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Environmental risk limits for pyrimethanil

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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 pyrimethanil

Dit rapport geeft milieurisicogrenzen voor het fungicide pyrimethanil 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 fungicide pyrimethanil. 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). Pyrimethanil 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) 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 preliminary 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 pyrimethanil, the evaluation report prepared within the framework of EU Directive 91/414/EC (Draft Assessment Report, DAR) was consulted (EC, 2005; 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 ($MPC_{hh\ food, water}$); the need for 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 pyrimethanil

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

3.1.1 Identity

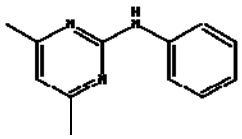

Figure 1. Structural formula of pyrimethanil.

Table 1. Identification of pyrimethanil.

Parameter	Name or number	Source
Common/trivial/other name	Pyrimethanil	EC, 2005
Chemical name	N-(4,6-dimethylpyrimidin-2-yl)aniline	EC, 2005
CAS number	53112-28-0	EC, 2005
EC number	414-220-3	EC, 2005
SMILES code	c1ccccc1Nc2nc(C)cc(C)n2	EC, 2005
Use class	Fungicide	EC, 2005
Mode of action	Unknown	EC, 2005
Authorised in NL	Yes	
Annex I placement	Yes	

3.1.2 Physico-chemical properties

Table 2. Physico-chemical properties of pyrimethanil.

Parameter	Unit	Value	Remark	Reference
Molecular weight	[g/mol]	199.28		EC, 2005
Water solubility	[g/L]	0.121	20 ºC, pH 6.2; at pH 4.2: 0.16	EC, 2005
pK_a	[-]	3.52	20 ºC	EC, 2005
log K_{OW}	[-]	2.84		EC, 2005
log K_{OC}	[-]	2.64		EC, 2005
Vapour pressure	[Pa]	1.1×10^{-3}	20 ºC	EC, 2005
Melting point	[°C]	96.3		EC, 2005
Boiling point	[°C]		not applicable	EC, 2005
Henry's law constant	[Pa.m^3/mol]	3.6×10^{-3}		EC, 2005

3.1.3 Behaviour in the environment

Table 3. Selected environmental properties of pyrimethanil.

Parameter	Unit	Value	Remark	Reference
Hydrolysis half-life	DT50 [d]	970 (extrapolated value) stable	pH 7; pH 5	EC, 2005
Photolysis half-life	DT50 [d]	No photolysis		EC, 2005
Readily biodegradable		No		EC, 2005
Degradation in water/sediment systems	DT50 [d]	40 - 121	system	EC, 2005
Relevant metabolites	2-amino-4,6-dimethylpyrimidin		6% in water after 100 d	EC, 2005

3.1.4 Bioconcentration and biomagnification

An overview of the bioaccumulation data for pyrimethanil is given in Table 4.

Table 4. Overview of bioaccumulation data for pyrimethanil.

Parameter	Unit	Value	Remark	Reference
BCF (fish)	[L/kg]	52	Calculated from log BCF_{fish} = 0.85 x log K_{ow} – 0.70	Veith et al. (1979)
BMF	[kg/kg]	1	Default value for BCF < 2000 L/kg	

3.1.5 Human toxicological threshold limits and carcinogenicity

No human toxicological R phrases are assigned (EC, 2005; http://ecb.jrc.it/esis/, date of search 18 April 2008). The substance is not carcinogenic or mutagenic and has no effects on reproduction. The human health protection assessment is not triggered (EC, 2005).

3.2 Trigger values

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

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

Parameter	Value	Unit	Method/Source	Derived at section
Log $K_{p,susp\text{-}water}$	1.64	[-]	$K_{OC} \times f_{OC,susp}$ [1]	K_{OC}: 3.1.2
BCF	52	[L/kg]		3.1.4
BMF	1 (default)	[kg/kg]		3.1.4
Log K_{OW}	2.84	[-]		3.1.2
R-phrases	R 51/53	[-]		3.1.5
A1 value	1.0	[µg/L]	Total pesticides	
DW standard	0.1	[µg/L]	Generic value for organic pesticides	

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

- Pyrimethanil has a log $K_{p,\ susp\text{-}water} < 3$; derivation of $MPC_{sediment}$ is not triggered.
- Pyrimethanil has a BCF < 100; assessment of secondary poisoning is not triggered.
- Pyrimethanil has no human toxicological classification (only R51/53 with respect to ecotoxicology. Therefore, an MPC_{water} for human health via food (fish) consumption ($MPC_{hh\ food,\ water}$) is not required.
- For pyrimethanil no specific A1 value or Drinking Water Standard are 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 $MPC_{water,\ eco}$ and $MPC_{marine,\ eco}$

An overview of the selected freshwater toxicity data for pyrimethanil is given in Table 6 Note that all values are given in mg/L. Detailed toxicity data for pyrimethanil are tabulated in Appendix 1. There are no marine toxicity data available.

Table 6. Pyrimethanil: selected aquatic freshwater data for ERL derivation.

Chronic[a]		**Acute**[a]	
Taxonomic group	**NOEC/EC10 (mg/L)**	**Taxonomic group**	**L(E)C50 (mg/L)**
Algae	1.18[b]	Algae	8.75[e]
Crustacea	0.53[c]	Macrophyta	46.1
Pisces	**0.07**[d]	Crustacea	**3.32**[f]
Insecta	4.0	Pisces	14.16[g]
		Pisces	35.36

[a] For detailed information see Appendix 1. Bold values are used for ERL derivation.
[b] Geometric mean of 1.0 and 1.4 mg/L for *Pseudokirchneriella subcapitata* (growth rate)
[c] Geometric mean of 0.94 and 0.30 mg/L for *Daphnia magna* (reproduction and mortality)
[d] Most sensitive test: Early Life Stage (parameter: dry weight) for *Oncorhynchus mykiss*
[e] Geometric mean of 5.84 and 13.1 mg/L for *Pseudokirchneriella subcapitata* (growth rate)
[f] Geometric mean of 2.9 and 3.8 mg/L for *Daphnia magna* (immobilisation)
[g] Geometric mean of 10.56 and 19 mg/L for *Oncorhynchus mykiss* (mortality)

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 pyrimethanil, no marine toxicity data are available and ERLs for the marine compartment cannot be derived.

3.3.1.2 Mesocosm and field studies

No mesocosm studies are available.

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

Four long-term NOEC values for fish, *Daphnia*, insects and algae are available. Therefore, the assessment factor is 10. The lowest available NOEC is that obtained from an Early Life Stage test with the fish *Oncorhynchus mykiss*: 0.07 mg/L. The $MPC_{eco,\ water}$ is derived as 0.07/10 = 0.007 mg/L.

In the absence of marine data, the $MPC_{eco,\ marine}$ cannot be derived.

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

Pyrimethanil has a BCF < 100 L/kg, thus assessment of secondary poisoning is not triggered.

3.3.3 $MPC_{hh\ food, water}$

Derivation of $MPC_{,hh\ food,\ water}$ for pyrimethanil is not triggered (Table 5).

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 $MPC_{eco,water}$. The MPC_{water} is 0.007 mg/L (7.0 µg/L).

3.3.6 MAC_{eco}

3.3.6.1 $MAC_{eco, water}$

The $MAC_{eco,\ water}$ is derived from the acute toxicity data. Since four short-term values for three trophic levels (fish, *Daphnia*, insects and algae) are available and there is no potential to bioaccumulate (BCF < 100 L/kg), an assessment factor of 100 is applied to the lowest $L(E)C_{50}$, i.e. the EC_{50} for *Daphnia magna*: 3.32 mg/L. Therefore, the MAC_{eco} is derived as 3.32/100 = 0.0332 mg/L (33.2 µg/L).

3.3.6.2 $MAC_{eco, marine}$

Because no data on saltwater organisms are available, the $MAC_{eco\ marine}$ cannot be derived.

3.3.7 $SRC_{eco, water}$

Since more than three 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 0.645 mg/L. Therefore, the $SRC_{eco,\ water}$ is derived as 0.647/1 = 0.647 mg/L (647 µg/L).

3.4 Toxicity data and derivation of ERLs for sediment

The log $K_{p,\ susp\text{-}water}$ of pyrimethanil 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 pyrimethanil in water. No risk limits were derived for the marine compartment because data were not 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 7. Derived MPC, MAC_{eco}, and SRC values for pyrimethanil.

ERL	Unit	MPC	MAC_{eco}	SRC
Water, old[a]	$\mu g.L^{-1}$	2.9	-	-
Water, new[b]	$\mu g.L^{-1}$	7.0	33.2	647
Drinking water[b]	$\mu g.L^{-1}$	0.1[C]	-	-
Marine	$\mu g.L^{-1}$	n.d.[d]	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. Detailed aquatic toxicity data

Table A1.1. Acute toxicity of pyrimethanil to freshwater organisms.

Species	Species properties	Analysis	Test type	Test compound	Purity [%]	Test water	pH	T [°C]	Hardness $CaCO_3$ [mg/L]	Exp. time	Criterion	Test endpoint	Value [mg/L]	Ri	Notes	Reference
Algae																
Scenedesmus acutus		N	S	Scala	Ca. 40	am		25	n.a.	48h	EC50	Chlorophyl content	23.1	3	1, 3	Verdisson et al., 2001
Pseudokirchneriella subcapitata	10^4 cells	Y	S	Pyrimethanil		am		21.5-22.4	n.a.	96 h	EC50	Biomass (AUG)	1.2	2	2	EC, 2005
Pseudokirchneriella subcapitata	10^4 cells	Y	S	Pyrimethanil		am		21.5-22.4	n.a.	96 h	EC50	Growth rate	5.84	2		EC, 2005
Pseudokirchneriella subcapitata	10^4 cells	Y	S	Scala	37.8	am	6.8-8.9	22-23.9	n.a.	96 h	EC50	Biomass (AUG)	7.1	2	2, 3	EC, 2005
Pseudokirchneriella subcapitata	10^4 cells	Y	S	Scala	37.8	am	6.8-8.9	22-23.9	n.a.	96 h	EC50	Growth rate	13.1	2	3	EC, 2005
Macrophyta																
Lemna minor	Mature fonds	N	S	Scala	Ca. 40	am	6.5	22	n.a.	72 h	EC50	Photosynthetic capacity by fluorescence emission	> 0.1	2	3, 4	Frankart et al., 2002
Lemna minor	Mature fonds	N	S	Scala	Ca. 40	am		25	n.a.	6 d	EC50	Biomass (AUG)	46.1	2	3, 5	Verdisson et al., 2001
Crustacea																
Daphnia magna	< 24 h	Y	S	Pyrimethanil			8.46	20-21		48 h	EC50	Immobilisation	2.9	2		EC, 2005
Daphnia magna	< 24 h	Y	S	Pyrimethanil			8.46	20-21		48 h	NOEC	Immobilisation	1.5	2		EC, 2005
Daphnia magna	< 24 H	Y	S	Scala	36.4	rw	7.6-7.9	21.2	166	48 h	EC50	Immobilisation	3.8	2	3	EC, 2005
Daphnia magna	< 24 H	Y	S	Scala	36.4	rw	7.6-7.9	21.2	166	48 h	NOEC	Immobilisation	2.6	2	3	EC, 2005
Pisces																
Oncorhynchus mykiss	Av. 42 mm, 0.77 g	Y	R	Pyrimethanil	99.5		7.2-7.6	12-15.5	76	96 h	LC50	Mortality	10.56	2		EC, 2005
Oncorhynchus mykiss	Av. 42 mm, 0.77 g	Y	R	Pyrimethanil	99.5		7.2-7.6	12-15.5	76	96 h	NOEC	Sublethal effects	4.0	2		EC, 2005
Oncorhynchus mykiss		Y	S	Scala	37.7					96 h	LC50	Mortality	19	2	3	EC, 2005
Oncorhynchus mykiss		Y	S	Scala	37.7					96 h	NOEC	Mortality	14	2	3	EC, 2005
Cyprinus carpio	Av. 45 mm, 1.58 g	Y	R	Pyrimethanil	99.5		6.8-8.0	19	65	96 h	LC50	Mortality	35.36	2		EC, 2005
Cyprinus carpio	Av. 45 mm, 1.58 g	Y	R	Pyrimethanil	99.5		6.8-8.0	19	65	96 h	NOEC	Sublethal effects	6.5	2		EC, 2005)

Notes:
1 The concentrations were measured in vessels not containing the organism. Growth rate nor AUG were measured
2 Not used for geomean, because EbC50 is not considered to be a relevant endpoint
3 Formulated as Scala
4 Not carried out according to Guideline; unusual endpoint
5 The concentrations were measured in vessels not containing the organism

Table A1.2. Chronic toxicity of pyrimethanil to freshwater organisms.

Species	Species properties	Analysis	Test type	Test compound	Purity [%]	Test water	pH	T [°C]	Hardness $CaCO_3$ [mg/L]	Exp. time	Criterion	Test endpoint	Value [mg/L]	Ri	Notes	Reference
Algae																
Pseudokirchneriella subcapitata	10^4 cells	Y	S	Pyrimethani		am		21.5-22.4	n.a.	96 h	NOEC	Biomass (AUG)	< 0.32	2	1	EC, 2005
Pseudokirchneriella subcapitata	10^4 cells	Y	S	Pyrimethani		am		21.5-22.4	n.a.	96 h	NOEC	Growth rate	1.0	2		EC, 2005
Pseudokirchneriella subcapitata	10^4 cells	Y	S	Scala	37.8	am	6.8-8.9	22-23.9	n.a.	96 h	NOEC	Growth rate and biomass	1.4	2	2	EC, 2005
Macrophyta																
Lemna minor	Mature fond	N	S	Scala	40	am	6.5	22	n.a.	72 h	NOEC	Photosynthe-tic capacity by fluorescence emissi	0.1	2	2, 3	Frankart et al., 2002
Crustacea																
Daphnia magna	< 24 H	Y	R	Pyrimethani			7.6-7.7	20	252	21 d	EC50	Reproduction and mortality	1.87	2		EC, 2005
Daphnia magna	< 24 H	Y	R	Pyrimethani			7.6-7.7	20	252	21 d	NOEC	Reproduction and mortality	0.94	2		EC, 2005
Daphnia magna	< 24 H	Y	R	Scala	37.3	rw	7.0-7.8	21.2	172	21d	EC50	Mortality	0.97	2	2	EC, 2005
Daphnia magna	< 24 H	Y	R	Scala	37.3	rw	7.0-7.8	21.2	172	21d	NOEC	Mortality and reproduction	0.30	2	2	EC, 2005
Insecta																
Chironomus riparius	Larvae	Y	S	Pyrimethani			6.1-7.5	19.6-22.1		28 d	EC50	Emergence	3.13	2		EC, 2005
Chironomus riparius	Larvae	Y	S				6.1-7.5	19.6-22.1		28 d	NOEC	Emergence	1.0	2		EC, 2005
Pisces																
Oncorhynchus mykiss	14 d old	Y	F	Pyrimethanitg				12.9		21 d	EC50	Mortality	> 7.3	2		EC, 2005
Oncorhynchus mykiss	14 d old	Y	F	Pyrimethanitg				12.9		21 d	NOEC	Weight	1.6	2		EC, 2005
Oncorhynchus mykiss	ELS	Y	F	Pyrimethani			6.9-7.6	6.6-10.9		91 d	EC10	Dry weight	0.07	2		EC, 2005

Notes:
1 Not used for geomean, because EbC50 is not considered to be a relevant endpoint
2 Formulated as Scala
3 Not carried out according to Guideline; unusual endpoint

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Appendix 2. References used in the appendices

EC. 2005. Draft Assessment Report (DAR) for Pyrimethanil.

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