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Environmental risk limits for monochloroacetic acid (MCAA)

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This investigation has been performed by order and for the account of the Directorate-General for Environmental Protection, Directorate for Chemicals, Waste and Radiation (SAS), within the framework of 'International and National Environmental Quality Standards for Substances in the Netherlands' (INS).

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Rapport in het kort

Environmental risk limits for monochloroacetic acid (MCAA)

Dit rapport geeft milieurisicogrenzen voor monochloorazijnzuur in (grond)water en bodem. Milieurisicogrenzen zijn de technisch-wetenschappelijke advieswaarden voor de uiteindelijke milieukwaliteitsnormen in Nederland. De milieurisicogrenzen voor monochloorazijnzuur zijn gebaseerd op de uitkomsten van de EU risicobeoordeling voor monochloorazijnzuur (Bestaande Stoffen Verordening 793/93). De afleiding van de milieurisicogrenzen sluit tevens aan bij de richtlijnen uit de Kaderrichtlijn Water.

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Summary

Environmental risk limits (ERLs) are derived using ecotoxicological, physico-chemical, and human toxicological data. They represent environmental concentrations of a substance offering different levels of protection to man and ecosystems. It should be noted that the ERLs are scientifically derived values. They serve as advisory values for the Dutch Steering Committee for Substances, which is appointed to set the Environmental Quality Standards (EQSs) from these ERLs. ERLs should thus be considered as preliminary values that do not have any official status.

This report contains ERLs for monochloroacetic acid (MCAA) in water, groundwater and soil. The following ERLs are derived: negligible concentration (NC), maximum permissible concentration (MPC), maximum acceptable concentration for ecosystems (MAC_{eco}), and serious risk concentration for ecosystems (SRC_{eco}). The risk limits were solely based on data presented in the Risk Assessment Reports (RAR) for this compound, created under the European Existing Substances Regulation (793/93/EEC). No risk limits were derived for the sediment compartment because risk for sediment organisms is considered negligible. For MCAA, no risk limits for the air compartment were derived, because no atmospheric toxicity data were available in the RAR.

For the derivation of the MPC and MAC_{eco} for water, the methodology used is in accordance with the Water Framework Directive. This methodology is based on the Technical Guidance Document on risk assessment for new and existing substances and biocides (European Commission (Joint Research Centre), 2003). For the NC and the SRC_{eco} and for the ERLs for the soil and atmospheric compartment, the guidance developed for the project 'International and National Environmental Quality Standards for Substances in the Netherlands' was used (Van Vlaardingen and Verbruggen, 2007). An overview of the derived environmental risk limits is given in **Table 1**.

Table 1. Derived MPC, NC, MAC_{eco}, and SRC_{eco} values for MCAA.

ERL	Unit	MPC	NC	MAC_{eco}	SRC_{eco}
Water[a]	$\mu g.l^{-1}$	0.58	$5.8x10^{-3}$	0.58	9,600
Drinking water[a]	$\mu g.l^{-1}$	0.10			
Marine	$\mu g.l^{-1}$	0.058	$5.8x10^{-4}$	0.058 [c]	9,600
Sediment		n.d.[b]			
Soil[d]	$\mu g.kg_{dw}^{-1}$	4.6	0.046		1,800
Groundwater	$\mu g.l^{-1}$	0.10	$1.0x10^{-3}$		9,600

[a] 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}.

[b] n.d. = not determined

[c] provisional value

[d] expressed on Dutch standard soil

1 Introduction

1.1 Project framework

In this report environmental risk limits (ERLs) for surface water (freshwater and marine) and soil are derived for monochloroacetic acid (MCAA). The following ERLs are derived:

- negligible concentration (NC) – concentration at which effects to ecosystems are expected to be negligible and functional properties of ecosystems must be safeguarded fully. It defines a safety margin which should exclude combination toxicity. The NC is derived by dividing the MPC (see next bullet) by a factor of 100.
- maximum permissible concentration (MPC) – concentration in an environmental compartment at which:
  1 no effect to be rated as negative is to be expected for ecosystems;
  2a no effect to be rated as negative is to be expected for humans (for non-carcinogenic substances);
  2b for humans no more than a probability of 10^{-6} over the whole life (one additional cancer incident in 10^{6} persons taking up the substance concerned for 70 years) can be calculated (for carcinogenic substances) (Lepper, 2005).
- maximum acceptable concentration (MAC_{eco}) – concentration protecting aquatic ecosystems for effects due to short-term exposure or concentration peaks.
- serious risk concentration (SRC_{eco}) – concentration at which serious negative effects in an ecosystem may occur.

It should be noted that ERLs are scientifically (based on (eco)toxicological, fate and physico-chemical data) derived values. They serve as advisory values for the Dutch Steering Committee for Substances, which is appointed to set the Environmental Quality Standards (EQSs) from these ERLs. ERLs should thus be considered as preliminary values that do not have any official status.

2 Methods

2.1 Data collection

The final Risk Assessment Report (RAR) of MCAA produced in the framework of Existing Substances Regulation (793/93/EEC) was used as only source of physico-chemical and (eco)toxicity data (European Commission, 2005). Information given in the RARs is checked thoroughly by European Union member states (Technical Committee) and approved by the Scientific Commission on Health and Environmental Risk (SCHER). Therefore, no additional evaluation of data is performed for the ERL derivation. Only valid data combined in an aggregated data table are presented in the present report. Occasionally, key studies are discussed when relevant for the derivation of a certain ERL.

In the aggregated data table only one effect value per species is presented. When for a species several effect data are available, the geometric mean of multiple values for the same endpoint is calculated where possible. Subsequently, when several endpoints are available for one species, the lowest of these endpoints (per species) is reported in the aggregated data table.

2.2 Methodology for derivation of environmental risk limits

The methodology for data selection and ERL derivation is described in Van Vlaardingen and Verbruggen (2007), which is in accordance with Lepper (2005).

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3 Derivation of environmental risk limits

3.1 Monochloroacetic acid (MCAA)

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

3.1.1.1 Identity

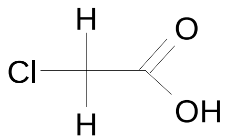

Figure 1. Structural formula of MCAA.

Table 2. Identification of MCAA. Data are derived from the RAR for MCAA.

Parameter	Name or number
Chemical name	Chloroacetic acid
Common/trivial/other name	α-chloroacetic acid, chloressigsauer, chloroethanoic acid, MCA, MKhUK, nonchloressigsauere, momchloroacetic acid, monochloroethanoic acid, MCAA
CAS number	79-11-8
EC number	201-178-4
SMILES code	O=C(O)CCl

3.1.1.2 Physico-chemical properties

Table 3. Physico-chemical properties of MCAA.

Parameter	Unit	Value	Remark
Molecular weight	[$g.mol^{-1}$]	94.5	
Water solubility	[$g.l^{-1}$]	4,210	at 20ºC
pK_a	[-]	2.85	at 25ºC
log K_{OW}	[-]	≤ 0.2	
log K_{OC}	[-]	0.5[1]	
Vapour pressure	[Pa]	<100 Pa	at 20ºC
		8.7	at 25ºC
		1100	at 80ºC
Melting point	[°C]	61.5-62.3	
Boiling point	[°C]	189	at 101,3 hPa
Henry's law constant	[$Pa.m^3.mol^{-1}$]	$1.9.10^{-4}$	at 20ºC

[1]K_{OC} = 3.16 is used for risk assessment.

3.1.1.3 Behaviour in the environment

Table 4. Selected environmental properties of MCAA.

Parameter	Unit	Value	Remark
hydrolysis half-life	DT_{50} [d]	-	experimental data were not reported[a]
photolysis half-life	DT_{50} [d]	58	estimated with QSARs[b]
degradability	readily biodegradable		

[a] In the RAR it is reported that after 30 days and at 20ºC only 0.01% of MCAA is hydrolysed.

[b] Direct photolysis is not expected because MCAA does not absorb UV radiation above 290 nm. MCAA emitted in aqueous solution in aerosols will probably remain in the aqueous phase because of its high solubility.

MCAA has a pK_a of 2.85 at 25 ^{0}C. Therefore, MCAA will be completely ionized under environmentally relevant pHs. In the RAR, MCAA is treated as anion. The physico-chemical parameters of the anion are used for risk assessment.

3.1.1.4 Bioconcentration and biomagnification

Table 5. Overview of bioaccumulation data for MCAA.

Parameter	Unit	Value	Remark
BCF (fish)	[$l.kg^{-1}$]	n.a.	on basis of MCAA's low hydrophobicity no bioaccumulation is expected
BCF (mussel)	[$l.kg^{-1}$]	n.a.	
BMF	[$kg.kg^{-1}$]	n.a.	

3.1.1.5 Human toxicological threshold limits and carcinogenicity

Classification as presented in the RAR for MCAA:
R23/24/25: toxic by inhalation, in contact with skin and if swallowed
R34: causes burns
R50: very toxic to aquatic organisms
No evidence of carcinogenity was found in rats or mice after oral administration in drinking water or by gavage.

A NOAEL of 3.5 $mg.kg_{bw}^{-1}.d^{-1}$ derived from a two-year drinking water study performed in rats was used as starting point of the risk characterisation. At this level, no effect on survival, body weight or neoplastic lesions was found (see section 4.1.2.8. of (European Commission, 2005) for a summary of the study).

3.1.2 Trigger values

This section reports on the trigger values for ERL_{water} derivation (following WFD methodology).

Table 6. MCAA: collected properties for comparison to MPC triggers for water ERL-derivation. n.a. = not available.

Parameter	Value	Unit	Method/Source	Derived at

				section
log $K_{P,susp-water}$	-0.5 [3]	[-]	$K_{OC} \times f_{OC,susp}$ [1]	K_{OC}: 3.1.1.2
BCF	n.a.[2]	[$l.kg^{-1}$]		3.1.1.2
BMF	n.a.[2]	[-]		3.1.1.2
log K_{OW}	≤ 0.2	[-]		3.1.1.2
R-phrases	R23/24/25-34-50	[-]		3.1.1.2
A1 value	n.a.	[$\mu g.l^{-1}$]		
DW standard	0.1	[$\mu g.l^{-1}$]		

[1] $f_{OC,susp}$ = 0.1 $kg_{OC}.kg_{solid}^{-1}$ ((European Commission (Joint Research Centre), 2003)).
[2]On basis of water solubility no bioaccumulation is expected
[3]K_{OC} = 3.16.

- MCAA has a log $K_{P,\ susp-water}$ << 3; derivation of $MPC_{sediment}$ is not triggered.
- MCAA has a log $K_{P,\ susp-water}$ << 3; expression of the MPC_{water} as $MPC_{susp,\ water}$ is not required.
- MCAA is not suspected to bioaccumulate on basis of its water solubility; assessment of secondary poisoning is not triggered.
- MCAA has an R23/24/25 classification. However, MCAA has no potential to bioaccumulate. Therefore, no MPC_{water} for human health via food (fish) consumption ($MPC_{hh\ food,\ water}$) needs to be derived.
- For MCAA, a Drinking Water value is available from Council Directive 98/83/EC, i.e. 0.10 $\mu g.l^{-1}$ for individual pesticides.

3.1.3 Toxicity data and derivation of ERLs for water

3.1.3.1 $MPC_{eco,\ water}$ and $MPC_{eco,\ marine}$

Freshwater toxicity data for MCAA reported in the RAR are listed in Table 7. No marine toxicity data are presented in the RAR. Most aquatic toxicity tests were conducted in neutralised medium (pH 7-9.6). As the pH of the medium is always above the pK_a (=2.8), MCAA is fully dissociated and dissolved. In neutralised medium MCAA was tested as monochloroacetate anion.
In the RAR, the validity of the studies is often not explicitly mentioned. When no details are given, it is assumed that the studies were considered to be reliable.

Table 7. MCAA: selected aquatic freshwater data for ERL derivation.

Chronic[a]		**Acute**[a]	
Taxonomic group	**NOEC or EC_{10} ($mg.l^{-1}$)**	**Taxonomic group**	**$L(E)C_{50}$ ($mg.l^{-1}$)**
Bacteria		**Algae**	
Pseudomonas putida	2152[i]	*Pseudokirchneriella subcapitata*	1.8
Protozoa		*Scenedesmus subspicatus*	0.0481[d]
Tetrahymena pyriformis	16[h]	**Crustacea**	
Algae		*Brachionus calyciflorus*	68.9
Pseudokirchneriella subcapitata	< 0.005[f]	*Daphnia magna*	121[c]
Scenedesmus quadricauda	< 0.13[e]	**Pisces**	
Scenedesmus subspicatus	0.0058[g]	*Danio rerio*	370
Crustacea		*Leuciscus idus melanotus*	> 100[a]
Daphnia magna	32	*Pimephales promelas*	145[a]
Pisces		*Poecillia reticulata*	369
Danio rerio	12.5 [b]		

[a] These values were not considered reliable, but were considered to be useful as supporting data.
[b] This NOEC is calculated from a LOEC of 25 $mg.l^{-1}$.
[c] Geometric mean of 77, 79, 427, 180, 75 and 88 $mg.l^{-1}$.
[d] Geometric mean of 33 and 70 $\mu g.l^{-1}$.
[e] LOEC = EC_3 = 130 $\mu g.l^{-1}$.
[f] LOEC = EC_3 = 5 $\mu g.l^{-1}$.
[g] A NOEC of 5.8 $\mu g.l^{-1}$ was reported from a 72-hour study, but the criterion (growth rate or biomass) was not reported in the RAR. In another study (48-hour) both values for biomass and growth rate were reported, i.e. 7 and 14 $\mu g.l^{-1}$, respectively. As a conservative approach, the lowest value of 5.8 $\mu g.l^{-1}$ is chosen as endpoint in the aggregated data table above.
[h] Test used for $PNEC_{microorganism}$ -derivation.
[i] Geometric mean of 1000 and 4630 $mg.l^{-1}$.

Treatment of fresh- and saltwater toxicity data

No marine toxicity data were presented in the RAR for MCAA. Therefore, the freshwater toxicity data are used to derive an $MPC_{eco, marine}$.

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

In the RAR, the algae are appointed as the most sensitive species to MCAA. This is not surprising, because MCAA is a known herbicide. The lowest long-term result is the NOEC of 5.8 $\mu g.l^{-1}$ for *Scenedesmus subspicatus*. This test is used for PNEC-derivation. An assessment factor of 10 was applied, because long-term studies are available for three different trophic levels. This lead to a $PNEC_{aquatic}$ of 0.58 $\mu g.l^{-1}$. The $MPC_{water, eco}$ is equal to the $PNEC_{aquatic}$. Thus, $MPC_{water, eco}$ = 0.58 $\mu g.l^{-1}$. In the RAR no effect assessment for the marine environment is carried out. Moreover, no marine data are presented in the RAR. When following the TGD and using the dataset for freshwater organisms an assessment factor of 100 should be applied to the lowest long-term NOEC of 5.8 $\mu g.l^{-1}$ -> $MPC_{marine, eco}$ = 0.058 $\mu g.l^{-1}$.

In the RAR, an individual $PNEC_{microorganisms}$ is derived for risk assessment of sewage treatment plants. In the framework of ERL, ecotoxicological data on microorganisms are used for the derivation of

$MPC_{eco, water}$ and $MPC_{eco, marine}$. No separate $MPC_{microorganisms}$ is applicable. Tests with micro-organisms showed lower sensitivity to MCAA compared to other freshwater and marine organisms, resulting $PNEC_{microorganisms}$ was 1.6 $mg.l^{-1}$. Therefore, the $MPC_{water, eco}$ and $MPC_{marine, eco}$ do not have to be adapted for micro-organism sensitivity.

Mesocosm studies

A mesocosm study with MCAA is described in the RAR. Effects of MCAA on invertebrate communities and periphytic algae were examined in experimental flow through channels in France. A NOEC of 236 $\mu g.l^{-1}$ was extracted from the study. In the RAR, the question is put forward if this mecocosm study is useful for the derivation of a $PNEC_{water}$.
The mesocosm study was not used to modify the $PNEC_{aquatic}$ of 0.58 $\mu g.l^{-1}$. In the mesocosm study the focus was on invertebrates and oligochaetes and for the primary producers initially only diatoms were recorded. The diatoms were selected because they were considered to be the main representatives of algae in a dynamic mesocosm. However, diatoms are not green algae. The absence of planktonic green algae in the mesocosm study was considered to be an important shortcoming and therefore it was not used for the derivation of a PNEC.

3.1.3.2 $MPC_{sp, water}$ and $MPC_{sp, marine}$

MCAA has a BCF<100. Thus, assessment of secondary poisoning is not triggered (Table 6).

3.1.3.3 $MPC_{hh food, water}$

Derivation of $MPC_{hh food, water}$ for MCAA is not triggered (Table 6).

3.1.3.4 $MPC_{dw, water}$

The salt of MCAA is used as an active ingredient of herbicides. However, MCAA is not registered for use in Europe. Only the sodium salt (SMCA, sodium monochloroacetate, CAS. 3926-62-3) is registered for use in the United Kingdom, but not in any other country in the European Union. Therefore, a Drinking Water Standard is available from Council Directive 98/83/EC, i.e. 0.10 $\mu g.l^{-1}$ for individual pesticides.
On basis of the Henry's Law constant, no removal of MCAA by evaporation is expected. On basis of the log $K_{OC} << 4$, no removal by coagulation and filtration is expected (Zwolsman et al., 2004). Therefore, no correction factor for removal by simple treatment is applied. The DW-standard is used as $MPC_{dw, water}$. $MPC_{dw, water} = 0.10$ $\mu g.l^{-1}$.

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

The lowest MPC_{water} is the drinking water standard of 0.10 $\mu g.l^{-1}$. In the Fraunhofer document (Lepper, 2005) it is prescribed that the lowest MPC value should be selected as the general MPC. In the proposal for the daughter directive Priority Substances, a standard based on drinking water was not included. In the Netherlands no policy decision has been taken yet on the procedure to be followed for drinking water. Therefore, in this report the $MPC_{dw, water}$ is reported separately. The $MPC_{eco, water}$ is selected as final MPC_{water}. Thus, $MPC_{water} = 0.58$ $\mu g.l^{-1}$.
The MPC_{marine} amounts to 0.058 $\mu g.l^{-1}$.

3.1.3.6 $MAC_{eco, water}$ and $MAC_{eco, marine}$

The EC_{50}-value of 48.1 $\mu g.l^{-1}$ for *Scenedesmus subspicatus* is the lowest reported acute toxicity value in the RAR. This value is the geomean of two effect concentrations for growth rate.

The base set is complete and MCAA is not bioaccumulative. Therefore, an AF of 100 is applied. The MAC_{eco} for fresh water is 48.1 μg.l^{-1}/100 = 0.48 μg.l^{-1}. However, this value is lower than the $MPC_{eco, water}$. Therefore, the $MAC_{water, eco}$ is set equal to the $MPC_{eco, water}$. The $MAC_{eco, water}$ = 0.58 μg.l^{-1}.
The $MAC_{eco, marine}$ is derived by applying an additional factor of 10 to the $MAC_{eco, water}$. The resulting $MAC_{eco, marine}$ is 0.058 μg.l^{-1}. It has to be noted that this procedure is currently not agreed upon. Therefore, the $MAC_{eco, marine}$ values need to be re-evaluated once an agreed procedure is available.

3.1.3.7 NC_{water} and NC_{marine}

The NC_{water} is set to a factor of 100 below the final, integrated MPC_{water}. Thus, the NC_{water} is 0.58/100 = 0.0058 μg.l^{-1}. The NC_{marine} is set a factor of 100 below the final, integrated MPC_{marine}. Resulting MPC_{marine} is 0.058/100 = 0.00058 μg.l^{-1}.

3.1.3.8 $SRC_{eco, water}$

For the calculation of the geometric mean of chronic freshwater toxicity data, the following values were used: 2152 mg.l^{-1} for *Pseudomonas putida*, 16 mg.l^{-1} for *Tetrahymena pyriformis*, 0.0058 mg.l^{-1} for *Scenedesmus subspicatus*, 32 mg.l^{-1} for *Daphnia magna* and 12.5 mg.l^{-1} for *Danio rerio*. No AF needs to be applied, because more than three NOECs, encompassing the base set, are available. The resulting $SRC_{eco, water}$ is 9.6 mg.l^{-1}.

3.1.4 Toxicity data and derivation of ERLs for sediment

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

3.1.5 Toxicity data and derivation of ERLs for soil

Two long-term studies with pine seedlings exposed to MCAA and trichloroacetic acid (TCAA) via roots and foliage were described in the RAR. No EC_{50}-value or NOEC-values could be extracted from these studies according to the RAR. Reason for this is not given.
A third terrestrial plants experiment was summarised in the RAR. A seedling emergence and seedling growth test of 21 days was carried out with one monocotyledon (oat) and two dicotyledons (rape and clover). For shoot height and fresh weight, the lowest NOEC of 3.2 mg.kg_{dwt}^{-1} was found for red clover and for seed emergence the lowest NOEC of 3.2 mg.kg_{dwt}^{-1} was found for oat. However, the test substance is reported to be mixed with the soil and after the start of the experiment no renewal took place. MCAA is known to degrade rapidly in soil with a DT_{50} of 66 hours in neutral soil at 15ºC. No analysis were carried out. In the RAR, the amount of MCAA during the experiment is questioned.

No data on toxicity to soil organisms are reported.

3.1.5.1 $MPC_{eco, soil}$

In the RAR, the equilibrium partitioning method is applied according to the TGD. EUSES is reported to have generated a $PNEC_{terrestrial}$ of 0.11 μg.kg wwt^{-1}. The validity of this PNEC is questioned, because it is based on partition coefficients.
The seedling emergence/growth test with three plant species as described in 3.1.5 is considered to be the only terrestrial ecotoxicity test suitable for deriving a $PNEC_{terrestrial}$. This test resulted in a 21-day NOEC of 3.2 mg.kg_{dwt}^{-1}. In the RAR the NOEC is recalculated using the DT_{50} of 66 hours. The resulting time weighted average NOEC was 0.6 mg.kg_{dwt}^{-1}. An assessment factor of 100 could be applied when following the TGD. Although chronic data are only available for one trophic level, it was expected that plants are most sensitive to MCAA. Therefore, an assessment of 10 could be suggested according to the authors of the RAR. However, during risk assessment the assessment factor of 100

was initially proposed as worst case resulting in PNECs of 32 $\mu g.kg_{dwt}^{-1}$ based on nominal concentration and 6 $\mu g.kg_{dwt}^{-1}$ based on time weighted average.
In the RAR preference is given to the PNEC based on experimental data, due to the uncertainties around the partition coefficients. For the present MPC-derivation, the time average of 6 $\mu g.kg_{dwt}^{-1}$ is proposed. $MPC_{eco,soil}$ = 6 $\mu g.kg_{dwt}^{-1}$ = 6*5.88/2 = 18 $\mu g.kg_{dwt}^{-1}$ Dutch standard soil.

3.1.5.2 $MPC_{human, soil}$

The $MPC_{human, soil}$ is based on the NOAEL of 3.5 $mg.kg_{bw}^{-1}.day^{-1}$ (see paragraph 3.1.2). The TL_{hh} = 3.5/100 = 0.035 $mg.kg_{bw}^{-1}.d^{-1}$. Specific human intake routes are allowed to contribute 10% of the human toxicological threshold limit. Four different routes contributing to human exposure have been incorporated: consumption of leafy crops, root crops, milk and meat. The critical route for MCAA was calculated to be consumption of leaf crops. The $MPC_{soil, human}$ was determined to be 4.6 $\mu g.kg_{dwt}^{-1}$ Dutch standard soil.

3.1.5.3 Selection of the MPC_{soil}

The lowest MPC_{soil} is the $MPC_{human, soil}$ of 4.6 $\mu g.kg_{dwt}^{-1}$ Dutch standard soil.

3.1.5.4 NC_{soil}

The NC_{soil} is set a factor 100 lower than the MPC_{soil}. NC_{soil} = 0.046 $\mu g.kg_{dwt}^{-1}$ Dutch standard soil.

3.1.5.5 $SRC_{eco, soil}$

Only chronic terrestrial data are presented in the RAR for MCAA, i.e. one experiment with oat, rape and clover (paragraph 3.1.5). Therefore, comparison of acute to chronic toxicity is not possible. The SRC-value can also be based on equilibrium partitioning, but in the RAR the validity of the partitioning coefficients is questioned. For ERL derivation, the time weighted average of 0.6 $mg.kg_{dwt}^{-1}$ is proposed as $SRC_{eco, soil}$. $SRC_{eco, soil}$ = 0.6*5.88/2 = 1.8 $mg.kg_{dwt}^{-1}$ Dutch standard soil.

3.1.6 Derivation of ERLs for groundwater

3.1.6.1 $MPC_{eco, gw}$

Since groundwater-specific ecotoxicological information is absent, the derived ERLs for surface water based on ecotoxicological data are taken as substitute. Thus, $MPC_{eco, gw}$ = $MPC_{eco, water}$ = 0.58 $\mu g.l^{-1}$.

3.1.6.2 $MPC_{human, gw}$

The $MPC_{human, gw}$ is set equal to the $MPC_{dw, water}$. Thus, $MPC_{human, gw}$ = $MPC_{dw, water}$ = 0.10 $\mu g.l^{-1}$.

3.1.6.3 Selection of MPC_{gw}

The lowest available MPC is the $MPC_{human, gw}$ of 0.10 $\mu g.l^{-1}$. Thus, the final MPC_{gw} = 0.10 $\mu g.l^{-1}$.

3.1.6.4 NC_{gw}

The NC_{gw} is set a factor 100 lower than the MPC_{gw}. Thus, NC_{gw} = 0.1/100 = 0.001 $\mu g.l^{-1}$.

3.1.6.5 $SRC_{eco, gw}$

The $SRC_{eco, gw}$ is set equal to the $SRC_{eco, water}$ of 9.6 $mg.l^{-1}$. $SRC_{eco, gw}$ = 9.6 $mg.l^{-1}$.

4 Conclusions

In this report, the environmental risk limits negligible concentration (NC), maximum permissible concentration (MPC), maximum acceptable concentration for aquatic ecosystems (MAC_{eco}), and serious risk concentration for ecosystems (SRC_{eco}) are derived for MCAA in water, groundwater and soil. No risk limits were derived for the sediment compartment because exposure of sediment is considered negligible. No MCAA data were available for air.
The ERLs that were obtained are summarised in the table 8 below.

Table 8. Derived MPC, NC, MAC_{eco}, and SRC_{eco} values for MCAA.

ERL	**Unit**	**MPC**	**NC**	**MAC_{eco}**	**SRC_{eco}**
Water[a]	$\mu g.l^{-1}$	0.58	$5.8x10^{-3}$	0.58	9,600
Drinking water[a]	$\mu g.l^{-1}$	0.10			
Marine	$\mu g.l^{-1}$	0.058	$5.8x10^{-4}$	0.058 [c]	9,600
Sediment		n.d.[b]			
Soil[d]	$\mu g.kg_{dw}^{-1}$	4.6	0.046		1,800
Groundwater	$\mu g.l^{-1}$	0.10	$1.0x10^{-3}$		9,600

[a] 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}.
[b] n.d. = not determined
[c] provisional value
[d] expressed on Dutch standard soil

rivm

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