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**MICROPROOF**  
**Micropollutants in Road RunOff**

**List of potential predicted  
environmental concentrations for  
microplastics and OMPs**

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## 1 Introduction

This deliverable provides a short description of the potential predicted environmental concentrations for microplastics and OMPs. The concentrations in this deliverable are based on literature research and assumptions regarding the dilution. These concentrations only include the concentration resulting from the traffic (and does not include concentrations resulting from other sources).

New measurements will be performed in the course of the Microproof project, but these have not yet been included in this deliverable.

The goal of making a first order estimate of these concentrations is to assess the water quality in a risk assessment (and to estimate whether the traffic could result in a significant increase of water quality risks).

## 2 Selection of 10 relevant pollutants

In Microproof report 1.3, an overview of relevant pollutants is presented. These are pollutants that are expected to be released in relatively high loads, or pollutants that are expected to be toxic in the aquatic environment. This list has also been compared to the priority substances in the Water Framework Directive.

This list needs to be condensed to a selection of 10 pollutants. The following criteria have been used to select the relevant pollutants:

1. Priority substances from the Water Framework Directive have been included in the list (if they are released from roads)
2. Other relevant pollutants (as selected in Markiewicz, et al., 2017; Baun et al., 2006)

Markiewicz et al. (2017) used the RICH (Ranking and Identification of Chemical Hazards) method to decide on the relevant pollutants. The ranking is based on the physicochemical properties and biological effects. Pollutants with the following properties are included in the list:

- Low volatility
- Persistent
- Risk for bioaccumulation
- Risk for toxicity
- Long-term adverse effects

Table 1 shows the ten selected pollutants. Even though the focus will be on these ten proposed pollutants, the other relevant pollutants presented in Microproof report 1.3 will also be considered, whenever possible.

**Table 1 Ten pollutants, proposed for inclusion in the risk assessment.**

	Pollutant	Short name	Cas number	Source
	Microplastics			Tyres, road marking, brakes
WFD	benzo(a)pyrene	BaP	50-32-8	Tyres, asphalt, lubricants
	Fluoranthene		206-44-0	Tyres, asphalt, lubricants
	Nonylphenol	NP	104-40-5	Vehicles
	4-tert-octylphenol	OP	140-66-9	Vehicles
	Di(2-ethylhexyl)phthalate	DEHP	117-81-7	Vehicles
	Bisphenol A	BPA	80-05-7	Brake fluid
Other	Mercaptobenzothiazole	MBT	149-30-4	Tyres
	Tolytriazole	TT	29385-43-1	Brake fluid, coolants
	Diisodecyl phthalate	DIDP	26761-40-0	Vehicles
	Hexa(methoxymethyl)melamine	HMMM	3089-11-0	Car coatings

### 3 Potential predicted environmental concentrations

#### 3.1 Introduction

This chapter provides a description of the predicted environmental concentrations (PEC) that need to be used in the environmental risk assessment (WP3). These concentrations only include the concentration resulting from the traffic (and does not include concentrations resulting from other sources).

The PECs have been based on available reported measurement data of concentrations in runoff in literature. Dilution will ensure that the concentrations in surface waters are lower than the concentrations in road runoff. Therefore, the concentration in road runoff could be used as a maximum PEC. If the risk assessment shows that the concentration in road runoff is not a problem, then it is likely that the pollutant will not be a problem in surface water.

Apart from the concentration in road runoff, also a predicted concentration in surface water is needed to perform the risk assessment. Predicted environmental concentrations will be derived for a theoretical surface water, which can be used as an example. This theoretical surface water is relatively small with a low discharge, and this results in relatively high concentrations (compared to surface waters with a higher discharge). The concentration is estimated based on the concentration in runoff and a potential dilution. The dilution is explained in paragraph 3.2.

#### 3.2 Derivation of dilution factors for surface water

The dilution factor in a river can be calculated by dividing the surface water concentration with the storm water concentration. In this example, the surface water concentration in a river is estimated using the emission-immission discharge test (Rijkswaterstaat, 2018). The emission-immission discharge test is designed to calculate the resulting concentration from a point source discharge. The discharge test determines the concentration in the near vicinity

of the point of discharge and assesses whether the concentration meets the EQS standard and the increase in concentration does not lead to a significant deterioration in water quality. ([www.immissietoets.nl](http://www.immissietoets.nl)).

The surface water concentration is calculated based on the following assumptions:

Assumptions for the discharge of runoff into the surface water body:

The discharge occurs during a rain event of 1 hour, in which 30 mm of precipitation has reached the road surface. It is assumed that all of the precipitation that fell on the road surface (100 meter length and 12 meter wide) is discharged into the surface water body, containing a concentration of 1 µg/l. This means that in total  $0.03 * 12 * 100 = 36 \text{ m}^3/\text{hour} = 0.01 \text{ m}^3/\text{sec}$  water is discharged in the river.

The discharge occurs at the bank side, near the surface of the water, with a discharge diameter of 1 meter and a density of  $999 \text{ kg/m}^3$ .

Assumptions for the surface water (small water body):

- Flow:  $1 \text{ m}^3/\text{sec}$ ,
- Width: 2 meter
- Depth: 1 meter
- Length downstream: 25000 meter
- Depth density jump: 0 meter
- Temperature near bed: 15 degrees Celsius
- Temperature near surface: 20 degrees Celsius
- Background concentration: 0 µg/l

In this example, a discharge concentration of 1 µg/l results in a concentration at the EQS assessment distance of 0.011 µg/l and it result in a concentration at MAC assessment distance of 0.15 µg/l. This implies that the concentration in the storm water is diluted by a factor 10-100 when it enters a small surface water body. In large water bodies, this dilution will be much larger.

For a first estimation of predicted environmental concentrations, it is assumed that the concentration in a water body equals the storm water concentration divided by 100. The potential predicted concentrations are calculated by multiplying the highest reported concentrations in storm water with the dilution factor of 1/100.

### **3.3 Potential predicted environmental concentrations in sediment**

Concentrations in sediment depend on the concentration in surface water, flow, turbulence, pollutant characteristics, etc. A first order estimate will be based on the following assumptions:

If reported concentrations in sediment of storm water treatment systems are available in literature, then this value is multiplied with the dilution factor that is used for surface water concentrations (see paragraph 3.2). In case that no concentration in sediment is available, a fixed ratio between the predicted water concentration and predicted sediment concentration is assumed.

Björklund et al. (2009) reported both storm water concentrations and sediment concentrations for a selection of pollutants. The ratio between the storm water concentration (in µg/l) and sediment concentration (in µg/g) in this study is a factor of 10. This means that a storm water concentration of 1 µg/l results in a sediment concentration of 10 µg/g.

### 3.4 Potential predicted environmental concentrations

The potential predicted concentrations in *surface water* are calculated by multiplying the highest reported concentrations in storm water with the dilution estimated in paragraph 3.2. For several pollutants, only one reported concentration was available. The pollutant loading calculated with these assumptions is relatively high. The resulting concentrations are presented in Table 2.

The potential predicted concentrations in *sediments* (in  $\mu\text{g/g}$  dry weight) are calculated by multiplying the predicted surface water concentration (in  $\mu\text{g/l}$ ) with a factor of 10. If literature data is available on concentrations in sediments of storm water treatments, then this data is used (with the same dilution as for predicted concentrations in surface water). The resulting concentrations are presented in Table 2.

**Table 2 Highest reported concentrations in storm water and predicted concentrations in surface water. Please note that these predicted concentrations are rough estimates, and not actual measurements.**

Pollutant			Reported concentrations		Ref	Predicted concentrations	
Pollutant	Short name	Cas number	Storm water ( $\mu\text{g/l}$ )	Storm water sediment ( $\mu\text{g/g}$ )		Water ( $\mu\text{g/l}$ )	Sediment ( $\mu\text{g/g}$ )
Microplastics <sup>1)</sup>						120	1200
benzo(a)pyrene	BaP	50-32-8	0,829		2)	0,00829	0,08290
Fluoranthene		206-44-0	3,649		2)	0,03649	0,36490
Nonylphenol	NP	104-40-5	0,36	3,1	3)	0,00360	0,03100
4-tert-octylphenol	OP	140-66-9	0,06		3)	0,00060	0,00600
Di(2-ethylhexyl)phthalate	DEHP	117-81-7	2,27	98	4)	0,02270	0,98000
Bisphenol A	BPA	80-05-7	0,55		3)	0,00550	0,05500
Mercaptobenzothiazole	MBT	149-30-4	0,11		5)	0,00110	0,01100
Tolyltriazole	TT	29385-43-1	2,3		5)	0,02300	0,23000
Diisodecyl phthalate	DIDP	26761-40-0	8,6		4)	0,08600	0,86000
Hexa(methoxymethyl)melamine	HMMM	3089-11-0	0,88		6)	0,00880	0,08800

1) Unice et al., 2019

2) Tromp, 2005

3) Gasperi et al., 2014

4) Holsteijn, 2014

5) Seitz & Winzenbacher, 2017

6) Dsikowitsky & Schwarzbauer, 2015

Please note that these predicted concentrations are rough estimates of concentrations resulting from road transport. These are not actual concentrations that have been measured in the environment.

For other organic micropollutants than PAH, the number of measurements of concentrations in runoff becomes sporadic. Relevant studies are carried out by Seitz & Winzenbacher (2017), Kloefer et al. (2005), Reddy & Quinn (1997), Holsteijn (2014), Baumann & Ismeier (1998), Gasperi et al. (2014), Dsikowitsky & Schwarzbauer (2015), and the concentrations from table 2 are reported only in one or two of these articles. Since only concentrations in one or two studies were available for each pollutant, the uncertainty in the predicted environmental concentrations in Table 2 are large and actual measurements could be an order of magnitude higher or lower.

For PAH, more concentration measurements of PAH in runoff are available. The runoff concentrations in Table 2 are the highest of multiple measurements in a selection of three studies. Since more measurements are available, the uncertainty of the potential predicted environmental concentrations will be lower.

For tyre wear, the uncertainty is the largest, since the concentration is not measured in any study, but it is modelled in Unice et al. (2019), showing a range between 3.7 and 120 µg/l. Alternatively, the concentration of rubber particles in storm water could be estimated from MBT concentration in storm water (0,11 µg/l from Seitz & Winzenbacher, 2017), and the amount of MBT in fresh TRWP (7.5 mg/kg from Unice, 2015). This would result in a runoff concentration of 14666 µg/l and a potential predicted environmental concentration of 147 µg/l, which is in the same order of magnitude as the highest modelled concentration in Unice et al. (2019).

## 4 Conclusions

Predicted environmental concentrations in this report will be used in the risk assessment to investigate whether these pollutants will result in a decrease of aquatic quality. The derived predicted environmental concentrations are a first estimate and will be improved with actual measurement data at a later stage of this study.

## 5 Acknowledgement

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