

PTFE from a Life Cycle Perspective and Essential Uses

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**RISE Online Workshop,
December 3, 2020**

Uses of PFAS?

Environmental
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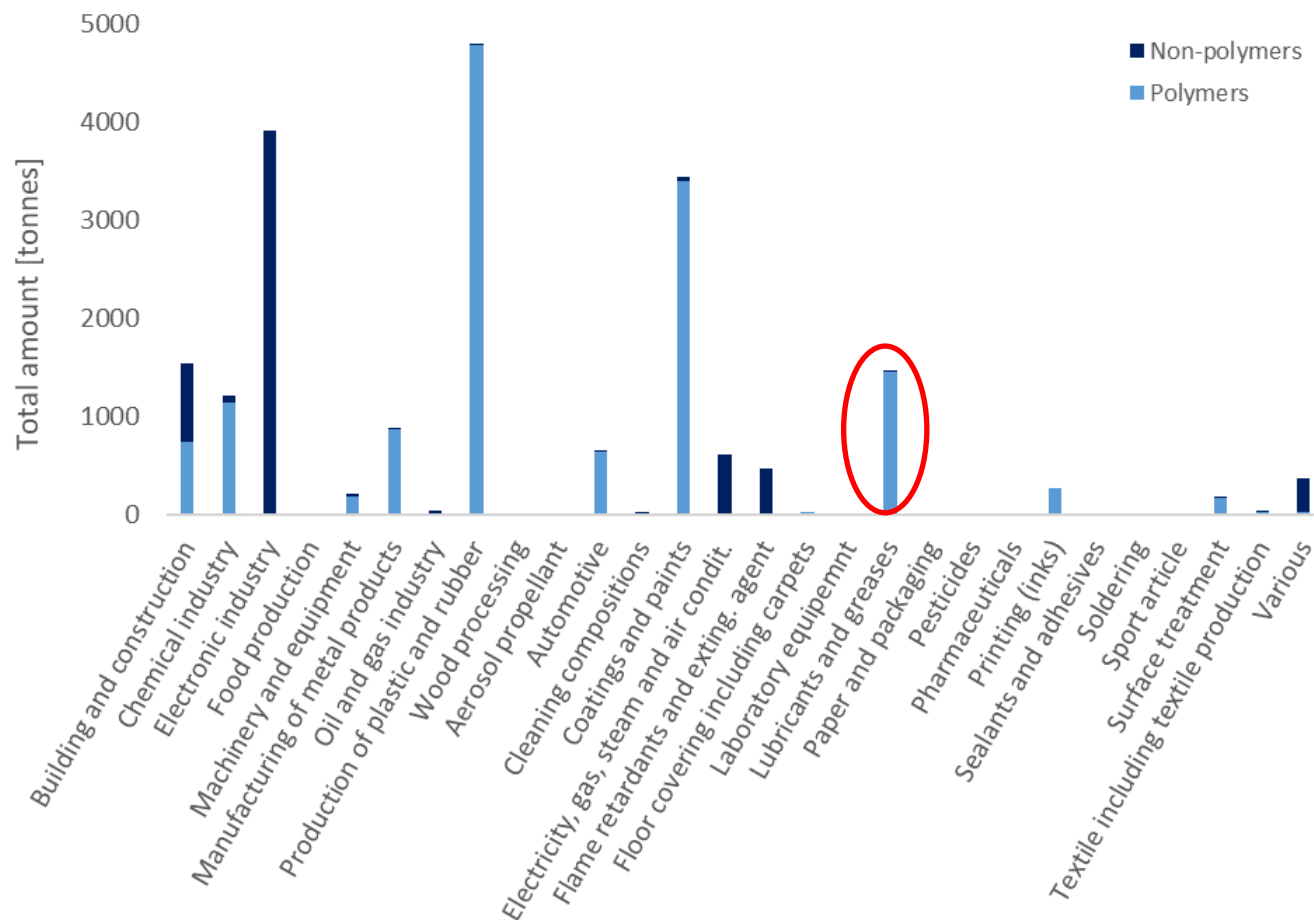
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Cite this: DOI: 10.1039/d0em00291g

An overview of the uses of per- and polyfluoroalkyl substances (PFAS)[†]

Juliane Glüge,^a Martin Scheringer,^a Ian T. Cousins,^b Jamie C. DeWitt,^c
Gretta Goldenman,^d Dorte Herzke,^e Rainer Lohmann,^e Carla A. Ng,^f
Xenia Trier^g and Zhanyun Wang^g



- More than 200 uses identified for more than 1400 PFAS
- Less well known uses:
 - ammunition,
 - climbing ropes,
 - guitar strings,
 - artificial turf,
 - soil remediation

Fluoroadditives in Lubricants

- Fluoroadditives, or micropowders, are finely-divided low molecular weight polytetrafluoroethylene (PTFE) powders
- PTFE powders added to plastics, rubbers, paints, **oils (lubricants)**, printing inks, cosmetics, and others
 - Bike chain oils: 0.09 g PTFE / 100 mL oil?
- Enhance abrasion resistance, reduce coefficient of friction and mechanical wear (e.g. of gears), reduce surface contamination

Introduction to Fluoropolymers

Materials, Technology, and Applications

Edited by

Sina Ebnesajjad

President, FluoroConsultants Group, LLC

Madrid Statement

Perspectives | Brief Communication

The Madrid Statement on Poly- and Perfluoroalkyl Substances (PFASs)

May 2015

<http://dx.doi.org/10.1289/ehp.1509934>

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- Production and use of PFAS should be limited
- Based on concerns regarding high persistence and lack of knowledge on chemical structures, properties, uses, and toxicological profiles

Phasing out Uses of PFAS

- Impractical to ban all uses in one step
 - Some may serve a critical role for which alternatives do not exist
 - **Non-essential uses** could be rapidly eliminated
- Concept of essentiality originated in the Montreal Protocol



Cosmetics



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Cite this: *Environ. Sci.: Processes
Impacts*, 2018, 20, 1690

Per- and polyfluoroalkyl substances and fluorine mass balance in cosmetic products from the Swedish market: implications for environmental emissions and human exposure†

Lara Schultes,^a Robin Vestergren,^{*b} Kristina Volkova,^c Emelie Westberg,^b Therese Jacobson^c and Jonathan P. Benskin^b

- Hair products, mascara, foundations, face creams, sun blocks, skin creams, lip pencils
- **Non-essential use**
- Several major retailers/brands (L'Oréal, H&M, Lumene, The Body Shop, Isadora and Kicks) phased out of PFAS

Ski Waxes



Non-essential use

FIS BANS SOME SKI WAXES

📅 6TH DECEMBER 2019

LAST MODIFIED ON FEBRUARY 19TH, 2020

Flourinated ski wax will not be able to be used by racers next season due to its impact on the environment and health.

What about PTFE in Lubricants?

- Open use so the PTFE will be released to environment
- A very persistent microplastic that will never degrade
- Is it toxic?
 - Toxic impurities in PTFE micropowders?
 - Micro- and nano-plastic research ongoing
- Is PTFE a Polymer of Low Concern (PLC)?

Integrated Environmental Assessment and Management — Volume 14, Number 3—pp. 316–334

316

Received: 26 September 2017 | Returned for Revision: 16 January 2018 | Accepted: 30 January 2018

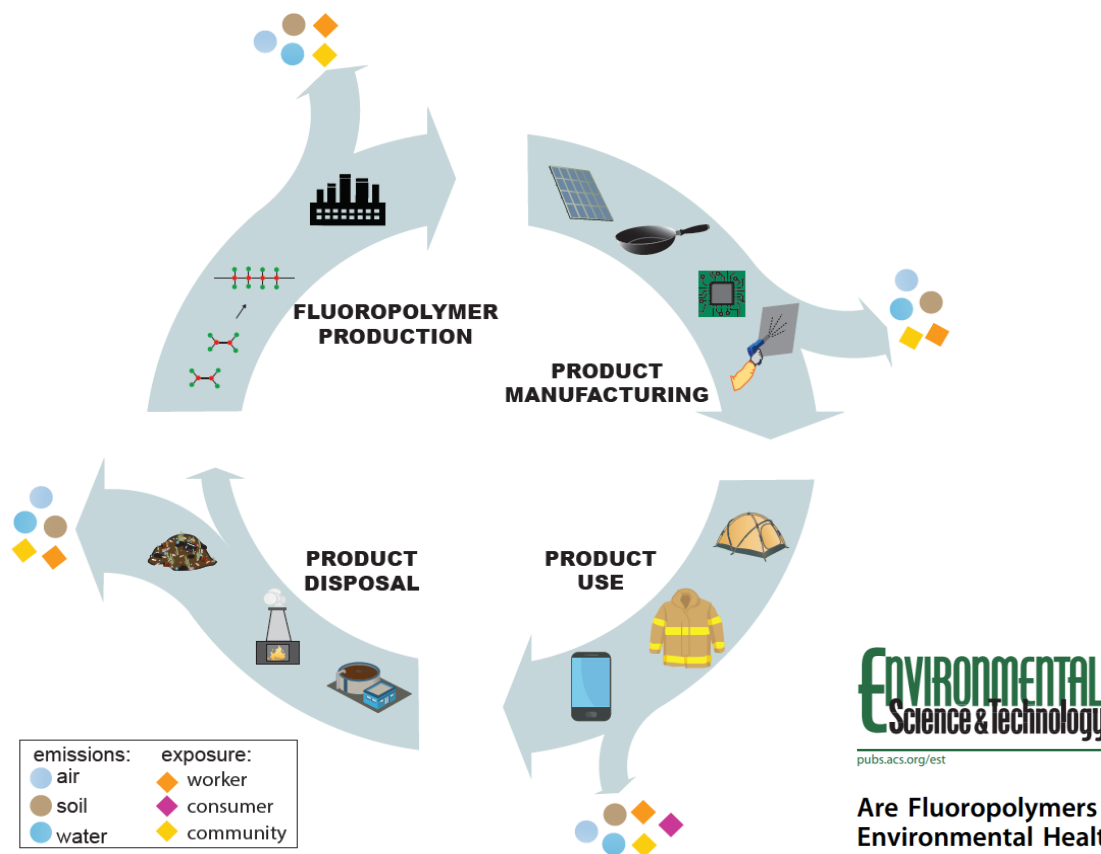
Critical Review

A Critical Review of the Application of Polymer of Low Concern and Regulatory Criteria to Fluoropolymers

Barbara J Henry,^{*,†} Joseph P Carlin,[†] Jon A Hammerschmidt,[†] Robert C Buck,[‡] L William Buxton,[‡] Heidelore Fiedler,[§] Jennifer Seed,^{||} and Oscar Hernandez[#]

Lifecycle Considerations

- But PLC only focuses on the use phase
- Lifecycle considerations important



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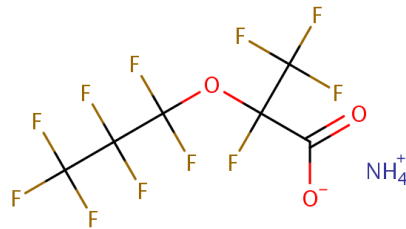
Policy Analysis

Are Fluoropolymers Really of Low Concern for Human and Environmental Health and Separate from Other PFAS?

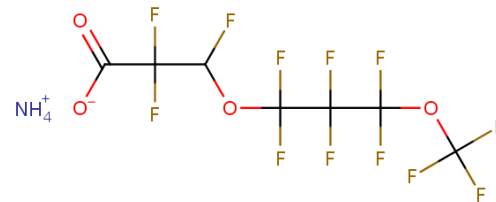
Rainer Lohmann,* Ian T. Cousins, Jamie C. DeWitt, Juliane Glüge, Gretta Goldenman, Dorte Herzke, Andrew B. Lindstrom, Mark F. Miller, Carla A. Ng, Sharyle Patton, Martin Scheringer, Xenia Trier, and Zhanyun Wang

PFAS Processing Aids Used to Manufacture PTFE

- In US, Europe and Japan, historically ammonium salt of PFOA used in PTFE fine power manufacture
 - PFOA everywhere in environment, wildlife and humans
- PFOA still used in large quantities in China
- Manufacturers in US, Europe and Japan now use fluorinated alternatives (also PFAS)

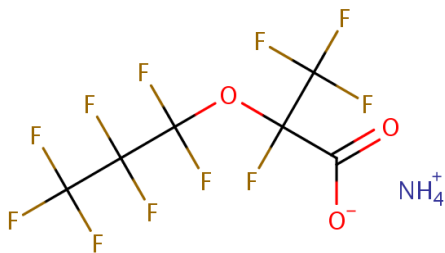


HFPO-DA

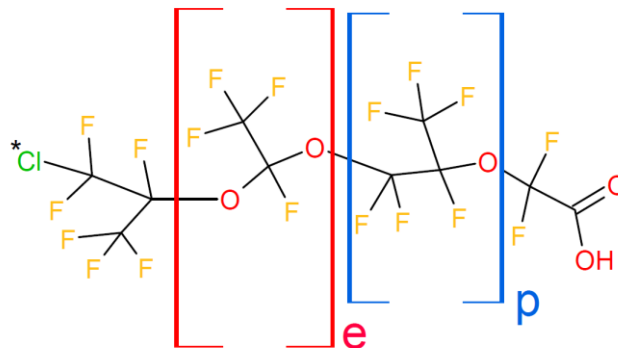


ADONA

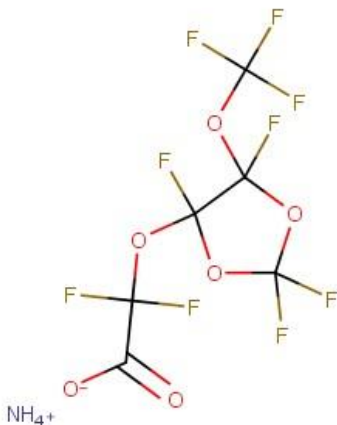
New Problems (vPvM and T?!)



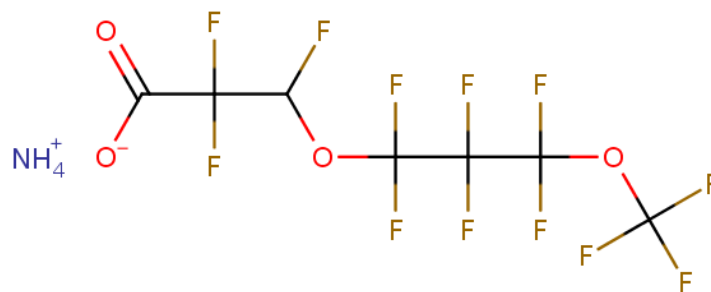
HFPO-DA: high contamination around Dordrecht, NL and Fayetteville, NC, US. Substance of Very High Concern (SVHC)



Perfluoropolyether (Solvay): high contamination in Bormida River (Italy) and New Jersey



Perfluoro{acetic acid, 2-[(5-methoxy-1,3-dioxolan-4-yl)oxy]}, ammonium salt (CAS No 1190931-27-1) (cC604) now observed in ground- and surface water in the Veneto region (Italy)



Ammonium 4,8-dioxa-3H-perfluorononanoate (CAS 958445-44-8) (ADONA) detected in the Rhine River and serum samples

Fluoropolymers in the News!

Dordrecht teflon plant is emitting cancer-causing chemicals: Volkskrant

Health     July 20, 2016



GenX is used to make teflon. Photo: Depositphotos.com



AG's PFAS lawsuit welcome news for advocates as it joins litany of litigation

The last few weeks have seen continued developments in the exploration of GenX and other PFAS.

By Emily Featherston



REPORT

Nontargeted mass-spectral detection of chloroperfluoropolyether carboxylates in New Jersey soils

 John W. Washington^{1,*}, Charlita G. Rosal¹,  James P. McCord²,  Mark J. Strynar²,  Andrew B. Lindstrom²,  Er...

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Science 05 Jun 2020:
Vol. 368, Issue 6495, pp. 1103-1107
DOI: 10.1126/science.aba7127

Safe Disposal of Fluoropolymers?

- Recycling?
 - Not yet for consumer products
- Landfilling of fluoropolymers = contamination of leachates with PFAS and release of microplastics
- Incineration effective to destroy PFAS?
 - formation of fluorinated organic by-products?
 - ongoing research

Conclusions/Way Forward

- Does PTFE provide an essential function?
- PTFE will be released and never degrade
- Environmental releases of hazardous PFAS occur during PTFE lifecycle
- PFAS and microplastics under regulatory pressure
- Safe, sustainable and functional alternatives apparently exist

Thank you for your Attention!
