



**Fire Industry Association**

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## **Environmental issues - Firefighting in Naval Vessels**

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# Environmental issues - Firefighting in Naval Vessels

- Impact of changing environmental legislation on firefighting capabilities on Naval Vessels
  - What's likely to be impacted and by what
    - Firefighting –
      - PFAS – Foams, Fixed gaseous systems,
      - F-Gas – Fixed gaseous systems,
    - PPE, Fire resistance
      - PFAS
  - Why
    - F-Gas
    - PFAS
- Where/When
  - Europe
  - UK
  - Worldwide
- What does it mean
  - Replacements
  - Changing over

# Environmental issues - Firefighting in Naval Vessels

- What's likely to be impacted and by what
  - Fire fighting equipment on ships
    - Fixed systems – Gaseous/foams/Watermist
    - Manual means – fire hoses/portable fire extinguishers
    - PPE



# Environmental issues - Firefighting in Naval Vessels

- What's likely to be impacted and by what
  - Fire fighting equipment on ships
    - Fixed systems –
    - Gaseous –
      - Montreal Protocol - F-Gas Regulations (UK & Europe)
      - PFAS – Europe General restriction
    - Foams –
      - PFAS –
        - POPS = PFOA (C8 chemistry)
        - PFAS – Europe PFHxA (C6 chemistry)
    - Watermist if foam enhanced
      - POPS = PFOA (C8 chemistry)
      - PFAS – Europe PFHxA (C6 chemistry)



# Environmental issues - Firefighting in Naval Vessels

- What's likely to be impacted and by what
  - Fire fighting equipment on ships
    - Manual means – fire hoses/portable fire extinguishers
    - Foams –
      - PFAS –
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# Environmental issues - Firefighting in Naval Vessels

- What's likely to be impacted and by what
  - Fire fighting equipment on ships
    - PPE
      - PFAS – Europe General restriction – waterproofing, fire resistance

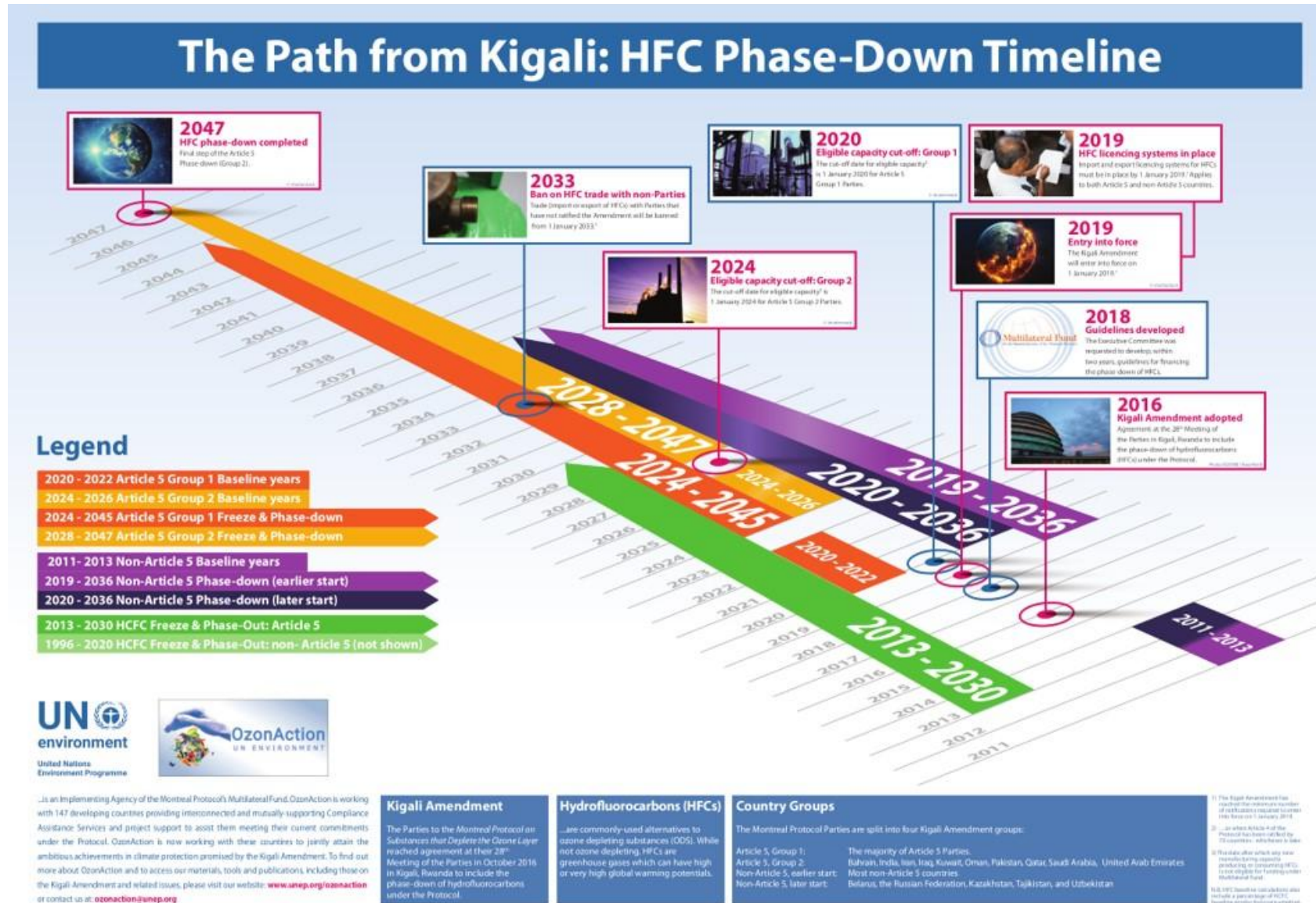


- WHY



- F-Gas

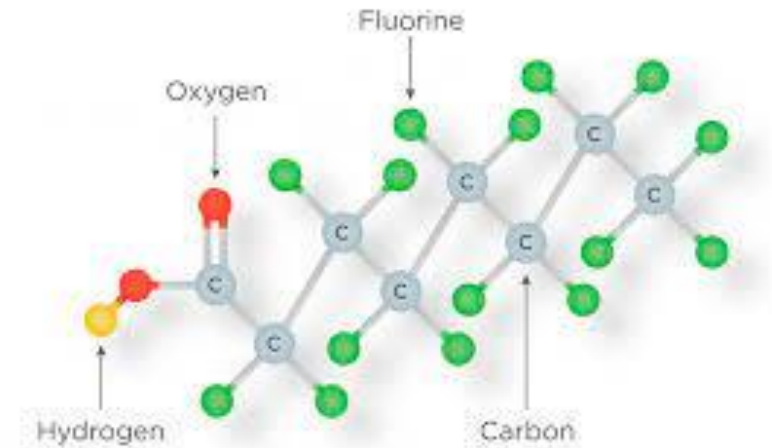
- Montreal protocol /Kigali agreement phase down





# PFAS - What is PFAS

- Per & Poly Fluorinated Alkyl Substances
- OCED definition
- "...the fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom..." i.e. substances are PFAS that have **at least one -CF<sub>2</sub>-or -CF<sub>3</sub>** moiety in their structure



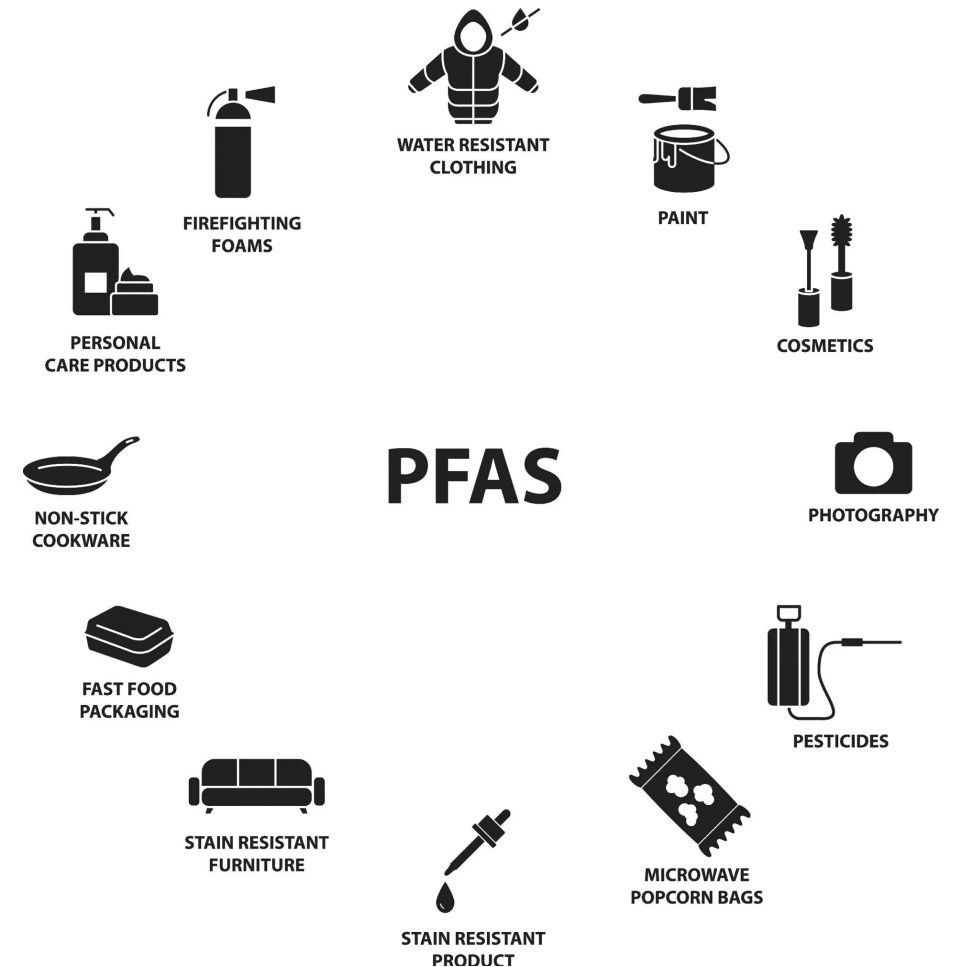
# PFAS How many PFAS are there

- Depends on how you count
  - lowest 2060
  - Highest 20 million
- In 2018, OECD published an updated PFAS List
  - **4730** CAS numbers identified
  - Current General ECHA Restriction proposal states 10,000



# PFAS Uses

- Many thousands of structurally diverse PFAS in use in society
  - polymers & non-polymers; neutral, anionic, cationic & zwitterionic; solids, liquids & gases; reactive & inert; soluble & insoluble; volatile & involatile; mobile & immobile; bioaccumulative & non-bioaccumulative; highly toxic and relatively non-toxic
- We don't know properties, toxicities etc. for most of them



# PFAS

**TOXIC 'FOREVER CHEMICALS' FOUND IN TOILET PAPER**

- Why is it bad
  - “Forever Chemicals”
  - CF bond very strong
  - Resistant to degradation
  - many PFAS are found in the blood of people and animals all over the world and are present at low levels in a variety of food products and in the environment.
  - Lots of negative press coverage



**ARE 'FOREVER CHEMICALS' POSING HEALTH RISK TO FIREFIGHTERS?**

**TIGHTEN 'FOREVER CHEMICALS' IN DRINKING WATER LAWS**  
Toxic PFAS chemicals used in packaging can end up in food, study finds



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- Where/When



# EU

## F-GAS

- 2006 First regulation 842/2006
  - Established company & personal certification/leak checks
- Revised 2014 517/2014
  - Phase down target
  - Quotas
- 2022 Revision

- Started in 2020
- Public consultations, workshops & impact assessments in 2021
- New Regulation proposal published April 2022
- New Regulation expected in place by 2023
- It is proposed it will:
  - Align F-Gas with the Green Deal
  - Include additional F-gas emission reductions to contribute to reaching the 55% of emissions reductions by 2030 and net carbon neutrality by 2050.
  - Ban new fire protection systems containing F-Gas from 1 Jan 2024

- Going forward
  - UK to review EU proposals/possible alignment
  - DEFRA to hold more Stakeholder events
- Amendments may
  - Extend Phase down
  - Improve leak checking and recovery recording

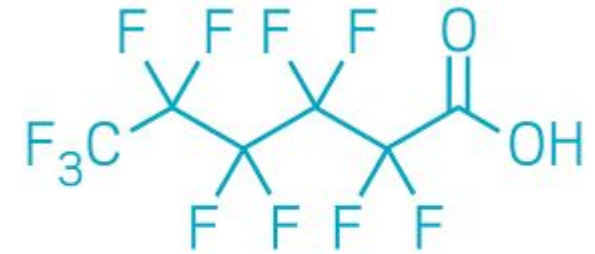


# PFAS - Existing restrictions

- PFOS
  - Listed as POPS in 2009
  - Banned in 2011
- PFOA
  - 4 July 2025, all uses are prohibited
  - C8 chemistry
  - Current fire fighting foams C6 chemistry



# PFAS - EU



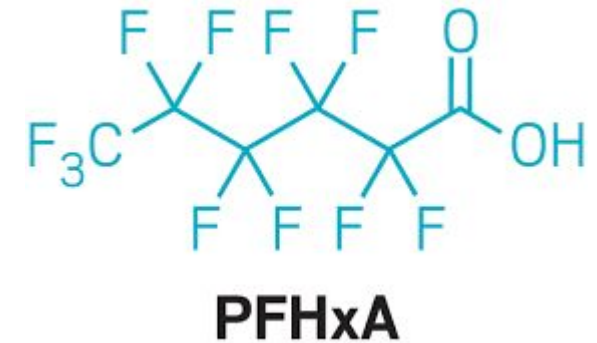
PFHxA

- Fire fighting foam restriction PFHxA -C6 chemistry
  - SEAC/RAC committee deliberations on going
  - Final SEAC position published 15 March 2023
  - Public Consultation ends 15 May 2023
  - Limit now expressed as **1mg/L of total PFAS** rather than ppm
  - REACH Restriction in force Q? 2024
  - Impacts portable fire extinguishers, Fire Service, airports use
  - C6 chemistry in FF foam banned in portables approx. 2030 based on proposed derogations



# PFAS - EU

- Derogations
- . 18 months after entry into force for training and testing (except testing of the firefighting systems for their function);
- b. 18 months after entry into force for municipal fire services (except if also in charge of industrial fires for establishments covered by paragraph 3.(e) and for use in these establishments only);
- c. three years after entry into force for civilian ships including tankers, ferries, tugboats and other commercial vessels;
- d. **five years after entry into force for civilian aviation (including in civilian airports) and defence; ;**
- e. 10 years after entry into force for establishments covered by the Directive 2012/18/EU (Seveso III)3 (upper and lower tiers) if they are not already covered by paragraph 3.(d);
- f. five years after entry into force for all other uses not covered by paragraphs 3(a), 3(b) 3(c), 3(d) and 3(e).
- g. five years after entry into force for portable fire extinguishers as defined by EN3-7, EN-1866 and EN-16856 placed on the market before 6 months after entry into force



# PFAS - EU

- General Restriction –includes F-Gases & related gaseous agents, PPE & indirectly FD&A
- Known
  - Submission of proposal to ECHA 13 January 2023
  - Proposal made available 7 February 2023
  - Preparation of RAC and SEAC opinions (Q2 to 4 2023)+public consultation
  - 22 March 2023 start of 6 month Public consultation
  - 5 April 2023 Online information session
- Estimated
  - Q1/2 2024 RAC/SEAC opinion adopted
  - completion of ECHA phase Q3 2024
  - EC proposal to amend Reach Q4 2024
  - In force Q4 2025
  - End of transition periods - if any 2039?

# PFAS - EU

- 1. Shall not be manufactured, used or placed on the market as substances on their own;
- 2. Shall not be placed on the market in:
  - a. another substance, as a constituent;
  - b. a mixture,
  - c. an article
- Proposed limits
  - **25 ppb** for any PFAS as measured with targeted PFAS analysis (polymeric PFASs excluded from quantification)
  - **250 ppb** for the sum of PFASs measured as sum of targeted PFAS analysis, optionally with prior degradation of precursors (polymeric PFASs excluded from quantification)
  - **50 ppm** for PFASs (polymeric PFASs included). If total fluorine exceeds 50 mg F/kg the manufacturer, importer or downstream user shall upon request provide to the enforcement authorities a proof for the fluorine measured as content of either PFASs or non-PFASs.

# PFAS - EU

- Proposed derogations (fire fighting specific)
- 5. By way of derogation, paragraphs 1 and 2 shall not apply to:
  - c. textiles used in **personal protective equipment (PPE) in professional firefighting activities** intended to protect users against risks as specified in Regulation (EU) 2016/425, Annex I, Risk Category III (a) - (m), until 13.5 years after EiF;
  - m. **clean fire suppressing agents** where current alternatives damage the assets to be protected or pose a risk to human health until 13.5 years after EiF; **NOT FIRE FIGHTING FOAMS**

# PFAS – UK

- UK RMOA published April
- Executive Summary conclusio
- Proposal/consultation 2023

1. Preparation of Annex XV dossiers to potentially support one or more restrictions of PFAS under UK REACH, including:

**a. the use and disposal of FFF where non-PFAS alternatives are available,**

b. other wide dispersive uses such as the application of coatings or use of cleaning agents,

c. the manufacture and placing on the market of consumer articles from which PFAS are likely to be released into air, water or soil, or directly transferred to humans. This includes textiles, upholstery, leather, apparel, rugs and carpets, paints, varnishes, waxes and polishes, cleaning products. Consideration may be given to other consumer articles if other gaps are identified in consultation with other legislative regimes such as food contact materials.

2. UK REACH authorisation of PFAS used in processing aids in the manufacture and processing of fluorinated polymers

3. Further evaluation and investigation of substances that have been highlighted to be of concern a. Trifluoroacetic acid, EEA-NH<sub>4</sub> and perfluoroalkanes and perfluorocycloalkanes

4. Continued collaborative work across government and with external stakeholders to bring together work on PFAS strategically, including:

**a. A review of the F-gas regulations to determine whether additional PFAS registered under UK REACH should be brought within scope**

b. Development of statutory standards for PFAS in drinking water in England and Wales



# Worldwide PFAS

	Key	Banned	Allowed with restrictions/timescales	in place					
Country		Training	Testing	Military	Airports	Fire fighting	Terminals	oil refineries	chemical plants
Australia									
	New South Wales				X <sup>1</sup>				
	Queensland								
	South Australia								
	Tasmania				X <sup>1</sup>				
	Victoria				X <sup>1</sup>				
	Western Australia				X <sup>1</sup>				
	Australian Capital Territory				X <sup>1</sup>				
	Jervis Bay Territory				X <sup>1</sup>				
	Northern Territory				X <sup>1</sup>				





# Worldwide PFAS

Country	Key	Banned	Allowed with restrictions/timescales		in place				
			Training	Testing	Military	Airports	Terminals	oil refineries	chemical plants
US									
	Arizona	AZ	Allowed with restrictions/timescales	Allowed with restrictions/timescales					
	California	CA	Banned	Banned	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales
	Colorado	CO	Banned	Banned	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales
	Georgia	GA	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales
	Illinois	IL	Banned	Banned					
	Indiana	IN	Allowed with restrictions/timescales	Allowed with restrictions/timescales					
	Kentucky <sup>[D]</sup>	KY	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales
	Maryland	MD	Allowed with restrictions/timescales	Allowed with restrictions/timescales					
	Massachusetts <sup>[D]</sup>	MA							
	Michigan	MI	Banned	Banned					
	Minnesota	MN	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales
	Nevada	NV	Banned	Banned					
	New Hampshire	NH	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales
	New York	NY	Banned	Banned	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales
	Vermont	VT	Banned	Banned					
	Virginia <sup>[D]</sup>	VA	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales
	Washington	WA	Banned	Banned	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales	Allowed with restrictions/timescales
	West Virginia	WV	Banned	Banned					
	Wisconsin	WI	Allowed with restrictions/timescales	Allowed with restrictions/timescales					
	FAA		Banned	Banned	Banned	Banned	Banned	Banned	Banned

- What does it mean
  - Defence usually has exemptions but not always
  - At the moment no need to change

However

Need to be ready and understand what the implications are

## Alternatives for F-Gases in Gaseous systems

- FK-5-1-12
  - A PFAS
  - Some manufacturers pulling out – generic FK still available
- CO<sub>2</sub>
  - Long history in ships
  - Non occupied rooms only
  - Toxicity issues at extinguishing Concentrations
- Inert gases
  - Need more containers than F-gases so more space needed to store them
  - May require additional pipework
- Watermist

- Alternatives to AFFF

- Fluorine free foams (non-PFAS)

- The new fluorine-free foams are similar to the legacy protein foams in that they rely solely on the foam blanket to contain the fuel vapors to extinguish the fire (i.e., fluorine-free foams do not produce a surfactant film of the fuel surface like AFFF).”
- As formulations are based on different technologies, F3 foams cannot be mixed unlike AFFF
  - difficulties for mutual aid operations and the potential of mixing incompatible foam;
- Generally, more viscous than AFFF
  - Low temperature performance may not be as good
- Not as tolerant to see water as AFFF
  - May need longer extinguishing times = more agent
- Will require different aspiration ratios/induction rates
- Type of class B fuel impacts on performance of F3 more than with AFFF
- Portable fire extinguishers F3 doesn't achieve the same Class B ratings as AFFF



- Alternatives to PFAs in PPE
  - ??



# Swapping out /Changing

- Not a straight swap for any application
  - Gaseous Extinguishing
    - Change pipework
    - Storage – number of containers
    - Change nozzles



# Swapping out /Changing

- Foam – fixed systems

- Depending on the restriction limit – 1ppm or 25ppb etc can it be measured & what is being measured

- Targeted PFAS
- Total PFAS

- Questions asked:

- Can't I just replace the foam in the tank and good to go?
  - No will still have residue above the limit in tank inc. lining and pipework
  - Different /aspiration induction ratios = may need new proportioner/monitors
  - Repeat fire tests to confirm effectiveness of new foam

- What if I wash it out?

Unclear how many washes will reduce the residue to below the limits

Tank Lining may be impregnated and therefore cannot wash out – will need replacing

Hoses will probably need replacing for the same reasons



# Swapping out /Changing

- Foam – fixed systems

- Questions asked:

- If I can't get company A's F3 can I just replace it with any other manufacturers?
      - No different F3's cannot be mixed as with AFFF
      - Will need to work out where stocks are to replace
    - What if I wash it out?

Unclear how many washes will reduce the residue to below the limits

Tank Lining may be impregnated and therefore cannot wash out – will need replacing

Hoses will probably need replacing for the same reasons

- Foam – Portables

- Simpler to just replace with new extinguisher
  - Same concerns as fixed systems

