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J.W.A. Scheepmaker

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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 dimethenamid-P

Dit rapport geeft milieurisicogrenzen voor het herbicide dimethenamid-P 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. De afleiding is gebaseerd op gegevens voor zowel dimethanamid-P als dimethenamid.

Contents

1 Introduction

In this report, environmental risk limits (ERLs) for surface water are derived for the herbicide dimethenamid-P. 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). Dimethenamid-P 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)

1.1 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 dimethenamid-P, the evaluation report prepared within the framework of EU Directive 91/414/EC (Draft Assessment Report, DAR) was consulted (EC, 2006; 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 Annexes 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} an additional comment 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 pesticides as specified in Directive 98/83/EC.

3 Derivation of environmental risk limits for dimethenamid-P

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

3.1.1 Identity

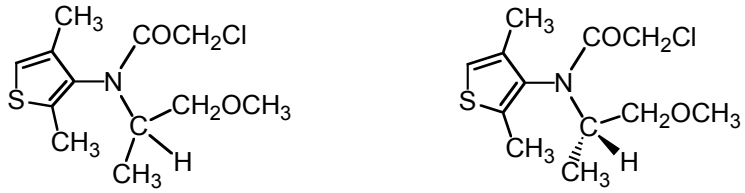

Figure 1. Structural formula of dimethenamid-P and dimethenamid.

Table 1. Identification of dimethenamid-P

Parameter	Name or number	Source
Common/trivial/other name	dimethenamid-P	Tomlin, 2002
Chemical name	(S)-2-chloro-N-(2,4-dimethyl-3-thienyl)-N-(2-methoxy-1-methylethyl)acetamide	Tomlin, 2002
CAS number	dimethenamid-P: 163515-14-8 dimethenamid: 87674-68-8	Tomlin, 2002
EC number	not assigned	
SMILES code	dimethenamid P: Cc1csc(C)c1N([C@@H](C)COC)C(=O)CCl dimethenamid: ClCC(=O)N(c1c(scc1C)C)C(COC)C	Footprint pesticide properties database
Use class	Herbicide	Tomlin, 2002
Mode of action	Soil applied herbicide, which enters the plant via root and epicotyl uptake. Inhibits cell division and tissue differentiation	Tomlin, 2002
Authorised in NL	Yes	
Annex 1 listing	Yes	

Dimethenamid is a racemic mixture, containing the herbicidal active R-enantionmer (dimethenamid-P) and the non-herbicidal active S-enantiomer in equal amounts.

3.1.2 Physico-chemical properties

Table 2. Physico-chemical properties of dimethenamid-P and dimethenamid

Parameter	Unit	Value	Remark	Reference
Molecular weight	[g/mol]	275.79		EC, 2005
Water solubility	[g/L]	1.2	dimethenamid, 25 ºC, pH 7	Tomlin, 2002
		ca. 1.4	dimethenamid-P, 20 ºC, pH 5-9	EC, 2005; Tomlin, 2002
		1.449	dimethenamid-P, 25 ºC	Tomlin, 2002
pK_a	[-]		no dissociation pH 1-11	EC, 2005
log K_{OW}	[-]	2.2	dimethenamid, 25 ºC	EC, 2005
		1.89	dimethenamid-P, 25 ºC	Tomlin, 2002
		2.21	ClogP	BioByte, 2006
		2.15	MlogP	BioByte, 2006
		2.57	KowWin	US EPA, 2007
log K_{OC}	[-]	2.47	dimethenamid-P; K_{oc} 170 L/kg (median 10 soils)	EC, 2005
		2.06	dimethenamid; K_{oc} 114 L/kg (median 9 soils)	EC, 2005
Vapour pressure	[Pa]	3.7×10^{-2}	dimethenamid, 25 ºC, 99.2%	EC, 2005
		2.51×10^{-2}	dimethenamid-P, 25 ºC	Tomlin, 2002
Melting point	[°C]	-		
Boiling point	[°C]	-		
Henry's law constant	[Pa.m^3/mol]	8.6×10^{-3}	dimethenamid, 25 ºC	EC, 2005
		8.32×10^{-3}	dimethenamid	Tomlin, 2002
		4.8×10^{-4}	dimethenamid-P	Tomlin, 2002

n.a. = not applicable.

3.1.3 Behaviour in the environment

Table 3. Selected environmental properties of dimethenamid-P and dimethenamid

Parameter	Unit	Value	Remark	Reference
Hydrolysis half-life	DT50 [d]	stable	dimethenamid; pH 5, 7, 9; 20 ºC, 30 d	EC, 2005
Photolysis half-life	DT50 [d]	16.4	pH 7	EC, 2005
Readily biodegradable			no information available	
Water/sediment system	DT_{50} [d]	23-33	dimethenamid; whole system	EC, 2005
Relevant metabolites	dechlorinated dimethenamid			EC, 2005
	water: 9.1, 8.0%; sediment: 5.2, 6% after 105 d			

3.1.4 Bioconcentration and biomagnification

An overview of the bioaccumulation data for dimethenamid-P is given in Table 4.

Table 4. Overview of bioaccumulation data for dimethenamid-P and dimethenamid

Parameter	Unit	Value	Remark	Reference
BCF (fish)	[L/kg]	13	QSAR with log K_{ow} 2.15	Veith et al., 1979
BCF (fish)	[L/kg]	**60**	dimethenamid (racemate), 42 d study	EC, 2005[a]
BMF	[kg/kg]	1	Default value for BCF < 2000 L/kg	

[a] details of the study were not given in the DAR

3.1.5 Human toxicological threshold limits and carcinogenicity

In the DAR, dimethenamid is proposed to be assigned R22, R41, R43. The ADI is 0.02 mg/kg bw/d, based on a NOEL of 2 mg/kg bw/d from a 2-year study with dogs, with a safety factor of 100.

3.2 Trigger values

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

Table 5. Dimethenamid-P and dimethenamid: collected properties for comparison to MPC triggers

Parameter	Value	Unit	Method/Source	Derived at section
Log $K_{p,susp\text{-}water}$	1.23	[-]	$K_{OC} \times f_{OC,susp}$ [1]	K_{OC}: 0
BCF	60	[L/kg]		3.1.4
BMF	1	[kg/kg]		3.1.4
Log K_{OW}	2.15	[-]		0
R-phrases	R22, R41, R43, R50/53	[-]		3.1.5
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).

- dimethenamid has a log $K_{p,\ susp\text{-}water} < 3$; derivation of $MPC_{sediment}$ is not triggered.
- dimethenamid has a log $K_{p,\ susp\text{-}water} < 3$; expression of the MPC_{water} as $MPC_{susp,\ water}$ is not required.
- dimethenamid-P has a BCF < 100 L/kg; assessment of secondary poisoning is not triggered.
- dimethenamid is assigned R22, but has a BCF < 100 L/kg. Therefore, an MPC_{water} for human health via food (fish) consumption ($MPC_{water,\ hh\ food}$) is not derived.
- For dimethenamid-P, 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 Treatment of data dimethenamid-P and racemic mixture

In this report, environmental risk limits (ERLs) for surface water (freshwater and marine) are derived for dimethenamid. Dimethenamid (CAS number 87674-68-8) is a racemic mixture, dimethenamid-P (CAS number 163515-14-8) is the S-isomer. According to the DAR toxicity of dimethenamid-P and dimethenamid is comparable, and the data of the racemic mixture were also used for risk assessment of dimethenamid-P in the DAR. According to Couderchet et al. 1997, the S-stereoisomer is 100 times more active in *Lemna minor* than the R-stereoisomer when tested separately. In a racemic mixture, however, the activity is only slightly less than in the case only the S-stereoisomer was used (Couderchet et al. 1997).
For this report, data on both dimethenamid-P and dimethenamid (Racemate) were collected, and a comparison was made for differences in toxicity. This could only be done on the basis of acute data, since too few chronic data were available to make a valid comparison. For algae, all available EC_{50}-values were taken into account, including cell counts, growth rate and biomass. Descriptive statistics are shown in Table 6 below, and presented in Figures 2 and 3.

Table 6. Descriptive statistics of acute aquatic toxicity data for dimethenamid-P and dimethenamid

	algae		*Lemna*	
	dimethenamid-P	**dimethenamid**	**dimethenamid-P**	**dimethenamid**
range (n)	10.0-95.5 (6)	9.0-86.4 (3)	6.2-39.0 (4)	10.8-54.0 (3)
mean	38.2	52.5	17.5	30.9
SD	30.3	39.6	14.9	21.8
	Daphnia		**fish**	
	dimethenamid-P	**dimethenamid**	**dimethenamid-P**	**dimethenamid**
range (n)	12000-12312 (2)	5220-16000 (2)	5717-10000 (3)	2286-9540 (5)
mean	12156	10610	7339	5525
SD	221	7623	2323	3064

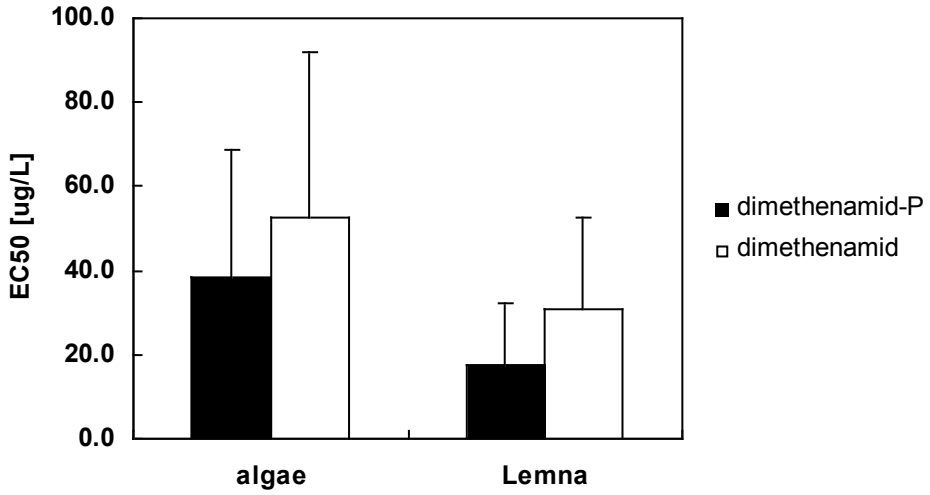

Figure 2. Comparison of toxicity of dimethenamid-P and dimethenamid for algae and *Lemna*. Mean and standard deviation of acute EC_{50} values.

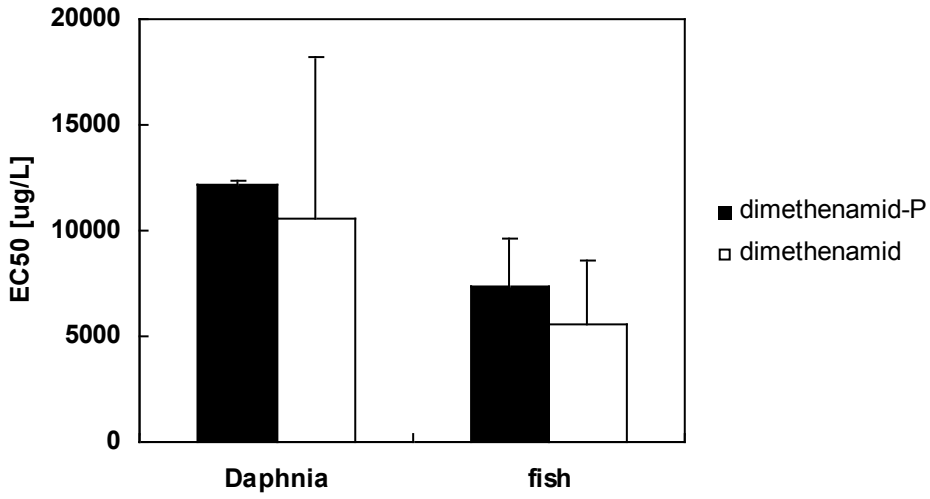

Figure 3. Comparison of toxicity of dimethenamid-P and dimethenamid for *Daphnia* and fish. Mean and standard deviation of acute EC_{50} values.

For algae, *Lemna* and fish, the datasets for dimethenamid-P and dimethenamid were not significantly different (t-test, $p < 0.05$), but the value of this analysis is limited because of the low number of data for either compound (n=3). A t-test was not performed for *Daphnia*, because only 2 values were available. It is concluded that the available data do not indicate a difference in toxicity between dimethenamid-P and the racemic mixture. It was therefore decided that the two data sets could be combined, which is in accordance with the DAR. Consequently the ERL derivation applies to both dimethenamid-P and the racemic mixture.

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

An overview of the selected freshwater toxicity data for is given in Table 7. There are no valid marine toxicity data. Detailed toxicity data are tabulated in Appendix 2.
With respect to macrophyta, the following should be noted. For *Lemna gibba* EC_{50} and NOEC-values are available from 7 and 14-days tests. In view of the generation time of these species, this is considered as chronic. However, when omitting the EC_{50}s from the acute dataset, the most sensitive species group would not be included in the derivation of the MAC. It is considered that the 7- and 14-days EC_{50}s are representative for shorter test durations, and therefore, the data are treated as acute.

Table 7. Dimethenamid-P and dimethenamid: selected freshwater toxicity data for ERL derivation

Chronic[a]		**Acute**[a]	
Taxonomic group	**NOEC/EC10 (µg/L)**	**Taxonomic group**	**L(E)C50 (µg/L)**
Bacteria		**Cyanobacteria**	
Pseudomonas putida	400000	*Anabaena flos-aquae*	2980[g]
Cyanobacteria		**Algae**	
Anabaena flos-aquae	25	*Navicula pelliculosa*	1790[h]
Algae		*Pseudokirchneriella subcapitata*	58.7[i]
Navicula pelliculosa	56	*Scenedesmus subspicatus*	95.5[h]
Pseudokirchneriella subcapitata	3.6[b]	**Crustacea**	
Scenedesmus subspicatus	20[c]	*Daphnia magna*	10540[j]
		Macrophyta	
Daphnia magna	1250[d]	*Lemna gibba*	**16**[k]
Macrophyta		**Pisces**	
Lemna gibba	**1.3**[e]	*Cyprinus carpio*	8054[l]
Pisces		*Lepomis macrochirus*	8000[m]
Onchorhynchus mykiss	500[f]	*Onchorhynchus mykiss*	3825[n]

[a] For detailed information see Appendix 2. Bold values are used for risk assessment.
[b] preferred endpoint growth rate
[c] only available endpoint biomass
[d] most sensitive endpoint growth
[e] geometric mean of 0.9 and 2.0 µg/L, preferred endpoint growth rate
[f] most sensitive endpoint hatching
[g] preferred endpoint growth rate
[h] preferred endpoint growth rate
[i] geometric mean of 40 and 86.4 µg/L, preferred endpoint growth rate
[j] geometric mean of 12000, 12312, 16000 and 5220 µg/L for *Daphnia magna*
[k] because it is not clear whether biomass represents actual weight or area under the curve, 14-days frond number is selected as being the most sensitive parameter.
[l] geometric mean of 6800 and 9540 µg/L
[m] geometric mean of 10000 and 6400 µg/L
[n] geometric mean of 5717, 2600 and 2286 µg/L

3.3.2.1 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 dimethenamid, marine data are not available. Marine ERLs cannot be derived.

3.3.2.2 Mesocosm and field studies

Mesocosm and field studies are not available.

3.3.2.3 Derivation of $MPC_{eco, water}$ and $MPC_{eco, marine}$

For freshwater, the base set is complete. As long-term NOECs are available for more than three species, representing three trophic levels including algae, *Daphnia* and fish, an assessment factor of 10 is applied to the lowest NOEC of 1.3 µg/L for *Lemna gibba*. The $MPC_{eco, water}$ is 0.13 µg/L.

The $MPC_{eco, marine}$ cannot be derived because the marine base set is not complete.

3.3.3 $MPC_{sp, water}$ and $MPC_{sp, marine}$

Dimethenamid (racemate) has a BCF < 100 L/kg, the assessment of secondary poisoning is not triggered.

3.3.4 $MPC_{hh\ food,water}$

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

3.3.5 $MPC_{dw,water}$

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

3.3.6 Selection of the MPC_{water} and MPC_{marine}

The only route included is the $MPC_{eco, water}$. The MPC_{water} is 0.13 µg/L.

The MPC_{marine} cannot be derived, because the marine data are not available.

3.3.7 MAC_{eco}

3.3.7.1 $MAC_{eco, water}$

The MAC_{eco} is based on the acute toxicity data. The base set is complete. Dimethenamid has no potential to bioaccumulate (BCF < 100 L/kg), has a known mode of action and the potentially most sensitive species groups (algae and macrophyta) are included in the dataset. Therefore, the default assessment factor of 10 is applied to the lowest EC_{50} of 16 µg/L for *Lemna gibba*. The $MAC_{eco, water}$ is 1.6 µg/L.

3.3.7.2 $MAC_{eco, marine}$

There are no marine data, the $MAC_{eco, marine}$ cannot be derived.

3.3.8 $SRC_{eco, water}$

NOECs are available for six taxa, including algae, *Daphnia* and fish. The $SRC_{eco, water}$ is therefore derived as the geometric mean of all available NOECs with an assessment factor of 1. The $SRC_{eco, water}$ is 129 µg/L (data fit a log-normal distribution).

3.4 Toxicity data and derivation of ERLs for sediment

The log $K_{p,\ susp\text{-}water}$ of dimethenamid 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 dimethenamid or dimethenamid-P in water. No risk limits were derived for the marine compartment because data were not available. Derivation of risk limits 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 8. Derived MPC, MAC_{eco}, and SRC values valid for both dimethenamid-P and dimethenamid

ERL	Unit	MPC	MAC_{eco}	SRC
Water, old[a]	µg/L	2.0 (dimethenamid)	-	-
	µg/L	1.1 (dimethenamid-P)	-	-
Water, new[b]	µg/L	0.13	1.6	1.3×10^2
Drinking water[b]	µg/L	0.1[d]	-	-
Marine	µg/L	n.d.[c]	n.d.[c]	n.d.[c]

[a] indicative MPC ('ad-hoc MTR') for dimethenamid and dimethenamid-P 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] n.d. = not derived due to lack of data

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

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Appendix 1. Detailed aquatic toxicity data

Table A1.1 Acute toxicity of dimethenamid-p and dimethenamid 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 [µg/L]	Ri	Notes	Reference
Cyanobacteria																
Anabaena flos-aquae		Y	S	dimethenamid-P						120 h	EC50	cell counts	340	2	1	DAR. Wat-nr. 1999-490
Anabaena flos-aquae		Y	S	dimethenamid-P						120 h	EC50	growth rate	2980	2	1	DAR. Wat-nr. 1999-490
Anabaena flos-aquae		Y	S	dimethenamid-P						120 h	EC50	biomass	250	2	1	DAR. Wat-nr. 1999-490
Anabaena flos-aquae				dimethenamid (racemate)						72 h	EC50	cell densities	450	3	1,7	DAR. Wat-nr. 98-00340
Anabaena flos-aquae				dimethenamid (racemate)						96 h	EC50	growth rate	1200	3	1,7	DAR. Wat-nr. 98-00340
Anabaena flos-aquae				dimethenamid (racemate)						72 h	EC50	biomass	350	3	1,7	DAR. Wat-nr. 98-00340
Algae															1,4	
Navicula pelliculosa		Y	S	dimethenamid-P						120 h	EC50	cell counts	340	2		DAR, Wat-nr. 1999-491
Navicula pelliculosa		Y	S	dimethenamid-P						120 h	EC50	growth rate	1790	2		DAR, Wat-nr. 1999-491
Navicula pelliculosa		Y	S	dimethenamid-P						120 h	EC50	biomass	300	2		DAR, Wat-nr. 1999-491
Pseudokirchneriella subcapitata		Y	S	dimethenamid-P						120 h	EC50	cell counts	17.0	2	1,4	DAR, Wat-nr. 1999-489
Pseudokirchneriella subcapitata		Y	S	dimethenamid-P						120 h	EC50	growth rate	40.0	2	1,4	DAR, Wat-nr. 1999-489
Pseudokirchneriella subcapitata		Y	S	dimethenamid-P						120 h	EC50	biomass	10.0	2	1,4,9	DAR, Wat-nr. 1999-489
Pseudokirchneriella subcapitata		Y	S	formulation, dimethenamid	900 g/L					120 h	EC50	growth rate	86.4	2	1,4,8	DAR, Wat-nr. 95-00677
Pseudokirchneriella subcapitata		Y	S	formulation, dimethenamid	900 g/L					120 h	EC50	biomass	9.0	2	1	DAR, Wat-nr. 95-00677
Scenedesmus subspicatus		N	R	dimethenamid (racemate)						72 h	EC50	biomass	62.0	2	1,2,16	DAR. Wat-nr. 95-00676
Scenedesmus subspicatus		Y	S	formulation, dimethenamid-P	720 g/L					72 h	EC50	growth rate	95.5	2	1,2,17	DAR. Wat-nr. 1999-497
Scenedesmus subspicatus		Y	S	formulation, dimethenamid-P	720 g/L					72 h	EC50	biomass	35.4	2		DAR. Wat-nr. 1999-497
Scenedesmus subspicatus				formulation, dimethenamid-P	600 g/L					72 h	EC50	biomass	31.5	2		Ctgb
Crustacea															1	
Daphnia magna		Y	F	dimethenamid-P						48 h	EC50	mortality	12000	2	1	DAR, Wat-nr. 1999-487
Daphnia magna		Y	F	dimethenamid-P						48 h	NOEC	mortality	3400	2	1	DAR, Wat-nr. 1999-487
Daphnia magna		Y	F	dimethenamid (racemate)						48 h	EC50	mortality	16000	2	1	DAR, Frazier, 1988, Wat-nr. 95-00680
Daphnia magna		Y	F	dimethenamid (racemate)						48 h	NOEC	mortality	12000	2	1,15	DAR, Frazier, 1988, Wat-nr. 95-00680
Daphnia magna		N	S	formulation, dimethenamid-P	720 g/L					48 h	EC50	mortality	12312	2	1,8	DAR, Wat-nr. 1999-496
Daphnia magna		Y	S	formulation, dimethenamid	900 g/L					48 h	EC50	mortality	5220	2		DAR, Wat-nr. 95-00681
Macrophyta															2,19,21	
Ceratophyllum demersum		N	S	formulation, dimethenamid-P	600 g/L					13 d	EC50		16.0	3	2,14,21	Ctgb
Crassula recurva		N	S	formulation, dimethenamid-P	600 g/L					13 d	EC50		99.7	3	2,14,21	Ctgb
Elodea densa		N	S	formulation, dimethenamid-P	600 g/L					13 d	EC50		204.4	3	2,14,21	Ctgb
Iris pseudacorus		N	S	formulation, dimethenamid-P	600 g/L					12 d	EC50		59.4	3		Ctgb
Lemna gibba		Y	R	dimethenamid-P						14 d	EC50	fronds	16.0	2	1,3	DAR, Wat-nr 1999-492
Lemna gibba		Y	R	dimethenamid-P						14 d	EC50	biomass	8.9	2	1	DAR, Wat-nr 1999-492
Lemna gibba		Y		dimethenamid (racemate)						14 d	EC50	growth	28.0	2	1,11	DAR, Wat-nr 1999-385
Lemna gibba		Y	S	formulation, dimethenamid	900 g/L					7 d	EC50	growth	54.0	2	1,12	DAR, Wat-nr 1999-873
Lemna gibba		Y	S	formulation, dimethenamid	900 g/L					7 d	EC50	biomass	10.8	2	1,2,24	DAR, Wat-nr 1999-873
Lemna gibba		N	S	formulation, dimethenamid-P	720 g/L					14 d	EC50	growth	39.0	2	1,2,18	DAR, Wat-nr 1999-498
Lemna gibba		N	S	formulation, dimethenamid-P	720 g/L					14 d	EC50	biomass	6.2	2	2,14,21	DAR, Wat-nr 1999-498
Ludwigia palustris		N	S	formulation, dimethenamid-P	600 g/L					13 d	EC50		11.5	3	2,14,21	Ctgb
Mentha aquatica		N	S	formulation, dimethenamid-P	600 g/L					13 d	EC50		69.6	3	2,14,21	Ctgb
Myriophyllum quitense		N	S	formulation, dimethenamid-P	600 g/L					13 d	EC50		97.1	3	2,14,21	Ctgb
Potamogeton crispus		N	S	formulation, dimethenamid-P	600 g/L					13 d	EC50		283.7	3	2,14,21	Ctgb
Sparganium erectum		N	S	formulation, dimethenamid-P	600 g/L					13 d	EC50		235.1	3	2,14,21	Ctgb
Vallisneria sp. iralis		N	S	formulation, dimethenamid-P	600 g/L					13 d	EC50		336.0	3	2,14,21	Ctgb
Veronica beccapunga		N	S	formulation, dimethenamid-P	600 g/L					13 d	EC50		29.4	3		Ctgb
Pisces																
Cyprinus carpio		Y		dimethenamid (racemate)						96 h	EC50	mortality	6800	2	1	DAR, Wat-nr. 95-00675
Cyprinus carpio				formulation, dimethenamid	900 g/L					96 h	EC50	mortality	9540	2	1,6	DAR, Wat-nr 95-00666
Lepomis macrochirus	0.29 g	Y	F	dimethenamid-P	91.9					96 h	EC50	mortality	10000	2	1	DAR, Wat-nr. 1999-482
Lepomis macrochirus		Y		dimethenamid (racemate)						96 h	EC50	mortality	6400	2	1	DAR, Bowman, 1988, Wat-nr. 95-00665

Species	Species properties	A	Test type	Test compound	Purity [%]	Test water	pH	T [°C]	Hardness CaCO3 [mg/L]	Exp. time	Criterion	Test endpoint	Value [µg/L]	Ri	Notes	Reference
Onchorhynchus mykiss			F	dimethenamid-P						96 h	EC50	mortality	6300	2	1	DAR, Wat-nr. 1999-481
Onchorhynchus mykiss		Y		dimethenamid (racemate)	94.1					96 h	EC50	mortality	2600	2	1	DAR, Wat-nr. 95-00664
Onchorhynchus mykiss		N	S	formulation, dimethenamid-P	720 g/L					96 h	EC50	mortality	5717	2	1,13	DAR, Wat-nr. 1999-495
Onchorhynchus mykiss		Y	S	formulation, dimethenamid	900 g/L					96 h	EC50	mortality	2286	2	1,5	DAR, Wat-nr. 95-00667

NOTES

1 from DAR but no summaries were given, all tests according to international guidelines
2 BAS 656 07 H (EC) containing dimethenamid-P 720 g/L. In Vol 3-B9 this formulation contained 703 g/L dimethenamid-P.
3 Not clear whether biomass represent actual fwt or dwt, or is calculated as area under the growth curve. Frond # is therefore selected
4 S. capricornutum
5 based on 2540 µg formulation/L
6 based on 10600 µg formulation/L
7 According to DAR study of poor quality
8 based on 5800 µg formulation/L
9 based on 96 µg formulation/L
10 based on 10 µg formulation/L
11 based on 60 µg formulation/L
12 based on 12 µg formulation/L
13 based on 7940 µg formulation/L
14 test with artificial soil in test medium, 2L feeding solution with formulation, actual concentrations not measured and high sorption to soil expected
15 based on 17.1 µg formulation/L
16 based on 132.7 µg formulation/L
17 based on 49.2 µg formulation/L
18 based on 8.6 µg formulation/L
19 the only test with water plants in which soil was not incorporated.
20 based on 54 µg formulation/L
21 endpoint not given

Table A1.2. Chronic toxicity of dimethenamid-p and dimethenamid to freshwater organisms

Species	Species properties	A	Test type	Test compound	Purity [%]	Test water	pH	T [°C]	Hardness $CaCO_3$ [mg/L]	Exp. time	Criterion	Test endpoint	Value [µg/L]	Ri	Notes	Reference
Bacteria																
Pseudomonas putida			S	dimethenamid (racemate)						16 h	NOEC	cell multiplication	400000	2	1	DAR. Wat-nr. 1999-499
Cyanobacteria																
Anabaena flos-aquae		Y	S	dimethenamid-P						120 h	NOEC	growth	25	2	1	DAR. Wat-nr. 1999-490
Anabaena flos-aquae				dimethenamid (racemate)						96 h	NOEC	growth rate	1800	3	1, 5	DAR, Hoberg, 1992 (a) Wat-nr. 98-00340
Anabaena flos-aquae				dimethenamid (racemate)						72 h	NOEC	cell densities	360	3	1, 5	DAR, Hoberg, 1992 (a) Wat-nr. 98-00340
Anabaena flos-aquae				dimethenamid (racemate)						72 h	NOEC	biomass	220	3	1, 5	DAR, Hoberg, 1992 (a) Wat-nr. 98-00340
Algae																
Navicula pelliculosa		Y	S	dimethenamid-P						120 h	NOEC	cell density	56	2		DAR, Wat-nr. 1999-491
Pseudokirchneriella subcapitata		Y	S	dimethenamid-P						120 h	NOEC	cell density	2.0	2	1, 2	DAR, Wat-nr. 1999-489
Pseudokirchneriella subcapitata		Y	S	formulation, dimethenamid	900 g/L					120 h	NOEC	growth rate	3.6	2	1,2,8	DAR, Wat-nr. 95-00677
Pseudokirchneriella subcapitata		Y	S	formulation, dimethenamid	900 g/L					120 h	NOEC	biomass	3.6	2	1,2,8	DAR, Wat-nr. 95-00677
Scenedesmus subspicatus		N	R	dimethenamid (racemate)						72 h	NOEC	biomass	20.0	2	1	DAR. Wat-nr. 95-00676
Scenedesmus subspicatus		Y	S	formulation, dimethenamid-P	720 g/L					72 h	NOEC	biomass	<1	2	10,12	DAR. Wat-nr. 1999-497
Crustacea																
Daphnia magna				dimethenamid (racemate)						21 d	NOEC	mortality	1250	2	1, 3	DAR, Wat-nr. 96-00153
Daphnia magna				dimethenamid (racemate)						21 d	NOEC	growth	1250	2	1, 3	DAR, Wat-nr. 96-00153
Daphnia magna				dimethenamid (racemate)						21 d	NOEC	reproduction	2500	2	1, 3	DAR, Wat-nr. 96-00153
Daphnia magna			R	dimethenamid (racemate)						21 d	NOEC	mortality	1300	2	1, 4	DAR, Wat-nr. 96-00154
Daphnia magna		Y	R	dimethenamid (racemate)						21 d	NOEC	reproduction	680	2	1, 4	DAR, Wat-nr. 96-00154
Daphnia magna		Y	R	formulation, dimethenamid	900 g/L					21 d	NOEC	immobilisation	2097	2	1,7	DAR, Wat-nr. 95-00681
Macrophyta																
Lemna gibba		Y	R	dimethenamid-P						14 d	NOEC	biomass	1.2	2	1,11	DAR, Wat-nr 1999-492
Lemna gibba				dimethenamid (racemate)						14 d	NOEC	growth	2.0	2	1	DAR, Wat-nr 1999-385
Lemna gibba		N	S	formulation, dimethenamid	900 g/L					7 d	NOEC	biomass	0.9	2	1,9	DAR, Wat-nr 1999-873
Lemna gibba		N	S	formulation, dimethenamid-P	720 g/L					14 d	NOEC	growth	0.9	2	1,13	DAR, Wat-nr 1999-498
Pisces																
Onchorhynchus mykiss			F	dimethenamid (racemate)						21 d	NOEC	mortality	2500	2	1	DAR, Wat-nr. 95-00668
Onchorhynchus mykiss			F	dimethenamid (racemate)						21 d	NOEC	growth	2500	2	1	DAR, Wat-nr. 95-00668
Onchorhynchus mykiss			F	dimethenamid (racemate)						90 d	NOEC	mortality	500	2	1,6	DAR, Wat-nr. 1999-484
Onchorhynchus mykiss			F	dimethenamid (racemate)						90 d	NOEC	hatch	500	2	1,6	DAR, Wat-nr. 1999-484
Onchorhynchus mykiss		Y	F	dimethenamid (racemate)		nw	8.0-8.3	11-13	136-200	90 d	NOEC	growth	120	2	1,6	DAR, Wat-nr. 1999-484

NOTES

1 from DAR but no summaries were given, all tests according to international guidelines
2 S. capricornutum
3 coefficient of variation was too high, but as the other study with the racemate had similar NOECs, this value was used
4 number of offspring per female was too low, but as the other study with the racemate had similar NOECs, this value was used
5 study of poor quality according to DAR
6 ELS test
7 based on 2330 µg formulation/L
8 based on 4 µg formulation/L
9 based on 1 µg formulation/L
10 revision in the addendum that could not be retraced, possibly Wat-nr. 1999-497
11 biomass is in this particular case selected as it is the only study in which actual concentraties were measured.
12 based on <0.98 µg formulation/L
13 based on 1.3 µg formulation/L

Appendix 2. References used in the appendices

DAR = EC. 2005. Draft Assessment Report Dimethenamid. Rapporteur Member State Germany. January 2005
Ctgb, herregistratie Frontier Optima, May 27, 2005

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