Durable Water Repellency and Chemical Management

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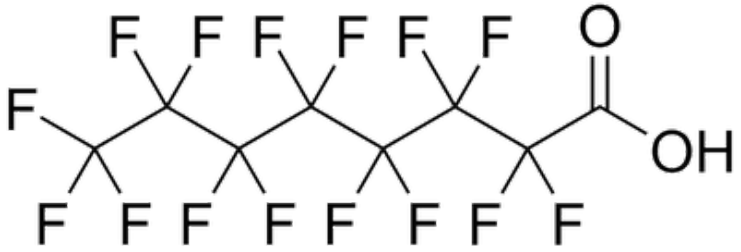
Safer Chemicals Healthy Families

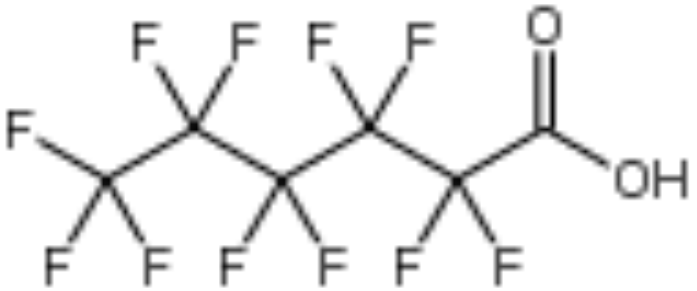
Topics Covered

- Growing concern about the use of PFCs
- Significant pressure to move away from long-chain PFCs, e.g. PFOS and PFOA
- C8 chemistry (PFOA) being replaced with C6 chemistry (PFHxA)
- Limitations of federal TSCA revealed
- Unanswered questions about whether C6 PFCs will be regrettable substitutes

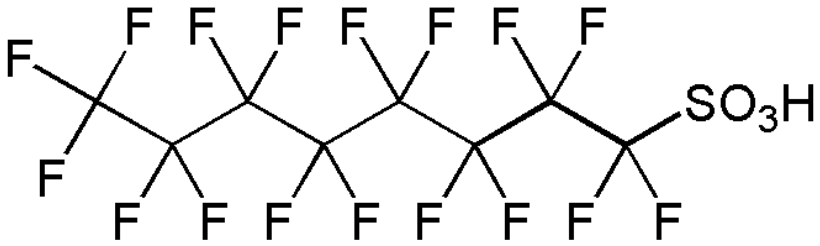
Perfluorinated Chemicals (PFCs)



PFOA (C8)



PFHxA (C6)



PFOS (C8)

PFHxS (C6)

Many PFCs are PBTs

- Persistent – long lived in environment
- Bioaccumulative – builds up in food web
- Toxic – harmful to living organisms
- Biopersistent exposure
- Precursors and Byproducts
- Defy traditional risk assessment

PFAS (PFOS) Timeline

- 1999 – PFOS detected in workers & blood
- 2000-2002 – 3M phases out PFOS mfg.
- 2002 – EPA rules: new uses of 88 chems.
- 2007 – EPA rules: new uses of 183 chems
- 2009 – EPA Long-chain PFCs Action Plan

PFAC (PFOA) Timeline

- 1981 – PFOA found in pregnant workers
- 1980s – PFOA in public drinking water
- 2001 – Lawsuits filed; settled $100 million
- 2004 –TSCA violations – failure to report
- 2006 - Voluntary reductions with EPA
- 2009 - EPA Long-chain PFCs Action Plan
- 2012 - Proposed rule – report significant new uses in carpeting

TSCA Limits Revealed

- Toxic Substances Control Act of 1976
- 62,000 existing chemicals grandfathered
- No testing required to fill data gaps
- No restrictions imposed on known hazards
- No mandatory safety determinations
- Extreme burden on US EPA chills action

PFOA Hazards

- Persistence: Extremely long-lived
- Bioaccumulative: fish and wildlife
- Half-life in humans: ~ 3 years
- Animal evidence of toxicity:
  - Body weight, cholesterol, liver, cancers, immune system, development, obesity
- C8 Science Panel: Probable human link:
  - High cholesterol, testicular cancer, thyroid disease, pregnancy-induced hypertension/ preeclampsia, ulcerative colitis

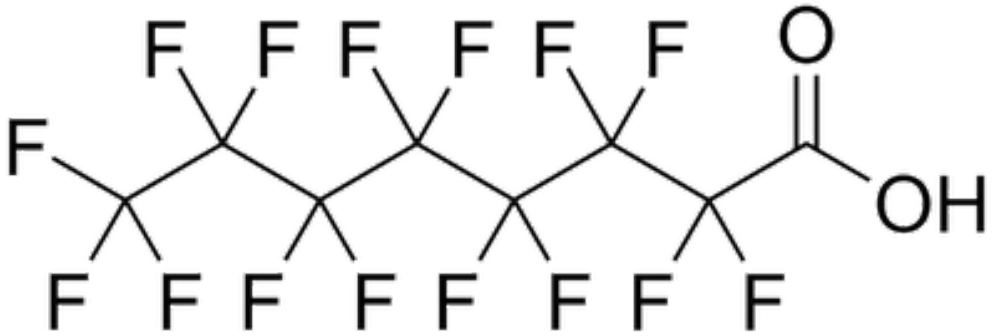
2010/2015 PFOA Stewardship

- Voluntary program agreed to between eight manufacturers and US EPA
- Covers PFOA, precursor chemicals, related longer chain chemicals
- By 2010, 95% reduction (from 2010) of facility emissions and product content
- By 2015, work toward elimination of same
- Significant progress reported, but does not cover all global production

Long-Chain PFCs Action Plan

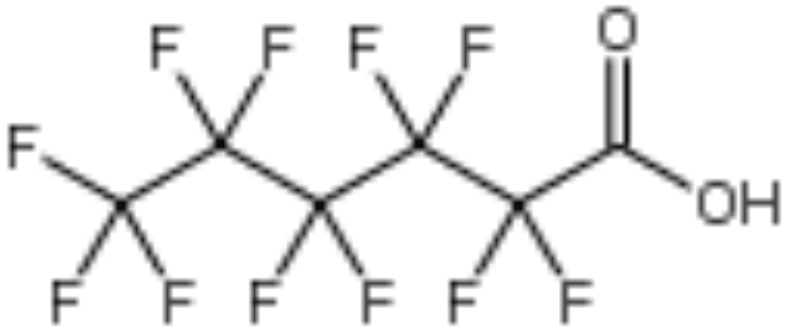
"Regulated"	NOT Included
PFAC:	
* PFOA (C8) and higher homologues	* PFHxA (C6) and shorter chain
PFAS:	
* PFHxS (C6) and higher homologues, including PFOS (C8)	* (C4) and shorter chain

C8 chemistry is on its way out



PFOA

C6 chemistry is offered substitute



PFHxA

C6 Chemistry

- Similar performance with 2 fewer carbons
- Persistent byproduct (PFHxA), but more rapid excretion (shorter half-life) and lower toxicity than PFOA in test animals
- 150 PMNs for filed for new C6 chemicals between 2006 and 2009
- Secretly “approved” by EPA without adequate data to determine safety

TSCA limits – New Chemicals

- No minimum data requirements
- 90 day EPA review before manufacture
- No affirmative safety determination
- Red flags can be raised, but typically not enough data to find “unreasonable risk”
- Routine CBI secrecy claims keep the public and companies down the supply chain in the dark about these chemistries

New Chemicals “work around”

- TSCA Section 5(e) Consent Orders:
- Voluntarily negotiated
- EPA allows new chemicals on the market
- Companies agree to test those chemicals to fill key data gaps over time
- Critical details kept secret: chemical identity, company, timeline, H&S data
- Does not prevent regrettable substitution

TSCA polymer exemption repealed by EPA for PFCs

- Exempt from *all* EPA scrutiny for ten years
- Formal concern expressed for all PFCs, including PFHxA and short-chain C2 to C7
- The chemicals and their breakdown products “may present an unreasonable risk to health and the environment”
- Can’t determine that without additional information on the safety of PFCs

Data Gaps on PFHxA (C6)

- Projected levels in environment and household dust
- Projected levels of human exposure
- Reproductive toxicity in mice (better animal model than rats)
- Half-life in human body
- Endocrine activity (hormone disruption)

PFHxA is a Persistent Chemical

- Carbon-fluorine bond is very strong
- PFHxA measured in household dust at levels comparable to PFOS and PFOA
- CONCERN: PFHxA levels will rise in homes and environment as C6 chemistry is more widely used and breaks down

Humans are exposed to PFHxA

- Already detected at much lower levels than PFOA in some biomonitoring studies
- Detected in one unpublished study of human umbilical cord blood
- CONCERN: Human exposure to PFHxA will increase as use of C6 PFCs rises

Is PFHxA biopersistent enough to be a human health concern?

Blood Elimination Half-Life of Several PFCs

Species	PFHxA (C6)	PFOA (C8)	PFOS (C8)	PFHxS (C6)
Rat	1.2 – 4.8 hrs	3 hrs – 5 dys	25 days	?
Mouse	???	16 – 22 days	?	?
Monkey	1 day	14 – 42 days	45 days	100 days
Humans	???	2.7 years	5.4 years	8.2 years

Reported by Gannon (2011), except for mouse data, which are cited in US EPA Long-chain PFCs Action Plan (2010)

Is PFHxA biopersistent enough?

- Rats and monkeys eliminate PFHxA more quickly than PFOA
- If data are accurate, and ratios between species are the same, then the half-life of PFHxA in humans could be 30 to 70 days
- CONCERN: With rising levels of C6 use, PFHxA exposure in humans could rise to a level of concern if toxicity proves greater

Reproductive toxicity – wrong animal model?

- Available repro tox data limited to one rat study, which found no significant toxicity
- In studies of other PFCs, rats were poor predictors of toxicity compared to mice
- Mice also eliminate PFHxA and PFOA more slowly than rats
- CONCERN: Toxicity of PFHxA may be greater than suggested by rat study

Is PFHxA a hormone disruptor?

- Several peer-reviews studies have shown endocrine activity for PFOA, which interferes with hormone receptors linked to obesity, thyroid function, etc.
- CONCERN: Given the similar chemical structures, PFHxA may be endocrine active but no data are available yet

Conclusion

- Summary of Concerns
- Are Safer Alternatives Available?
  - Robust methodologies and practitioners
  - Excellent tools, e.g. CML and GreenScreen
- Trending:
  - Market movement away from C8 PFCs, toward C6 PFCs and non-PFC alternatives
  - Likely increase in “retail regulation”
  - Continued state & global regulation
  - Eventual wave of federal reform & regulation