Safe and Sustainable Alternatives to PFAS – *Insights for How?*

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1-2nd February 2024

PFAS in Flanders: Event in the context of the Belgian Presidency of the Council of the EU

www.changechemistry.org

Who are we?

- We are a collaboration of companies that aim to make safer and sustainable chemistries widely available in the marketplace
- Our current 111 retailer, consumer goods and chemical company members represent over **$3.5T** in economic turnover
- Our membership also includes innovative start-up companies, strategically aligned service providers, foundations, NGOs and advocacy groups
- We are unified by a common goal of transforming value chains to maximize triple-bottom-line performance – people, planet & profit
- Formerly known as GC3 – Green Chemistry & Commerce Council

A Sustainable Global Economy

- At **Change Chemistry**, we are guided by our **VISION** of a global economy where all chemicals, materials and products are safe and sustainable - from creation through to disposal and reuse.
- Our **MISSION** is to catalyze the identification, assessment, development and commercialization of sustainable chemistries to improve human health, protect our planet and drive economic growth. We do this by:
    - Fostering value chain collaboration
    - Cultivating first-movers
    - Convening industry decision-makers to secure meaningful commitments
    - Advocating for a supportive policy environment

Sustainable Chemistry Catalyst

We strive to reduce the impacts of toxic chemicals by driving growth in safer and sustainable chemistries.

The Sustainable Chemistry Catalyst is an independent research and strategy initiative, based at the Lowell Center for Sustainable Production at the University of Massachusetts Lowell, that is focused on accelerating the transition to safer, more sustainable chemistry through research and analysis, and stakeholder engagement with scientists, policymakers, and commercial actors. The Catalyst works to understand barriers and opportunities to commercialization, identifies model solutions and strategies, develops methods to evaluate safer alternatives, and builds a community of expertise to support the transition to safer, more sustainable chemistries and technologies.

UMASS LOWELL

Lowell Center for Sustainable Production
UNIVERSITY OF MASSACHUSETTS LOWELL

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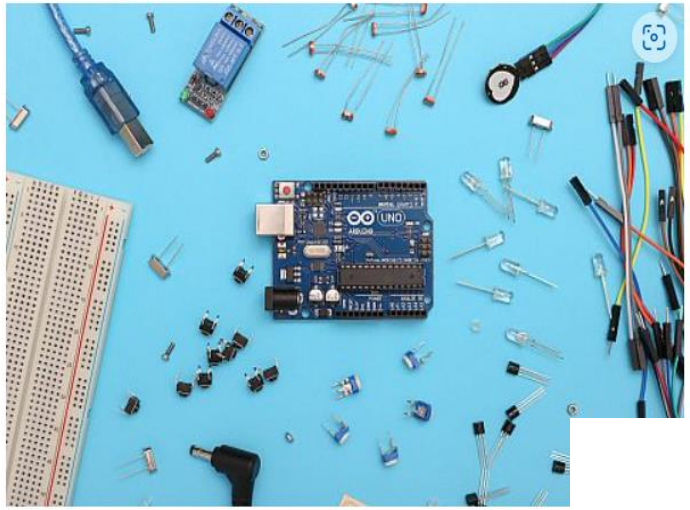
The Association for the Advancement of Alternatives Assessment (A4)

The Association for the Advancement of Alternatives Assessment (A4) is a professional association solely dedicated to advancing the science, practice, and policy of alternatives assessment and informed substitution. A4 is an interdisciplinary community of researchers and practitioners from government agencies, academia, industry, and non-profits working collaboratively to accelerate the transition to the use of safer chemicals, materials, processes, and products.

PFAS Alternatives in Electronics

A4 Perspective Paper



Using Alternatives Assessment to Support Infc

August 2023

What will they use instead and are alternatives actually safer?

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Challenges, Successes, and Needs for PFAS substitution:
Supporting the Transition to Safer Alternatives

Tuesday, October 10, 2023 | 11:00 AM - 12:30 PM (EDT)
Event Recording

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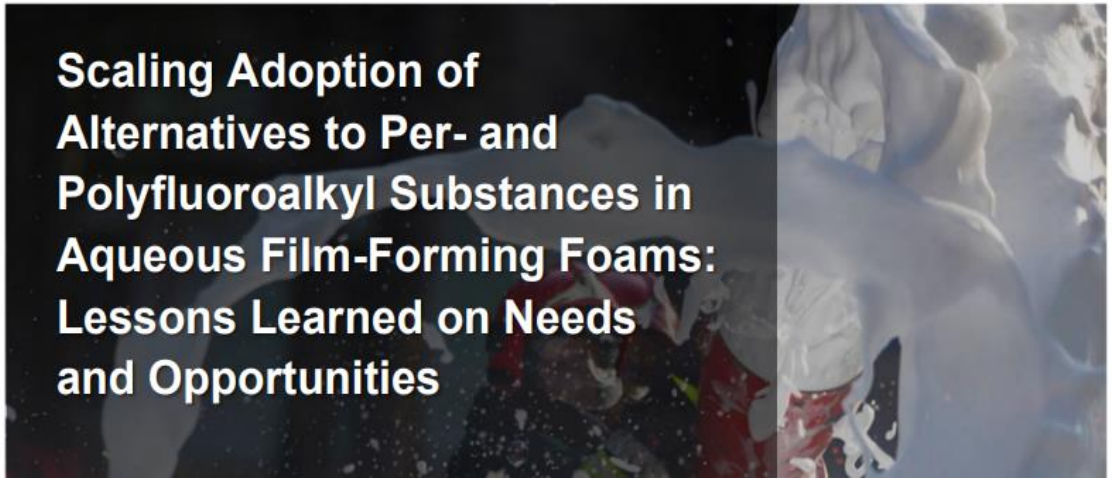
ROADMAP TO ZERO

PFAS substitution has been top of mind for many industry sectors for over a decade. While current restrictions and reporting requirements are increasing the pressure to transition away from PFAS chemicals, the efforts to move away from this chemical class is a cross-sector challenge. First, we will discuss the implications of applying a standard definition of sustainable chemistry to PFAS substitution to better avoid regrettable substitutes. Next, we will discuss current challenges regarding PFAS including accessing critical actionable information across the value chain. Then we will highlight how current tools and standard-setting frameworks can help address these challenges, while identifying future needs. Finally, we will hear about perspectives from the global fashion and design company, the H&M Group, and their history of PFAS-free products.

Cathy Rudisill, Founder & F
Chemistry Advisory LLC

PANELIST PERSPECTIVES:

UMASS University of Massachusetts Lowell



Our PFAS research

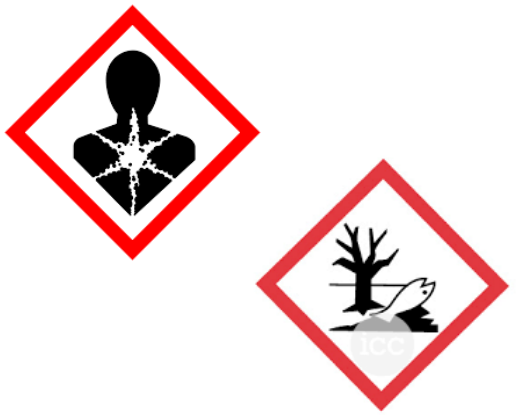
Alternatives Assessment: What is it?

A tool for “informed substitution”

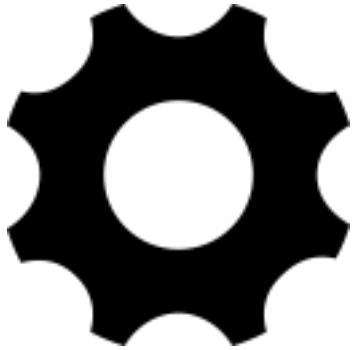
A process for identifying, comparing and selecting safer alternatives to chemicals of concern

Facilitates informed consideration of the various pros/cons of alternatives

“One of the most essential, and powerful steps to change is **understanding that there are alternatives**” – Mary O’Brien



Safer



Technically Feasible

Economically Feasible

Different types of substitutes:

- Alternative chemical
- Alternative material
- Alternative technology
- Process change/redesign
- System change

IS IT NECESSARY?

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Gear icon by Daniel Bruce through Creative Commons on Iconfinder.com

What Does Alternatives Assessment Address?

Component	What it involves
1. Scoping, problem formulation, identifying alternatives for consideration	Establishes the scope of and plan for assessment. Identifies stakeholders to engage and decision rules that will guide the assessment; gathers data on chemical of concern, its function and application; determines assessment methods and identifies alternatives to be considered.
2. Hazard/comparative exposure assessment	Evaluates human health and ecological hazards and assesses comparative exposures
3. Technical feasibility assessment	Assesses the performance of alternatives against the needs established is step 1
4. Economic feasibility assessment	Assesses the economic feasibility of alternatives against the needs established in step 1
5. Other life cycle considerations	Addresses additional potential upstream or downstream ecological and human health hazards as well as other potential trade-offs such as energy, climate impacts, and natural resources
6. Decision making	Combines information from previous steps to evaluate trade-offs and preferences and identify acceptable alternatives. Where no alternatives are currently viable, initiates R&D to develop safer/technically feasible substitutes.

Case Study: Alternatives to (AFFF)

- US 2020 National Defense Authorization Act required the **Department of Defense (DoD)** to phase out the use of **PFAS based AFFF** for firefighting at military installations (by Oct 2024)
- Strengthen and expand use of **alternatives assessment methods** to better support government and industry in making **informed choices** to **accelerate** the adoption of high performing, safer, and more sustainable chemicals, products, and processes.

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SERDP ESTCP

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Advancing alternatives assessment and informed substitution for chemicals of concern: Case example of PFAS in AFFF

WP19-1424

This work was supported by DoD's Strategic Environmental Research and Development Program (SERDP) (Project # WP19-1424) Conducted in collaboration with NEWMOA and MA TURI

Photo credit: Arjan Bruinstroop AIFireE, NFPA 2021 Workshop

Objectives

- An understanding of critical technology, market or policy factors (actual and perceived) that are **inhibiting the implementation of alternatives** to AFFF.
- An understanding of critical technology, market or policy factors that are **enabling and scaling a transition** to safer and feasible alternatives to AFFF
- An understanding of **lessons learned** from DoD's current efforts to accelerate the adoption of safer and effective AFFF alternatives **that can improve efforts to address future material challenges**.

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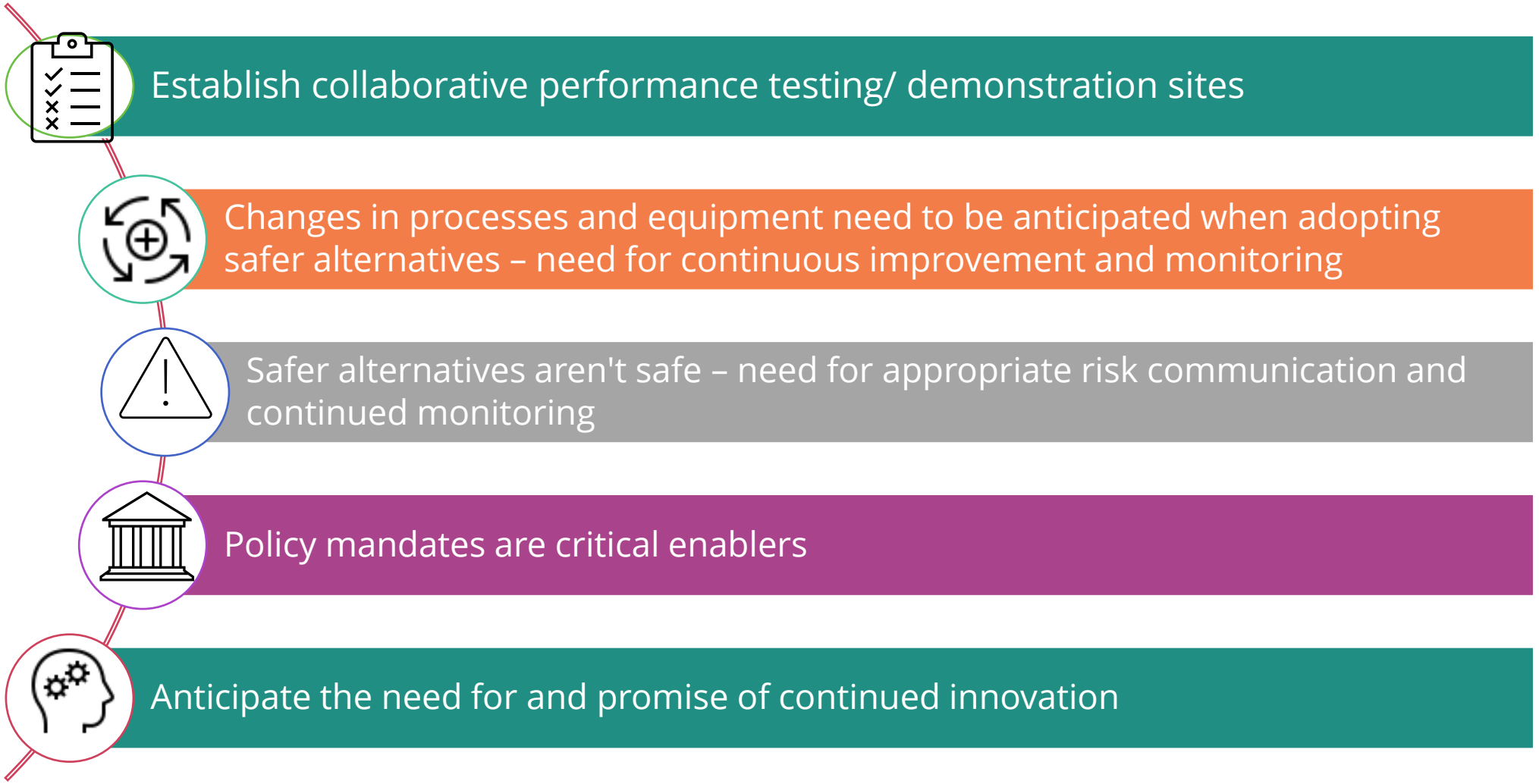
Lessons Learnt for Effective Substitution



Safer not Safe

Product Name	Components of PFAS-free Foam Examples					PFAS Foams for Reference	
CAS	112-34-5	151-21-3	1643-20-5	3332-27-2	3088-31-1	1763-23-1	335-67-1
Component Name	2-(2-Butoxyethoxy)ethanol	Sodium dodecyl sulfate	N,N-Dimethyldodecylamine-N-oxide	N,N-Dimethyl-1-tetradecanamine N-oxide	Diethylene glycol monolauryl ether sulfate sodium salt	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)
Outputs from Hazard Comparison Dashboard (HCD)							
Acute Mammalian Toxicity Oral	M	M	M	M	M	M	M
Acute Mammalian Toxicity Inhalation	I	I	I	I		M	M
Acute Mammalian Toxicity Dermal	L	VH	L	L	H	I	I
Skin Sensitization	I	L	L	I	M	I	I
Skin Irritation	M	H	VH	I	H	L	VH
Eye Irritation	H	VH	VH	VH	H	M	VH
Carcinogenicity	I	I	I	I	H	H	H
Genotoxicity Mutagenicity	L	L	L	L	H	H	VH
Endocrine Disruption	H	L	L	H	L	L	H
Reproductive	L	M	M	H	L	H	H
Developmental	L	I	L	L	I	H	H
Neurotoxicity Repeat Exposure	N/A	N/A	I	I	N/A	N/A	H
Neurotoxicity Single Exposure	N/A	H	I	I	N/A	I	N/A
Systemic Toxicity Repeat Exposure	H	M	L	I	N/A	H	H
Systemic Toxicity Single Exposure	N/A	M	I	I	N/A	I	M
Acute Aquatic Toxicity	L	H	H	VH	M	VH	L
Chronic Aquatic Toxicity	N/A	H	VH	VH	N/A	VH	H
Persistence	L	L	L	L	L	VH	H
Bioaccumulation	L	L	L	L	L	VH	H
Exposure	VH	VH	H	H	M	M	L
Toxicity: VH - Very High | H - High | M - Medium | L - Low | I - Inconclusive | N/A - Not Applicable							

Figure 4. Example for the output from the Hazard Comparison Dashboard (HCD) for chemicals disclosed in the safety data sheets (SDS) of some F3s.

Sunrise of PFAS Replacements: A perspective on Fluorine-Free Foams – *Ateia et. al., ACS Sustainable Chem. Eng., 2023, 11, 7986 – 7996.*

Final thoughts

Current fleet of alternatives are “safer” not “safe”

We need more research and continued monitoring and education

Data is key to inform priorities for substitution