Hazardous Chemicals – An Overview and Focus on How the CSS Addresses the Issue

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March 18, 2021

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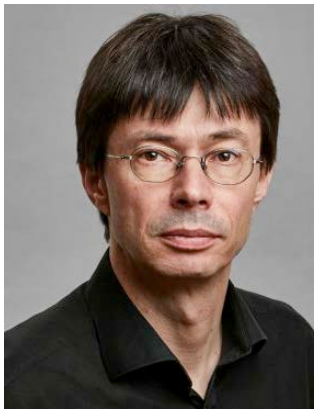
Introduction Martin Scheringer

- Chemist by training
- Professor of environmental chemistry, Masaryk University, Brno, Czech Republic
- Senior scientist and group leader, ETH Zürich, Switzerland



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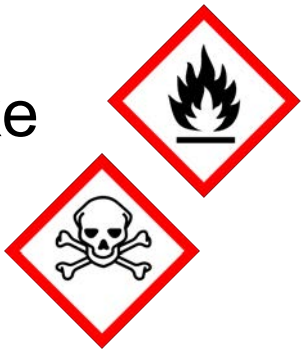
Chemicals: Benefits, but also Hazards

- Chemicals provide many benefits to society

- Many chemicals available; the **same function** may be served by **different chemicals**.

- Wide range of properties. Some properties make chemicals **hazardous**: flammability, toxicity, ...



Hazard, Exposure, and Risk (I)

- Hazard
  - chemical-specific properties, e.g. toxicity
  - independent of how a chemical is used (and where, and by whom, ...)
- Hazardous properties
  - carcinogenicity, mutagenicity, toxicity for reproduction (CMR)
  - persistence, bioaccumulation, toxicity (PBT)
  - persistence, mobility, toxicity (PMT)

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- Inherently safe chemicals: no hazardous properties

Hazard, Exposure, and Risk (II)

- **Exposure:** a chemical is present in the environment of an organism (or in the tissue: internal exposure). Measured as concentration of chemical in water or food.
- **Risk:** combination of hazard and exposure
  - Risk assessment requires many data, involves many uncertainties, takes a long time.
  - Danger of “paralysis by analysis” and “absence of evidence = evidence of absence”.

The Chemicals Strategy for Sustainability

European Commission | EN English | Search

Environment

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Chemicals strategy

The EU's chemicals strategy for sustainability towards a toxic-free environment

Chemicals are essential for the well-being, high living standards and comfort of modern society. They are used in many sectors, including health, energy, mobility and housing.

However, most chemicals have hazardous properties which can harm the environment and human health.

The EU already has sophisticated chemicals laws in place, but global chemicals production is expected to double by 2030. The already widespread use of chemicals will also increase, including in consumer products.

The European Commission published a chemicals strategy for sustainability on 14 October 2020. It is part of the EU's zero pollution ambition, which is a key commitment of the European Green Deal.

https://ec.europa.eu/environment/strategy/chemicals-strategy_en

The Chemicals Strategy for Sustainability

- The CSS has a strong focus on hazards of chemicals.

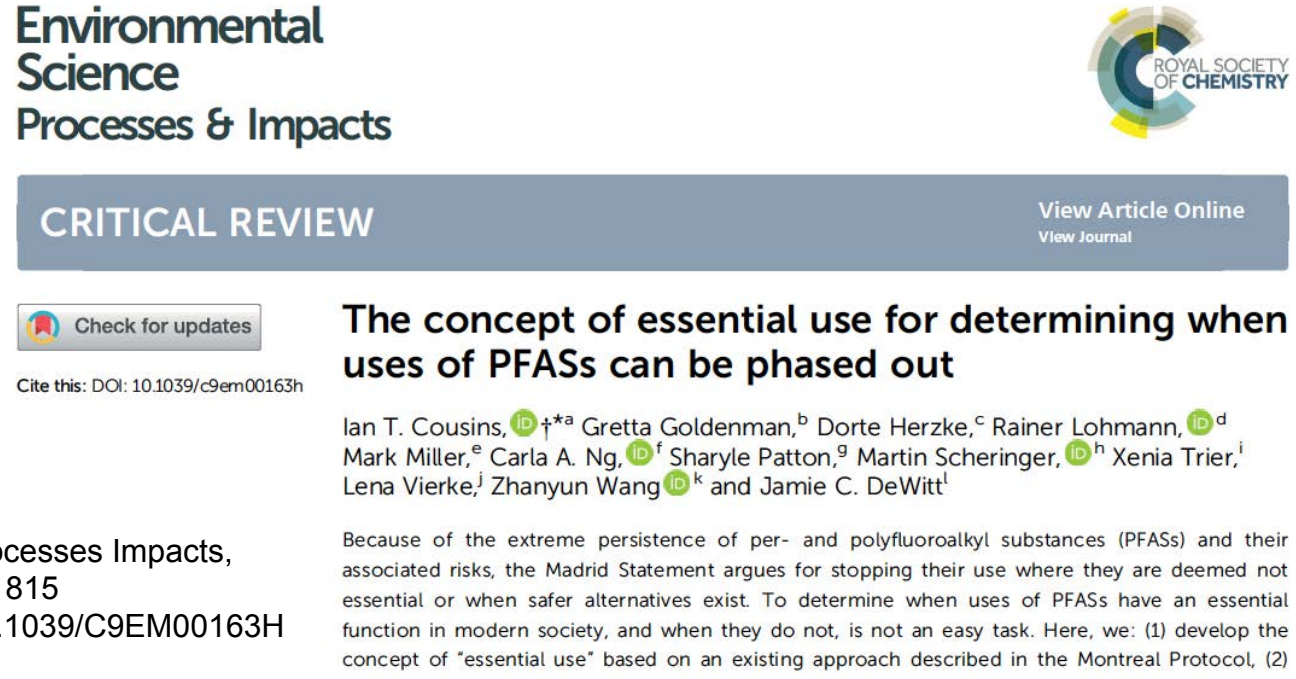
  This is new and important.

- The CSS adopts the concept of “essential uses”.

  This opens a pathway for a more efficient, yet targeted phase-out of chemicals of concern.

The Concept of Essential Use

- Introduced under the Montreal Protocol on ODS
- Now proposed also for other chemicals of concern



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ROYAL SOCIETY OF CHEMISTRY

CRITICAL REVIEW

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Cite this: DOI: 10.1039/c9em00163h

The concept of essential use for determining when uses of PFASs can be phased out

Ian T. Cousins,[a]† Gretta Goldenman,[b] Dorte Herzke,[c] Rainer Lohmann,[d] Mark Miller,[e] Carla A. Ng,[f] Sharyle Patton,[g] Martin Scheringer,[h] Xenia Trier,[i] Lena Vierke,[j] Zhanyun Wang[k] and Jamie C. DeWitt[l]

Because of the extreme persistence of per- and polyfluoroalkyl substances (PFASs) and their associated risks, the Madrid Statement argues for stopping their use where they are deemed not essential or when safer alternatives exist. To determine when uses of PFASs have an essential function in modern society, and when they do not, is not an easy task. Here, we: (1) develop the concept of "essential use" based on an existing approach described in the Montreal Protocol, (2)

Environ. Sci.: Processes Impacts, 2019, 21, 1803–1815
https://doi.org/10.1039/C9EM00163H

The Concept of Essential Use

- Introduced under the Montreal Protocol on ODS
- Now proposed also for other chemicals of concern

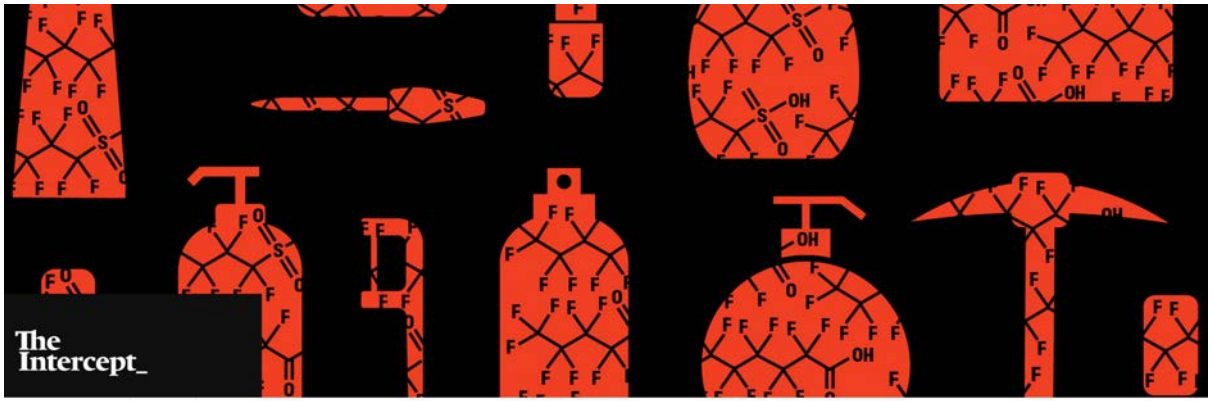
  Two elements:

  - a use is “necessary for health, safety or is critical for the functioning of society”
  - and “there are no available technically and economically feasible alternatives”

- key point: essential uses, not “essential chemicals”

The Concept of Essential Use in the CSS

- to be applied to harmful chemicals in consumer products
- to be applied to PFAS



S. Lerner, The Intercept, December 2, 2020
https://theintercept.com/2020/12/02/pfas-chemicals-products/

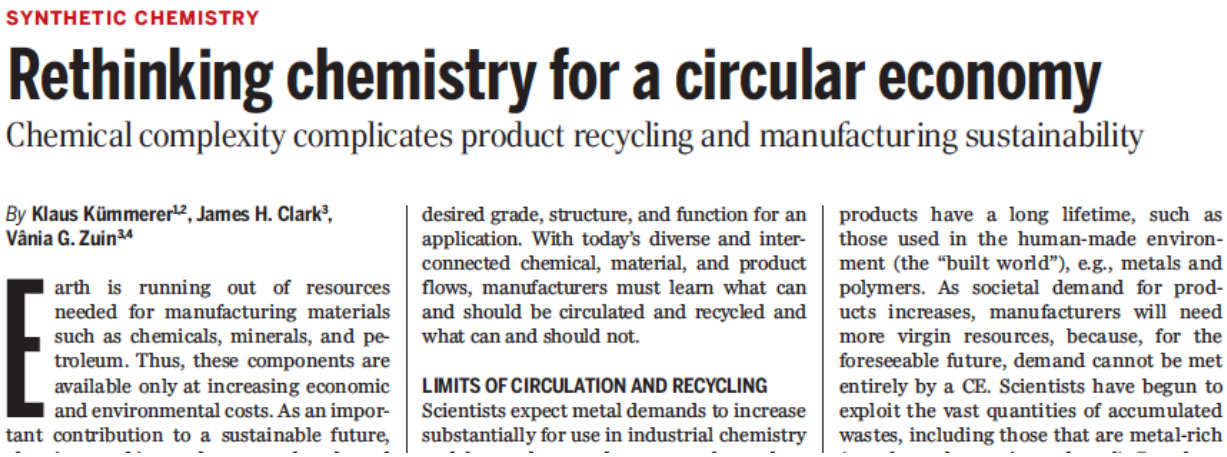
The CSS: Other Areas

- Chemical mixtures (“cocktail effect”)
- Endocrine disrupting chemicals (better hazard identification, better information; phase-out)
- Safe and Sustainable by Design (SSbD)

- The circular economy

The Circular Economy

- Hazardous chemicals in plastics contaminate goods made from recycled materials.
- This substantially undermines the idea of the CE.



SYNTHETIC CHEMISTRY

Rethinking chemistry for a circular economy

Chemical complexity complicates product recycling and manufacturing sustainability

By **Klaus Kümmerer[1,2], James H. Clark[3], Vânia G. Zuin[3,4]**

Earth is running out of resources needed for manufacturing materials such as chemicals, minerals, and petroleum. Thus, these components are available only at increasing economic and environmental costs. As an important contribution to a sustainable future, desired grade, structure, and function for an application. With today's diverse and interconnected chemical, material, and product flows, manufacturers must learn what can and should be circulated and recycled and what can and should not.

LIMITS OF CIRCULATION AND RECYCLING

Scientists expect metal demands to increase substantially for use in industrial chemistry products have a long lifetime, such as those used in the human-made environment (the "built world"), e.g., metals and polymers. As societal demand for products increases, manufacturers will need more virgin resources, because, for the foreseeable future, demand cannot be met entirely by a CE. Scientists have begun to exploit the vast quantities of accumulated wastes, including those that are metal-rich

Kümmerer et al. (2020) Science 367, 369–370

Thank You
for Your Attention

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