



# Protection of water resources from persistent, mobile and toxic (PMT) substances

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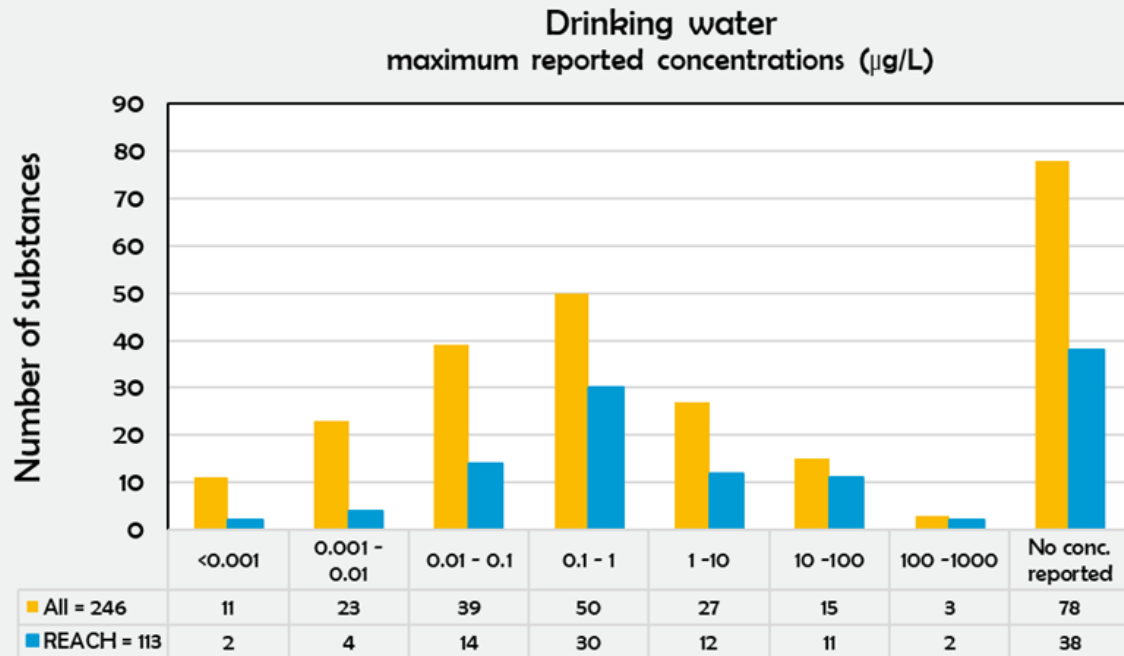


Temamøte «Risikovurdering og tiltaksbehov på land og i sjø»  
16-17.03.2022

# Agenda

- Hva er en PMT-stoff (og vPvM stoff)
- Utvikling av PMT/vPvM kriteria under REACH
- Løsninger- H2020 ZeroPM

# There are chemicals in drinking water

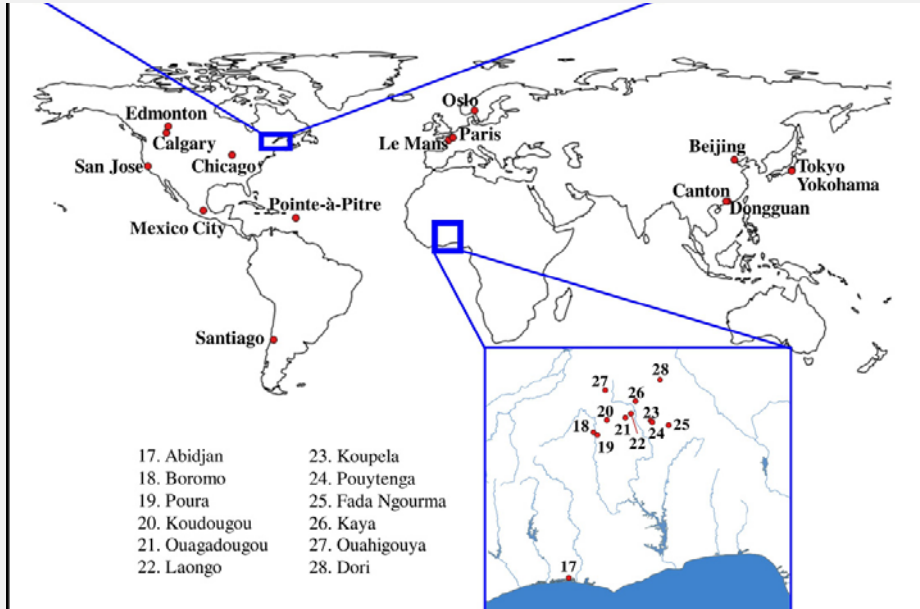


Quelle: Arp and Hale (2019), FKZ: 3716 67 416 0

- Summary of 25 Studies conducted between 2000-2018



# PFAS i Oslo's drinking water and the world's cities

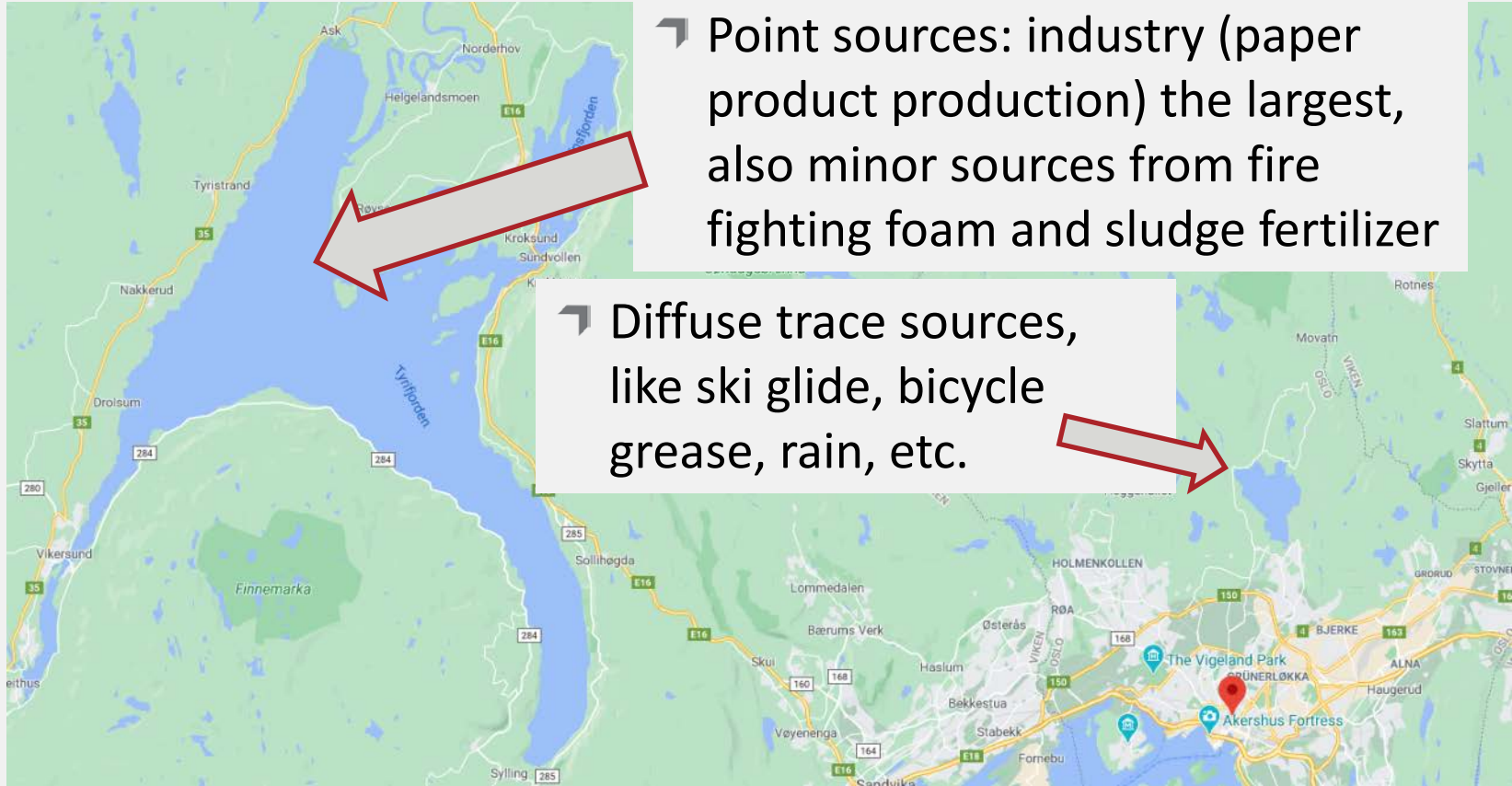


➤ Kaboré et al.  
STOTEN 2018

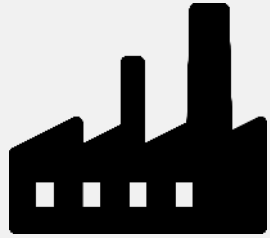
## Mean (ng/L) of PFAS in drinking water

	Paris	Tokyo	Oslo
PFBA	0.91	3.31	1.56
PFPA	2.96	2.31	2.33
PFHxA	3.65	4.64	0.29
PFHpA	1.27	3.19	0.36
<b>PFOA</b>	<b>0.97</b>	<b>3.85</b>	<b>0.30</b>
<b>PFNA</b>	<b>0.11</b>	<b>4.46</b>	<b>0.32</b>
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6:2 FTSA	6.43	0.07	-
ΣEFSA PFAS	2.7	10.17	0.83
ΣPFAS	18.39	25.18	5.78

# Sources of PFAS in Maridalen & Tyrifjorden



# Properties of a PMT substance



Chemical Synthesis



Transport through the environment or infrastructure



Water treatment and production



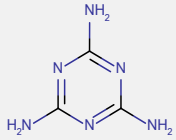
Consumption



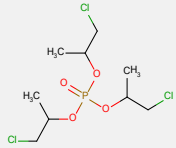
*Persistency and Mobility*

*Toxicity*

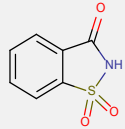
# Not just PFAS



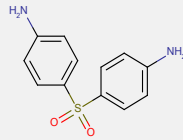
Melamine



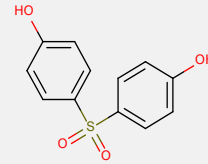
TCPP



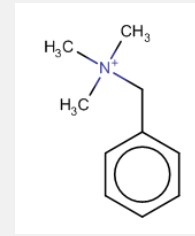
Saccharine



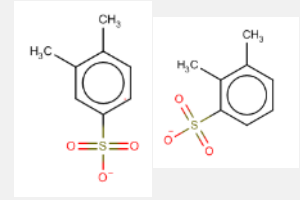
Dapsone



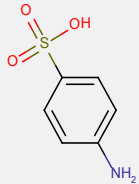
Bisphenol S



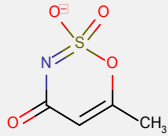
Benzyltrimethyl ammonium



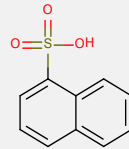
Dimethylbenzene sulfonic acid



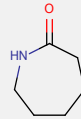
Sulfanilic acid



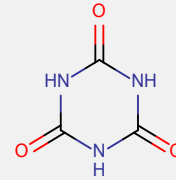
Acesulfame



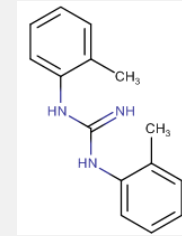
Naphthalene sulfonic acid



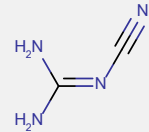
ε-Caprolactam



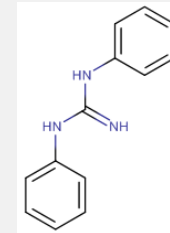
Cyanuric acid



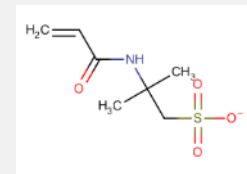
1,3-Di-*o*-tolylguanidine



Cyanoguanidine



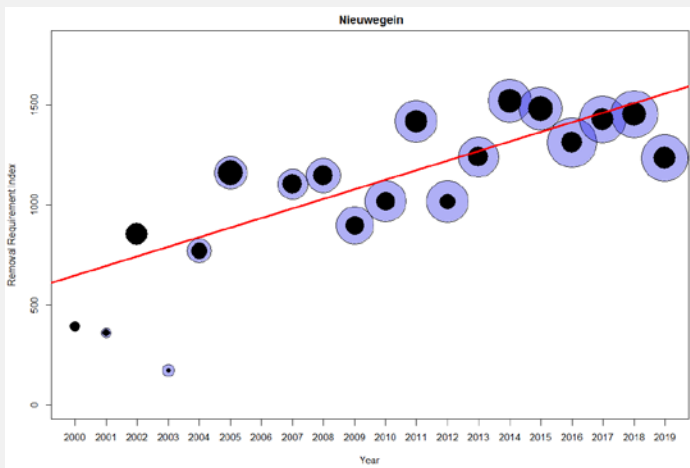
1,3-Diphenylguanidine



2-Acrylamido-2-methylpropane sulfonic acid


# The need for hazard based criteria

- Persistent, mobile and toxic (PMT) and very persistent, very mobile (vPvM) substances are a threat to sources of drinking water
- Water suppliers have been raising concern, calling for stewardship by industry and regulatory action by authorities.



➤ Costs of NL water treatment due to PMT/vPvM substances

6 August 2019  
Moving Forward on PMT and vPvM Substances



**Briefing Note**

**Moving Forward on PMT and vPvM Substances**

1. Introduction

The purpose of this paper is to demonstrate the impact of persistent, mobile and toxic (PMT) and very persistent, very mobile (vPvM) substances on water services. We will describe possible regulatory approaches to restrict their use.

A water quality index for the removal requirement and purification treatment effort of micropollutants.  
Water Supply 1 February 2021; 21 (1): 128–145. doi: <https://doi.org/10.2166/ws.2020.289>



# Problem will get worse if no action taken

- Drinking wastewater a «sustainable» re-use
- No (expensive) remediation technology is perfect for all substances
- Increased, unknown exposure to PMT substances

Setting the agenda in research

## Comment

Tortajada and van Rensburg, Nature, 2020



One of five water-reuse plants in Singapore, which together supply about 40% of the nation's water for drinking and other uses.

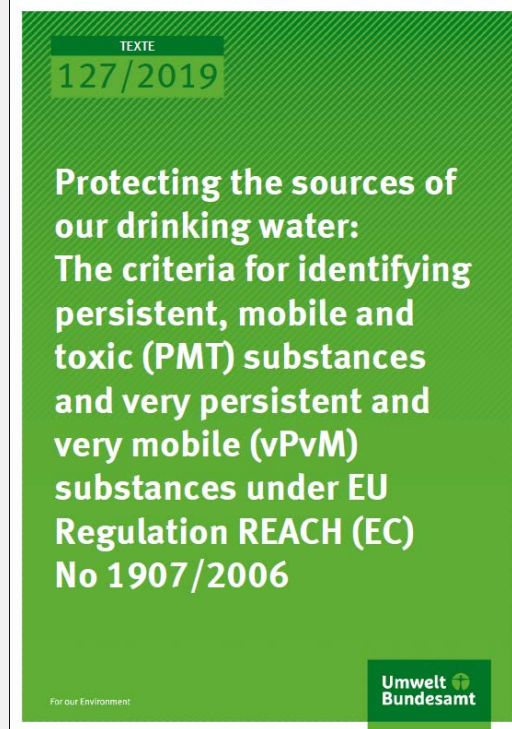
## Drink more recycled wastewater

Cecilia Tortajada and Pierre van Rensburg

# Development of PMT/vPvM criteria under REACH

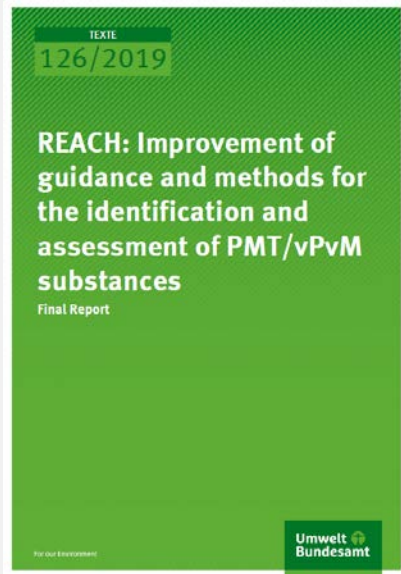
- Started already in 2009 by German Environment Agency (UBA)
- Based on latest available science, as evaluated by expert committees (e.g. ECHA's PBT expert group, dedicated workshops)
- Is consistent with existing chemical regulations (e.g. REACH, Ground water directive), or at least does not conflict with them
- Is practical, transparent, and feasible for compliance or enforcement

## Derived Criteria

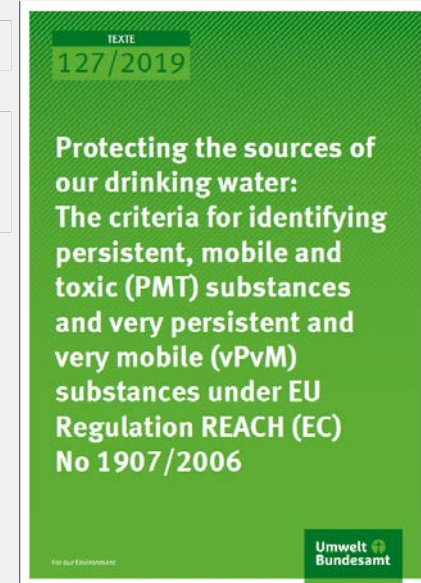
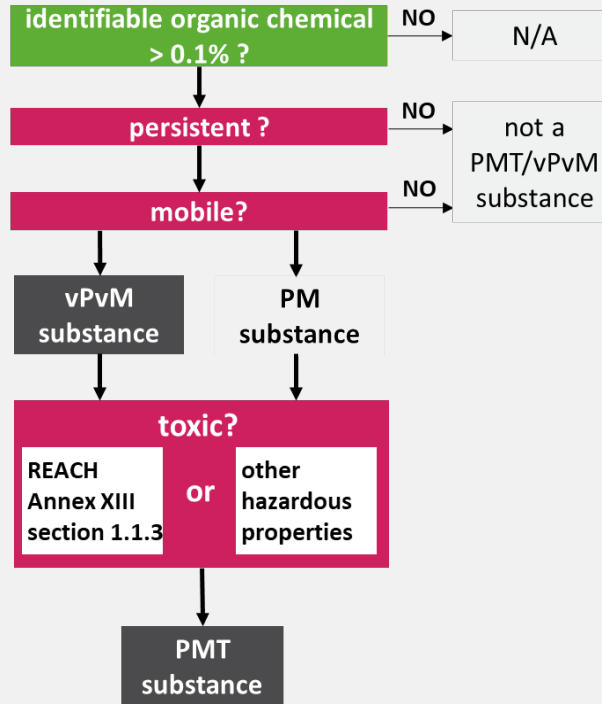


Neuman & Schliebner, 2019

# PMT/vPvM substance criteria and guidelines



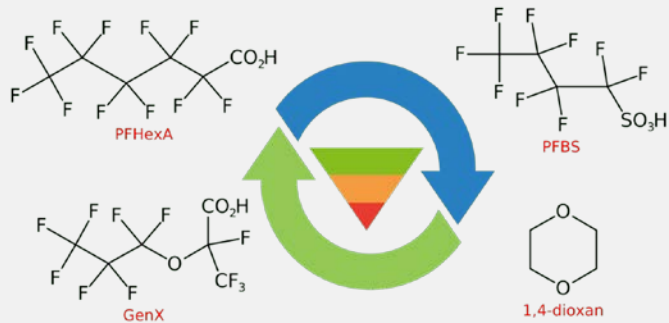
Scientific  
Background and  
Guidelines  
Arp & Hale (2019)



PMT/vPvM  
Criteria  
Neumann &  
Schliebner (2019)

# REACH: Equivalent Level of concern (ELoC) to PBT/vPvB substances

- PFBS, GenX and 1,4-dioxane identified by MSC as substance of very high concern (SVHC)
- Ongoing discussion: Restriction of PFHxA under REACH
- Under REACH assessed and compared 16 categories on health effects, environment effects and other effects
- Intrinsic substance properties cause hazard



Hale et al. *Environ Sci Eur* (2020) 12:155  
<https://doi.org/10.1186/s12302-020-00440-4>

Environmental Sciences Europe

RESEARCH Open Access

## Persistent, mobile and toxic (PMT) and very persistent and very mobile (vPvM) substances pose an equivalent level of concern to persistent, bioaccumulative and toxic (PBT) and very persistent and very bioaccumulative (vPvB) substances under REACH

Sarah E. Hale<sup>1\*</sup>, Hans Peter H. Arp<sup>1,2</sup>, Ivo Schliebner<sup>3</sup> and Michael Neumann<sup>1</sup>

**Abstract**  
**Background:** Under the EU chemicals regulation REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals, EC 1907/2006), registrants are not obliged to provide information related to intrinsic substance properties for substances that pose a threat to the drinking water resources. In 2019, perfluorobutane sulfonic acid (PFBS) and 2,3,3,3-tetrafluoro-2-(heptafluoropropoxy) propanoic acid (PFPO-DA trade name GenX) were demonstrated to have an equivalent level of concern (ELoC) to persistent, bioaccumulative and toxic or very persistent and very bioaccumulative (PBT/vPvB) substances owing to their persistent, mobile and toxic (PMT) substance properties and very persistent and very mobile (vPvM) substance properties, respectively. They were both subsequently identified as substances of very high concern (SVHC) applying Article 57(f) in REACH. This work follows up on this regulatory decision by presenting a science based, conceptual level comparison that all PMT/vPvM substances pose an ELoC to PBT/vPvB substances. Using the two cases named above, as well as 1,4-dioxane, 16 categories were developed to evaluate a) serious effects on human health, b) serious effects on the environment and c) additional effects. 1,4-dioxane has recently been proposed to be classified as Carcinogenic 1B by the Committee for Risk Assessment (RAC). The aim was to enable an objective and scientifically justified conclusion that these classes of substances have an equivalent level of concern for the environment and human health.  
**Results:** In all of the categories related to human health, the environment and other effects, the PMT/vPvM case study substances exhibited comparable effects to PBT/vPvB substances. A difference in the human and environmental exposure pathways of PMT/vPvM and PBT/vPvB substances exists as they vary temporally and spatially. However, effects and impacts are similar, with PMT/vPvM substances potentially accumulating in (semi-)closed drinking water cycles and pristine aquatic environments, and PBT/vPvB substances accumulating in humans and the food chain. Both PMT/vPvM and PBT/vPvB substances share the common difficulty that long term and long-range transport and risk of exposure is very difficult to determine in advance and with sufficient accuracy.

\*Correspondence: [sah@ngi.no](mailto:sah@ngi.no)  
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Full list of author information is available at the end of the article

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# PMT/vPvM an Equivalent Level of Concern to PBT/vPvB



	REACH: PMT/vPvM Persistent, mobile, toxic	REACH: PBT/vPvB Persistent, bioaccumulative, toxic
<b>Persistency &amp; Toxicity</b>	Criteria for P/vP identical and T nearly identical	
<b>Exposure</b>	<i>Chronic, inter-generational presence in fresh/drinking water sources; accumulates relative to dilution rates</i>	<i>Chronic, inter-generational presence in food chain; accumulates relative to depuration rates</i>
<b>Criteria for Mobility (M) &amp; Bioaccumulation (B)</b>	<b>M:</b> Experimental log Koc < 4 <i>(breakthrough WWTP, bank filtrate)</i> <b>vM:</b> Experimental log Koc < 3 <i>(groundwater transport)</i>	<b>B:</b> Bioconcentration factor > 2000 <b>vB:</b> Bioconcentration factor > 5000

# EU Green Deal: PMT/vPvM criteria and hazard class to be introduced in Europe

## ↳ Into force:

- CLP 2022/3
- REACH 2024
- UN-GHS??



### Revision of EU legislation on hazard classification, labelling and packaging of chemicals

Have your say > **Published initiatives** > Revision of EU legislation on hazard classification, labelling and packaging of chemicals

<b>In preparation</b>	<b>Topic</b> Environment
	<b>Type of act</b> Proposal for a regulation

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**Roadmap**

Feedback period  
04 May 2021 - 01 June 2021  
**FEEDBACK: CLOSED**

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**Public consultation**

Consultation period  
09 August 2021 - 15 November 2021  
**FEEDBACK: CLOSED**

**UPCOMING**

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**Commission adoption**

Planned for  
Second quarter 2022  
**FEEDBACK: UPCOMING**

**Roadmap**

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**Feedback period**  
04 May 2021 - 01 June 2021 (midnight Brussels time)  
[View feedback received >](#)

 **Inception impact assessment - Ares(2021)2969734**  
English (300.6 KB - PDF - 4 pages) [Download](#)

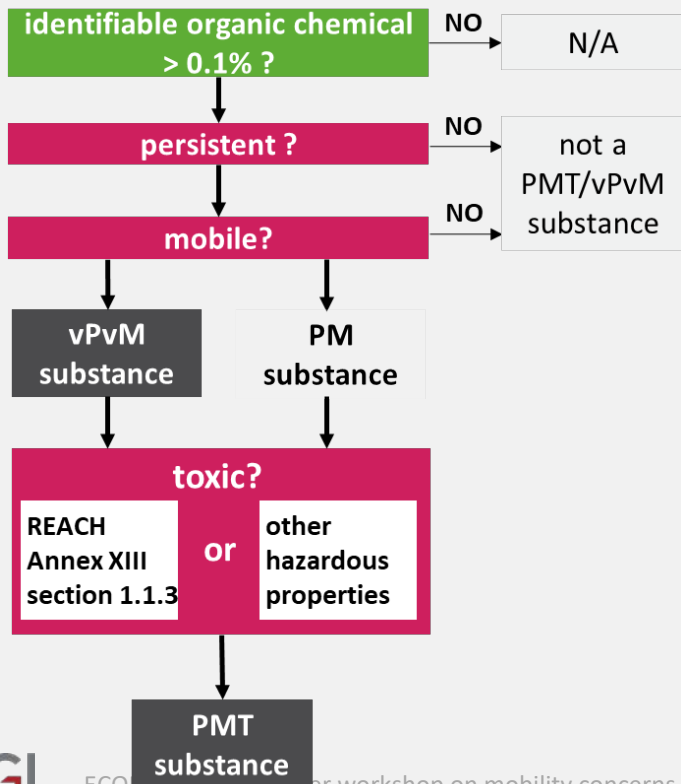
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**Feedback (182)**

01 June 2021 | Non-governmental organisation (NGO)  
**Green Transition Denmark/Rådet for Grøn Omstilling (Denmark)**

Green Transition Denmark (GTD) welcomes the opportunity to provide feedback on the Commission's discussions of the revision of EU's CLP Regulation. GTD is a Danish NGO working to promote a green and sustainable transition of society. CLP is an essential tool to regulate hazardous chemicals. However, it needs to be updated to sufficiently support the implementation of the new Chemicals Strategy of Sustainability. For many years GTD have been

# State-of-the-Art PMT/vPvM hazard assessment

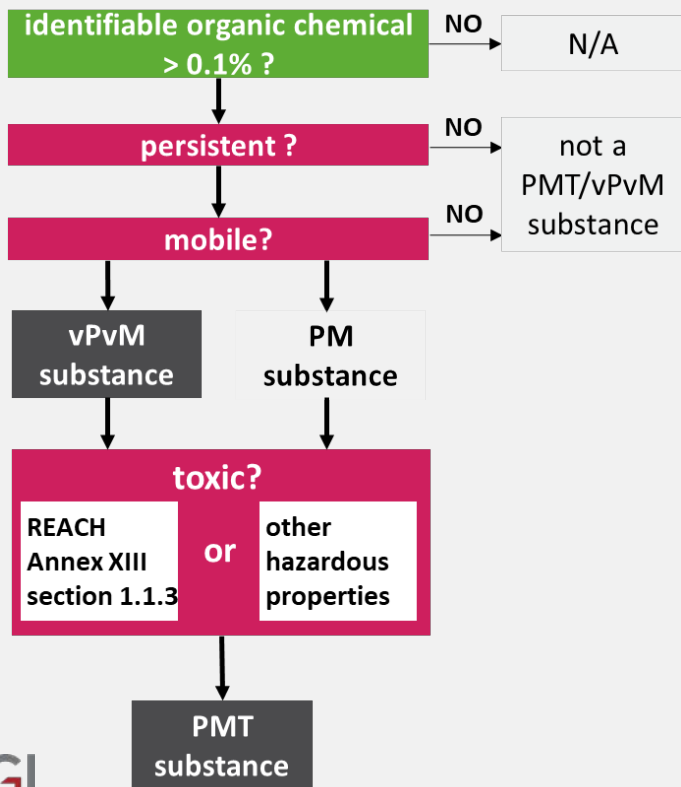


Scientific background and guidance



Arp & Hale, 2019

# First Step: Assessing persistency (P and vP)



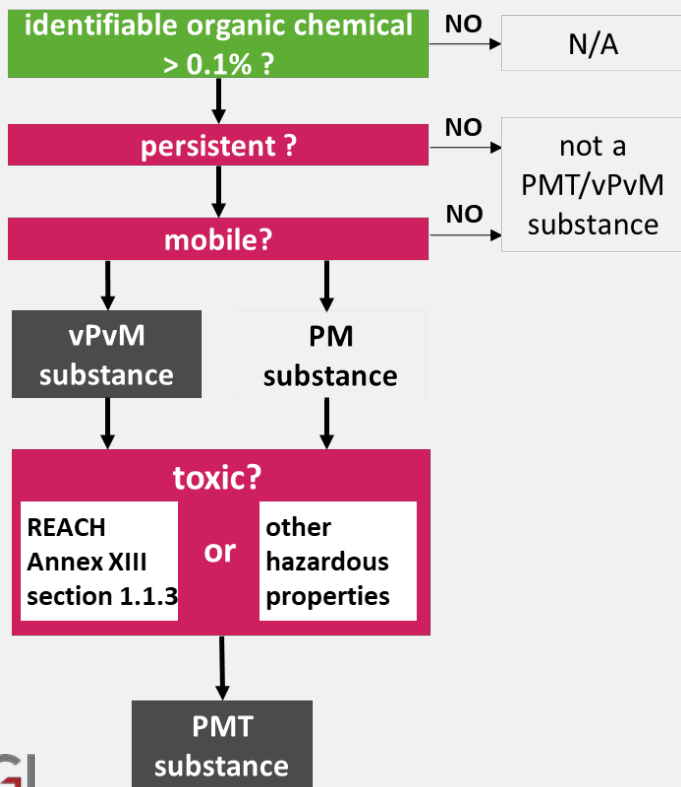
## P and vP criteria identical to Annex XIII of REACH

	<b>persistent (P)</b> in any of the following situations	<b>very persistent (vP)</b> in any of the following situations
marine water	half-life > 60 days	half-life > 60 days
fresh water	half-life > 40 days	half-life > 60 days
marine sediment	half-life > 180 days	half-life > 180 days
fresh water sediment	half-life > 120 days	half-life > 180 days
soil	half-life > 120 days	half-life > 180 days

ECHA Chapter R.11. Version 3.0 (June 2017)  
Neumann & Schliebner (2019)



## Second Step: Assessing Mobility (M and vM)



### Currently two proposals for M and vM criteria

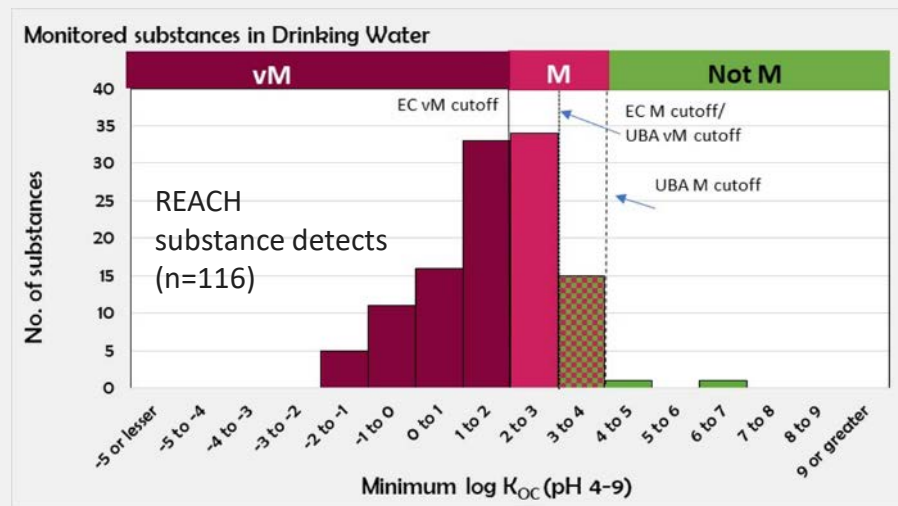
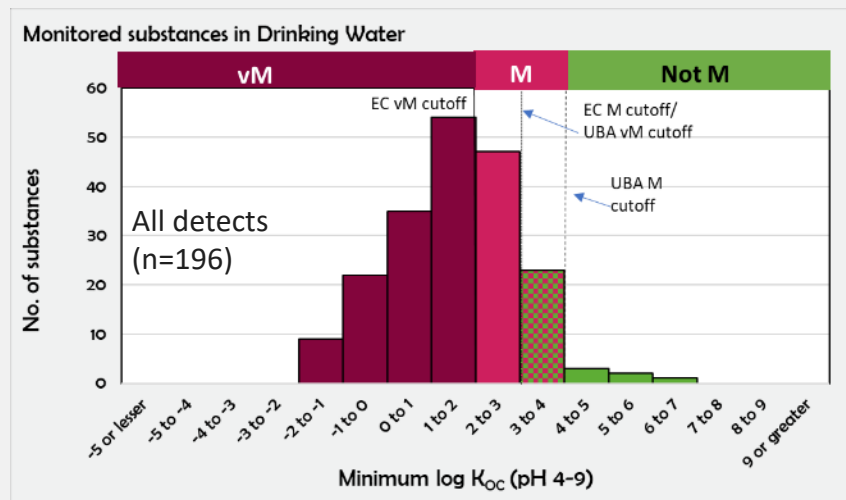
	<b>Mobile (M)</b> if it fulfills P or vP and the following situation	<b>very mobile (vM)</b> if it fulfills P or vP and the following situation
Neumann & Schliebner (2019)	< 4.0	<3.0
lowest experimental <b>log K<sub>oc</sub></b> (pH 4-9)		
EC proposal for CLP at CARACAL	< 3.0	<2.0
<b>log K<sub>oc</sub></b>		

# Mobility: Rationelle for log K<sub>oc</sub> and cutoff values

- Annex II section 12.4 of REACH
  - log K<sub>oc</sub> is a way to describe soil mobility
- Half-lives combined with log K<sub>oc</sub> used by many organizations for mobility
  - Groundwater Ubiquity Score (1979)
  - EU Common Implementation Strategy Working Group (log K<sub>oc</sub> < 3.0)
  - Biocide regulation (log K<sub>oc</sub> < 2.7)
  - UNEP FAO (different categories)
- Simulation Model: If M (log K<sub>oc</sub> = 4.0) and P (soil half-life = 120 day)  
8% of river concentrations could penetrate bank filtration (sandy soil) to drinking water extraction points

# Empirical Data compared with proposed log K<sub>oc</sub> cutoff values

- 196 chemicals (including 116 REACH substances) **detected** in drinking water **and** an **experimental log K<sub>oc</sub> value** is available
- Less detected substances are classified as PMT/vPvM if log K<sub>oc</sub> cutoff is lowered





# What about risk assessment?



## European Food Safety Authority (EFSA)

tolerable weekly intake (TWI) of **4 PFAS** (PFHxS, PFOS, PFNA, PFOA) – 4.4 ng/kg body weight/week.

DVS: 70 kg mann, 3 L drikkevann per dag:  
**< 15 ng/L EFSA PFAS**

10 kg barn, 2 L drikkevan per dag  
**< 3 ng/L EFSA PFAS**

- Oslo «trygg» for EFSA PFAS i sw
- Men det finnes andre PFAS kilder

## Mean (ng/L) of PFAS in drinking water

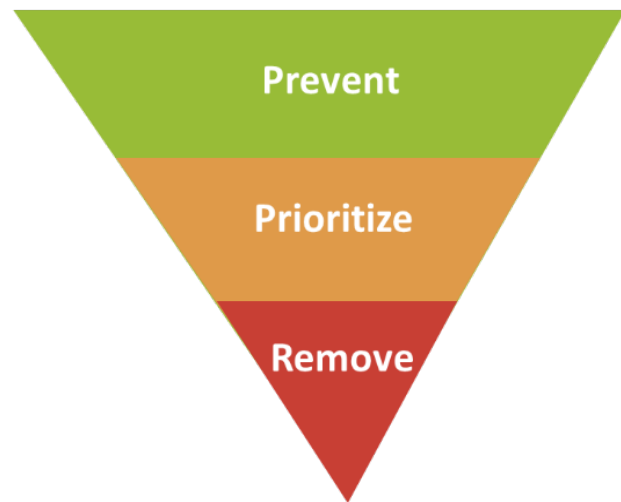
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# Ny H2020 Projekt: ZeroPM

## Zero pollution of persistent, mobile substances

- ZeroPM will interlink and synergize three strategies to protect the environment and human health from persistent, mobile substances: **Prevent**, **Prioritize** and **Remove**.
- 11.6 Million €, 15 EU institutes
- Coordination NGI, Sarah Hale (PC) and Hans Peter Arp (co-PC)
- [www.zeropm.eu](http://www.zeropm.eu)

ZeroPM



# ZeroPM's concept

ZeroPM

## Multilevel framework



Chemical Technology, Policy and Markets



Water Exposure and Hazards



Remediation and Impacts

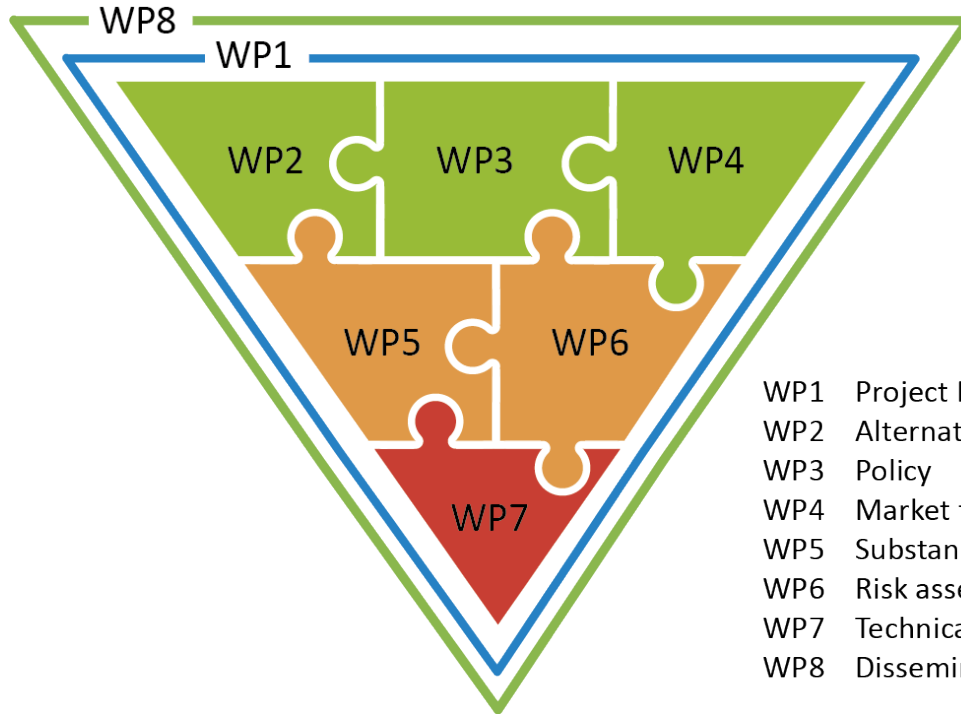
## Interlinked Strategy

**Preventing** regrettable substitution for **prioritized** PM substances, by assessing hazards, sustainability, exposure and **removal**.

**Prioritizing** PM substances and groups based on intrinsic properties, exposure, and hazard to select those substances to **prevent** and **remove** most urgently

**Removing** **prioritized** PM substances via effective, sustainable and safe remediation methods, that **prevent** unfocused remediation effort

# ZeroPM's work packages



- WP1 Project Management
- WP2 Alternatives Assessment
- WP3 Policy
- WP4 Market transition
- WP5 Substance grouping
- WP6 Risk assessment
- WP7 Technical solutions
- WP8 Dissemination & Communication

## Thank-you! More information

- Funding from the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety of Germany (FKZ 3719 65 408 0)
  - [www.umweltbundesamt.de/en/PMT-substances](http://www.umweltbundesamt.de/en/PMT-substances)
- The EU research project **ZeroPM** funded by Horizon 2020 (No 101036756)
  - [zeropm.eu](http://zeropm.eu) (please subscribe to our newsletter!)



zeropm.eu



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036756







#påsikkergrunn