (-1)
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	
Alkalinity within organism tolerance and/or dilution water specifications	2	NR (-2)
Dissolved oxygen ≥60%	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to ± 1°C (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	NR (-1)
pH within organism tolerance and/or dilution water specifications	2	

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	Hill 1980a	<i>Lepomis macrochirus</i>
Parameter	Value	Comment
Photoperiod and light intensity within organism tolerance and/or test guidance	2	NR (-2)
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	NR (-2)
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	NR (-1)
LOEC response reasonable compared to control	1	NR (-1)
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	(-24)

Hill 1980b

Toxicity Data Summary Relevance: 90 Reliability: 79.5

Parameter	Hill 1980b Value	<i>Oncorhynchus mykiss</i> Comment
Test method cited	NR	
Phylum	Chordata	
Class	Osteichthyes	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>mykiss</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	1.94 g/54.5 mm	
Source of organisms	Samaaki Trout Farm	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Survival	
Control response 1	100% survival	
Temperature	11-12.6 °C	
Test type	Flow through	
Photoperiod/light intensity	NR	
Dilution water	20,000 g reservoir	
pH	7.45-8.0	
Hardness	38-52 mg/L CaCO ₃	EPA standard states range of 40-180 mg/L CaCO ₃ required
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	9.4-12.4 mg/L	
Feeding	None	
Purity of test substance	91.5%	
Concentrations measured?	Measured	
Measured is what % of nominal?	43.8-79.8%	
Toxicity values calculated based on nominal or measured concentrations?	Measured	
Chemical method documented?	GC/ECD	
Concentration of carrier (if any) in test solutions	DMSO; 10 mg/L	
Concentration 1 Nom/Meas (µg/L)	0.32/0.14	1 rep/20 per rep
Concentration 2 Nom/Meas (µg/L)	0.56/0.25	1 rep/20 per rep
Concentration 3 Nom/Meas (µg/L)	0.75/0.43	1 rep/20 per rep
Concentration 4 Nom/Meas (µg/L)	1.0/0.55	1 rep/20 per rep

Comments on Draft Cypermethrin Criteria

	Hill 1980b	<i>Oncorhynchus mykiss</i>
Parameter	Value	Comment
Concentration 5 Nom/Meas (µg/L)	1.8/1.08	1 rep/20 per rep
Concentration 6 Nom/Meas (µg/L)	2.4/1.49	1 rep/20 per rep
Concentration 7 Nom/Meas (µg/L)	3.2/1.95	1 rep/20 per rep
Concentration 8 Nom/Meas (µg/L)	4.2/3.35	1 rep/20 per rep
Control (describe type)	Solvent and Dilution water	1 rep/20 per rep
LC50 (µg/L; indicate calculation method)	0.92 (0.81-1.05)	Method: Probit

Reliability points taken off for:

Documentation:

Alkalinity (2), conductivity (2), photoperiod (3), hypothesis tests (8)

Total 15

Acceptability:

Acceptable standard (5), measured concentrations within 20% of nominal (4), carrier solvent (4), organisms randomly assigned (1), hardness (2), alkalinity (2), conductivity (1), photoperiod (2), random design (2), hypothesis tests (3)

Total 26

Hill 1980b

Rating of relevance/usability of single-species data for derivation of criteria.

	Hill 1980b	<i>Oncorhynchus mykiss</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	NR (-10)
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	91.5%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	(-10)

Hill 1980b

Documentation rating for single-species aquatic laboratory data.

	Hill 1980b	<i>Oncorhynchus mykiss</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	
Measured concentrations	3	
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	NR (-2)
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	NR (-2)
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	NR (-3)
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	NR (-2)
Significance level	2	NR (-2)
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	NR (-2)
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-15)

Hill 1980b

Acceptability rating for single-species aquatic laboratory data.

	Hill 1980b	<i>Oncorhynchus mykiss</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	NR (-5)
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	No (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	No (-4)
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	NR (-1)
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	Too low (-2)
Alkalinity within organism tolerance and/or dilution water specifications	2	NR (-2)
Dissolved oxygen ≥60%	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to ± 1°C (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	NR (-1)
pH within organism tolerance and/or dilution water specifications	2	

Comments on Draft Cypermethrin Criteria

	Hill 1980b	<i>Oncorhynchus mykiss</i>
Parameter	Value	Comment
Photoperiod and light intensity within organism tolerance and/or test guidance	2	NR (-2)
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	NR (-2)
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	NR (-1)
LOEC response reasonable compared to control	1	NR (-1)
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	(-26)

Hill 1981

Toxicity Data Summary Relevance: 90 Reliability: 80.5

Parameter	Hill 1981 Value	<i>Cyprinus carpio</i> Comment
Test method cited	NR	
Phylum	Chordata	
Class	Osteichthyes	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Cyprinus</i>	
Species	<i>carpio</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	2.51 g/47.2 mm	
Source of organisms	Priory Fisheries	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Survival	
Control response 1	100% survival	
Temperature	22-22.6 °C	
Test type	Flow through	
Photoperiod/light intensity	NR	
Dilution water	20,000 gallon reservoir	
pH	7.35-7.95	
Hardness	39-45 mg/L CaCO ₃	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	6.9-9.6 mg/L	
Feeding	None	
Purity of test substance	91.5%	
Concentrations measured?	Measured	
Measured is what % of nominal?	49.7-77.8%	
Toxicity values calculated based on nominal or measured concentrations?	Measured	
Chemical method documented?	GC/ECD	
Concentration of carrier (if any) in test solutions	DMSO; 10 mg/L	
Concentration 1 Nom/Meas (µg/L)	0.18/0.14	1 rep/20 per rep
Concentration 2 Nom/Meas (µg/L)	0.32/0.24	1 rep/20 per rep
Concentration 3 Nom/Meas (µg/L)	0.56/0.43	1 rep/20 per rep
Concentration 4 Nom/Meas (µg/L)	1.0/0.60	1 rep/20 per rep
Concentration 5 Nom/Meas (µg/L)	3.2/1.59	1 rep/20 per rep
Concentration 6 Nom/Meas (µg/L)	5.6/3.47	1 rep/20 per rep

Comments on Draft Cypermethrin Criteria

	Hill 1981	<i>Cyprinus carpio</i>
Parameter	Value	Comment
Concentration 7 Nom/Meas (µg/L)	10/6.72	1 rep/20 per rep
Concentration 8 Nom/Meas (µg/L)	32/18.5	1 rep/20 per rep
Concentration 9 Nom/Meas (µg/L)	56/30.0	1 rep/20 per rep
Control (describe type)	Solvent and Dilution water	1 rep/20 per rep
LC50 (µg/L; indicate calculation method)	1.6 (1.3-2.0)	Method: Probit

Reliability points taken off for:

Documentation:

Alkalinity (2), conductivity (2), photoperiod (3), hypothesis tests (8)
Total 15

Acceptability:

Acceptable standard (5), measured concentrations within 20% of nominal (4), carrier solvent (4), organisms randomly assigned (1), alkalinity (2), conductivity (1), photoperiod (2), random design (2), hypothesis tests (3)
Total 24

Hill 1981

Rating of relevance/usability of single-species data for derivation of criteria.

	Hill 1981	<i>Cyprinus carpio</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	NR (-10)
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	91.5%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	(-10)

Hill 1981

Documentation rating for single-species aquatic laboratory data.

	Hill 1981	<i>Cyprinus carpio</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	
Measured concentrations	3	
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	NR (-2)
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	NR (-2)
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	NR (-3)
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	NR (-2)
Significance level	2	NR (-2)
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	NR (-2)
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-15)

Hill 1981

Acceptability rating for single-species aquatic laboratory data.

	Hill 1981	<i>Cyprinus carpio</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	NR (-5)
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	No (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	No (-4)
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	NR (-1)
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	
Alkalinity within organism tolerance and/or dilution water specifications	2	NR (-2)
Dissolved oxygen ≥60%	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to ± 1°C (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	NR (-1)
pH within organism tolerance and/or dilution water specifications	2	

Comments on Draft Cypermethrin Criteria

	Hill 1981	<i>Cyprinus carpio</i>
Parameter	Value	Comment
Photoperiod and light intensity within organism tolerance and/or test guidance	2	NR (-2)
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	NR (-2)
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	NR (-1)
LOEC response reasonable compared to control	1	NR (-1)
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	(-24)

Edwards et al. 1980a

Toxicity Data Summary Relevance: 100

Reliability: 90.5

	Edwards et al. 1980a	<i>Baetis rhodani</i>
Parameter	Value	Comment
Test method cited	EPA 1975	
Phylum	Arthropoda	
Class	Insecta	
Order	Ephemeroptera	
Family	Baetidae	
Genus	<i>Baetis</i>	
Species	<i>rhodani</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Early instar	
Source of organisms	Field-collected	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Survival	
Control response 1	98.3% survival	
Effect 2	Immobilization	
Control response 2	96.6% immobilization	
Temperature	11-13 °C	
Test type	Flow through	
Photoperiod/light intensity	16 L:8 D; 370 lux	
Dilution water	Dechlorinated mains water	
pH	8.2-8.4	
Hardness	184-220 mg/L CaCO ₃	
Alkalinity	250-260 mg/L CaCO ₃	
Conductivity	540-640 µmho's	
Dissolved Oxygen	>95% saturation	
Feeding	None	
Purity of test substance	>97.6%	
Concentrations measured?	Measured	
Measured is what % of nominal?	60-70%	
Toxicity values calculated based on nominal or measured concentrations?	Measured	
Chemical method documented?	Liquid Scintillation Counting (LSC)	
Concentration of carrier (if any) in test solutions	0.12% acetone	
Concentration 1 Nom/Meas (µg/L)	0.0023/0.00165	1 rep/30 per rep
Concentration 2 Nom/Meas (µg/L)	0.0046/0.0031	1 rep/30 per rep
Concentration 3 Nom/Meas (µg/L)	0.0092/0.0057	1 rep/30 per rep

Comments on Draft Cypermethrin Criteria

	Edwards et al. 1980a	<i>Baetis rhodani</i>
Parameter	Value	Comment
Concentration 4 Nom/Meas (µg/L)	0.0184/0.0109	1 rep/30 per rep
Concentration 5 Nom/Meas (µg/L)	0.0367/0.0225	1 rep/30 per rep
Control (describe type)	Solvent	1 rep/30 per rep
LC50 (µg/L; indicate calculation method)	0.0123 (0.0098-0.0162)	Method: Linear regression
EC50 (µg/L; indicate calculation method)	0.0057 (0.0041-0.0079)	Method: Linear regression

Reliability points taken off for:

Documentation:

Hypothesis tests (8)

Total 8

Acceptability:

Measured concentrations within 20% of nominal (4), carrier solvent (4), hypothesis tests (3)

Total 11

Edwards et al. 1980a

Rating of relevance/usability of single-species data for derivation of criteria.

	Edwards et al. 1980a	<i>Baetis rhodani</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	Yes
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	>97.6%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	

Edwards et al. 1980a

Documentation rating for single-species aquatic laboratory data.

	Edwards et al. 1980a	<i>Baetis rhodani</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	
Measured concentrations	3	
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	NR (-2)
Significance level	2	NR (-2)
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	NR (-2)
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-8)

Edwards et al. 1980a

Acceptability rating for single-species aquatic laboratory data.

	Edwards et al. 1980a	<i>Baetis rhodani</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	No (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤ 0.5 mL/L (acute); ≤ 0.1 mL/L (chronic); score 4 if not used	4	No (-4)
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	
Alkalinity within organism tolerance and/or dilution water specifications	2	
Dissolved oxygen $\geq 60\%$	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to $\pm 1^\circ\text{C}$ (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	
pH within organism tolerance and/or dilution water specifications	2	

Comments on Draft Cypermethrin Criteria

	Edwards et al. 1980a	<i>Baetis rhodani</i>
Parameter	Value	Comment
Photoperiod and light intensity within organism tolerance and/or test guidance	2	
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	NR (-1)
LOEC response reasonable compared to control	1	NR (-1)
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	(-11)

Jaber 1981a

Toxicity Data Summary Relevance: 90

Reliability: 84.5

	Jaber 1981a	<i>Orconectes sp.</i>
Parameter	Value	Comment
Test method cited	NR	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Decapoda	
Family	Cambaridae	
Genus	<i>Orconectes</i>	
Species	NR	
Family in North America?	Yes	
Age/size at start of test/growth phase	2.32 g/42 mm	
Source of organisms	Biological Supply Company	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Survival	
Control response 1	100% survival	
Temperature	19.8-20.2 °C	
Test type	Flow through	
Photoperiod/light intensity	NR	
Dilution water	Sterilized well water	
pH	7.89-8.09	
Hardness	220 mg/L CaCO ₃	
Alkalinity	160 mg/L CaCO ₃	
Conductivity	600 µmhos/cm	
Dissolved Oxygen	>90% saturation	
Feeding	None	
Purity of test substance	91.69%	
Concentrations measured?	Measured	
Measured is what % of nominal?	72-82%	
Toxicity values calculated based on nominal or measured concentrations?	Measured	
Chemical method documented?	GLC	
Concentration of carrier (if any) in test solutions	DMF / Level not reported	
Concentration 1 Nom/Meas (µg/L)	0.06/0.017	1 rep/10 per rep
Concentration 2 Nom/Meas (µg/L)	0.13/0.023	1 rep/10 per rep
Concentration 3 Nom/Meas (µg/L)	0.25/0.044	1 rep/10 per rep
Concentration 4 Nom/Meas (µg/L)	0.50/0.11	1 rep/10 per rep
Concentration 5 Nom/Meas (µg/L)	1.0/0.21	1 rep/10 per rep
Control (describe type)	Solvent and Dilution water	1 rep/10 per rep

Comments on Draft Cypermethrin Criteria

	Jaber 1981a	<i>Orconectes sp.</i>
Parameter	Value	Comment
LC50 (µg/L; indicate calculation method)	0.068 (0.053-0.09)	Method: Moving Average Angle

Reliability points taken off for:

Documentation:

Photoperiod (3), hypothesis tests (8)

Total 11

Acceptability:

Acceptable standard (5), Measured concentrations within 20% of nominal (4), Carrier solvent (4), photoperiod (2), random design (2), hypothesis tests (3)

Total 20

Jaber 1981a

Rating of relevance/usability of single-species data for derivation of criteria.

	Jaber 1981a	<i>Orconectes sp.</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	NR (-10)
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	91.69%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	(-10)

Jaber 1981a

Documentation rating for single-species aquatic laboratory data.

	Jaber 1981a	<i>Orconectes sp.</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	
Measured concentrations	3	
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	NR (-3)
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	NR (-2)
Significance level	2	NR (-2)
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	NR (-2)
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-11)

Jaber 1981a

Acceptability rating for single-species aquatic laboratory data.

	Jaber 1981a	<i>Orconectes sp.</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	NR (-5)
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	No (-4)
Concentrations do not exceed 2× water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	NR (-4)
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	
Alkalinity within organism tolerance and/or dilution water specifications	2	
Dissolved oxygen ≥60%	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to ± 1°C (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	
pH within organism tolerance and/or dilution water specifications	2	

Comments on Draft Cypermethrin Criteria

	Jaber 1981a	<i>Orconectes sp.</i>
Parameter	Value	Comment
Photoperiod and light intensity within organism tolerance and/or test guidance	2	NR (-2)
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	NR (-2)
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	NR (-1)
LOEC response reasonable compared to control	1	NR (-1)
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	(-20)

Balog 1989a

Toxicity Data Summary Relevance: 100

Reliability: 82

Parameter	Balog 1989a	<i>Pimephales promelas</i>
	Value	Comment
Test method cited	ASTM E 729-80	
Phylum	Chordata	
Class	Osteichthyes	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Pimephales</i>	
Species	<i>promelas</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	24-d	
Source of organisms	Cultured in-house	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Survival	
Control response 1	100%	
Temperature	22-23.5 °C	
Test type	Static	
Photoperiod/light intensity	16 L:8 D; 40-45 fc	
Dilution water	Round Valley Reservoir Water	
pH	6.49-8.45	
Hardness	76-120 mg/L CaCO ₃	
Alkalinity	60-84 mg/L CaCO ₃	
Conductivity	130-180 µmhos	
Dissolved Oxygen	>60% first 48 h; >40% after that	
Feeding	NR	
Purity of test substance	93.5%	
Concentrations measured?	No	
Measured is what % of nominal?	N/A	
Toxicity values calculated based on nominal or measured concentrations?	Nominal	
Chemical method documented?	N/A	
Concentration of carrier (if any) in test solutions	Acetone; <0.5ml/L	
Concentration 1 Nom/Meas (µg/L)	0.3125	2 reps/10 per rep
Concentration 2 Nom/Meas (µg/L)	0.625	2 reps/10 per rep
Concentration 3 Nom/Meas (µg/L)	1.25	2 reps/10 per rep
Concentration 4 Nom/Meas (µg/L)	2.50	2 reps/10 per rep

Comments on Draft Cypermethrin Criteria

	Balog 1989a	<i>Pimephales promelas</i>
Parameter	Value	Comment
Concentration 5 Nom/Meas (µg/L)	5.00	2 reps/10 per rep
Control (describe type)	Solvent and Dilution water	2 reps/10 per rep
LC50 (µg/L; indicate calculation method)	0.84 (0.66-1.04)	Method: Probit

Reliability points taken off for:

Documentation:

Analytical method (4), measured concentrations (3), hypothesis tests (8)

Total 15

Acceptability:

Measured concentrations within 20% of nominal (4), appropriate size/age/growth phase (3), organisms fed 2 h before solution renewal or not fed in acute tests (3), dissolved oxygen (6), random design (2), hypothesis tests (3)

Total 21

Balog 1989a

Rating of relevance/usability of single-species data for derivation of criteria.

	Balog 1989a	<i>Pimephales promelas</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	Yes
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	93.5%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	

Balog 1989a

Documentation rating for single-species aquatic laboratory data.

	Balog 1989a	<i>Pimephales promelas</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	NR (-4)
Nominal concentrations	3	
Measured concentrations	3	NR (-3)
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	NR (-2)
Significance level	2	NR (-2)
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	NR (-2)
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-15)

Balog 1989a

Acceptability rating for single-species aquatic laboratory data.

	Balog 1989a	<i>Pimephales promelas</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	NR (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	
Organisms		
Appropriate size/age/growth phase	3	Too old (-3)
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	NR (-3)
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	
Alkalinity within organism tolerance and/or dilution water specifications	2	
Dissolved oxygen ≥60%	6	No (-6)
Temperature within organism tolerance (3 pts) and/or test guidance and held to ± 1°C (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	
pH within organism tolerance and/or dilution water specifications	2	

Comments on Draft Cypermethrin Criteria

	Balog 1989a	<i>Pimephales promelas</i>
Parameter	Value	Comment
Photoperiod and light intensity within organism tolerance and/or test guidance	2	
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	NR (-2)
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	NR (-1)
LOEC response reasonable compared to control	1	NR (-1)
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	(-21)

Balog 1989b

Toxicity Data Summary Relevance: 100

Reliability: 84.5

	Balog 1989b	<i>Pimephales promelas</i>
Parameter	Value	Comment
Test method cited	ASTM E 729-80	
Phylum	Chordata	
Class	Osteichthyes	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Pimephales</i>	
Species	<i>promelas</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	32-d	
Source of organisms	Cultured in-house	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	≤5% Mortality	
Temperature	21-23.3 °C	
Test type	Static	
Photoperiod/light intensity	16 L:8 D; 40-45 fc	
Dilution water	Round Valley Reservoir water	
pH	6.39-7.91	
Hardness	72-116 mg/L CaCO ₃	
Alkalinity	48-80 mg/L CaCO ₃	
Conductivity	120-150 µmhos	
Dissolved Oxygen	6.7-8.2 mg/L	
Feeding	NR	
Purity of test substance	93.5%	
Concentrations measured?	Nominal	
Measured is what % of nominal?	N/A	
Toxicity values calculated based on nominal or measured concentrations?	Nominal	
Chemical method documented?	N/A	
Concentration of carrier (if any) in test solutions	Acetone; <0.5ml/L	
Concentration 1 Nom/Meas (µg/L)	0.25	2 reps/10 per rep
Concentration 2 Nom/Meas (µg/L)	0.50	2 reps/10 per rep
Concentration 3 Nom/Meas (µg/L)	1.0	2 reps/10 per rep
Concentration 4 Nom/Meas (µg/L)	2.0	2 reps/10 per rep
Concentration 5 Nom/Meas (µg/L)	4.0	2 reps/10 per rep
Control (describe type)	Solvent and Dilution water	2 reps/10 per rep

Comments on Draft Cypermethrin Criteria

	Balog 1989b	<i>Pimephales promelas</i>
Parameter	Value	Comment
LC50 (µg/L; indicate calculation method)	1.28 (0.99-1.72)	Method: Moving average

Reliability points taken off for:

Documentation:

Analytical method (4), measured concentrations (3), hypothesis tests (8)

Total 15

Acceptability:

Measured concentrations within 20% of nominal (4), appropriate size/age/growth phase (3), organisms fed 2 h before solution renewal or not fed in acute tests (3), temperature (3), hypothesis tests (3)

Total 16

Balog 1989b

Rating of relevance/usability of single-species data for derivation of criteria.

	Balog 1989b	<i>Pimephales promelas</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	Yes
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	93.5%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	

Balog 1989b

Documentation rating for single-species aquatic laboratory data.

	Balog 1989b	<i>Pimephales promelas</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	NR (-4)
Nominal concentrations	3	
Measured concentrations	3	NR (-3)
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	NR (-2)
Significance level	2	NR (-2)
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	NR (-2)
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-15)

Balog 1989b

Acceptability rating for single-species aquatic laboratory data.

	Balog 1989b	<i>Pimephales promelas</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	NR (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	
Organisms		
Appropriate size/age/growth phase	3	Too old (-3)
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	NR (-3)
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	
Alkalinity within organism tolerance and/or dilution water specifications	2	
Dissolved oxygen ≥60%	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to ± 1°C (3 pts)	6	No (-3)
Conductivity within organism tolerance and/or dilution water specifications	1	
pH within organism tolerance and/or dilution water specifications	2	

Comments on Draft Cypermethrin Criteria

	Balog 1989b	<i>Pimephales promelas</i>
Parameter	Value	Comment
Photoperiod and light intensity within organism tolerance and/or test guidance	2	
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	NR (-1)
LOEC response reasonable compared to control	1	NR (-1)
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	(-16)

Thorpe 1982

Toxicity Data Summary Relevance: 90

Reliability: 82.5

Parameter	Thorpe 1982 Value	<i>Daphnia magna</i> Comment
Test method cited	NR	
Phylum	Arthropoda	
Class	Crustacea	
Order	Diplostraca	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	<24-h	
Source of organisms	Cultured in-house	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	Yes	
Effect 1	Immobilization	
Control response 1	0% immobilization	
Temperature	18-22°C	
Test type	Static-renewal	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated mains water	
pH	7.9-8.5	
Hardness	240-280 mg/L CaCO ₃	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	8.7-9.5 mg/L	
Feeding	None	
Purity of test substance	>98%	
Concentrations measured?	Yes	
Measured is what % of nominal?	~51% @ 24 h	
Toxicity values calculated based on nominal or measured concentrations?	Nominal	
Chemical method documented?	GLC/EC	
Concentration of carrier (if any) in test solutions	Acetone; ≤0.5ml/L	
Concentration 1 Nom/Meas (µg/L)	0.5/0.3 @ 24 h	3 reps/10 per rep
Concentration 2 Nom/Meas (µg/L)	1.0/0.6 @ 24 h	3 reps/10 per rep
Concentration 3 Nom/Meas (µg/L)	1.5/1.9 @ 24 h	3 reps/10 per rep
Concentration 4 Nom/Meas (µg/L)	4/1.8 @ 24 h	3 reps/10 per rep
Concentration 5 Nom/Meas (µg/L)	10/4.6 @ 24 h	3 reps/10 per rep
Control (describe type)	Solvent	3 reps/10 per rep

Comments on Draft Cypermethrin Criteria

	Thorpe 1982	<i>Daphnia magna</i>
Parameter	Value	Comment
LC50 (µg/L; indicate calculation method)	0.3 (0.2-0.4)	Method: Probit

Reliability points taken off for:

Documentation:

Alkalinity (2), conductivity (2), photoperiod (3), hypothesis tests (8)

Total 18

Acceptability:

Acceptable standard (5), measured concentrations within 20% of nominal (4), organisms randomly assigned (1), alkalinity (2), conductivity (1), photoperiod (2) random design (2), hypothesis tests (3)

Total 20

Thorpe 1982

Toxicity Data Summary Relevance: 90

Reliability: 81.5

	Thorpe 1982	<i>Oncorhynchus mykiss</i>
Parameter	Value	Comment
Test method cited	NR	
Phylum	Chordata	
Class	Osteichthyes	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>mykiss</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	3.3 g/5.7-7.8 cm	
Source of organisms	Hammer Trout Hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Survival	
Control response 1	100% Survival	
Temperature	14-16°C	
Test type	Static-renewal	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated mains water	
pH	7.9-8.5	
Hardness	230-270 mg/L CaCO ₃	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	8.5-10.5 mg/L	
Feeding	None	
Purity of test substance	>98%	
Concentrations measured?	Yes	
Measured is what % of nominal?	~56% @ 12 h	
Toxicity values calculated based on nominal or measured concentrations?	Nominal	
Chemical method documented?	GLC/EC	
Concentration of carrier (if any) in test solutions	Acetone; ≤0.5ml/L	
Concentration 1 Nom/Meas (µg/L)	1.5/0.8 @ 12 h	1 reps/10 per rep
Concentration 2 Nom/Meas (µg/L)	2.5/1.4 @ 12 h	1 reps/10 per rep
Concentration 3 Nom/Meas (µg/L)	4.0/2.2 @ 12 h	1 reps/10 per rep
Concentration 4 Nom/Meas (µg/L)	6.5/3.7 @ 12 h	1 reps/10 per rep
Control (describe type)	Solvent	1 reps/10 per rep
LC50 (µg/L; indicate calculation method)	2.8 (2.2-3.4)	Method: Probit

Comments on Draft Cypermethrin Criteria

Reliability points taken off for:

Documentation:

Alkalinity (2), conductivity (2), photoperiod (3), hypothesis tests (8)

Total 18

Acceptability:

Acceptable standard (5), measured concentrations within 20% of nominal (4), organisms randomly assigned (1), hardness (2), alkalinity (2), conductivity (1), photoperiod (2) random design (2), hypothesis tests (3)

Total 22

Thorpe 1982

Rating of relevance/usability of single-species data for derivation of criteria.

	Thorpe 1982	<i>Daphnia magna/</i> <i>Oncorhynchus mykiss</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	NR (-10)
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	>98%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	(-10)

Thorpe 1982

Documentation rating for single-species aquatic laboratory data.

	Thorpe 1982	<i>Daphnia magna/ Oncorhynchus mykiss</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	
Measured concentrations	3	
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	NR (-2)
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	NR (-2)
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	NR (-3)
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	NR (-2)
Significance level	2	NR (-2)
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	NR (-2)
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-15)

Thorpe 1982

Acceptability rating for single-species aquatic laboratory data.

	Thorpe 1982	<i>Daphnia magna/</i> <i>Oncorhynchus mykiss</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	NR (-5)
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	No (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	NR (-1)
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	Trout only; EPA standard states range of 40-180 mg/L CaCO ₃ required (-2)
Alkalinity within organism tolerance and/or dilution water specifications	2	NR (-2)
Dissolved oxygen ≥60%	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to ± 1°C (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	NR (-1)

Comments on Draft Cypermethrin Criteria

	Thorpe 1982	<i>Daphnia magna/</i> <i>Oncorhynchus mykiss</i>
Parameter	Value	Comment
pH within organism tolerance and/or dilution water specifications	2	
Photoperiod and light intensity within organism tolerance and/or test guidance	2	NR (-2)
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	NR (-2)
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	NR (-1)
LOEC response reasonable compared to control	1	NR (-1)
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	Daphnia (-20)/Trout (-22)

Stephenson 1980b

Toxicity Data Summary **Relevance: 90** **Reliability: 81**

Parameter	Stephenson 1980b Value	<i>Gammarus pulex</i> Comment
Test method cited	NR	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Gammaridae	
Genus	<i>Gammarus</i>	
Species	<i>pulex</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	1-2 mm	
Source of organisms	River Sherway (field-collected)	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes	
Effect 1	Survival	
Control response 1	100% survival	
Effect 2	Immobilization	
Control response 2	100% unaffected	
Temperature	14-16°C	
Test type	Flow through	
Photoperiod/light intensity	NR	
Dilution water	Filtered dechlorinated tap water	
pH	7.5-8.0	
Hardness	200-280 mg/L CaCO ₃	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	9-10.5 mg/L	
Feeding	None	
Purity of test substance	98.1%	
Concentrations measured?	Measured	
Measured is what % of nominal?	72-130%	
Toxicity values calculated based on nominal or measured concentrations?	Measured	
Chemical method documented?	GLC	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (µg/L)	NR/0.0007	1 rep/10 per rep
Concentration 2 Nom/Meas (µg/L)	NR/0.002	1 rep/10 per rep

Comments on Draft Cypermethrin Criteria

	Stephenson 1980b	<i>Gammarus pulex</i>
Parameter	Value	Comment
Concentration 3 Nom/Meas (µg/L)	NR/0.007	1 rep/10 per rep
Concentration 4 Nom/Meas (µg/L)	NR/0.010	1 rep/10 per rep
Concentration 5 Nom/Meas (µg/L)	NR/0.024	1 rep/10 per rep
Control (describe type)	Dilution water	1 rep/10 per rep
LC50 (µg/L; indicate calculation method)	0.009 (0.007-0.01)	Method: Holmes 1969
EC50 (µg/L; indicate calculation method)	0.004 (0.002-0.007)	Method: Holmes 1969

Reliability points taken off for:

Documentation:

Nominal concentrations (3), alkalinity (2), conductivity (2), photoperiod (3), hypothesis tests (8)

Total 18

Acceptability:

Acceptable standard (5), measured concentrations within 20% of nominal (4), organisms randomly assigned (1), alkalinity (2), conductivity (1), photoperiod (2) random design (2), hypothesis tests (3)

Total 20

Stephenson 1980b

Toxicity Data Summary **Relevance: 90** **Reliability: 81**

Parameter	Stephenson 1980b Value	<i>Cloeon dipterum</i> Comment
Test method cited	NR	
Phylum	Arthropoda	
Class	Insecta	
Order	Ephemeroptera	
Family	Baetidae	
Genus	<i>Cloeon</i>	
Species	<i>Dipterum</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	0.5-1 cm	
Source of organisms	River Sherway (field-collected)	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96-h	
Data for multiple times?	Yes	
Effect 1	Survival	
Control response 1	93.3% survival	
Effect 2	Immobilization	
Control response 2	93.3% unaffected	
Temperature	14-16°C	
Test type	Flow through	
Photoperiod/light intensity	NR	
Dilution water	Filtered dechlorinated tap water	
pH	7.5-8.0	
Hardness	200-280 mg/L CaCO ₃	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	9-10.5 mg/L	
Feeding	None	
Purity of test substance	98.1%	
Concentrations measured?	Measured	
Measured is what % of nominal?	72-130%	
Toxicity values calculated based on nominal or measured concentrations?	Measured	
Chemical method documented?	GLC	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (µg/L)	NR/0.002	1 rep/15 per rep
Concentration 2 Nom/Meas (µg/L)	NR/0.006	1 rep/15 per rep

Comments on Draft Cypermethrin Criteria

	Stephenson 1980b	<i>Cloeon dipterum</i>
Parameter	Value	Comment
Concentration 3 Nom/Meas (µg/L)	NR/0.024	1 rep/15 per rep
Concentration 4 Nom/Meas (µg/L)	NR/0.047	1 rep/15 per rep
Concentration 5 Nom/Meas (µg/L)	NR/0.083	1 rep/15 per rep
Control (describe type)	Dilution water	1 rep/15 per rep
LC50 (µg/L; indicate calculation method)	0.02 (0.01-0.07)	Method: Holmes 1969
EC50 (µg/L; indicate calculation method)	0.004 (0.002-0.006)	Method: Holmes 1969

Reliability points taken off for:

Documentation:

Nominal concentrations (3), alkalinity (2), conductivity (2), photoperiod (3), hypothesis tests (8)

Total 18

Acceptability:

Acceptable standard (5), measured concentrations within 20% of nominal (4), organisms randomly assigned (1), alkalinity (2), conductivity (1), photoperiod (2) random design (2), hypothesis tests (3)

Total 20

Stephenson 1980b

Rating of relevance/usability of single-species data for derivation of criteria.

	Stephenson 1980b	<i>Gammarus pulex/ Cloeon dipterum</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	NR (-10)
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	98.1%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	(-10)

Stephenson 1980b

Documentation rating for single-species aquatic laboratory data.

	Stephenson 1980b	<i>Gammarus pulex/Cloeon dipterum</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	NR (-3)
Measured concentrations	3	
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	NR (-2)
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	NR (-2)
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	NR (-3)
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	NR (-2)
Significance level	2	NR (-2)
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	NR (-2)
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-18)

Stephenson 1980b

Acceptability rating for single-species aquatic laboratory data.

	Stephenson 1980b	<i>Gammarus pulex/Cloeon dipterum</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	NR (-5)
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	No (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	NR (-1)
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	
Alkalinity within organism tolerance and/or dilution water specifications	2	NR (-2)
Dissolved oxygen ≥60%	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to ± 1°C (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	NR (-1)
pH within organism tolerance and/or dilution water	2	

Comments on Draft Cypermethrin Criteria

	Stephenson 1980b	<i>Gammarus pulex/Cloeon dipterum</i>
Parameter	Value	Comment
specifications		
Photoperiod and light intensity within organism tolerance and/or test guidance	2	NR (-2)
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	NR (-2)
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	NR (-1)
LOEC response reasonable compared to control	1	NR (-1)
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	(-20)

Edwards et al. 1981

Toxicity Data Summary Relevance: 100

Reliability: 93.5

	Edwards et al. 1981	<i>Daphnia magna</i> (Tests 1 & 2)
Parameter	Value	Comment
Test method cited	EPA 1975	
Phylum	Arthropoda	
Class	Crustacea	
Order	Diplostraca	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	<24-h	
Source of organisms	Cultured in-house	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	21 d	
Data for multiple times?	No	
Effect 1	Reproduction	
Control response 1	Test 1: 56.4 offspring/female Test 2: 43.1 offspring/female	
Effect 2	Growth	
Control response 2	Test 1: 3.67 mm Test 2: 3.74 mm	
Temperature	16-18°C	
Test type	Flow through	
Photoperiod/light intensity	16 L:8 D; 370 lux	
Dilution water	Dechlorinated mains water	
pH	Test 1: 7.9-8.5 Test 2: 8.1-8.4	
Hardness	184-230 mg/L CaCO ₃	
Alkalinity	240-260 mg/L CaCO ₃	
Conductivity	540-690 mmhos	
Dissolved Oxygen	Test 1: >91% saturation Test 2: >94% saturation	
Feeding	2x daily w/algae	
Purity of test substance	>93%	
Concentrations measured?	Yes	
Measured is what % of nominal?	70-80%	
Toxicity values calculated based on nominal or measured concentrations?	Measured	
Chemical method documented?	Liquid Scintillation Counting	

Comments on Draft Cypermethrin Criteria

	Edwards et al. 1981	<i>Daphnia magna</i> (Tests 1 & 2)
Parameter	Value	Comment
	(LSC)	
Concentration of carrier (if any) in test solutions	0.12% acetone	
Concentration 1 Nom/Meas (µg/L)	Test 1: 0.0062/0.0047 Test 2: 0.0083/0.006	1 rep/80 per rep
Concentration 2 Nom/Meas (µg/L)	Test 1: 0.0125/0.0093 Test 2: 0.0166/0.0136	1 rep/80 per rep
Concentration 3 Nom/Meas (µg/L)	Test 1: 0.0249/0.0172 Test 2: 0.0332/0.023	1 rep/80 per rep
Concentration 4 Nom/Meas (µg/L)	Test 1: 0.0498/0.0398 Test 2: 0.0665/0.0443	1 rep/80 per rep
Concentration 5 Nom/Meas (µg/L)	Test 1: 0.0996/0.0792 Test 2: 0.1329/0.0834	1 rep/80 per rep
Control (describe type)	Solvent	1 rep/80 per rep
EC50 (µg/L; indicate calculation method)	Test 1: 0.0484 (0.0378-0.0589) Test 2: 0.0629 (0.0367-0.0891)	Method: Weighted linear regression
NOEC (µg/L) (indicate calculation method, sig level/p value, and MSD)	Test 1 growth: 0.0093 Test 2 growth: 0.006 Test 1 repro: 0.0172 Test 2 repro: 0.023	Method: ANOVA P value: 0.05 MSD: NR
LOEC (µg/L) (indicate calculation method and sig level/p value)	Test 1 growth: 0.0172 Test 2 growth: 0.0136 Test 1 repro: 0.0398 Test 2 repro: 0.0443	Method: ANOVA P value: 0.05
MATC (GeoMean NOEC, LOEC) (µg/L)	Test 1 growth: 0.0126 Test 2 growth: 0.009 Test 1 repro: 0.0262 Test 2 repro: 0.0319	
% of control at NOEC	74.5-102%	
% of control at LOEC	62.7-98.4%	

Reliability points taken off for:

Documentation:

Minimum significant difference (2)

Total 2

Acceptability:

Measured concentrations within 20% of nominal (4), carrier solvent (4), adequate number per replicate (2), minimum significant difference (1)

Total 11

Edwards et al. 1981

Rating of relevance/usability of single-species data for derivation of criteria.

	Edwards et al. 1981	<i>Daphnia magna</i> (Tests 1 & 2)
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	Yes
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	>93%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	

Edwards et al. 1981

Documentation rating for single-species aquatic laboratory data.

	Edwards et al. 1981	<i>Daphnia magna</i> (Tests 1 & 2)
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	
Measured concentrations	3	
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	
Significance level	2	
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	
Point estimates (i.e., LC50, EC25)	8	
Total	100	(-2)

Edwards et al. 1981

Acceptability rating for single-species aquatic laboratory data.

	Edwards et al. 1981	<i>Daphnia magna</i> (Tests 1 & 2)
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	No (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤ 0.5 mL/L (acute); ≤ 0.1 mL/L (chronic); score 4 if not used	4	No (-4)
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	
Adequate number per replicate/appropriate cell density	2	Too many (-2)
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	
Alkalinity within organism tolerance and/or dilution water specifications	2	
Dissolved oxygen $\geq 60\%$	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to $\pm 1^\circ\text{C}$ (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	
pH within organism tolerance and/or dilution water	2	

Comments on Draft Cypermethrin Criteria

	Edwards et al. 1981	<i>Daphnia magna</i> (Tests 1 & 2)
Parameter	Value	Comment
specifications		
Photoperiod and light intensity within organism tolerance and/or test guidance	2	
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	
LOEC response reasonable compared to control	1	
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	
Total	100	(-11)

Jaber 1981b

Toxicity Data Summary Relevance: 100

Reliability: 87

Parameter	Jaber 1981b Value	<i>Pimephales promelas</i> Comment
Test method cited	EPA 1972	
Phylum	Chordata	
Class	Osteichthyes	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Pimephales</i>	
Species	<i>promelas</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Larvae	
Source of organisms	Cultured in-house	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	720 h post-hatch	
Data for multiple times?	No	
Effect 1	Survival	
Control response 1	97% (Both controls)	
Temperature	25-26°C	
Test type	Flow through	
Photoperiod/light intensity	12 L:12 D	
Dilution water	Well water	
pH	6.9-7.4	
Hardness	25-40 mg/L CaCO ₃	
Alkalinity	NR	
Conductivity	120-170 µmhos/cm	
Dissolved Oxygen	8.2-8.4 mg/L	
Feeding	Brine shrimp (2-3x/day)	
Purity of test substance	91.5%	
Concentrations measured?	Yes	
Measured is what % of nominal?	~65%	
Toxicity values calculated based on nominal or measured concentrations?	Measured	
Chemical method documented?	Gas liquid chromatography	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	0.031/0.048	2 reps/40 per rep
Concentration 2 Nom/Meas (µg/L)	0.062/0.045	2 reps/40 per rep
Concentration 3 Nom/Meas (µg/L)	0.12/0.063	2 reps/40 per rep
Concentration 4 Nom/Meas (µg/L)	0.25/0.14	2 reps/40 per rep
Concentration 5 Nom/Meas (µg/L)	0.50/0.33	2 reps/40 per rep
Control (describe type)	Solvent and Dilution water	2 reps/40 per rep

Comments on Draft Cypermethrin Criteria

	Jaber 1981b	<i>Pimephales promelas</i>
Parameter	Value	Comment
NOEC (µg/L) (indicate calculation method, sig level/p value, and MSD)	0.14	Method: ANOVA/Dunnetts P value: ≤0.05 MSD: NR
LOEC (µg/L) (indicate calculation method and sig level/p value)	0.33	Method: ANOVA/Dunnetts P value: ≤0.05
MATC (GeoMean NOEC, LOEC) (µg/L)	0.21	
% of control at NOEC	91/97=93.8%	
% of control at LOEC	17/97=17.5%	

Reliability points taken off for:

Documentation:

Alkalinity (2), minimum significant difference (2), point estimates (8)
Total 12

Acceptability:

Measured concentrations within 20% of nominal (4), carrier solvent (4), alkalinity (2), minimum significant difference (1), point estimates (3)
Total 14

Jaber 1981b

Rating of relevance/usability of single-species data for derivation of criteria.

	Jaber 1981b	<i>Pimephales promelas</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	Yes
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	91.5%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	

Jaber 1981b

Documentation rating for single-species aquatic laboratory data.

	Jaber 1981b	<i>Pimephales promelas</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	
Measured concentrations	3	
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	NR (-2)
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	
Significance level	2	
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	
Point estimates (i.e., LC50, EC25)	8	NR (-8)
Total	100	(-12)

Jaber 1981b

Acceptability rating for single-species aquatic laboratory data.

	Jaber 1981b	<i>Pimephales promelas</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	No (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	NR (-4)
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	
Alkalinity within organism tolerance and/or dilution water specifications	2	NR (-2)
Dissolved oxygen ≥60%	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to ± 1°C (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	
pH within organism tolerance and/or dilution water specifications	2	

Comments on Draft Cypermethrin Criteria

	Jaber 1981b	<i>Pimephales promelas</i>
Parameter	Value	Comment
Photoperiod and light intensity within organism tolerance and/or test guidance	2	
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	
LOEC response reasonable compared to control	1	
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	NR (-3)
Total	100	(-14)

Garforth 1982

Toxicity Data Summary Relevance: 90

Reliability: 80.5

	Garforth 1982	<i>Daphnia magna</i>
Parameter	Value	Comment
Test method cited	NR	
Phylum	Anthropoda	
Class	Crustacea	
Order	Diplostraca	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	<24-h	
Source of organisms	Cultured in-house	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	504 h	
Data for multiple times?	No	
Effect 1	Survival	
Control response 1	96% (both controls)	
Effect 2	Growth	
Control response 2	4.64 mm (both controls)	
Effect 3	Reproduction	
Control response 3	135/adult (both controls)	
Temperature	18.5-20.2°C	
Test type	Static renewal	
Photoperiod/light intensity	16 L:8 D	
Dilution water	Fitered dechlorinated water	
pH	8.1-8.7	
Hardness	182-208 mg/L CaCO3	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	8.8-11.8 mg/L	
Feeding	Algal cell, beef extract, fish food, glucose & vitamins	
Purity of test substance	>98%	
Concentrations measured?	Yes	
Measured is what % of nominal?	37-60%	Initial & after 24 h only
Toxicity values calculated based on nominal or measured concentrations?	Nominal	
Chemical method documented?	Yes; GLC	
Concentration of carrier (if any) in test solutions	Acetone	
Concentration 1 Nom/Meas (µg/L)	0.003/NR	4 reps/10 per rep

Comments on Draft Cypermethrin Criteria

	Garforth 1982	<i>Daphnia magna</i>
Parameter	Value	Comment
Concentration 2 Nom/Meas (µg/L)	0.01/NR	4 reps/10 per rep
Concentration 3 Nom/Meas (µg/L)	0.03/NR	4 reps/10 per rep
Concentration 4 Nom/Meas (µg/L)	0.1/0.04-0.06	4 reps/10 per rep
Concentration 5 Nom/Meas (µg/L)	0.3/0.11-0.12	4 reps/10 per rep
Control (describe type)	Solvent and Dilution water	4 reps/10 per rep
NOEC (µg/L) (indicate calculation method, sig level/p value, and MSD)	0.1 for all 3 endpoints	Method: ANOVA P value: 0.05 MSD: NR
LOEC (µg/L) (indicate calculation method and sig level/p value)	0.3 for all 3 endpoints	Method: ANOVA P value:0.05
MATC (GeoMean NOEC,LOEC) (µg/L)	0.17 for all 3 endpoints	
% of control at NOEC	94.1-99.8%	
% of control at LOEC	10.5-34.5%	

Documentation:

Measured concentrations (3), alkalinity (2), conductivity (2), minimum significant difference (2), point estimates (8)
Total 17

Acceptability:

Acceptable standard (5), measured concentrations within 20% of nominal (4), carrier solvent (4), alkalinity (2), conductivity (1), random design (2), minimum significant difference (1), point estimates (3)
Total 22

Garforth 1982

Rating of relevance/usability of single-species data for derivation of criteria.

	Garforth 1982	<i>Daphnia magna</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used	10	NR (-10)
Endpoint linked to survival/growth/reproduction	15	Yes
Freshwater	15	Yes
Chemical \geq 80% pure	15	>98%
Species is in a family that resides in North America	15	Yes
Toxicity value calculated or calculable (e.g., LC50)	15	Yes
Controls		
Described (i.e., solvent, dilution water)	7.5	Yes
Response reported and meets acceptability requirements	7.5	Yes
Total	100	(-10)

Garforth 1982

Documentation rating for single-species aquatic laboratory data.

	Garforth 1982	<i>Daphnia magna</i>
Parameter	Value	Comment
Results published or in signed, dated format	6	
Exposure duration	12	
Control type	8	
Organism information (i.e., age, life stage)		
Source	5	
Age/life stage/size/growth phase	5	
Chemical		
Grade or purity	5	
Analytical method (if measured)	4	
Nominal concentrations	3	
Measured concentrations	3	NR (-3)
Exposure type	5	
Dilution water source	3	
Hardness	2	
Alkalinity	2	NR (-2)
Dissolved oxygen	4	
Temperature	4	
Conductivity	2	NR (-2)
pH	3	
Photoperiod and/or light intensity (plant studies must include intensity)	3	
Statistics		
Methods identified	5	
Hypothesis tests		
Statistical significance	2	
Significance level	2	
Minimum significant difference	2	NR (-2)
% of control at NOEC and/or LOEC	2	
Point estimates (i.e., LC50, EC25)	8	NR (-8)
Total	100	(-17)

Garforth 1982

Acceptability rating for single-species aquatic laboratory data.

	Garforth 1982	<i>Daphnia magna</i>
Parameter	Value	Comment
Acceptable standard (or equivalent) method used (e.g., ASTM, USEPA, OECD, APHA)	5	NR (-5)
Test was of appropriate duration	2	
Control		
Appropriate (e.g., solvent control included, if carrier was used)	6	
Response within test guidance	9	
Chemical		
Purity >80% pure	10	
Measured concentrations within 20% of nominal	4	No (-4)
Concentrations do not exceed 2x water solubility	4	
Carrier solvent ≤0.5 mL/L (acute); ≤0.1 mL/L (chronic); score 4 if not used	4	NR (-4)
Organisms		
Appropriate size/age/growth phase	3	
No prior contaminant exposure	4	
Organisms randomly assigned to test containers	1	
Adequate number per replicate/appropriate cell density	2	
Organisms fed 2 h before solution renewal or not fed in acute tests; fed appropriately in chronic tests	3	
Organisms properly acclimated and disease-free prior to testing	1	
Exposure type and renewal frequency appropriate to chemical	2	
Dilution water source acceptable	2	
Hardness within organism tolerance and/or dilution water specifications	2	
Alkalinity within organism tolerance and/or dilution water specifications	2	NR (-2)
Dissolved oxygen ≥60%	6	
Temperature within organism tolerance (3 pts) and/or test guidance and held to ± 1°C (3 pts)	6	
Conductivity within organism tolerance and/or dilution water specifications	1	NR (-1)
pH within organism tolerance and/or dilution water specifications	2	

Comments on Draft Cypermethrin Criteria

	Garforth 1982	<i>Daphnia magna</i>
Parameter	Value	Comment
Photoperiod and light intensity within organism tolerance and/or test guidance	2	
Statistics		
Adequate number of concentrations	3	
Random or random block design employed	2	NR (-2)
Adequate replication	2	
Appropriate spacing between concentrations (dilution factor ≥ 0.3)	2	
Appropriate statistical method used	2	
Hypothesis tests		
Minimum significant difference (MSD) below recommended upper bound	1	NR (-1)
NOEC response reasonable compared to control	1	
LOEC response reasonable compared to control	1	
Point estimates		
LC/EC values calculable (i.e., no < or > results)	3	NR (-3)
Total	100	(-22)