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Rapport in het kort

Milieurisicogrenzen voor methacrylzuur

Dit rapport geeft milieurisicogrenzen voor methacrylzuur in (grond)water, bodem en lucht. Milieurisicogrenzen zijn de technisch-wetenschappelijke advieswaarden voor de uiteindelijke milieukwaliteitsnormen in Nederland. De milieurisicogrenzen voor methacrylzuur zijn gebaseerd op de uitkomsten van de EU risicobeoordeling voor methacrylzuur (Bestaande Stoffen Verordening 793/93). De afleiding van de milieurisicogrenzen sluit tevens aan bij de richtlijnen uit de Kaderrichtlijn Water. Monitoringsgegevens voor het Nederlandse milieu zijn niet beschikbaar. Hierdoor is geen uitspraak mogelijk of de afgeleide milieurisicogrenzen worden overschreden.

Trefwoorden: milieukwaliteitsnormen; milieurisicogrenzen; methacrylzuur; maximaal toelaatbaar risiconiveau; verwaarloosbaar risiconiveau

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Contents

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 methacrylic acid in water, groundwater, soil and air. 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, prepared under the European Existing Substances Regulation (793/93/EEC). No risk limits were derived for the sediment compartment, because of the relatively low sediment-water partition coefficient.

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}, 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.

Monitoring data for methacrylic acid in the Dutch environment are not available. Therefore it cannot be judged if the derived ERLs are being exceeded.

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

ERL	**unit**	**value**			
		MPC	NC	MAC_{eco}	SRC_{eco}
water	$mg.L^{-1}$	0.16	1.6×10^{-3}	0.45	9.5
drinking water [a]	$mg.L^{-1}$	5.8			
marine	$mg.L^{-1}$	0.016	0.16×10^{-3}	4.5×10^{-2}	9.5
sediment	$mg.kg_{dwt}^{-1}$	n.d.			
soil	$mg.kg_{dwt}^{-1}$	0.10	1.0×10^{-3}		6.0
groundwater	$mg.L^{-1}$	0.16	1.6×10^{-3}		9.5
air	$mg.m^{-3}$	0.71	7.1×10^{-3}		

[a] The exact way of implementation of the $MPC_{dw, water}$ in the Netherlands is at present under discussion. Therefore, the $MPC_{dw, water}$ is presented as a separate value in this report.

n.d. = not derived.

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1 Introduction

1.1 Project framework

In this report environmental risk limits (ERLs) for surface water (freshwater and marine), soil and groundwater are derived for methacrylic acid. The following ERLs are considered:

- 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 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) from these ERLs. ERLs should thus be considered as preliminary values that do not have any official status.

1.2 Production and use of methacrylic acid

Methacrylic acid is used as an internal and external intermediate in the chemical industry for the production of methacrylic acid esters and as co-monomer in different kinds of polymers. The main use of methacrylic acid is in the preparation of ethyl methacrylate and higher homologues by direct esterification. In addition, methacrylic acid is used in the preparation of carboxylated polymers and emulsion polymers for paints, adhesives and textile applications. The Risk Assessment Report (RAR) (European Commission, 2002) calculates a total production volume of 40,000 tons per year. Taking the import volume into consideration, 45,000 tons per year are assumed to be available in the European market. More information can be found in the RAR (European Commission, 2002). In 2008, 2-ethylhexyl acrylate acid has been pre-registered for REACH meaning an expected production volume of at least 1 tonne a year. However, no specific production volumes are given on the ECHA website (echa.europa.eu). Furthermore, it is not known whether the pre-registration will be followed by a definitive registration. No conclusions can be drawn on the current production and import in Europe.

2 Methods

2.1 Data collection

The final Risk Assessment Report (RAR) of methacrylic acid (European Commission, 2002) produced in the framework of Existing Substances Regulation (793/93/EEC) was used as only source of physico-chemical and (eco)toxicity data. Information given in the RARs is checked thoroughly by European Union member states (Technical Committee) and afterwards peer-reviewed by the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE, now the Scientific Committee on Health and Environmental Risk - SCHER). In their opinion, the CSTEE does agree with the derived PNEC values. 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 current 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). For the derivation of ERLs for air, no specific guidance is available. However, as much as possible the basic principles underpinning the ERL derivation for the other compartments are followed for the atmospheric ERL derivation (if relevant for a chemical).

2.2.1 Drinking water abstraction

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_{water} value. The $MPC_{dw,\ water}$ is therefore presented as a separate value in this report.

The $MPC_{dw,\ water}$ is also used to derive the MPC_{gw}. For the derivation of the $MPC_{dw,\ water}$, a substance specific removal efficiency related to simple water treatment may be needed. Because there is no agreement as yet on how the removal fraction should be calculated, water treatment is not taken into account.

2.2.2 $MAC_{eco,\ marine}$

In this report, a MAC_{eco} is also derived for the marine environment. The assessment factor for the $MAC_{eco,\ marine}$ value is based on:

- the assessment factor for the $MAC_{eco, water}$ value when acute toxicity data for at least two specific marine taxa are available, or
- using an additional assessment factor of 5 when acute toxicity data for only one specific marine taxon are available (analogous to the derivation of the MPC according to Van Vlaardingen and Verbruggen (2007)), or
- using an additional assessment factor of 10 when no acute toxicity data are available for specific marine taxa.

If freshwater and marine data sets are not combined the $MAC_{eco, marine}$ is derived on the marine toxicity data using the same additional assessment factors as mentioned above. It has to be noted that this procedure is currently not formalised. Therefore, the $MAC_{eco, marine}$ value needs to be re-evaluated once an agreed procedure is available.

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3 Derivation of environmental risk limits for methacrylic acid

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

3.1.1 Identity

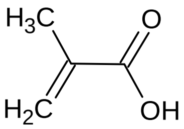

Figure 1. Structural formula of methacrylic acid.

Table 2. Identification of methacrylic acid.

Parameter	Name or number
Chemical name	2-methyl-2-propenoic acid
Common/trivial/other name	methacrylic acid
CAS number	79-41-4
EC number	201-204-4
Molecular formula	$C_4O_2H_6$

3.1.2 Physico-chemical properties

Table 3. Physico-chemical properties of methacrylic acid.

Parameter	Unit	Value	Remark
Molecular weight	[g.mol^{-1}]	86.09	
Water solubility	[mg.L^{-1}]	89	for 25°C
log K_{OW}	[-]	0.93	
K_{OC}	[L.kg^{-1}]	n.r.	see section 3.1.3
Vapour pressure	[Pa]	90	20°C
Melting point	[°C]	14-16	
Boiling point	[°C]	159-163	1013 hPa
Henry's law constant	[Pa.m^3.mol^{-1}]	0.087	

n.r. = not reported.

3.1.3 Behaviour in the environment

Table 4. Selected environmental properties of methacrylic acid.

Parameter	Unit	Value	Remark	Reference
Hydrolysis half-life	DT50 [d]	>28 days	hydrolytically stable	RAR
Photolysis half-life	DT50 [d]	n.r.		RAR
Degradability			readily biodagradable	RAR

n.r. = not reported

In the atmosphere, methacrylic acid will react with the photochemically produced hydroxyl radicals. The atmospheric half-life of methacrylic acid has been estimated to be 20 hours based upon atmospheric concentrations of 5 x 10^5 OH.cm^{-3} and 24 hours based upon atmospheric concentrations of 7 x 10^{11} O_3.cm^{-3} (Atkinson, 1987). From these half-lifes an overall rate constant of 1.49 d^{-1} for photodegradation in the atmosphere is calculated.

In the EU-RAR it is stated that since no correlation between adsorption coefficient (Kp) and the organic carbon contents was observed, the method proposed in the TGD to estimate the partition coefficients in the different compartments using default organic carbon contents in the different compartments is not applicable. Therefore, a uniform Kp value was chosen to be used for all compartments (soil, sediment, suspended matter and sludge). Depending on the data basis on which the mean value is calculated (from all the measured adsorption and desorption coefficients or from the given ranges), the resulting values are 0.4 L.kg^{-1} and 0.6 L.kg^{-1}, respectively. For the risk assessment purpose an average Kp value of 0.5 L.kg^{-1} was chosen.

3.1.4 Bioconcentration and biomagnification

An overview of the bioaccumulation data for methacrylic acid is given in Table 5.

Table 5. Overview of bioaccumulation data for methacrylic acid.

Parameter	Unit	Value	Remark	Reference
BCF (fish)	[L.kg^{-1}]	1.2	QSAR derived value	RAR
BMF	[kg.kg^{-1}]	1	Default value since the log K_{ow} < 4.5.	

3.1.5 Human toxicological threshold limits and carcinogenicity

Classification and labelling according to the 25th ATP of Directive 67/548/EEC:
Classification: Xn; R21/22; C; R35

No existing TDIs or TCAs available and these values have been derived with assistance of RIVM-SIR. In the risk characterization of the EU-RAR, the lowest NOAEL mentioned is 167 mg.kg^{-1}.day^{-1} (reproductive toxicity). This was based on a repeated dose toxicity studies in mice (90-day inhalation). The NOAEC of this study was 100 ppm (0.357 mg.L_{air}^{-1}) for systemic effects. The derived concentration in air was converted to the inhaled amount of the substance using the respiratory minute volume 1.3 L.min^{-1}.kg^{-1} and exposure duration of 360 min.day^{-1}: 0.357 x 1.3 x 360 =
167 mg.kg_{bw}^{-1}.day^{-1}.
Using an assessment factor of 100 leads to a TDI of 1.67 mg.kg_{bw}^{-1}.day^{-1}.

Methacrylic acid is irritating to the respiratory tract. The corresponding NOAEC is 20 ppm (71.4 mg.m^{-3}, semi-chronic). Using an assessment factor of 100 results in a TCA of 0.714 mg.m^{-3}, which will be used to derive risk limits for air.

3.2 Trigger values

This section reports on the trigger values for ERL_{water} derivation (as demanded in WFD framework).

Table 6. Methacrylic acid: collected properties for comparison to MPC triggers.

Parameter	Value	Unit	Method/Source
Log $K_{p,susp-water}$	-0.3	[-]	Kp = 0.5 see section 3.1.3
BCF	1.2	[$L.kg^{-1}$]	
BMF	1	[kg,kg^{-1}]	
Log K_{OW}	0.93	[-]	
R-phrases	R21/22, R35	[-]	
A1 value	n.a.	[$\mu g.L^{-1}$]	
DW standard	n.a.	[$\mu g.L^{-1}$]	

- o methacrylic acid has a log $K_{p, susp-water}$ < 3; derivation of $MPC_{sediment}$ is not triggered.
- o methacrylic acid has a log $K_{p, susp-water}$ < 3; expression of the MPC_{water} as $MPC_{susp, water}$ is not required.
- o methacrylic acid has a log K_{ow} < 3; assessment of secondary poisoning is not triggered.
- o methacrylic acid has an R21/22 and R35 classification. Therefore, an MPC_{water} for human health via food (fish) consumption ($MPC_{hh food, water}$) does not have to be derived.

3.3 Toxicity data and derivation of ERLs for water

An overview of the selected freshwater toxicity data for methacrylic acid as reported in the RAR is given in Table 7. No marine toxicity data is available according to the RAR.

Table 7. Methacrylic acid: selected freshwater toxicity data for ERL derivation.

Chronic Taxonomic group	$NOEC/EC_{10}$ ($mg.L^{-1}$)	Acute Taxonomic group	$L(E)C_{50}$ ($mg.L^{-1}$)
Algae		**Algae**	
Selenastrum capricornutum [a]	**8.2**	*Selenastrum capricornutum*	45
Crustacea		**Crustacea**	
Daphnia magna [b]	53	*Daphnia magna* [c]	>130[g]
		Pisces	
		Danio rerio [d]	100 -180
		Leuciscus idus [e]	224
		Oncorhynchus mykiss [f]	84

The bold value is used for derivation of the $MPC_{eco, water}$.

[a] considered to be the most relevant algae study in the EU-RAR.

[b] during the test the pH-values ranged from 6.6 to 7.6 at 53 $mg.L^{-1}$ and from 5.6 to 7.0 at 110 $mg.L^{-1}$ so that the toxicity effects can be ascribed to methacrylic acid rather than to a pH change.

[c] measured pH values ranged between 7.9 and 7.0 at the end of the test.

[d] at 180 $mg.L^{-1}$, the pH decreased to ≤ 5.1, indicating that the 100% mortality observed might be caused by a pH effect.

[e] pH adjusted to 7.7.

[f] pH decreased from 7.8 in control up to 5.3 in highest test concentration, so a pH effect cannot be excluded.

[g] This value is not used for the MPC derivation but to indicate that the toxicity has been tested and that the base set is complete.

3.3.1 Treatment of fresh- and saltwater toxicity data

Since no saltwater data were available, the MPC derivation is based on freshwater data only.

3.3.2 Mesocosm studies

No mesocosm studies were available.

3.3.3 Derivation of MPC_{water} and MPC_{marine}

3.3.3.1 $MPC_{eco, water}$ and $MPC_{eco, marine}$

Results from acute tests with species from three trophic levels are available. In addition, for *Daphnia* a prolonged toxicity test is available. The lowest test result considered relevant for PNEC derivation was recorded with algae (*Selenastrum capricornutum*: E_rC_{10} = 8.2 mg.L^{-1}).
For the determination of the PNEC this EC_{10} is regarded as a long-term NOEC test result, according to the TGD. An assessment factor of 50 is used as suggested for a complete dataset and NOECs for two trophic levels. Therefore, in the RAR the derived PNEC is: 8200 / 50 = 164 µg.L^{-1}. The $MPC_{eco, water}$ is set equal to the PNEC at: 164 µg.L^{-1}.

No saltwater data are available in the EU-RAR, therefore the $MPC_{eco, marine}$ is based on the same dataset using an additional assessment factor of 10. This results in an $MPC_{eco, marine}$ of 16.4 µg.L^{-1}.

3.3.3.2 $MPC_{sp, water}$ and $MPC_{sp, marine}$

Methacrylic acid has a log K_{ow} < 3, thus assessment of secondary poisoning is not triggered.

3.3.3.3 $MPC_{hh food, water}$

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

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

The only MPC_{water} derived is the $MPC_{eco, water}$, this MPC sets the MPC_{water} at 164 µg.L^{-1}. The MPC_{marine} is 16.4 µg.L^{-1}.

3.3.4 Derivation of $MPC_{dw, water}$

No A1 value and DW standard are available for methacrylic acid. With the TDI of 1.67 mg.kg$_{bw}^{-1}$day^{-1} an $MPC_{dw, water, provisional}$ can be calculated with the following formula: $MPC_{dw, water, provisional}$ = 0.1 x TL_{hh} x BW / $uptake_{dw}$ where the TL_{hh} is the TDI, BW is a body weight of 70 kg, and $uptake_{dw}$ is a daily uptake of 2 L. As described in section 2.2 water treatment is currently not taken into account. Therefore the $MPC_{dw, water}$ = $MPC_{dw, water, provisional}$ and becomes: 0.1 x 1.67 x 70 / 2 = 5.8 mg.L^{-1}.

3.3.5 Derivation of MAC_{eco}

The MAC_{eco} is based on the lowest L(E)C50 available. This is the EC50 of 45 mg.L^{-1} for *Selenastrum capricornutum*. An assessment factor of 100 is applied because the compound has no potential to bioaccumulate. The MAC_{eco} is 45 / 100 = 0.45 mg.L^{-1}.

Since there are no marine data, an additional assessment factor of 10 is applied for the $MAC_{eco, marine}$: 45 / 1000 = 0.045 mg.L^{-1}. It has to be noted that this procedure for the $MAC_{eco, marine}$ is currently not formalised. Therefore, the $MAC_{eco, marine}$ needs to be re-evaluated once an agreed procedure is available.

3.3.6 Derivation of NC_{water}

According to the RAR, methacrylic acid does occur naturally as methacrylic acid-coenzyme-A. Since no natural background concentration in water is currently known, the NC_{water} is set a factor 100 below the MPC_{water}: 1.64 µg.L^{-1}. The NC_{marine} is 0.16 µg.L^{-1}.

3.3.7 Derivation of $SRC_{eco,\ aquatic}$

The geometric means of the LC_{50} and NOEC data are 94.6 mg.L^{-1} and 20.8 mg.L^{-1}, respectively. Unbound values (>) and ranges have not been used in this calculation. Since the geometric mean of $LC_{50}/10$ is < the geometric mean of NOEC data, the $SRC_{eco,\ aquatic}$ is set to 9.5 mg.L^{-1}. The $SRC_{eco,\ aquatic}$ is valid for the marine and the freshwater environment.

3.4 Toxicity data and derivation of ERLs for sediment

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

3.5 Toxicity data and derivation of ERLs for soil

No terrestrial ecotoxicity data are available according to the RAR.

3.5.1 Derivation of MPC_{soil}

3.5.1.1 $MPC_{eco,\ soil}$

Since no toxicity data are available, the $MPC_{eco,\ soil}$ is calculated from the $MPC_{eco,\ water}$ using equilibrium partitioning. With an $MPC_{eco,\ water}$ of 164 µg.L^{-1} and a Kp_{soil} of 0.5 L.kg^{-1}, the $MPC_{eco,\ soil}$ is to 91.6 µg.kg_{wwt}^{-1}. Conversion to dry soil gives 104 µg.kg_{dwt}^{-1}. Conversion to Dutch standard soil is not considered necessary, as the organic content of the soil is not critical for the adsorption behaviour of methacrylic acid.

3.5.1.2 $MPC_{sp,\ soil}$

Methacrylic acid has a log K_{ow} < 3 and therefore secondary poisoning is not triggered.

3.5.1.3 $MPC_{human,\ soil}$

For the derivation of the $MPC_{human,\ soil}$, the TDI of 1.67 mg.kg_{bw}^{-1}.day^{-1} can be used as TL_{hh} with the method as described in van Vlaardingen and Verbruggen (2007). The $MPC_{human,\ soil}$ can be calculated using the Kp of 0.5 L.kg^{-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. Uptake via root crops was determined to be the critical route. The calculated $MPC_{human,\ soil}$ is 18.4 mg.kg_{dwt}^{-1}. Conversion to Dutch standard soil is not considered necessary, as the organic content of the soil is not critical for the adsorption behaviour of acrylic acid.

3.5.1.4 Selection of the MPC_{soil}

The lowest MPC_{soil} is the $MPC_{eco,\ soil}$, this will set the MPC_{soil} to 104 µg.kg_{dwt}^{-1}.

3.5.2 Derivation of NC_{soil}

According to the RAR, methacrylic acid does occur naturally as methacrylic acid-coenzyme-A. Since a natural background concentration in soil is currently not known, the NC_{soil} is set a factor of 100 lower than the MPC_{soil}: 1.0 $\mu g.kg_{dwt}^{-1}$.

3.5.3 Derivation of $SRC_{eco,\ soil}$

The $SRC_{eco,\ soil}$ can be calculated from the $SRC_{eco,\ aquatic}$ using equilibrium partitioning. This results in an $SRC_{eco,\ soil}$ of 6.0 $mg.kg_{dwt}^{-1}$.

3.6 Derivation of ERLs for groundwater

3.6.1 Derivation of MPC_{gw}

3.6.1.1 $MPC_{eco,\ gw}$

The $MPC_{eco,\ gw}$ is set equal to the $MPC_{eco,\ water}$: 164 $\mu g.L^{-1}$.

3.6.1.2 $MPC_{human,\ gw}$

The $MPC_{human,\ gw}$ is set equal to the $MPC_{dw,\ water}$: 5.8 $mg.L^{-1}$.

3.6.1.3 Selection of the MPC_{gw}

The lowest MPC_{gw} is the $MPC_{eco,\ gw}$. Thus, the MPC_{gw} is 164 $\mu g.L^{-1}$.

3.6.2 Derivation of NC_{gw}

According to the RAR, methacrylic acid does occur naturally as methacrylic acid-coenzyme-A. Since a natural background concentration in groundwater is currently unknown, the NC_{gw} is set a factor 100 lower than the MPC_{gw}: 164 / 100 = 1.64 $\mu g.L^{-1}$.

3.6.3 Derivation of $SRC_{eco,\ gw}$

The $SRC_{eco,\ gw}$ is set equal to the $SRC_{eco,\ aquatic}$ at 9.5 $mg.L^{-1}$.

3.7 Derivation of ERLs for air

3.7.1 Derivation of MPC_{air}

3.7.1.1 $MPC_{eco,\ air}$

No ecotoxicological data is available for the air compartment. Therefore, no $MPC_{eco,\ air}$ can be derived.

3.7.1.2 $MPC_{human,\ air}$

The TCA as derived in section 3.1.5 will set the $MPC_{human,\ air}$: 714 $\mu g.m^{-3}$.

3.7.1.3 Selection of the MPC_{air}

The MPC_{air} is the only value available: 714 $\mu g.m^{-3}$ ($MPC_{human,\ air}$).

3.7.2 Derivation of NC_{air}

According to the RAR, methacrylic acid does occur naturally as methacrylic acid-coenzyme-A. Since a natural background concentration in air is currently unknown, the MPC_{air} divided by 100 is the NC_{air}: 7.1 µg.m^{-3}.

3.8 Comparison of derived ERLs with monitoring data

The RIWA (Dutch Association of River Water companies) does not report monitoring data for methacrylic acid in their annual reports between 2001 and 2007. The Dutch Ministry of Transport, Public Works and Water Management does not present monitoring data for methacrylic acid on their website (www.waterbase.nl). Therefore, a comparison of the derived ERLs with monitoring data is not possible.

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4 Conclusions

In this report, the risk limits Negligible Concentration (NC), Maximum Permissible Concentration (MPC), Maximum Acceptable Concentration for ecosystems (MAC_{eco}), and Serious Risk Concentration for ecosystems (SRC_{eco}) are derived for methacrylic acid in water, groundwater, soil and air. No risk limits were derived for the sediment compartment because exposure of sediment is considered negligible. The ERLs that were obtained are summarised in Table 8. Monitoring data for methacrylic acid in the Dutch environment are not available. Therefore cannot be estimated if the derived ERLs are being exceeded. Considering the large production volumes and the toxicity of the compound, environmental monitoring should be considered.

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

ERL	**unit**	**value**			
		MPC	NC	MAC_{eco}	SRC_{eco}
water	$mg.L^{-1}$	0.16	1.6×10^{-3}	0.45	9.5
drinking water [a]	$mg.L^{-1}$	5.8			
marine	$mg.L^{-1}$	0.016	0.16×10^{-3}	4.5×10^{-2}	9.5
sediment	$mg.kg_{dwt}^{-1}$	n.d.			
soil	$mg.kg_{dwt}^{-1}$	0.10	1.0×10^{-3}		6.0
groundwater	$mg.L^{-1}$	0.16	1.6×10^{-3}		9.5
air	$mg.m^{-3}$	0.71	7.1×10^{-3}		

[a] The exact way of implementation of the $MPC_{dw, water}$ in the Netherlands is at present under discussion. Therefore, the $MPC_{dw, water}$ is presented as a separate value in this report.

n.d. = not derived.

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