National Institute
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**Letter report 601716008/2008**
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# Environmental risk limits for fenoxycarb

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This investigation has been performed by order and for the account of Directorate-General for Environmental Protection, Directorate for Soil, Water and Rural Area (BWL), within the framework of the project 'Standard setting for other relevant substances within the WFD'.

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# Rapport in het kort

## Environmental risk limits for fenoxycarb

Dit rapport geeft milieurisicogrenzen voor het insecticide fenoxycarb in water. Milieurisicogrenzen zijn de technisch-wetenschappelijke advieswaarden voor de uiteindelijke milieukwaliteitsnormen in Nederland. De milieurisicogrenzen zijn afgeleid volgens de methodiek die is voorgeschreven in de Europese Kaderrichtlijn Water. Hierbij is gebruikgemaakt van de beoordeling in het kader van de Europese toelating van gewasbeschermingsmiddelen (Richtlijn 91/414/EEG), aangevuld met gegevens uit de openbare literatuur.

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# 1 Introduction

## 1.1 Background and scope of the report

In this report, environmental risk limits (ERLs) for surface water are derived for the insecticide fenoxycarb. The derivation is performed within the framework of the project 'Standard setting for other relevant substances within the WFD', which is closely related to the project 'International and national environmental quality standards for substances in the Netherlands' (INS). Fenoxycarb is part of a series of 25 pesticides that appeared to have a high environmental impact in the evaluation of the policy document on sustainable crop protection ('Tussenevaluatie van de nota Duurzame Gewasbescherming'; MNP, 2006) and/or were selected by the Water Boards ('Unie van Waterschappen'; project 'Schone Bronnen'; http://www.schonebronnen.nl/).

The following ERLs are considered:

- Maximum Permissible Concentration (MPC) – the concentration protecting aquatic ecosystems and humans from effects due to long-term exposure
- Maximum Acceptable Concentration ($MAC_{eco}$) – the concentration protecting aquatic ecosystems from effects due to short-term exposure or concentration peaks.
- Serious Risk Concentration ($SRC_{eco}$) – the concentration at which possibly serious ecotoxicological effects are to be expected.

More specific, the following ERLs can be derived depending on the availability of data and characteristics of the compound:

| | |
|---|---|
| $MPC_{eco, water}$ | MPC for freshwater based on ecotoxicological data (direct exposure) |
| $MPC_{sp, water}$ | MPC for freshwater based on secondary poisoning |
| $MPC_{hh\ food, water}$ | MPC for fresh and marine water based on human consumption of fishery products |
| $MPC_{dw, water}$ | MPC for surface waters intended for the abstraction of drinking water |
| $MAC_{eco, water}$ | MAC for freshwater based on ecotoxicological data (direct exposure) |
| $SRC_{eco, water}$ | SRC for freshwater based on ecotoxicological data (direct exposure) |
| $MPC_{eco, marine}$ | MPC for marine water based on ecotoxicological data (direct exposure) |
| $MPC_{sp, marine}$ | MPC for marine water based on secondary poisoning |
| $MAC_{eco, marine}$ | MAC for marine water based on ecotoxicological data (direct exposure) |

## 1.2 Status of the results

The results presented in this report have been discussed by the members of the scientific advisory group for the INS-project (WK-INS). It should be noted that the Environmental Risk Limits (ERLs) in this report are scientifically derived values, based on (eco)toxicological, fate and physico-chemical data. They serve as advisory values for the Dutch Steering Committee for Substances, which is appointed to set the Environmental Quality Standards (EQSs). ERLs should thus be considered as proposed values that do not have any official status.

# 2 Methods

The methodology for the derivation of ERLs is described in detail by Van Vlaardingen and Verbruggen (2007), further referred to as the 'INS-Guidance'. This guidance is in accordance with the guidance of the Fraunhofer Institute (FHI; Lepper, 2005).

The process of ERL-derivation contains the following steps: data collection, data evaluation and selection, and derivation of the ERLs on the basis of the selected data.

## 2.1 Data collection

In accordance with the WFD, data of existing evaluations were used as a starting point. For fenoxycarb, the evaluation report prepared within the framework of EU Directive 91/414/EC (Draft Assessment Report, DAR) was consulted (EC, 2007; further referred to as DAR). An on-line literature search was performed on TOXLINE (literature from 1985 to 2001) and Current Contents (literature from 1997 to 2007). In addition to this, all potentially relevant references in the RIVM e-tox base and EPA's ECOTOX database were checked.

## 2.2 Data evaluation and selection

For substance identification, physico-chemical properties and environmental behaviour, information from the List of Endpoints of the DAR was used. When needed, additional information was included according to the methods as described in Section 2.1 of the INS-Guidance. Information on human toxicological threshold limits and classification was also primarily taken from the DAR.

Ecotoxicity studies (including bird and mammal studies) were screened for relevant endpoints (i.e. those endpoints that have consequences at the population level of the test species). All ecotoxicity and bioaccumulation tests were then thoroughly evaluated with respect to the validity (scientific reliability) of the study. A detailed description of the evaluation procedure is given in the INS-Guidance (see Section 2.2.2 and 2.3.2). In short, the following reliability indices were assigned:

- Ri 1: Reliable without restriction
  'Studies or data … generated according to generally valid and/or internationally accepted testing guidelines (preferably performed according to GLP) or in which the test parameters documented are based on a specific (national) testing guideline … or in which all parameters described are closely related/comparable to a guideline method.'
- Ri 2: Reliable with restrictions
  'Studies or data … (mostly not performed according to GLP), in which the test parameters documented do not totally comply with the specific testing guideline, but are sufficient to accept the data or in which investigations are described which cannot be subsumed under a testing guideline, but which are nevertheless well documented and scientifically acceptable.'
- Ri 3: Not reliable
  'Studies or data … in which there are interferences between the measuring system and the test substance or in which organisms/test systems were used which are not relevant in relation to the exposure (e.g., unphysiologic pathways of application) or which were carried out or generated according to a method which is not acceptable, the documentation of which is not sufficient for an assessment and which is not convincing for an expert judgment.'

- Ri 4: Not assignable
  'Studies or data … which do not give sufficient experimental details and which are only listed in short abstracts or secondary literature (books, reviews, etc.).'

All available studies were summarised in data-tables, that are included as Appendices to this report. These tables contain information on species characteristics, test conditions and endpoints. Explanatory notes are included with respect to the assignment of the reliability indices.

With respect to the DAR, it was chosen not to re-evaluate the underlying studies. In principle, the endpoints that were accepted in the DAR were also accepted for ERL-derivation with Ri 2, except in cases where the reported information was too poor to decide on the reliability or when there was reasonable doubt on the validity of the tests. This applies especially to DARs prepared in the early 1990s, which do not always meet the current standards of evaluation and reporting.

In some cases, the characteristics of a compound (i.e. fast hydrolysis, strong sorption, low water solubility) put special demands on the way toxicity tests are performed. This implies that in some cases endpoints were not considered reliable, although the test was performed and documented according to accepted guidelines. If specific choices were made for assigning reliability indices, these are outlined in Section 3.3 of this report.

Endpoints with Ri 1 or 2 are accepted as valid, but this does not automatically mean that the endpoint is selected for the derivation of ERLs. The validity scores are assigned on the basis of scientific reliability, but valid endpoints may not be relevant for the purpose of ERL-derivation (e.g. due to inappropriate exposure times or test conditions that are not relevant for the Dutch situation).

After data collection and validation, toxicity data were combined into an aggregated data table with one effect value per species according to Section 2.2.6 of the INS-Guidance. When for a species several effect data were available, the geometric mean of multiple values for the same endpoint was calculated where possible. Subsequently, when several endpoints were available for one species, the lowest of these endpoints (per species) is reported in the aggregated data table.

## 2.3 Derivation of ERLs

For a detailed description of the procedure for derivation of the ERLs, reference is made to the INS-Guidance. With respect to the selection of the final $MPC_{water}$ some additional comments should be made:

### 2.3.1 Drinking water

The INS-Guidance includes the MPC for surface waters intended for the abstraction of drinking water ($MPC_{dw, water}$) as one of the MPCs from which the lowest value should be selected as the general $MPC_{water}$ (see INS-Guidance, Section 3.1.6 and 3.1.7). According to the proposal for the daughter directive Priority Substances, however, the derivation of the AA-EQS (= MPC) should be based on direct exposure, secondary poisoning, and human exposure due to the consumption of fish. Drinking water was not included in the proposal and is thus not guiding for the general MPC value. The exact way of implementation of the $MPC_{dw, water}$ in the Netherlands is at present under discussion within the framework of the "AMvB Kwaliteitseisen en Monitoring Water". No policy decision has been taken yet, and the $MPC_{dw, water}$ is therefore presented as a separate value in this report. The $MPC_{water}$ is thus derived considering the individual MPCs based on direct exposure ($MPC_{eco, water}$), secondary poisoning ($MPC_{sp, water}$) or human consumption of fishery products ($MPC_{hh\ food, water}$); derivation of the latter two is dependent on the characteristics of the compound.

Related to this is the inclusion of water treatment for the derivation of the $MPC_{dw, water}$. According to the INS-Guidance (see Section 3.1.7), a substance specific removal efficiency related to simple water treatment should be derived in case the $MPC_{dw, water}$ is lower than the other MPCs. For pesticides, there is no agreement as yet on how the removal fraction should be calculated, and water treatment is therefore not taken into account. In case no A1 value is set in Directive 75/440/EEC, the $MPC_{dw, water}$ is set to the general Drinking Water Standard of 0.1 µg/L for organic pesticides as specified in Directive 98/83/EC.

# 3 Derivation of environmental risk limits for fenoxycarb

## 3.1 Substance identification, physico-chemical properties, fate and human toxicology

### 3.1.1 Identity

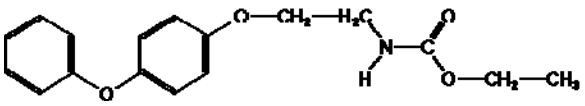

Figure 1. Structural formula of fenoxycarb.

Table 1. Identification of fenoxycarb.

| Parameter | Name or number | Source |
|---|---|---|
| Common/trivial/other name | Fenoxycarb | EC, 2007, Tomlin 2002 |
| Chemical name | Ethyl 2-(4-phenoxyphenoxy)ethylcarba-mate | EC, 2007 |
| CAS number | 79127-80-3 | EC, 2007 |
| EC number | 276-696-7 | |
| SMILES code | CCOC(=O)NCCOc1ccc(Oc2ccccc2)cc1 | U.S.EPA, 2007 |
| Use class | Insecticide | |
| Mode of action | Juvenile hormone analogue | Tomlin, 2002 |
| Authorised in NL | Yes | |
| Annex 1 listing | No | |

### 3.1.2 Physico-chemical properties

Table 2. Physico-chemical properties of fenoxycarb.

| Parameter | Unit | Value | Remark | Reference |
|---|---|---|---|---|
| Molecular mass | [g/mol] | 301.4 | | EC, 2007 |
| Water solubility | [g/L] | 0.0079 | 25 ºC | EC, 2007 |
| p$K_a$ | [-] | n.a. | | EC, 2007 |
| log $K_{OW}$ | [-] | 4.07 | 25 ºC | EC, 2007 |
| log $K_{OC}$ | [-] | 3.26 | | EC, 2007 |
| Vapour pressure | [Pa] | $8.67 \times 10^{-7}$ | 25 ºC | EC, 2007 |
| Melting point | [°C] | 53.6 | | EC, 2007 |
| Boiling point | [°C] | 100.4 | at 65 mPa | EC, 2007 |
| Henry's law constant | [Pa.m$^3$/mol] | $3.3 \times 10^{-5}$ | | EC, 2007 |

n.a. = not applicable.

### 3.1.3 Behaviour in the environment

Table 3. Selected environmental properties of fenoxycarb.

| Parameter | Unit | Value | Remark | Reference |
|---|---|---|---|---|
| Hydrolysis half-life | DT50 [d] | Stable | At pH 3-9 | EC, 2007 |
| Photolysis half-life | DT50 [d] | 4 h-29 d | Artificial sunlight, 3 studies | EC, 2007 |
| Readily biodegradable | | No | | EC, 2007 |
| Degradation in water/sediment systems | DT50 (system) [d] | 4.4-6.0 | | EC, 2007 |
| Relevant metabolites | | None | | EC, 2007 |

### 3.1.4 Bioconcentration and biomagnification

An overview of the bioaccumulation data for fenoxycarb is given in Table 4. Detailed bioaccumulation data for fenoxycarb are tabulated in Appendix 1.

Table 4. Overview of bioaccumulation data for fenoxycarb.

| Parameter | Unit | Value | Remark | Reference |
|---|---|---|---|---|
| BCF (fish) | [L/kg] | 208 | Geometric mean of two values | EC, 2007 |
| BMF | [kg/kg] | 1 | Default value for BCF < 2000 L/kg | Van Vlaardingen en Verbruggen (2007) |

### 3.1.5 Human toxicological threshold limits and carcinogenicity

Fenoxycarb has the following R phrases: R 40. The ADI is 0.06 mg/kg bw. The AOEL is 0.1 mg/kg bw/day. Fenoxycarb is not a known mutagen or a substance known or suspected to affect reproduction (EC, 2007).

## 3.2 Trigger values

This section reports on the trigger values for ERLwater derivation (as demanded in WFD framework).

Table 5. Fenoxycarb: collected properties for comparison to MPC triggers.

| Parameter | Value | Unit | Method/Source | Derived at section |
|---|---|---|---|---|
| Log $K_{p,susp\text{-}water}$ | 2.26 | [-] | $K_{OC} \times f_{OC,susp}$ [1] | $K_{OC}$: 3.1.2 |
| BCF | 208 | [L/kg] | | 3.1.4 |
| BMF | 1 | [kg/kg] | | 3.1.4 |
| Log $K_{OW}$ | 4.07 | [-] | | 3.1.2 |
| R-phrases | R 40, 50/53 | [-] | | |
| A1 value | 1.0 | [µg/L] | Total pesticides | |
| DW Standard | 0.1 | [µg/L] | General value for organic pesticides | |

[1] $f_{OC,susp}$ = 0.1 $kg_{OC}/kg_{solid}$ (EC, 2003).

- Fenoxycarb has a log $K_{p,\ susp\text{-}water} < 3$; derivation of $MPC_{sediment}$ is not triggered.
- Fenoxycarb has a log $K_{p,\ susp\text{-}water} < 3$; expression of the $MPC_{water}$ as $MPC_{susp,\ water}$ is not required.
- Fenoxycarb has a BCF $\geq$ 100; assessment of secondary poisoning is triggered.
- Fenoxycarb has an R 40 classification. Therefore, an $MPC_{water}$ for human health via food (fish) consumption ($MPC_{hh\ food,\ water}$) is required, based on R 40.
- For fenoxycarb, no specific A1 value or Drinking Water Standard is available from Council Directives 75/440, EEC and 98/83/EC, respectively. Therefore, the general Drinking Water Standard for organic pesticides applies.

## 3.3 Toxicity data and derivation of ERLs for water

### 3.3.1 $MPC_{eco,\ water}$ and $MPC_{eco,\ marine}$

An overview of the selected aquatic toxicity data for fenoxycarb is given in Table 6 for freshwater and in Table 7 for the marine environment. Detailed aquatic toxicity data for fenoxycarb are tabulated in Appendix 2.

Table 6. Fenoxycarb: selected freshwater toxicity data for ERL derivation.

| **Chronic**[a] | | **Acute**[a] | |
|---|---|---|---|
| **Taxonomic group** | **NOEC/EC10 (µg/L)** | **Taxonomic group** | **L(E)C50 (µg/L)** |
| Algae | 210[b] | Algae | 1080[d] |
| Crustacea | **0.003** | Crustacea | **520**[e] |
| Crustacea | 0.072[c] | Pisces | 1500 |
| Insecta | 0.75 | Pisces | 880 |
| Pisces | 48 | Pisces | 740 |
| | | Pisces | 660 |

[a] For detailed information see Appendix 2. Bold values are used for ERL derivation.
[b] Geometric mean of 0.38 and 0.12 mg/L for *Pseudokirchneriella subcapitata* (growth rate).
[c] Geometric mean of 0.0000016 and 0.0032 mg/L for *Daphnia magna* (reproduction).
[d] Geometric mean of 1.4 and 0.84 mg/L for *Pseudokirchneriella subcapitata* (growth rate).
[e] Geometric mean of 0.21, 0.52, 0.48, 0.65, 0.49, 0.86, 0.26, 0.5 and 1.5 mg/L for *Daphnia magna* (immobilisation).

Table 7. Fenoxycarb: selected marine toxicity data for ERL derivation.

| **Chronic** [a] | | **Acute** [a] | |
|---|---|---|---|
| **Taxonomic group** | **NOEC/EC10 (mg/L)** | **Taxonomic group** | **L(E)C50 (µg/L)** |
| - | - | Mollusca | 520 |
| | | Crustacea | 350 |
| | | Crustacea | 1900 |
| | | Pisces | 1100 |
| | | Pisces | 860 |

[a] For detailed information see Appendix 2.

#### 3.3.1.1 Treatment of fresh- and saltwater toxicity data

ERLs for freshwater and marine waters should be derived separately. For pesticides, data can only be combined if it is possible to determine with high probability that marine organisms are not more sensitive than freshwater organisms (Lepper, 2005). For fenoxycarb, no marine toxicity data are available and ERLs for the marine compartment cannot be derived.

### 3.3.1.2 Mesocosm and field studies

In the DAR (EC, 2007) an extensive summary of an outdoor mesocosm study (including fish) is given. An abstract is shown in Appendix 3. The treatment level of 0.123 µg a.s./L nominally (mean maximum measured concentration 0.096 µg a.s./L) was the lowest level with effects. It appeared that the cladoceran *Bosmina longirostris* was the most sensitive species, with significant reductions of the population at this level in week 3 after application. **Based on this treatment level, the NOEC was established as the next lower treatment level of 0.026 µg/L (mean measured maximum concentration).** The study is considered to be reliable. However, it cannot be used for MPC derivation because of the rapid disappearance of fenoxycarb from the system ($DT_{50}$ < 0.5 d); this means that there is no continuous exposure during the experiment. This value can be used for the derivation of the MAC value (see Section 3.3.6).
An indoor artificial stream microcosm (see Appendix 3) cannot be used for MPC derivation because of the limited amount of species of one taxon and the fact that the system is not representative for Dutch surface water.

### 3.3.1.3 Derivation of $MPC_{eco, water}$ and $MPC_{eco, marine}$

The base-set for freshwater toxicity data is complete. Chronic NOECs are available for three trophic levels (algae, crustaceans and fish). Thus, with three NOECs available for three trophic levels, an assessment factor of 10 can be used on the lowest NOEC (0.003 µg/L for *Ceriodaphnia dubia*), which results in an $MPC_{eco, water}$ of 0.003 / 10 = 0.0003 µg/L (0.3 ng/L).

For the marine environment not sufficient data are available (base set not complete); therefore an $MPC_{eco, marine}$ is not derived.

## 3.3.2 $MPC_{sp, water}$ and $MPC_{sp, marine}$

Fenoxycarb has a BCF ≥ 100 L/kg, thus assessment of secondary poisoning is triggered.

The lowest $MPC_{oral}$ is 0.89 mg/kg diet for rats (see Table 8). The $MPC_{sp, water}$ is calculated as $MPC_{oral}$ / (BCF x $BMF_1$). Using a BCF of 208 L/kg and a $BMF_1$ of 1 (Table 5) the $MPC_{sp, water}$ is 0.89/ (208 × 1) = 0.0043 mg/L (4.3 µg/L).

Table 8. Fenoxycarb: selected bird and mammal data for ERL derivation.

| Species[a] | Exposure time | Criterion | Effect concentration ($mg/kg_{diet}$) | Assessment factor | $MPC_{oral}$ ($mg/kg_{diet}$) |
|---|---|---|---|---|---|
| Bobwhite quail | 5 d | LC50 | 10000 | 3000 | 3.33 |
| Mallard duck | 5 d | LC50 | 5000 | 3000 | 1.67 |
| Mallard duck | 19 w | NOEC | 160 | 30 | 5.33 |
| Rat | 13 w | NOAEC | 80 | 90 | **0.89** |
| Rat | 13 w | NOAEC | 750 | 90 | 8.33 |
| Mouse | 72 w | NOAEC | 50 | 30 | 1.67 |
| Dog | 1 y | NOAEC | 3200 | 30 | 107 |
| Rat | 2 gen. | NOAEC | 200 | 90 | 2.22 |

[a] For detailed information see Appendix 4. Bold values are used for ERL derivation.

Because toxicity data for marine predators are generally not available, the $MPC_{oral, min}$ as derived above is used as a representative for the marine environment also. To account for the longer food chains in the marine environment, an additional biomagnification step is introduced ($BMF_2$). This factor is the same as given in Table 4. The $MPC_{sp, marine}$ is calculated as $MPC_{oral}$ / (BCF x $BMF_1$ x $BMF_2$) and becomes: 0.89/ (208 × 1 × 1) = 0.0043 mg/L (4.3 µg/L).

### 3.3.3 $MPC_{hh\ food,\ water}$

Derivation of $MPC_{hh\ food,\ water}$ for fenoxycarb is triggered (Table 5). $MPC_{hh\ food}$ is calculated from the ADI (0.06 $mg/kg_{bw}/d$), a body weight of 70 kg and a daily fish consumption of 115 g as $MPC_{hh\ food}$ = 0.1 x 0.06 x 70/0.115 = 3.65 mg/kg (Van Vlaardingen en Verbruggen, 2007). Subsequently the $MPC_{hh\ food,\ water}$ is calculated according to $MPC_{hh\ food,\ water} = 3.65/(BCF_{fish} \times BMF_1) = 3.65/208 = 0.018$ mg/L (18 µg/L).

### 3.3.4 $MPC_{dw,\ water}$

The Drinking Water Standard is 0.1 µg/L. Thus, the $MPC_{dw,water}$ is 0.1 µg/L.

### 3.3.5 Selection of the $MPC_{water}$ and $MPC_{marine}$

The lowest MPC value should be selected as the general MPC. The lowest value of the routes included (see Section 2.3.1) is the $MPC_{eco,\ water}$. Therefore, the $MPC_{water}$ is 0.0003 µg/L.
The $MPC_{marine}$ cannot be derived.

### 3.3.6 $MAC_{eco}$

#### 3.3.6.1 $MAC_{eco,\ water}$

The $MAC_{eco,\ water}$ may be derived from the acute toxicity data. Six short-term values for three trophic levels (fish, *Daphnia*, and algae) are available, fenoxycarb has a potential to bioaccumulate (BCF ≥ 100 L/kg), the mode of action for the tested species is specific, and the most sensitive species (Crustacea, see Table 6 and the mesocosm study) are included in the data set. Therefore, an assessment factor of 100 would be appropriate according the INS-guidance (Van Vlaardingen and Verbruggen, 2007). This factor 100 is applied to the lowest $L(E)C_{50}$, i.e. the $EC_{50}$ for *Daphnia magna*: 0.52 mg/L. Therefore, the $MAC_{eco}$ as derived in first instance from acute toxicity data is 0.52/100 = 0.0052 mg/L (5.2 µg/L).
It should be kept in mind that the mode of action of fenoxycarb (juvenile hormone analogue) requires some time before the toxic action comes to expression. Since also the ratio between acute and chronic toxicity data is very high, it may be doubted whether acute toxicity data are useful to derive a $MAC_{eco}$ value.
An outdoor mesocosm study (total duration 115 days) is available (see Section 3.3.1.2). From this study a NOEC of 0.026 µg/L was established (mean measured maximum concentration). This concentration is lower than the $MAC_{eco,\ water}$ on the basis of acute toxicity data. Fenoxycarb disappeared rapidly from the system ($DT_{50}$ < 0.5 d). Since the effect on the most sensitive organism, *Bosmina longirostris,* occurred already three weeks after application of fenoxycarb and it reflects relatively acute effects in relation to the total duration of the study, it is more appropriate to consider the NOEC from this mesocosm study as $MAC_{eco,\ water}$ rather than the MAC derived from short term toxicity tests. The effects in the mesocosm study are clearly related to the initial short term exposure. The $MAC_{eco,\ water}$ thus becomes 0.026 µg/L. An assessment factor on this value is not deemed necessary because this value is already much lower than the value derived from acute toxicity data.

#### 3.3.6.2 $MAC_{eco,\ marine}$

Because data on marine algae are not available, a comparison between freshwater toxicity data and marine toxicity data cannot be made. Therefore, no $MAC_{eco,\ marine}$ can be derived.

### 3.3.7 $SRC_{eco,\ water}$

Since four long-term NOECs of all required trophic levels are available, the $SRC_{eco,\ water}$ is derived from the geometric mean of all available NOECs with an assessment factor 1. The geometric mean is 0.0011 mg/L. Therefore, the $SRC_{eco,\ water}$ is derived as 0.0011 / 1 = 0.0011 mg/L (1.1 µg/L).

## 3.4 Toxicity data and derivation of ERLs for sediment

The $K_{p,\ susp\text{-}water}$ of fenoxycarb is below the trigger value of 3; therefore, ERLs are not derived for sediment.

# 4 Conclusions

In this report, the risk limits Maximum Permissible Concentration (MPC), Maximum Acceptable Concentration for ecosystems ($MAC_{eco}$), and Serious Risk Concentration for ecosystems ($SRC_{eco}$) are derived for fenoxycarb in water. No risk limits were derived for the marine compartment because not enough data were available. Derivation of ERLs for sediment was not triggered.

The ERLs that were obtained are summarised in the table below. The MPC value that was set for this compound until now, is also presented in this table for comparison reasons. It should be noted that this is an indicative MPC ('ad-hoc MTR'), derived using a different methodology and based on limited data.

Table 9. Derived MPC, $MAC_{eco}$, and SRC values for fenoxycarb.

| ERL | Unit | MPC | $MAC_{eco}$ | SRC |
|---|---|---|---|---|
| Water, old[a] | µg/L | $1.4 \times 10^{-3}$ | - | - |
| Water, new[b] | µg/L | $0.30 \times 10^{-3}$ | 0.026 | 1.1 |
| Drinking water[b] | µg/L | 0.1[c] | - | - |
| Marine | µg/L | n.d.[d] | n.d.[d] | - |

[a] indicative MPC ('ad-hoc MTR'), source: Helpdesk Water http://www.helpdeskwater.nl/emissiebeheer/normen_voor_het/zoeksysteem_normen/

[b] The $MPC_{dw, water}$ is reported as a separate value from the other $MPC_{water}$ values ($MPC_{eco, water}$, $MPC_{sp, water}$ or $MPC_{hh\ food, water}$). From these other $MPC_{water}$ values (thus excluding the $MPC_{dw, water}$) the lowest one is selected as the 'overall' $MPC_{water}$.

[c] provisional value pending the decision on implementation of the $MPC_{dw, water}$, (see Section 2.3.1)

[d] n.d. = not derived due to lack of data

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# Appendix 1. Information on bioconcentration

| Species | Species proper-ties | Test compound | Purity [%] | A | Test type | Test water | pH | Hardness/ Salinity [g/L] | Exp. Time [d] | Temperature [°C] | Exp. concn. [µg/L] | BCF [$L/kg_{w.w.}$] | BCF type | Method | Ri | Notes | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lepomis macrochirus* | | [14C-hydrochinone]-fenoxycarb | 99.5 | Y | F | | 8.0-8.2 | | 28+14 | 22.0-22.3 | 1.5 | 215 | Whole fish | Equilibrium | 2 | 1 | DAR, Volz, 2001 |
| *Lepomis macrochirus* | | [14C-hydrochinone]-fenoxycarb | 99.5 | Y | F | | 8.0-8.2 | | 28+14 | 22.0-22.3 | 15 | 201 | Whole fish | Equilibrium | 2 | 1 | DAR, Volz, 2001 |

1 Based on parent compound in fish and water, normalised to 6% fat.

# Appendix 2. Detailed aquatic toxicity data

Table A2.1. Acute toxicity of fenoxycarb to freshwater organisms.

| Species | Species properties | A | Test type | Test compound | Purity [%] | Test water | pH | T [°C] | Hardness CaCO3 [mg/L] | Exp. time | Criterion | Test endpoint | Value [mg/L] | Ri | Notes | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **algae** | | | | | | | | | | | | | | | | |
| *Pseudokirchneriella subcapitata* | | Y | S | 25 WG | 25.6 | | | | | 72 h | EbC50 | | 0.82 | 2 | 1,4,19,22 | DAR, Maetzler, 1999 |
| *Pseudokirchneriella subcapitata* | | Y | S | 25 WG | 25.6 | | | | | 72 h | ErC50 | | 1.4 | 2 | 1,4,19,22 | DAR, Maetzler, 1999 |
| *Pseudokirchneriella subcapitata* | | Y | S | 25 WG | 25.6 | | | | | 96 h | 72h-EbC50 | | 0.38 | 2 | 1,4,19,22,23 | DAR, Desjardins et al., 2001 |
| *Pseudokirchneriella subcapitata* | | Y | S | 25 WG | 25.6 | | | | | 96 h | 72h-ErC50 | | 0.84 | 2 | 1,4,19,22,23 | DAR, Desjardins et al., 2001 |
| *Scenedesmus subspicatus* | | Y | S | Fenoxycarb | 96.6 | | | | | 96 h | EbC50 | | 1.1 | 3 | 1,5,6,16 | DAR, Ellgehausen, 1983 |
| *Scenedesmus subspicatus* | | | S | Fenoxycarb | tg | | | | | 96 h | EC50 | | 1.1 | 4* | 1,6,19,25 | PSD, 1997 |
| **Crustacea** | | | | | | | | | | | | | | | | |
| *Daphnia magna* | < 24 h, EPA strain | Y | Sc | Fenoxycarb | 99.6 | am | | 21±1 | | 48 h | EC50 | immobilization | 0.21 | 2 | 1,2,3,4 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, Bayer strain | Y | Sc | Fenoxycarb | 99.6 | am | | 21±1 | | 48 h | EC50 | immobilization | 0.52 | 2 | 1,2,3,4 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, Denmark strain | Y | Sc | Fenoxycarb | 99.6 | am | | 21±1 | | 48 h | EC50 | immobilization | 0.48 | 2 | 1,2,3,4 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, EAUK strain | Y | Sc | Fenoxycarb | 99.6 | am | | 21±1 | | 48 h | EC50 | immobilization | 0.65 | 2 | 1,2,3,4 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, AstraZeneca strain | Y | Sc | Fenoxycarb | 99.6 | am | | 21±1 | | 48 h | EC50 | immobilization | 0.49 | 2 | 1,2,3,4 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, Finland strain | Y | Sc | Fenoxycarb | 99.6 | am | | 21±1 | | 48 h | EC50 | immobilization | 0.86 | 2 | 1,2,3,4 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, NIES strain | Y | Sc | Fenoxycarb | 99.6 | am | | 21±1 | | 48 h | EC50 | immobilization | 0.26 | 2 | 1,2,3,4 | Oda et al., 2007 |
| *Daphnia magna* | | Y | S | Fenoxycarb | 95 | | | | | 48 h | EC50 | immobilization | 0.4 | 3 | 6,7,10,14,17 | DAR, Ellgehausen, 1982 |
| *Daphnia magna* | | Y | S | Fenoxycarb | 95 | | | | | 48 h | NOEC | immobilization | 0.05 | 3 | 6,7,10,14,17 | DAR, Ellgehausen, 1982 |
| *Daphnia magna* | | Y | F | Fenoxycarb | 97.8 | | | | | 48 h | EC50 | immobilization | 0.5 | 2 | 4,5,15 | DAR, Ward and Boeri, 1993f |
| *Daphnia magna* | | Y | F | Fenoxycarb | 97.8 | | | | | 48 h | NOEC | immobilization | 0.26 | 2 | 4,5,15 | DAR, Ward and Boeri, 1993f |
| *Daphnia magna* | | Y | F | Fenoxycarb | | | 8.0-8.3 | 20.6-20.9 | | 48 h | LC50 | immobilization | 0.6 | 4* | 4,15,19,25 | PSD , 1997 |
| *Daphnia magna* | | Y | F | Fenoxycarb | | | 8.0-8.3 | 20.6-20.9 | | 48 h | NOEC | immobilization | 0.26 | 4* | 4,15,19,25 | PSD , 1997 |
| *Daphnia magna* | | | S | Fenoxycarb | | | | | | 48 h | EC50 | immobilization | 0.4 | 3 | 7,10,19 | PSD , 1997 |
| *Daphnia magna* | | Y | S | Fenoxycarb | 25.6 | | | | | 48 h | EC50 | immobilization | 1.5 | 2 | 1,19,20,21 | DAR, Maetzler, 2000 |
| *Daphnia magna* | | Y | S | Fenoxycarb | 25.6 | | | | | 48 h | NOEC | immobilization | 0.49 | 2 | 1,19,20,21 | DAR, Maetzler, 2000 |
| **Pisces** | | | | Fenoxycarb | | | | | | | | | | | | |
| *Cyprinus carpio* | | Y | S | Fenoxycarb | | | | | | 96 h | LC50 | mortality | 5.9 | 3 | | DAR, Bathe, 1982b |
| *Cyprinus carpio* | | Y | S | Fenoxycarb | | | | | | 96 h | NOEC | mortality | <4.8 | 3 | | DAR, Bathe, 1982b |
| *Cyprinus carpio* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | LC50 | mortality | 1.5 | 2 | 1,4,5 | DAR, Bathe, 1982b |
| *Cyprinus carpio* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | NOEC | mortality | 0.68 | 2 | 1,4,5 | DAR, Ward and Boeri, 1993c |
| *Cyprinus carpio* | 3.0 mg, 76 mm | N | S | Fenoxycarb | tg | | 7.3-7.6 | 20-22 | | 96 h | LC50 | mortality | 10.3 | 3 | 5,7,10,19 | PSD , 1997 |
| *Cyprinus carpio* | 3.0 mg, 76 mm | N | S | Fenoxycarb | tg | | 7.3-7.6 | 20-22 | | 96 h | NOEC | mortality | <6 | 3 | 5,7,10,19 | PSD , 1997 |
| *Cyprinus carpio* | 0.62 g, 35 mm | Y | F | Fenoxycarb | tg | | 6.7-7.4 | 22±2 | | 96 h | LC50 | mortality | 1.5 | 4* | 1,4,5,19,25 | PSD , 1997 |
| *Cyprinus carpio* | 0.62 g, 35 mm | Y | F | Fenoxycarb | tg | | 6.7-7.4 | 22±2 | | 96 h | NOEC | mortality | 0.46 | 4* | 1,4,5,19,25 | PSD , 1997 |
| *Gambusia affinis* | 3-5 d old | N | S | Pictyl EC | nw | | | 27±0.5 | | 48 h | LC50 | Mortality | 1.05 | 3 | 26 | Tietze et al.,1991 |
| *Ictalurus punctatus* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | LC50 | mortality | 0.88 | 2 | 1,4,5 | DAR, Ward and Boeri, 1993d |
| *Ictalurus punctatus* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | NOEC | mortality | 0.49 | 2 | 1,4,5 | DAR, Ward and Boeri, 1993d |
| *Ictalurus punctatus* | | Y | F | Fenoxycarb | | | 7.1-7.4 | 21.1-22.4 | | 96 h | LC50 | mortality | 0.88 | 4* | 1,4,5,19,25 | PSD , 1997 |
| *Ictalurus punctatus* | | Y | F | Fenoxycarb | | | 7.1-7.4 | 21.1-22.4 | | 96 h | NOEC | mortality | 0.49 | 4* | 1,4,5,19,25 | PSD , 1997 |

| Species | Species properties | A | Test type | Test compound | Purity [%] | Test water | pH | T [°C] | Hardness CaCO3 [mg/L] | Exp. time | Criterion | Test endpoint | Value [mg/L] | Ri | Notes | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lepomis macrochirus* | | Y | S | Fenoxycarb | | | | | | 96 h | LC50 | mortality | 2.9 | 3 | 5,6,7,8,9 | DAR, Bathe, 1982a |
| *Lepomis macrochirus* | | Y | S | Fenoxycarb | | | | | | 96 h | NOEC | mortality | 1 | 3 | 5,6,7,8,9 | DAR, Bathe, 1982a |
| *Lepomis macrochirus* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | LC50 | mortality | 0.74 | 2 | 4,5,12 | DAR, Ward and Boeri, 1993b |
| *Lepomis macrochirus* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | NOEC | mortality | 0.42 | 2 | 4,5,12 | DAR, Ward and Boeri, 1993b |
| *Lepomis macrochirus* | 4.2 g, 63 mm | Y | S | Fenoxycarb | tg | | 7.3-7.7 | 20-22 | | 96 h | LC50 | mortality | 2.9 | 4* | 5,19,24,25 | PSD, 1997 |
| *Lepomis macrochirus* | 4.2 g, 63 mm | Y | S | Fenoxycarb | tg | | 7.3-7.7 | 20-22 | | 96 h | NOEC | mortality | <1 | 4* | 5,19,24,25 | PSD, 1997 |
| *Lepomis macrochirus* | 0.55 g, 37 mm | Y | F | Fenoxycarb | tg | | 7.3-7.6 | 21.8-22.3 | | 96 h | LC50 | mortality | 0.74 | 4* | 4,5,12,19,25 | PSD, 1997 |
| *Lepomis macrochirus* | 0.55 g, 37 mm | Y | F | Fenoxycarb | tg | | 7.3-7.6 | 21.8-22.3 | | 96 h | NOEC | mortality | 0.42 | 4* | 4,5,12,19,25 | PSD, 1997 |
| *Oncorhynchus mykiss* | | N | S | Fenoxycarb | 97 | | | | | 96 h | LC50 | mortality | 1.6 | 3 | 5,6 | DAR, Buchanan and Pell, 1980 |
| *Oncorhynchus mykiss* | | N | S | Fenoxycarb | 97 | | | | | 96 h | NOEC | mortality | <0.5 | 3 | 5,6 | DAR, Buchanan and Pell, 1980 |
| *Oncorhynchus mykiss* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | LC50 | mortality | 0.66 | 2 | 4,5,12 | DAR, Ward and Boeri, 1993a |
| *Oncorhynchus mykiss* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | NOEC | mortality | 0.26 | 2 | 4,5,12 | DAR, Ward and Boeri, 1993a |
| *Oncorhynchus mykiss* | | Y | S | Fenoxycarb | 25.6 | | | | | 96 h | LC50 | mortality | 3.4 | 3 | 1,4,10,18,19 | DAR, Pfeifle, 1999 |
| *Oncorhynchus mykiss* | | Y | S | Fenoxycarb | 25.6 | | | | | 96 h | NOEC | mortality | <1.0 | 3 | 1,4,10,18,19 | DAR, Pfeifle, 1999 |
| *Oncorhynchus mykiss* | 4.0 g | N | S | Fenoxycarb | tg | | 7.2-7.5 | 12-13 | | 96 h | LC50 | mortality | 1.6 | 4* | 5,6,19,25 | PSD , 1997 |
| *Oncorhynchus mykiss* | 4.0 g | N | S | Fenoxycarb | tg | | 7.2-7.5 | 12-13 | | 96 h | NOEC | mortality | <0.5 | 4* | 5,6,19,25 | PSD , 1997 |
| *Oncorhynchus mykiss* | 0.24 g, 31 mm (end of test) | Y | F | Fenoxycarb | tg | | 7.4 | 12±1 | | 96 h | LC50 | mortality | 0.66 | 4* | 4,5,12,19,25 | PSD , 1997 |
| *Oncorhynchus mykiss* | 0.24 g, 31 mm (end of test) | Y | F | Fenoxycarb | tg | | 7.4 | 12±1 | | 96 h | NOEC | mortality | 0.26 | 4* | 4,5,12,19,25 | PSD , 1997 |

**NOTES**

1 According to OECD protocols.
2 Dimethylformamid used as solvent in concentration <0.01 %. Solvent control conducted, but no information about solvent control mortality.
3 Glass jars were tightly closed with Teflon cups to minimize volatilization.
4 Test result based on measured concentrations.
5 Acetone used as solvent.
6 Test result based on nominal concentrations.
7 According to EPA-660/3-75-009 (1975).
8 Measured concentrations represented 85-157 % of nominal after 2 hours, 61-99 % after 48 h and 54-75 % after 96 h.
9 Purity is not clear; it is also not clear if results are reported in mg/L formulation or mg/L active ingredient
10 Test result and/or some test concentrations above solubility limits.
11 Measured concentrations represented 45-131 % of nominal after 2 hours, 23-45 % after 48 h and 13-37 % after 96 h.
12 According EPA 72-1.
13 According EPA 72-3.
14 Ethanol used as solvent.
15 According to EPA 72-2.
16 Measured concentrations represented 20-120 % of nominal.
17 Measured concentrations represented 59-280 % of nominal.
18 According EEC-C.1.
19 Results are reported in active ingredient.
20 According EEC-C.2.
21 Measured concentrations represented 85-93 % of nominal.
22 According EEC-C.3.
23 According to OPPTS 850.5400.
24 Not clear if results are based on nominal or measured concentrations.
25 Seems to be the same study as from DAR, but citation is not mentioned.
26 Test substance added in acetone, ca. 1600 mg/L. Acetone concentration too high.

Table A2.2. Acute toxicity of fenoxycarb to marine organisms.

| Species | Species properties | A | Test type | Test compound | Purity [%] | Test water | pH | T [°C] | Hardness CaCO3 [mg/L] | Exp. time | Criterion | Test endpoint | Value [mg/L] | Ri | Notes | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mollusca** | | | | | | | | | | | | | | | | |
| *Crassostrea virginica* | | N | S | Fenoxycarb | 96.3 | | 7.8-7.9 | 20 | 27-30 | 48 h | LC50 | mortality | 0.15 | 3 | 7,8,10 | DAR, Simon, 1985 |
| *Crassostrea virginica* | | N | S | Fenoxycarb | 96.3 | | 7.8-7.9 | 20 | 27-30 | 48 h | NOEC | mortality | 0.1 | 3 | 7,8,10 | DAR, Simon, 1985 |
| *Crassostrea virginica* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | EC50 | mortality | 0.52 | 2 | 11,12,13 | DAR, Ward and Boeri, 1993h |
| *Crassostrea virginica* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | NOEC | mortality | 0.18 | 2 | 11,12,13 | DAR, Ward and Boeri, 1993h |
| **Crustacea** | | | | | | | | | | | | | | | | |
| *Mysidopsis bahia* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | LC50 | mortality | 0.35 | 2 | 11,12,13 | DAR, Ward and Boeri, 1993g |
| *Mysidopsis bahia* | | Y | F | Fenoxycarb | 97.8 | | | | | 96 h | NOEC | mortality | 0.22 | 2 | 11,12,13 | DAR, Ward and Boeri, 1993g |
| *Palaemonetes pugio* | | Y | R | Fenoxycarb | 96.3 | | 7.3-7.9 | 22 | 24-25 | 96 h | LC50 | mortality | 1.9 | 2 | 7,8,9 | DAR, Simon, 1985 |
| *Palaemonetes pugio* | | Y | R | Fenoxycarb | 96.3 | | 7.3-7.9 | 22 | 24-25 | 96 h | NOEC | mortality | 0.73 | 2 | 7,8,9 | DAR, Simon, 1985 |
| *Palaemonetes pugio* | 1 day old larvae | Y | R | Fenoxycarb | tg | nw | | 25 | 20 | 96 h | LC50 | mortality | 0.92 | 3 | 17,18,19 | Key and Scott, 1994 |
| **Pisces** | | | | | | | | | | | | | | | | |
| *Cyprinodon variegatus* | | Y | F | Fenoxycarb | 97.8 | | 7.3-7.6 | 22±1 | | 96 h | LC50 | mortality | 1.1 | 2 | 11,12,13,16 | DAR, Ward and Boeri, 1993e |
| *Cyprinodon variegatus* | | Y | F | Fenoxycarb | 97.8 | | 7.3-7.6 | 22±1 | | 96 h | NOEC | mortality | 0.53 | 2 | 11,12,13,16 | DAR, Ward and Boeri, 1993e |
| *Cyprinodon variegatus* | 0.71 g, 34 mm | Y | F | Fenoxycarb | | | 7.3-7.6 | 22±1 | | 96 h | LC50 | mortality | 1.1 | 4* | 11,12,13,14,15, 16 | PSD, 1997 |
| *Cyprinodon variegatus* | 0.71 g, 34 mm | Y | F | Fenoxycarb | | | 7.3-7.6 | 22±1 | | 96 h | NOEC | mortality | 0.53 | 4* | 11,12,13,14,15, 16 | PSD, 1997 |
| *Fundulus heteroclitus* | adult, 4.2-5.8 cm, 1.99-3.92 g | N | R | Fenoxycarb | tg | nw | 8.03±0.26 | 23.9±1.4 | 20 | 96 h | LC50 | mortality | 2.32 | 4 | 1,3,4,5,6 | Lee and Scott, 1989 |
| *Fundulus heteroclitus* | adult, 4.2-5.8 cm, 1.99-3.92 g | N | R | Fenoxycarb | tg | nw | 8.03±0.26 | 23.9±1.4 | 20 | 96 h | NOEC | mortality | 1.41 | 3 | 1,2,3,4,6 | Lee and Scott, 1989 |
| *Menidia menidia* | | Y | R | Fenoxycarb | 96.3 | | 7.4-7.8 | 21.5-22 | 26-28 | 96 h | LC50 | mortality | 0.86 | 2 | 7,8,9 | DAR, Simon, 1985 |
| *Menidia menidia* | | Y | R | Fenoxycarb | 96.3 | | 7.4-7.8 | 21.5-22 | 26-28 | 96 h | NOEC | mortality | 0.66 | 2 | 7,8,9 | DAR, Simon, 1985 |

**NOTES**

1 Acetone used as solvent in unknown concentration. Solvent control conducted, but no information about solvent control mortality.
2 NOEC calculated as the geometric mean of the highest concentration in which no mortality was observed and the subsequent concentration causing significant toxicity.
3 Test solutions were gently aerated to maintain 60-100% dissolved oxygen saturation.
4 To prevent volatilization the tops of the test vessels were sealed.
5 Different values of LC50 mentioned in article: 2.32 mg/l in the text but 2.14 mg/l in the table.
6 Purity is not clear; it is also not clear if results are reported in mg/L formulation or mg/L active ingredient.
7 According to APHA 1980.
8 According to ASTM 1980.
9 Test result based on measured concentrations, calculated by RMS.
10 Test result based on nominal concentrations.
11 According EPA 72-3.
12 Acetone used as solvent.
13 Test result based on measured concentrations.
14 Results are reported in active ingredient.
15 Seems to be the same study as from DAR, but citation is not mentioned.
16 Tested in seawater.
17 Test result based on nominal concentrations.
18 Acetone used as solvent in concentration of 0.1 %. Solvent control conducted. Control survival was 57.6 % at the end of the study.
19 Measured concentrations were 50.8-116.7 % at 24 h, 54% after 96 h and 12 % after 216 hours.

Table A2.3. Chronic toxicity of fenoxycarb to freshwater organisms.

| Species | Species properties | A | Test type | Test compound | Purity [%] | Test water | pH | T [°C] | Hardness CaCO3 [mg/L] | Exp. time | Criterion | Test endpoint | Value [mg/L] | Ri | Notes | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Algae** | | | | | | | | | | | | | | | | |
| *Pseudokirchneriella subcapitata* | | Y | S | WG25 | 25.6 | | | | | 72 h | NOEbC | | 0.38 | 2 | 19,23,30,31 | DAR, Maetzler, 1999 |
| *Pseudokirchneriella subcapitata* | | Y | S | WG25 | 25.6 | | | | | 72 h | NOErC | | 0.38 | 2 | 19,23,30,31 | DAR, Maetzler, 1999 |
| *Pseudokirchneriella subcapitata* | | Y | S | WG25 | 25.6 | | | | | 96 h | 72h-NOEbC | | 0.064 | 2 | 19,23,30,31,32 | DAR, Desjardins et al., 2001 |
| *Pseudokirchneriella subcapitata* | | Y | S | WG25 | 25.6 | | | | | 96 h | 72h-NOErC | | 0.12 | 2 | 19,23,30,31,32 | DAR, Desjardins et al., 2001 |
| *Scenedesmus subspicatus* | | Y | S | Fenoxycarb | 96.6 | | | | | 96 h | NOEC | | <0.8 | 3 | 19,24,28,29 | DAR, Ellgehausen, 1983 |
| *Scenedesmus subspicatus* | | | S | Fenoxycarb | tg | | | | | 96 h | NOEC | | 0.57 | 3 | 19,24,30 | PSD, 1997 |
| **Crustacea** | | | | | | | | | | | | | | | | |
| *Ceriodaphnia dubia* | < 24 h | N | R | Fenoxycarb | >98 | dtw | | 25±1 | 65 | 35 d | NOEC | population growth rate | 0.000003 | 2 | 8,10,17 | Rose et al., 2002 |
| *Ceriodaphnia dubia* | < 24 h | N | R | Fenoxycarb | >98 | dtw | | 25±1 | 65 | 35 d | NOEC | population growth rate | ≥ 0.00003 | 2 | 9,10,11,12, 17 | Rose et al., 2002 |
| *Ceriodaphnia dubia* | < 24 h | N | R | Fenoxycarb | >98 | dtw | | 25±1 | | 35 d | NOEC | population growth rate | 0.000003 | 4* | 10,13 | Rose et al., 2001 |
| *Ceriodaphnia dubia* | < 24 h | N | R | Fenoxycarb | 96.6 | dtw | 7.0-7.5 | 24±1 | 75-85 | 9 d | IC50 | reproduction | 0.000033 | 2 | 19,20,21,22 | Oda et al., 2005b |
| *Ceriodaphnia dubia* | < 24 h | N | R | Fenoxycarb | 96.6 | dtw | 7.0-7.5 | 24±1 | 75-85 | 9 d | EC50 | production male neonates | 0.0022 | 2 | 19,20,21,22 | Oda et al., 2005b |
| *Ceriodaphnia reticulata* | < 24 h | N | R | Fenoxycarb | 96.6 | dtw | 7.0-7.5 | 24±1 | 75-85 | 14 d | IC50 | reproduction | 0.000032 | 2 | 19,20,21,22 | Oda et al., 2005b |
| *Ceriodaphnia reticulata* | < 24 h | N | R | Fenoxycarb | 96.6 | dtw | 7.0-7.5 | 24±1 | 75-85 | 14 d | EC50 | production of male neonates | 0.0092 | 2 | 19,20,21,22 | Oda et al., 2005b |
| *Daphnia magna* | < 24 h | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | mortality | ≥ 0.045 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 4-6 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | mortality | ≥ 0.045 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 8 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | mortality | ≥ 0.045 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 11 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | mortality | ≥ 0.045 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | < 24 h | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | $F_0$ daphnids growth | ≥ 0.045 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 4-6 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | $F_0$ daphnids growth | ≥ 0.045 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 8 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | $F_0$ daphnids growth | < 0.00017 | 3 | 1,2,3,5,6,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 11 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | $F_0$ daphnids growth | ≥ 0.045 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | < 24 h | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | $F_1$ daphnids growth | ≥ 0.045 | 3 | 1,2,3,4,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 4-6 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | $F_1$ daphnids growth | ≥ 0.045 | 3 | 1,2,3,4,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 8 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | $F_1$ daphnids growth | ≥ 0.045 | 3 | 1,2,3,4,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 11 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | $F_1$ daphnids growth | ≥ 0.045 | 3 | 1,2,3,4,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | < 24 h | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | reproduction | 0.0099 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 4-6 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | reproduction | ≥ 0.045 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 8 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | reproduction | ≥ 0.045 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | 11 days | Y | F | Fenoxycarb | 97.7 | dtw | 8.1-8.7 | 19.2-20.9 | 160-168 | 21 d | NOEC | reproduction | ≥ 0.045 | 3 | 1,2,3,5,7 | Hosmer et al., 1998 |
| *Daphnia magna* | < 24 h | N | R | Fenoxycarb | 96.6 | dtw | 7.0-7.5 | 21±1 | 80 | 21 d | EC50 | production of male neonates | 0.00092 | 2 | 18,19,20,21 | Oda et al., 2005a |
| *Daphnia magna* | < 24 h | N | R | Fenoxycarb | 96.6 | dtw | 7.0-7.5 | 21±1 | 80 | 21 d | NOEC | reproduction | <0.00013 | 2 | 18,19,20 | Oda et al., 2005a |
| *Daphnia magna* | < 24 h, EPA strain | Y | R | Fenoxycarb | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | NOEC | reproduction | <0.00049 | 2 | 19,20,23,25 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, Bayer strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | NOEC | reproduction | <0.00034 | 2 | 19,20,23,25 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, Denmark strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | NOEC | reproduction | <0.00033 | 2 | 19,20,23,25 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, EAUK strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | NOEC | reproduction | <0.00034 | 2 | 19,20,23,25 | Oda et al., 2007 |

| Species | Species properties | A | Test type | Test compound | Purity [%] | Test water | pH | T [°C] | Hardness CaCO3 [mg/L] | Exp. time | Criterion | Test endpoint | Value [mg/L] | Ri | Notes | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Daphnia magna* | < 24 h, AstraZeneca strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | NOEC | reproduction | <0.00045 | 2 | 19,20,23,25 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, Finland strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | NOEC | reproduction | <0.00028 | 2 | 19,20,23,25 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, NIES strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | NOEC | reproduction | <0.00022 | 2 | 19,20,23,25 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, EPA strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | EC50 | production of male neonates | 0.00045 | 3 | 19,20,24,25,27 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, Bayer strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | EC50 | production of male neonates | 0.0032 | 2 | 19,20,24,25,26 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, Denmark strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | EC50 | production of male neonates | 0.0069 | 2 | 19,20,24,25,26 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, EAUK strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | EC50 | production of male neonates | 0.01 | 2 | 19,20,24,25,26 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, AstraZeneca strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | EC50 | production of male neonates | 0.0074 | 2 | 19,20,24,25,26 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, Finland strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | EC50 | production of male neonates | 0.0012 | 3 | 19,20,24,25,27 | Oda et al., 2007 |
| *Daphnia magna* | < 24 h, NIES strain | Y | R | | 99.6 | am | 7.3-8.5 | 21±1 | 250 | 21 d | EC50 | production of male neonates | 0.00057 | 3 | 19,20,24,25,27 | Oda et al., 2007 |
| *Daphnia magna* | ≤ 24 h | N | F | | 93 | | | | | 21 d | NOEC | reproduction | <0.0029 | 3 | 24,28,30,35,36 | DAR, Forbis, 1987a |
| *Daphnia magna* | ≤ 24 h | Y | F | | 99 | | | | | 21 d | NOEC | reproduction | 0.0000016 | 2 | 23,28,33 | DAR, Forbis, 1987b |
| *Daphnia magna* | ≤ 24 h | Y | F | | 99 | | | | | 21 d | NOEC | body length | 0.0000016 | 2 | 23,28,33 | DAR, Forbis, 1987b |
| *Daphnia magna* | ≤ 24 h | Y | F | | 99 | | | | | 21 d | NOEC | survival | >0.000017 | 2 | 23,28,33 | DAR, Forbis, 1987b |
| *Daphnia magna* | < 24 h | Y | F | | 97.7 | | | | | 21 d | NOEC | mortality | ≥ 0.05 | 2 | 3,24,28,33, 37 | DAR, Ward et al., 1995 |
| *Daphnia magna* | < 24 h | Y | F | | 97.7 | | | 20±1 | 160-180 | 21 d | NOEC | reproduction | 0.013 | 2 | 3,24,28,33,37 | DAR, Ward et al., 1995; PSD 1997 |
| *Daphnia magna* | < 24 h | Y | F | | 97.7 | | | | | 21 d | NOEC | time to first brood | 0.0032 | 2 | 3,24,28,33, 37 | DAR, Ward et al., 1995 |
| *Daphnia magna* | 4-6 days | Y | F | | 97.7 | | | | | 21 d | NOEC | time to first brood | 0.0032 | 2 | 3,24,28,33,37 | DAR, Ward et al., 1995 |
| *Daphnia magna* | 8 days | Y | F | | 97.7 | | | | | 21 d | NOEC | time to first brood | 0.0032 | 2 | 3,24,28,33,37 | DAR, Ward et al., 1995 |
| *Daphnia magna* | 11 days | Y | F | | 97.7 | | | | | 21 d | NOEC | time to first brood | 0.0032 | 2 | 3,24,28,33,37 | DAR, Ward et al., 1995 |
| *Daphnia magna* | < 24 h | Y | F | | | | | | | 21 d | NOEC | reproduction | 0.013 | 4* | 3,24,28,33,14 | PSD, 1997 |
| *Moina macrocopa* | < 24 h | N | R | | 96.6 | dtw | 7.0-7.5 | 24±1 | 75-85 | 6 d | IC50 | reproduction | 0.0002 | 2 | 19,20,21,22 | Oda et al., 2005b |
| *Moina macrocopa* | < 24 h | N | R | | 96.6 | dtw | 7.0-7.5 | 24±1 | 75-85 | 6 d | EC50 | production of male neonates | 0.0093 | 2 | 19,20,21,22 | Oda et al., 2005b |
| *Moina micrura* | < 24 h | N | R | | 96.6 | dtw | 7.0-7.5 | 24±1 | 75-85 | 6 d | IC50 | reproduction | 0.000015 | 2 | 19,20,21,22 | Oda et al., 2005b |
| *Moina micrura* | < 24 h | N | R | | 96.6 | dtw | 7.0-7.5 | 24±1 | 75-85 | 6 d | EC50 | production of male neonates | 0.0006 | 2 | 19,20,21,22 | Oda et al., 2005b |
| **Insecta** | | | | | | | | | | | | | | | | |
| *Chironomus riparius* | 2-3 d old, first instar larvae | Y | S | | 97.4 | | | | | 28 d | EC50 | emergence | 0.00107 | 2 | 19,24,34,38,39,40 | DAR, Pfeifle, 2002a |
| *Chironomus riparius* | 2-3 d old, first instar larvae | Y | S | | 97.4 | | | | | 28 d | EC50 | development | 0.00269 | 2 | 19,24,34,38,39,40 | DAR, Pfeifle, 2002a |
| *Chironomus riparius* | 2-3 d old, first instar larvae | Y | S | | 97.4 | | | | | 28 d | NOEC | emergence | 0.00075 | 2 | 19,24,34,38,39,40 | DAR, Pfeifle, 2002a |
| *Chironomus riparius* | 2-3 d old, first instar larvae | Y | S | | 97.4 | | | | | 28 d | NOEC | development | 0.0015 | 2 | 19,24,34,38,39,40 | DAR, Pfeifle, 2002a |
| *Culex quinquefasciatus* | third instar larvae | N | | EC product | 12.5 | dw | | 28±1 | | until adult | NOEC | fecundity | 0.00001 | 4 | 16,24 | Mohsen and Zayia, 1995 |
| *Culex pipiens molestus* | third instar larvae | N | | EC product | 12.5 | dw | | 28±1 | | until adult | NOEC | fecundity | 0.00001 | 4 | 16,24,15 | Mohsen and Zayia, 1995 |
| *Culex quinquefasciatus* | third instar larvae | N | | EC product | 12.5 | dw | | 28±1 | | until adult | NOEC | hatching | 0.00001 | 4 | 24,16 | Mohsen and Zayia, 1995 |
| *Culex quinquefasciatus* | | | | | | | | | | | LOEC | Larval development | 0.00050 | 3 | 41 | Grenier and Grenier, 1993 |
| *Culex pipiens molestus* | third instar larvae | N | | EC product | 12.5 | dw | | 28±1 | | until adult | NOEC | hatching | 0.000005 | 4 | 16, 24,15 | Mohsen and Zayia, 1995 |
| **Pisces** | | | | | | | | | | | | | | | | |
| *Oncorhynchus mykiss* | newly fertilised eggs | Y | F | | 93 | | | | | 2.5 mo | NOEC | body weight/length | <0.062 | 2 | 23,33,34 | DAR, McAllister, 1987 |

| Species | Species properties | A | Test type | Test compound | Purity [%] | Test water | pH | T [°C] | Hardness CaCO3 [mg/L] | Exp. time | Criterion | Test endpoint | Value [mg/L] | Ri | Notes | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Oncorhynchus mykiss* | newly fertilised eyed eggs (<8-hour post fertilisation) | Y | F | | 94.75 | | 7.7-8.1 | 9.1-11.8 | | 3.2 mo | NOEC | body weight/length | 0.048 | 2 | 23,33,34 | DAR, Thompson and Cohle, 1990; PSD 1997 |

**NOTES**

1 Acetone used as solvent in concentration of 0.01 %. Survival of control and solvent control daphnids that were < 24 h and 11 d at the start of the test was 90-100%, control survival for 4-6 d daphnids was 85% (solvent control survival was 90%) and control survival for 8 d daphnids was 85 % (solvent control survival was 80 %).
2 Following the procedure contained in EPA/FIFRA Guideline Number 72-1: U.S. Environmental Protection Agency. 1986. Standard evaluation procedure: *Daphnia magna* life-cycle (21-day renewal) chronic toxicity tests. EPA-540/9-86-141. Washington, DC.
3 The diluter ensuring flow-through conditions was modified so that the concentrations of fenoxycarb in test media were gradually reduced to approximately 50% of initial concentration during the first 10 h and further reduced by approximately 50 % during each successive 10-h period throughout 21-d test (to mimic the reduction of fenoxycarb that occurs following field application to natural waters - half-life ≈ 10 hours).
4 F1 generation daphnids were collected and placed in dilution water without fenoxycarb for 10 to 12 days.
5 Based on initial measured concentrations.
6 Significant difference from controls was detected for daphnids exposed to the lowest concentration; there was no other indication of toxic effects on growth at higher concentrations.
7 Time to first brood of $F_0$ and also $F_1$ daphnids was observed, but no statistical significant differences were shown at the highest tested concentration (0.045 mg/l) comparing to control.
8 Daphnids exposed to fenoxycarb under high food conditions ($15x10^4$ algae/ml).
9 Daphnids exposed to fenoxycarb under low food conditions ($3x10^4$ algae/ml).
10 For the first three broods.
11 For the fourth brood.
12 For the fifth to tenth broods.
13 Same base set of data as Rose et al., 2002.
14 Seems to be the same study as from DAR, but citation is not mentioned.
15 20% mortality in control.
16 Not clear if results are reported in mg/L formulation or mg/L active ingredient.
17 IC20 (in mg/l) was evaluated for fecundity: 0.0000054 for first brood, 0.00000578 for second brood, 0.00000576 for third brood, 0.00001992 for fourth brood, 0.00001869 for ninth brood, 0.00001295 for tenth brood at high food concentration; 0.00000256 for sixth, 0.00001271 for seventh brood at low food concentration.
18 Dimethylformamid used as solvent in concentration <0.01 %. No information about solvent control and its mortality.
19 According to OECD protocols.
20 Glass jars were tightly closed with Teflon cups to minimize volatilization.
21 Neonates were raised for several days and they were examined for sex differentiation by the length and morphology of the first antennae.
22 Ethanol used as solvent in concentration <0.1 %. No information about solvent control and its mortality.
23 Test result based on measured concentrations.
24 Test result based on nominal concentrations.
25 Dimethylformamid used as solvent in concentration <0.01 %. Solvent control conducted, but no information about solvent control mortality.
26 Measured concentrations were >80% of nominal.
27 Measured concentrations were <80% of nominal.
28 Acetone used as solvent.
29 Measured concentrations represented 20-120 % of nominal.
30 Results are reported in active ingredient.
31 According EEC-C.3.
32 According to OPPTS 850.5400.
33 According to EPA 72-4.
34 DMF used as solvent.
35 According to EPA-660/3-75-009.
36 According to ASTM E-47.01.
37 Measured concentrations represented 86-109 % of nominal. Fenoxycarb concentrations fell below the limit of detection within 3-7 days.
38 According to OPPTS 850.1790.
39 Water sediment system.
40 Concentrations fell below the limit of detection.
41 Not sufficient details reported. Exposure time not reported.

Table A2.4. Chronic toxicity of fenoxycarb to marine organisms.

| Species | Species properties | A | Test type | Test compound | Purity [%] | Test water | pH | T [°C] | Hardness CaCO3 [mg/L] | Exp. time | Criterion | Test endpoint | Value [mg/L] | Ri | Notes | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Crustacea** | | | | | | | | | | | | | | | | |
| *Americamysis bahia* | | | | Fenoxycarb | | | | | | | NOEC | mortality | 0.006 | 4 | 7,8 | McKenney, 2005 |
| *Americamysis bahia* | | | | Fenoxycarb | | | | | | | NOEC | reproduction | ≥ 0.043 | 4 | 7,8 | McKenney, 2005 |
| *Americamysis bahia* | | | | Fenoxycarb | | | | | | | NOEC | sex ratio | ≥ 0.043 | 4 | 7,8 | McKenney, 2005 |
| *Americamysis bahia* | | | | Fenoxycarb | | | | | | | NOEC | mortality | ≥ 0.043 | 4 | 7,9 | McKenney, 2005 |
| *Americamysis bahia* | | | | Fenoxycarb | | | | | | | NOEC | reproduction | 0.001 | 4 | 7,9 | McKenney, 2005 |
| *Americamysis bahia* | | | | Fenoxycarb | | | | | | | NOEC | sex ratio | < 0.001 | 4 | 7,9 | McKenney, 2005 |
| *Palaemonetes pugio* | | | | Fenoxycarb | | | | | | | NOEC | embryonic development | ≤ 0.502 | 4 | 7 | McKenney, 2005 |
| *Palaemonetes pugio* | 1 day old larvae | Y | R | Fenoxycarb | tg | nw | | 25 | 20 | 24 d | 96-h LC50 | mortality | 0.92 | 3 | 11,12,6 | Key and Scott, 1994 |
| *Palaemonetes pugio* | 1 day old larvae | Y | R | Fenoxycarb | tg | nw | | 25 | 20 | 24 d | 9-d LC50 | mortality | 0.41 | 3 | 11,12,6 | Key and Scott, 1994 |
| *Palaemonetes pugio* | 1 day old larvae | Y | R | Fenoxycarb | tg | nw | | 25 | 20 | 24 d | 18-d LC50 | mortality | 0.35 | 3 | 11,12,6 | Key and Scott, 1994 |
| *Palaemonetes pugio* | 1 day old larvae | Y | R | Fenoxycarb | tg | nw | | 25 | 20 | 24 d | 24-d LC50 | mortality | 0.35 | 3 | 11,12,6 | Key and Scott, 1994 |
| *Palaemonetes pugio* | 1 day old larvae | Y | R | Fenoxycarb | tg | nw | | 25 | 20 | 24 d | NOEC | mortality | 0.18 | 3 | 11,12,3,6 | Key and Scott, 1994 |
| *Palaemonetes pugio* | 1 day old larvae | Y | R | Fenoxycarb | tg | nw | | 25 | 20 | 24 d | NOEC | postlarvae emergence | <0.018 | 3 | 11,12,3,6 | Key and Scott, 1994 |
| *Palaemonetes pugio* | | | | Fenoxycarb | | | | | | | NOEC | larval development | < 0.01 | 3 | 13 | McKenney et al., 1999 |
| *Rhithropanopeus harrisii* | newly released larvae | Y | R | Fenoxycarb | | nw | | 25 | 20 | from hatch of zoeae to development into megalopae | NOEC | zoeal mortality | 0.091 | 3 | 1,2,4,5 | Cripe et al., 2003 |
| *Rhithropanopeus harrisii* | newly released larvae | Y | R | Fenoxycarb | | nw | | 25 | 20 | from hatch of zoeae to development into megalopae | NOEC | rate of development | ≥ 0.24 | 3 | 1,2,4,5 | Cripe et al., 2003 |
| *Rhithropanopeus harrisii* | newly released larvae | Y | R | Fenoxycarb | | nw | | 25 | 20 | from megalopae to first crab stage | NOEC | megalopal mortality | 0.012 | 3 | 1,2,4,5 | Cripe et al., 2003 |
| *Rhithropanopeus harrisii* | newly released larvae | Y | R | Fenoxycarb | | nw | | 25 | 20 | from megalopae to first crab stage | NOEC | rate of development | 0.012 | 3 | 1,2,4,5 | Cripe et al., 2003 |
| *Rhithropanopeus harrisii* | newly released larvae | Y | R | Fenoxycarb | | nw | | 25 | 20 | entire larval development | NOEC | larval mortality | 0.091 | 3 | 1,2,4,5 | Cripe et al., 2003 |
| *Rhithropanopeus harrisii* | newly released larvae | Y | R | Fenoxycarb | | nw | | 25 | 20 | entire larval development | NOEC | rate of development | 0.012 | 3 | 1,2,4,5 | Cripe et al., 2003 |
| *Rhithropanopeus harrisii* | newly released larvae | N | R | Fenoxycarb | | nw | | 25±1 | 20 | entire larval development | NOEC | growth (weight) | 0.1 | 3 | 5,6,10,11 | Nates and McKenney, 2000 |

**NOTES**

1 According to method described in: Nates, S.F., McKenney Jr., C.L., 2000. Growth, lipid class and fatty acid composition in juvenile mud crabs (*Rhithropanopeus harrisii)* following larval exposure to fenoxycarb, insect juvenile hormone analogue. Comp. Biochem. Physiol. 127C, 317-325.
2 Test result based on measured concentrations. Measured concentrations were > 80 % of nominal.
3 NOEC calculated as the geometric mean of the highest concentration in which no mortality was observed and the subsequent concentration causing significant toxicity.
4 Survival of control zoeae was ≥ 80 % throughout development. Survival of control megalopae was ≥ 89 %.
5 Zoeal stages were exposed to fenoxycarb in glass bowls, megalopal stages were exposed in plastic boxes. Because of the plastic boxes and the high Log Kow an Ri of 3 is given.
6 Measured concentrations were 50.8-116.7 % at 24 h, 54% after 96 h and 12 % after 216 hours.
7 Review.
8 For first generation.
9 For second generation.
10 Acetone used as solvent in concentration of 0.02%. Solvent control conducted, but no information about solvent control mortality.
11 Test result based on nominal concentrations.
12 Acetone used as solvent in concentration of 0.1 %. Solvent control conducted. Control survival was 57.6 % at the end of the study.
13 Not sufficient details reported. Exposure time not reported.

# Appendix 3. Description of mesocosm studies

**Kennedy J.H. (1995).** Source of the summary: DAR (European Commission, 2007)

| | |
|---|---|
| Species/ Population/ Community | Phytoplankton, zooplankton, macroinvertebrates, crayfish, fish, macrophyte coverage and biomass, community metabolism, chlorophyll-a |
| Test method | Outdoor microcosm study, 10-$m^3$ outdoor fibreglass tanks |
| Test substance | Technical grade fenoxycarb, 97.8% |
| Analysed | Y |
| Exposure regime | 1 x or 2 x (28 days interval) with water + soil/water slurry |
| T [°C] | 19-29 |
| pH | 8.6-10 |
| Exp. time | 115 d |
| Criterion | NOEC |
| Test endpoint | population level *Bosmina longirostris* |
| Value [µg/L] | 0.026 |
| GLP | Y |
| Validity | 1 |

**Methods**

*Design and treatment*

The study was conducted in 1993 in Texas, USA, in 24 10-$m^3$ outdoor fibreglass tanks (1.7 m deep, 3.0 m diameter) buried into the ground. Each treatment was assigned to 3 tanks. In October 1992 each tank was lined with clay and about 15 cm of topsoil was added. The tanks were then filled with water containing algae, zooplankton, and other invertebrates. Submergent vascular plants were transplanted into each tank. Each tank was stocked with 40 bluegill sunfish. Prior to fish stocking invertebrate refugia (one/tank), which had been colonised by macro-invertebrates in an on-site pond for 4 weeks, were placed in each tank. Caged crayfish (*Procambarus*) were placed in each tank.
One or two treatments were made. With every treatment fenoxycarb was applied simultaneously in two phases. Eighty percent of the total mass of fenoxycarb was prepared as a solution, the remaining twenty percent was prepared in soil/water slurry. The control enclosures received only soil/water slurry. Immediately after application the tanks were stirred in an attempt to achieve an even distribution of the treatment solution. The nominal treatment rates were 0.014, 0.041, 0.123, 0.370, 1.11, 3.33 and 10.0 µg a.s./L. The microcosms treated with the lower three dose rates (0.014-0.123 µg a.s./L) received a single application (T1; May 1993), whilst those treated at the 4 highest dose rates (0.370-10.0 µg a.s./L) received a second application (T2) at the same dose, 28 days after the first application. Biotic and abiotic parameters were monitored from 6-7 days before the first treatment until 17 weeks later (September 1993).

*Analysis*

Samples from the water column were collected at a regular base. $O_2$, pH, alkalinity, hardness and turbidity were measured 5 days before the first application, and then biweekly beginning two days after the first application.

*Biological parameters*

The following biological parameters were measured:

*Phytoplankton*

The species composition and abundance of phytoplankton and chlorophyll-a content were determined 5 days before the first application, and then biweekly beginning two days after the first application.

*Macrophytes*

Coverage and growth of macrophytes was assessed biweekly.

*Zooplankton*

The species composition and abundance of zooplankton was determined to the lowest level possible in composite water samples collected 5 days before the first application, and then biweekly beginning two days after the first application.

*Macroinvertebrates*

Non-benthic macroinvertebrates colonising artificial substrates were collected 4 days before the first application, and then biweekly beginning 4 days after the first application. Emerging adult insects were collected with floating emergence traps (one per tank), at the same time as artificial substrates. Macroinvertebrates in all samples were identified and enumerated.

*Crayfish*

Carapace width and weight of each crayfish were recorded prior to introduction and biweekly until study end.

*Fish*

Fish mortality and abnormal behaviour were monitored daily from the time of stocking through one week after the second treatment, and fish length and weight were recorded at study end.

*Data analysis*

Results were based on the measured concentrations of the test substance (for justification see section Results; microcosm water). Data were log(a$x$+1) transformed. Univariate statistics using Dunnett's multiple t-test for differences at taxon or parameter level ($p \leq 0.05$; one sided) and to calculate the NOEC. Effects on the diversity of the communities of zooplankton, artificial substrates, Ekman grab samples and emergence trap collections were analysed using the Bray-Curtis Percent Similarity (PS) index. Cluster analysis was performed on the PS values utilising the unweighted pair-group method using arithmetic averages. A non-parametrical statistical technique, utilizing a 'bootstrap' method, was then used to distinguish between statistically significant clusters and clusters that reflect only random variability within a community.

*Procedure for evaluation*

Data were evaluated and classified (classes 1-5B) according to De Jong FMW, Brock TCM, Foekema EM, Leeuwangh P.: Guidance for summarizing of higher Tier studies on aquatic organisms (to be published, 2008).

**Results**

***Meteorological conditions***

138 mm of rain falling between April 8 and September 8. No rain fell in July, and there were 12 days with a maximum air temperature of 37.8°C or higher in June through August.

***Residue analysis***

*Application solutions*

The levels of fenoxycarb in the dissolved and absorbed phase ranged between 84-114% of the theoretical value, except for two samples, but this was probably due to sample inhomogeneity since the measured fenoxycarb levels in the tanks dosed with these two solutions were close to the expected values.

*Microcosm hydrosoil*

Levels were <1 µg/kg except for 2 isolated findings at the highest test dose: 1.7 µg/kg at 1 day after T1 in tank 55 and 1.3 µg/kg at 14 days after T1 in tank 63.

*Microcosm water*

A summary of the main results is shown in Tables 3-1 and 3-2 below. Residue values are not corrected for recoveries. The first order DT50 values were calculated by the author of the report by linear regression analysis on natural-log transformed concentration data versus time after treatment.

Table 3-1 Concentrations of fenoxycarb in microcosm water of the three lowest test doses and 1st order DT50 values for dissipation from the water

| **nominal concn (µg/L) per appln** | 0.014 | | | 0.041 | | | 0.123 | | |
|---|---|---|---|---|---|---|---|---|---|
| **no. of applications** | 1 | | | 1 | | | 1 | | |
| **tank no.** | 51 | 75 | 83 | 62 | 70 | 84 | 53 | 71 | 85 |
| **initial max. concn. (µg/L) after T1** | 0.0079 | 0.0084 | 0.0088 | 0.028 | 0.025 | 0.11 | 0.098 | 0.097 | 0.093 |
| **mean initial max. concn. (µg/L)** | 0.0084 | | | 0.026(A) | | | 0.096 | | |
| **<0.001 µg/L after days (no. of days):** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **1st order DT50 (d)** | 0.33 | 0.28 | 0.30 | 0.20 | 0.22 | 0.15 | 0.23 | 0.26 | 0.22 |
| **$r^2$** | 0.898 | 0.991 | 0.970 | 0.999 | 0.987 | 0.967 | 0.99 | 0.999 | 0.999 |
| **mean DT50 (d)** | 0.30 | | | 0.19 | | | 0.24 | | |

(A) Excluding value for tank 84

Table 3-2 Concentrations of fenoxycarb in microcosm water of the four highest test doses and 1st order DT50 values for dissipation from the water

| **nominal concn (µg/L) per appln** | 0.37 | | | 1.11 | | | 3.33 | | | 10 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **no. of applications** | 2 | | | 2 | | | 2 | | | 2 | | |
| **tank no.** | 54 | 60 | 73 | 52 | 61 | 74 | 50 | 65 | 72 | 55 | 63 | 81 |
| **initial max. concn. (µg/L) after T1** | 0.34 | 0.32 | 0.36 | 1.1 | 1.1 | 1.1 | 3.3 | 3.4 | 3.5 | 12 | 11 | 11 |
| **mean initial max. concn. (µg/L)** | 0.34 | | | 1.1 | | | 3.4 | | | 11 | | |
| **<0.001 µg/L after days (no. of days):** | 5 | 5 | 5 | 5 | 5 | 5 | 14 | 14 | 14 | >28(A) | 28 | 28 |
| **1st order DT50 (d)** | 0.28 | 0.30 | 0.30 | 0.55 | 0.51 | 0.57 | 0.70 | 0.75 | 0.74 | 1.9 | 1.2 | 1.5 |
| **$r^2$** | 0.99 | 0.97 | 0.98 | 0.98 | 0.98 | 0.99 | 0.98 | 0.96 | 0.97 | 0.89 | 0.92 | 0.94 |
| **mean DT50 (d)** | 0.29 | | | 0.54 | | | 0.73 | | | 1.5 | | |
| **initial max. concn. (µg/L) after T2** | 0.24 | 0.30 | 0.27 | 1.1 | 0.82 | 1.1 | 3.2 | 3.0 | 2.8 | 9.9 | 11 | 10 |
| **mean initial max. concn. (µg/L)** | 0.27 | | | 1.0 | | | 3.0 | | | 10 | | |
| **<0.001 g/L after days (no. of days):** | 2 | 7 | 5 | 5 | 7 | 5 | 42 | 28 | 14 | 56 | 56 | 28 |
| **1st order DT50 (d)** | 0.14 | 0.66 | 0.24 | 0.26 | 0.55 | 0.42 | 2.3 | 1.2 | 0.69 | 3.2 | 2.9 | 1.9 |
| **$r^2$** | 0.81 | 0.83 | 0.82 | 0.99 | 0.98 | 1.00 | 0.62 | 0.99 | 0.97 | 0.81 | 0.83 | 0.82 |
| **mean DT50 (d)** | 0.35 | | | 0.41 | | | 1.4 | | | 2.7 | | |

(A) 0.0013 µg/L after 28 days

***Functional parameters***

*Oxygen, temperature, pH, alkalinity, hardness, turbidity*

There were no apparent dose-related differences in any of the above parameters. The NOEC for all physico-chemical parameters was ≥11 µg/L.

*Chlorophyll-a*

Phytoplankton chlorophyll-a concentrations increased during the study. Developments were similar between controls and treatments. The NOEC was ≥ 11 µg/L.

***Structural parameters***

Phytoplankton species richness in the microcosms: up to 296 phytoplankton taxa. Zooplankton species richness in the microcosms: 16 orders including 92 zooplankton taxa. Macroinvertebrate species richness in the microcosms: 6 phyla comprising ≥ 45 families and ≥ 64 genera (with representatives of the phyla of Coelenterates, Platyhelminthes, Nematoda, Annelida, Mollusca, Arthropoda). For artificial substrate samplers, Ekman grab samples and emergence samples separately, the number of species (species richness), total numbers of macroinvertebrates, and 47, 34 and 14 individual families or genera, respectively, were subjected to statistical analysis. Species richness in the microcosms and abundance were sufficiently high to provide valid data.

*Macrophytes*

The dominant taxa were *Potamogeton* and *Chara*. There were no significant differences in the plant biomass between treatments and the controls (NOEC ≥ 11 µg/L).

*Phytoplankton*

No statistically significant effects on total counts of phytoplankton, individual phyla or individual taxa and on species richness (number of taxa) were observed at any sampling time, except for an increase of the number of Pyrrhophyta and its taxon *Gymnodium* spp. 7 weeks after T1 at the highest test dose ($NOEC_{population}$ 3.2 µg a.s./L). This may be an indirect effect of fenoxycarb. The effect class is 2 (classification system according to De Jong et al., to be published, 2008).

*Zooplankton*

In Table 3-3 NOECs are presented for taxa that statistically significant were reduced in numbers. In case the effect was observed at a certain concentration but not at higher concentrations, the effect was considered to be not relevant ("NOEC" not included in the table).

The cladoceran *Bosmina longirostris* was the most sensitive species, with significant reductions of the population levels from 0.096 µg a.s./L in week 3 after T1 ($NOEC_{population}$ 0.026 µg a.s./L, effect class 2). This coincided with a significant increase of rotifers in week 3 (all doses except 1.11 µg a.s./L). Similarity analysis showed that in week 3 and weeks 9 through 13 after T1, the highest dose clustered separately from all other treatments (statistically significant). At study end, there were no apparent differences in community structure between treatment levels ($NOEC_{community}$ 3.2 µg a.s./L, effect class 5A, since recovery period is >8 weeks and full recovery within the test period).

Table 3-3 Statistically significant NOECs (Dunnett's test, $p<0.05$) per sampling date for zooplankton populations (measured treatment levels, µg a.s./L). NOECs based on non-consistent data are not shown. Statistically significant effects (E) on similarity of the communities are based on Bray-Curtis similarity coefficients.

| | **NOEC (µg a.s./L) at sampling week after T1** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **parameter** | **1** | **3** | **5** | **7** | **9** | **11** | **13** | **15** |
| Cladocera | | | | | | | | |
| *Bosmina longirostris* | | 0.026 | | | | | | |
| *Chydoris sphaericus* | | | 3.2 | | | | | |
| *Diaphanosoma brachyurum* | | | | | 3.2 | 3.2 | | |
| Rotatoria | | | | | | | | |
| *Trichocerca pusilla* | | | | 3.2 | | | | |
| Unidentified rotifer | | | | | | | | 3.2 |
| Similarity (Bray-Curtis) | | 3.2 (E) | | | 3.2 (E) | 3.2 (E) | 3.2 (E) | |

*Macroinvertebrates*

In Table 3-4 a summary is presented of consistent statistically significant NOECs (Dunnett's test, $p<0.05$) per sampling date. Criteria for consistency were identical to those applied for zooplankton.

Table 3-4 NOECs (Dunnett's test, p<0.05) per sampling date for macroinvertebrate populations (measured treatment levels, µg a.s./L). Only statistically significant NOECs or effects (E, for similarity) are presented. NOECs based on poor data are not shown.

| | NOEC (µg a.s./L) at sampling week after T1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **parameter** | **1** | **3** | **5** | **7** | **9** | **11** | **13** | **15** |
| Ceratopogonidae larvae | | | | | | | 3.2 | |
| Leptoceridae larvae | | | | | 3.2 | | | |
| Chironominae | | | | 3.2 | | | | |
| Tanypodinae | | | | 3.2 | | | | |
| Chironominae pupae | | | | 1.1 | | | | |
| Hydroptilidae larvae | | | | 1.1 | | | | |
| Emergent insects | | | | | | | | |
| species richness | | | | 3.2 | | | | |
| total abundance | | | | 3.2 | | | | |
| Similarity (Bray-Curtis) | | | | | | | | |
| emergence traps | | 3.2 (E) | | | | | | |

*Crayfish*

No statistically significant effects ($NOEC_{population}$ 11 µg a.s./L).

*Fish*

Fish length and weight were unaffected by the treatment up to the highest test dose ($NOEC_{population}$ 11 µg a.s./L).

**Evaluation**

***Evaluation of the scientific reliability of the field study***

Criteria for a suitable (semi)field study:

1. Does the test system represent a realistic freshwater community? Yes
2. Is the experimental set-up adequate and unambiguous? Not completely. Sampling/monitoring of phytoplankton, macrophytes, zooplankton, and macroinvertebrates was only biweekly, starting 2 or 4 days after application.
3. Is the exposure regime adequately described? Yes
4. Are the investigated endpoints sensitive and in accordance with the working mechanism of the compound? Yes, crustaceans and juvenile insect stages were included.
5. Is it possible to evaluate the observed effects statistically? Yes

***Evaluation of the results of the study***

A summary of the effects according to the classification of De Jong et al. is given in the Table below.

Table 3-5 Summary of the effect classes observed for several endpoints in the indoor microcosm study with fenoxycarb

| Species/group | (Mean) maximum measured concentration [µg as/L] | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0.0084 | 0.026 | 0.096 | 0.31 | 1.1 | 3.2 | 11 |
| Chemico-Physical | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Chlorophyll-a | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Phytoplankton abundance | 1 | 1 | 1 | 1 | 1 | 1 | 2* |
| Macrophytes | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Zooplankton abundance | 1 | 1 | 2 | 2 | 2 | 2 | 5B |
| Zooplankton similarity | 1 | 1 | 1 | 1 | 1 | 1 | 5A |
| Macroinvertebrate abundance | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| Macroinvertebrate similarity | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Crayfish | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Fish | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

* Increase in numbers (possibly an indirect effect)

On the basis of the univariate analysis of the data sets, an overall $NOEC_{microcosm}$ of 0.026 µg a.s./L can be derived from the evaluated microcosm experiment. At the exposure level of 0.096 µg a.s./L and above a statistically significant effect on the abundance of the cladoceran *Bosmina longirostris* was seen in week 3 after T1. Complete recovery was demonstrated within 2 weeks (week 5 after T1; effect class 2). Following the second application of fenoxycarb no such effect was observed.
Considering the fact that the effects on the cladoceran *Bosmina longirostris,* and on Chironominae pupae and Hydroptilidae larvae were one-time events, the NOEAEC of the evaluated microcosm study is 3.2 µg a.s./L.

A summary of endpoints as derived from this study is presented in the Table below.

Table 3-6 Summary of endpoints in the outdoor microcosm study with fenoxycarb, values based on mean maximum measured concentrations.

| Group | NOEC [µg as/L] | NOEAEC [µg as/L] |
|---|---|---|
| Phytoplankton | 3.2* (2 applications at 28 days interval) | |
| Macrophytes | ≥ 11 (2 applications at 28 days interval) | |
| Zooplankton | 0.026 (single application) | 3.2 (2 applications at 28 days interval) |
| Macroinvertebrates | 1.1 (2 applications at 28 days interval) | 3.2 (2 applications at 28 days interval) |
| Crayfish | ≥ 11 (2 applications at 28 days interval) | |
| Fish | ≥ 11 (2 applications at 28 days interval) | |
| Community | 3.2 (2 applications at 28 days interval) | |

* Increase in numbers (possibly an indirect effect)

**Licht, et al., 2003**

| | |
|---|---|
| Species/ Population/ Community | Mayfly larvae, chlorophyll-a |
| Test method | Indoor small artificial streams containing gravel |
| Test substance | fenoxycarb |
| Analysed | Y |
| Exposure regime | Single application |
| T [°C] | Not reported |
| pH | Not reported |
| Exp. time | 98 d |
| Criterion | NOEC |
| Test endpoint | *Rhithrogena semicolorata* |
| Value [µg/L] | 0.5 |
| GLP | Y |
| Validity | 3 |

A poorly described experiment with indoor artificial stream of stainless steel (test bed 3.7 m x 0.5 m) and filled with gravel. On the gravel a layer of algal communities (periphyton, “aufwuchs”) developed. Fenoxycarb was dosed in the pipes in an unspecified way. It disappeared with a DT50 of 1-2 days. The dynamics of chlorophyll-a and dry-weight of the aufwuchs were unaffected by fenoxycarb (0.05-50 µg/L). Mayflies (*Rhithrogena semicolorata and Ephemerella ignata)* were introduced. Effects on *R. semicolorata* were observed at concentrations of 5 µg/L.
Because of the poor description of the experiment and the restricted number of species the test cannot be used for MPC derivation.

**Licht, et al., 2004**

| | |
|---|---|
| Species/ Population/ Community | Mayfly larvae, chlorophyll-a |
| Test method | Indoor small artificial streams containing gravel |
| Test substance | fenoxycarb, 98% |
| Analysed | Y |
| Exposure regime | Single application |
| T [°C] | 13-15 |
| pH | 8.2-9.2 |
| Exp. time | 98 d |
| Criterion | NOEC |
| Test endpoint | *Rhithrogena semicolorata* |
| Value [µg/L] | 0.5 |
| GLP | Y |
| Validity | 2 |

*Description*

A well-described experiment with indoor artificial streams. The streams consisted of stainless steel (test bed 3.7 m x 0.5 m) and were filled with gravel. Charcoal-filtered tap water streamed with 0.2 m/sec and was recycled. Nutrient concentrations were kept constant. The green surface, the so-called aufwuchs (mainly algae, bacteria and some crustaceans), of stones from the Lockwitzbach (near Dresden, Germany) was collected and introduced into the artificial stream. Unglazed tiles were used to establish the dynamics of the aufwuchs. Larvae of *Rhithrogena semicolorata* (a mayfly) were introduced into the artificial streams and into small enclosures placed in the streams. Emerging adults were trapped and dead larvae were counted at the exit filter.

Fenoxycarb (purity 98%) was added to the streams in concentrations of 0 (control), 0.05, 0.5, 5 and 50 µg/L. Total exposure time to fenoxycarb was 98 days. There were no replicate treatments.

Concentrations were measured during the experiment. Initial concentrations were within 15% of nominal concentrations. Fenoxycarb disappeared rapidly from the water phase with an estimated $DT_{50}$ of 1-2 days. Concentrations in the aufwuchs were not measured.

Another mayfly, *Ephemerella ignata*, was introduced 72 days after the fenoxycarb application (at this time no fenoxycarb was detectable in the water).

*Result*

Fenoxycarb had no influence on physico-chemical parameters and on the dynamics of aufwuchs (measured as chlorophyll-a and dry weight). *R. semicolarata* was affected by treatments of 5 and 50 µg/L (NOEC 0.5 µg/L). For the larvae in the stream the LC50 was 3.3 µg/L and for the larvae in the enclosures the LC50 was 2.5 µg/L.

The emergence of *E. ignata* was affected at 50 µg/L. 90% of the imagines showed morphological abnormalities at the abdomen.

*Remark*

Because of the limited amount of species of one taxon the result of this study cannot be used for MPC derivation. Moreover, the system is not considered representative for Dutch surface water (stony water bottom).

# Appendix 4. Detailed bird and mammal toxicity data

| Species | Species properties (age, sex) | Product Substance | Purity [%] | Application route | Vehicle | Test duration | Exposure time | Criterion | Test endpoint | Criterion Oral dosing [mg/kg$_{bw}$/d] | Criterion Diet [mg/kg$_{diet}$] | Ri | Notes | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Birds** | | | | | | | | | | | | | | |
| *Colinus virginianus* | 10 d old | Fenoxycarb | 97.8 | Diet | | 8 d | 5 d | mortality | LC50 | | > 5620 | 2 | | DAR, Campbell and Jaber, 1993 |
| *Colinus virginianus* | 10 d old | Fenoxycarb | 97.8 | Diet | | 8 d | 5 d | body weight | NOEC | | 1780 | 2 | | DAR, Campbell and Jaber, 1993 |
| *Colinus virginianus* | 15 d old | Fenoxycarb | 95 | Diet | | 11 d | 5 d | mortality | LC50 | | 10000 | 2 | | DAR, Roberts et al., 1982c |
| *Colinus virginianus* | 15 d old | Fenoxycarb | 95 | Diet | | 11 d | 5 d | mortality | NOEC | | 5000 | 2 | | DAR, Roberts et al., 1982c |
| *Colinus virginianus* | 29 w old | Fenoxycarb | 94.8 | Diet | | 21 w | 21 w | reproduction | NOEC | | ≥ 400 | 2 | | DAR, Beavers et al., 1990a |
| *Anas platyrhynchos* | 13 d old | Fenoxycarb | 95 | Diet | | 8 d | 5 d | mortality | LC50 | | > 20000 | 2 | | DAR, Roberts et al., 1982d |
| *Anas platyrhynchos* | 13 d old | Fenoxycarb | 95 | Diet | | 8 d | 5 d | body weight | NOEC | | 5000 | 2 | | DAR, Roberts et al., 1982d |
| *Anas platyrhynchos* | 31 w old | Fenoxycarb | 94.8 | Diet | | 19 w | 19 w | reduced hatchability | NOEC | | 160 | 2 | | DAR, Beavers et al., 1990b |
| **Mammals** | | | | | | | | | | | | | | |
| Rat | Albino, male & female | Fenoxycarb | 98 | Diet | | 17 w | 13 w | body weight | NOAEC | | 80 | 2 | | DAR, Buser, 1983 |
| Rat | Tif: RAlf, male & female | Fenoxycarb | 97.6 | Diet | Acetone | 17 w | 13 w | body weight | NOAEC | | 750 | 2 | | DAR, Bachman, 1993 |
| Mouse | Albino, male & female | Fenoxycarb | 98 | Diet | | 13 w | 13 w | body weight | NOEAL | ≥ 900 | ≥ 7470 | 2 | | DAR, Camponovo, 1983 |
| Mouse | Albino, male & female | Fenoxycarb | 97.6 | Diet | | 72 w | 72 w | body weight | NOEAC | | 50 | *2* | 2 | DAR, Bachmann, 1995 |
| Mouse | CD-1 | Fenoxycarb | 96.6 | Diet | | 52 w | 52 w | body weight | NOEAC | | ≥ 420 ♂ | *2* | 2 | DAR, Everett, 1987 |
| Mouse | CD-1 | Fenoxycarb | 96.6 | Diet | | 52 w | 52 w | body weight | NOEAC | | ≥ 320 ♀ | | | DAR, Everett, 1987 |
| Dog | Beagle, male & female | Fenoxycarb | 96.6 | capsule | | 1 year | 1 year | body weight | NOEAL | 80 | 3200 | 2 | | DAR, Keller-Rupp, 1988 |
| Rat | Sprague-Dawley, male & female | Fenoxycarb | 96.6 | Diet | | 2 gen. | | Reproductive effect | NOAEL | 13 | 200 | 2 | 1 | DAR, Barker, 1986 |

1 Exposure starting 80 days before mating.
2 Females

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