Für Mensch & Umwelt

Umwelt Bundesamt

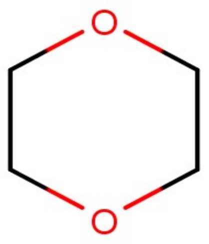
Third PMT Workshop: Getting control of PMT and vPvM substances under REACH

Getting control on 1,4-dioxane

Daniela Claßen, Daniel Sättler, Sabine Germer, Jona Schulze, Michael Neumann and Ivo Schliebner

Section IV 2.3 – Chemicals
German Environment Agency

1,4-Dioxane appears as a priority substance for assessment



2017/2019: Research projects recommend 1,4-dioxane to UBA for further assessment

2017: A question to Bavarian parliament reveals evidence of the substance in Bavarian surface waters in 2015/2016

2018: DVGW-UBA expert meeting suggests increasing relevance of the substance for drinking water resources

2018: UBA IV 2.3 establishes a team to assess the environmental relevance of 1,4-dioxane and other PMT/vPvM substances

1,4-Dioxane is detected in groundwater

- 75% of EU inhabitants depend on **groundwater** for their drinking water supply (EU COM, 2019)

Year	Location	results	Reference
2014	Selected sites w in Germany	sites selected based on suspected occurence 44 of 44 samples c ≥ LOD 0.04 µg/L ≤ c ≤ 152.11 µg/L	Magg et al., 2013
2015	lower Llobregat River basin (Spain)	70 samples 1.68 µg/L ≤ c ≤ 241 µg/L	Carrera et al., 2017
2016/2017	Flanders (Belgien)	sites with known 1,1,1-trichloroethane GW contamination 16/16 samples c ≥ LOD 13/ 16 c ≥ 50 µ/L (GW limit value) with cmax = 26,000 µg/L	OVAM, 2017
2019	Austria	26/149 samples c ≥ LOD 0.025 µg/L ≤ c ≤ 14 µg/L with 95% of the samples having a concentration of 0.25 µg/L or lower	Personal communication, 2020
various	USA and Japan	Reports demonstrate co-occurence of 1,4-dioxane with 1,1,1-trichloroethane and trichloroethylene in GW bodies	Abe (1999) Zenker et al. (2003) Anderson et al. (2012) Adamson et al. (2014)

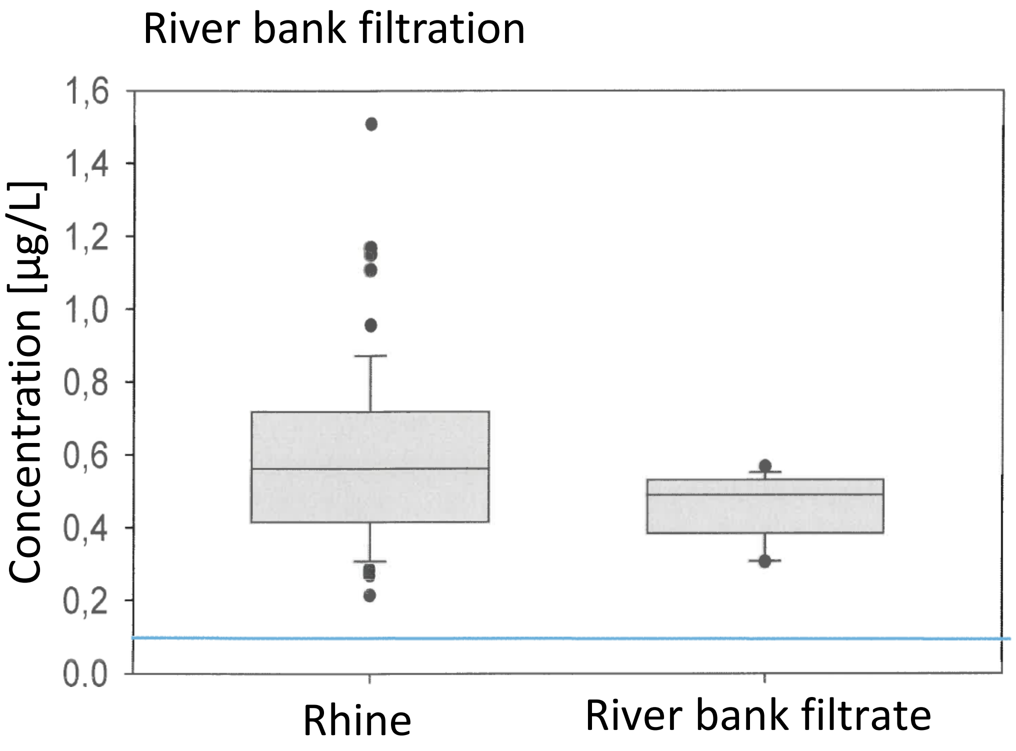
1,4-Dioxane is detected in river water

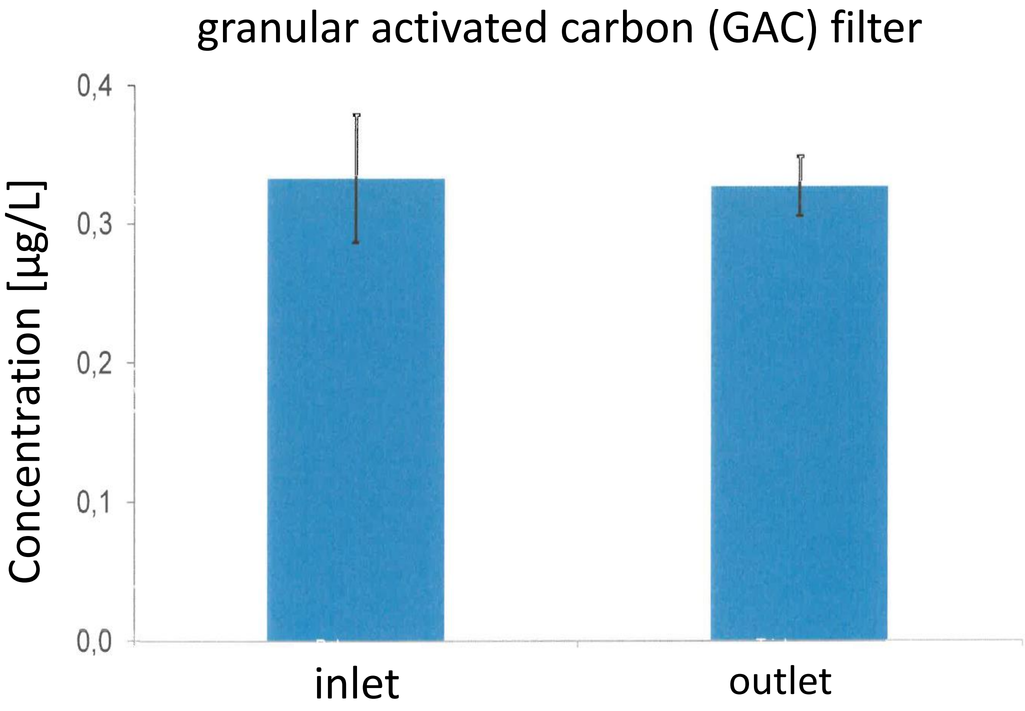
- River Bank filtrate makes up a remarkable share of total water used for drinking water production
- For 1,4-dioxane, the quality of River Bank filtrate relies on the quality of corresponding surface water
- Detected at relevant river sites

Year	Location	results	Reference
2010 - 2018	Lobith, Lower Rhine (Germany)	Basal levels between 1 – 2 µg/L, cmax > 5 µg/L	LANUV, 2019
2012/2013	River Oder (Poland/Germany)	cmax = 2.2 µg/L	Stepien et al., 2014
2012/2013	River Main (Germany)	cmax = 0.86 µg/L	Stepien et al., 2014
2016	Lech (Germany)	26/149 0.025 µg/L ≤ c ≤ 14 µg/L with 95% of the samples having a concentration of 0.25 µg/L or lower	Rüdel et al., 2020

1,4-Dioxane passes filters

- River bank filtration and granular activated carbon (GAC) filter only marginally removes 1,4-dioxane





Source: Röden et al. (2016)

1,4-Dioxane is detected in drinking water

- Detected in drinking water in Germany, Spain and outside Europe

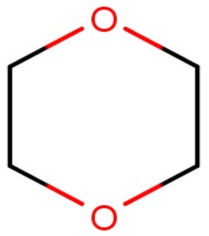
Year	Location	results	Reference
unknown	Frankfurt (Main) (Germany)	7 of 12 samples contained 1,4-dioxane with an c_{avr} = 0.22µg/L, c_{max} = 0.58µg/L	Magg et al., 2013
2015/2016	Germany	finished drinking water obtained managed aquifer recharge systems 80% of samples, contained 0.034 µg/L to 2.05 µg/L 1,4-dioxane	Karges et al., 2018
2016 - 2018	Sant Joan Despi, mouth Llobregat river (Spain)	n = 89 c_{avr} = 1.062 ± 0.923µg/L c_{max} = 4.356 µg/L	Carrera et al., 2019
2013 - 2015	U.S. public DW in USA	In 21% of 4864 public water systems detected 6.9% exceeded 0.35µg/L (U.S. health-based reference concetration)	Adamson et al., 2017
1995 - 1996	Kanagawa Prefecture (Japan)	Concentration between 0.2µg/L – 1.5µg/L (n = 12)	Abe, 1997

Relevant uses of 1,4-dioxane in REACH

Exposure assessment:

- Substance produced in or imported into EU >1000 tonnes per annum
- used as processing aid (solvent), intermediate for the production of other chemicals and as laboratory reagents (wide spread application)
- Is a by-product during synthesis of polyethoxylates and polyesters
- Widespread uses of polyethoxylates (and polyesters) containing residual concentrations of 1,4 dioxane suggest emissions to the environment, main environmental input path is highly likely to be emissions to waste water

1,4-Dioxane is very persistent



Persistence:

Abiotic degradation

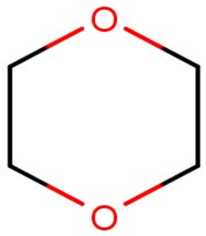
- 1,4-Dioxane is not hydrolysable
- 1,4-Dioxane is photodegradable in air; however negligible volatilisation to air (low Henry‘s Law constant)
- Photodegradation of 1,4-dioxane is expected to be no relevant degradation pathway for surface waters

Biotic degradation

- 1,4-Dioxane determined to be “not readily biodegradable” based on OECD screening tests
- no degradation observed in surface water simulation test (OECD 309; Hofman-Caris and Claßen, 2020) - **DT_{50}surface water (SFO) = >10,000 days**
- is not biodegradable in soil , except conditions being not representative for the unencumbered environment

→ **1,4-Dioxane is a very persistent substance.**

1,4-Dioxane is very mobile



Mobility:

- Adsorption/Desorption behaviour: Log Koc = 0.85 (EU RAR, 2002)

→ **1,4-Dioxane is a very mobile (vM) substance.**

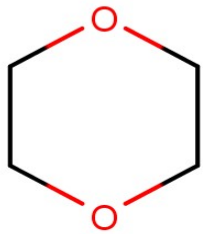
Long range transport potential

- Transportation in environment mainly via water due to high water solubility, low volatility from water and low potential for adsorption

- characteristic travel distance (CTD) of 2917 km with an overall persistence (P_{ov}) of 1771 days (OECD LRTP tool)

→ **1,4-Dioxane is capable of reaching regions far away from the point of initial emission.**

1,4-Dioxane is toxic



Toxicity:

- Risk Assessment Committee (RAC) has concluded that 1,4-dioxane fulfils the criteria for classification as carcinogenic Carc. 1B.

- This classification was also included in the draft 17th ATP to CLP.

→ **1,4-dioxane is a toxic (T) substance.**

Concerns arising from 1,4-dioxane‘s PMT substance properties

This substance …

- is persistent
- is mobile
- is toxic
- has the potential for long range transport
- is present in groundwater
- is present in EU’s surface water at constant if not increasing concentrations
- is present in single drinking water sites

Concerns arising from 1,4-dioxane‘s PMT substance properties

The concerns arising from the properties are…

- Irreversible and increasing presence in the environment
- Decontamination from environment and drinking water sources is difficult
- Continuous presence in water results in continuous exposure of humans and the environment
- Human Health effects
- Societal concern
- Long term effects are unknown

For these reasons and to exercise the precautionary principle, the release of 1,4-dioxane to the environment should be prevented.

Getting control of 1,4-dioxane

Steps to identify risk mitigation measures for 1,4-dioxane

- 2016: studies to identify relevant PMT substances commissioned
  → recommend 1,4-dioxane for further assessment

- 2018: substance issued at DVGW-UBA-expert discussion

- 2019: Consultation with industry about uses and environmental exposure

- 2020: Risk mangement option analysis (RMOA)
  two regulatory measures are needed to get control emissions of
  1,4-dioxane to the environment. (Link to ECHA)

Getting control of 1,4-dioxane

Regulatory Measures

1. Identification as a substance of very high concern (SVHC) according to Art. 57f of REACH

- Combination of its substance properties causing high concern to the environment and men via environment
- Formal recognition of SVHC properties, triggers additional information obligations, initiates substitution

2. Restriction

- Allows a tailored regulation of those uses of 1,4-dioxane itself and substances containing 1,4-dioxane, which result in environmental releases
- Can define acceptable residual concentrations in articles manufactured or imported into the EU
- currently **Call for Comments and Evidence** at ECHA (Link to ECHA)

Thank you for your attention!

Umwelt Bundesamt

Thanks to my UBA colleagues

Daniela Claßen
Daniel Sättler
Sabine Germer
Juliane Ackermann
Jona Schulze
Michael Neumann
Nannett Aust
Frauke Stock

Ivo Schliebner
German Environment Agency (UBA)
Section IV 2.3 „Chemicals“

Wörlitzer Platz 1, 06844 Dessau
+49-340-2103-2967

Ivo.Schliebner@uba.de
https://www.umweltbundesamt.de/en/PMT-substances