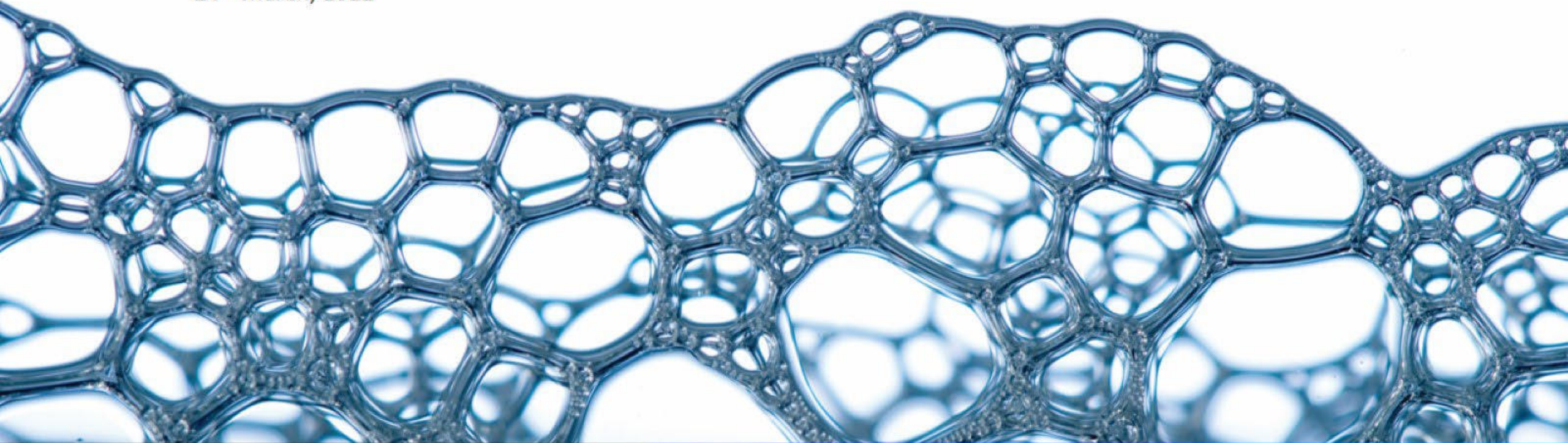


PFAS-free Firefighting Foams

– Global Product Manager

24th March, 2022



An aerial photograph of an industrial facility, likely a refinery or chemical plant, showing several large, dark, cylindrical storage tanks. A large fire is burning in the center, with thick white smoke rising from it. A bright, intense fire is visible on the right side of the image, with a large plume of white smoke rising from it. A fire truck is visible on the ground, with a long hose extending from it towards the burning area. The ground is covered in a layer of white foam, which is being used to suppress the fire. The tanks are surrounded by various pipes and structures, and the overall scene is one of a major industrial fire being fought.

Firefighting foam

What does it do and why is it used?

Small incidents can become big fires



EU Sales of Firefighting Foam by Sector

■ Oil & Gas, Industrial & Chemical	59%
■ Municipal / local authority	13%
■ Marine	12%
■ Civilian aviation	9%
■ Military	6%
■ Other	1%

Source: EuroFeu / Wood plc (2019)

What does
PFAS-free or fluorine free
mean to you

Just 'non-PFAS' or moving away from persistent ingredients?

No definition for F3 firefighting foam

"Readily bio-degradable"

Even persistent foams can be classified as
"readily bio-degradable"

Fluorosurfactant free foam (FSFF)

Have been launched (by others)
although contained fluoropolymers

EN1568 - Fluorine Free Foam (F3)
NFPA 403 - Fluorine Free Synthetic Foam (FFSF)
NFPA 11 - Synthetic Fluorine Free Foam (SFFF)

May contain non-fluorinated yet
chemicals of high concern such as
siloxanes/silicone surfactants, etc.

"Non-persistent"
"100% biodegradable"

PFAS-free* and avoids
other chemicals of high concern

** As PFAS are ubiquitous in the environment, GreenScreen defines
"no intentionally added PFAS" as <1mg/L Total Organic Fluorine (TOF)
as measured by combustion ion chromatography .*

Supporting producers, regulators and end-users



“

GreenScreen Certified makes it simpler for purchasers to identify safer firefighting foams by certifying that they meet rigorous environmental and health criteria.

As more PFAS-free firefighting foams become available we need to ensure these alternative products are not equally hazardous to firefighting personnel or the environment.

Source: San Francisco Department of the Environment (2020)

2024 – US Department of Defence ‘use’ deadline



2023; PFAS-free ‘MIL-SPEC’ specification must be available

2023; Services must be able to buy from it

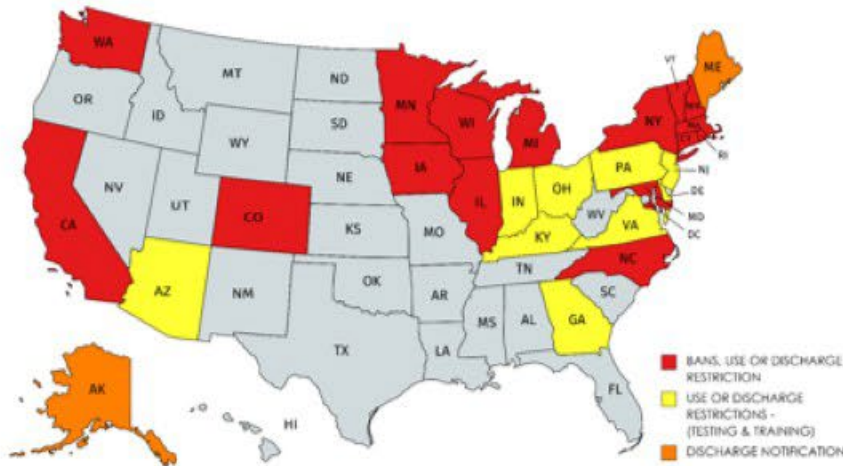
2023; Prohibits Services buying PFAS-based foams

2024; Prohibits use of PFAS-based foams (exemptions for shipboard use)

Source: National Defense Authorization Act (2019)

Changing marketplace

US States restricting all 'PFAS'



US States restrict PFAS-based foams

- Some States have introduced a total ban, exemptions for Federally mandated uses (includes all certified civilian airports).
- Other States require reporting of a discharge, or a ban on testing/training.

EU PFHxA regulation expected 2022

		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
		Y-1	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13
Fluorosurfactants	Manufacturing	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	Sale	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	Export	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Firefighting Foams	Manufacturing	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	Sale	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	Export	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
End-users -> Use	Testing	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	Training	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	Defence *	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	General users	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	>400m ² - 22m	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	New reporting	Grey	Grey	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow

New EU reporting burdens

- Work done to move from PFHxA to F3.
- Quantities used in previous year, % training, contained/collected/safe disposal or emitted to the environment.
- ECHA to collate then submit to EC.

Production & EU export

- Manufacturing will only be permitted for uses on tanks over 400m² (~22m dia.)
- 'Spirit of the regulation' includes buying, production, selling, and including export?
- How will this be audited & regulated?

The EU's approach to PFAS



“

The Commission will ban all PFAS as a group in fire-fighting foams as well as in other uses, allowing their use only where they are essential for society.

Source: European Commission (2020)

What is meant by essential for society

Firefighting foam is clearly an essential use, but are persistent foams?

European foam manufacturers

eurofeu 

Phase out scenarios for
Fluorine-containing foams



A transition to PFAS-free foam is possible

- **Aviation**
 - ARFFV; “able to immediately transition to [F3]”
 - Hangar; “may be capable to transition to [F3] with minimal technical changes”
 - Fuel storage tank farm; “possible to select a [F3] agent which is effective”
- **General industry;** “may be significant costs and efforts for the engineering”
- **Municipal;** “there are no technical obstacles for an immediate transition”
- **Military**
 - Land; “relatively easy change to [F3]”
 - Sea; “this will be very challenging”
 - USA MIL-SPEC; “will be done in-line with US operations”
- **Oil & Gas;** “can be extremely complicated depending on the degree of change”
- **Marine;** “no more complex compared to other areas of use of fixed installed systems”
- **Chemical industry;** “likely requires a screening of the chemical” or risk being protected
- **Training;** “can already be done with [F3]... all manufacturers offer special training foams”
- **Testing;** “can be done using special surrogates” (which should be F3).

Source: EuroFeu (2020)

Proven performance – Respondol ATF



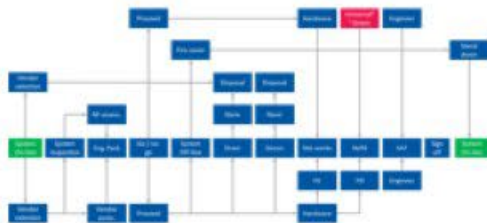
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FFFs are not a “drop in” replacement for AFFFs. However, some can be made to perform effectively as an AFFF alternative with proper testing and design.

Source: Fire Protection Research Foundation (2020)

Deploying F3 in fire protection systems

All services are scalable from single asset, to multi-site conversions using C6 or F3



Understand the process, pinch-points and cost drivers of the system/site conversion.

Asses the system and what a conversion could mean, i.e. pressure/flow, tank size, knock-on-effects, etc

Working with the fire protection teams, engineers, EH&S to deliver a successful conversion.

Full documentation detailing the proposed changes and options throughout the process.

Full conversion pathways are available

Industry challenges

- **EU and USA regulations beginning to harden**
 - C8-PFAS regulation now active (EU) with new obligations
 - C6-PFAS and all-PFAS regulatory landscape to change 2022-2025
- **Avoiding chemicals of concern**
 - Containment, clean-up and destruction of PFAS is advised and often required
 - GreenScreen Certified can help inform the move away from regrettable substitutes
- **Existing engineered systems can be converted**
 - Scope out your decontamination plan first; “How clean is clean?”
 - System listings are available for a wide range of applications



Thank you, are there any questions?

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