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Fluorine-free foam and its implications for fire extinguishing systems

Final Ban on PFAS

By 2025, the use of fluorine-containing foam for firefighting will be prohibited. The European Chemicals Agency (ECHA) intends to ban approximately six thousand hazardous substances collectively known as PFAS. These chemical substances are present in many products we use daily, such as cosmetics, non-stick pans, mobile phones, and firefighting foam.

A ban on PFOS was already implemented in 2011, followed by a ban on PFOA in 2023. The aim is that from 2025 onwards, no substance falling under the PFAS group will be used in the production of goods and liquids.

This has implications for foam-based fire suppression. Not only does all fluorine-containing foam concentrate need to be replaced, but it is also necessary to reassess firefighting installations. Do they still meet the properties and qualities of the 'new' foam? What are the consequences of fluorine-free foam concentrate for the installations? And what should installers or end-users consider? These are questions to take into account.

Fluor-what?

Fluorine-containing foam, such as AFFF (Aqueous Film Forming Foam), contains perfluorinated compounds (PFAS). One of the advantages of PFAS is that it can form a stable, thin film on the surface of flammable liquids. This slows down evaporation and suppresses flames, making PFAS foam effective in combating fires caused by flammable liquids such as gasoline, oil, and alcohol. However, PFAS also has several (hazardous) disadvantages. The substances are harmful to the environment and can cause diseases such as cancer. An essential part of all global PFAS pollution comes from firefighting foam. Consequently, many countries have adopted laws and regulations to prohibit or restrict the use of fluorine-containing (PFAS) foam.

Timeline on regulations:

Substance	Regulation/ legal basis	Stop production/ stop placing on the market	Stop the use
PFOS > 10ppm	EU2006/122 EU2019/1021 (POP)	2004	27.06.2011
PFOA > 25ppb PFOA-related substances Total > 1000ppb	EU2017/ 1000 EU2019/ 1021 (POP), supplemented by EU2020/ 784 (POP annex update)	04.07.2020 (C8 based foaming agents)	01.01.2023 without extinguishing water retention 04.07.2025 with extinguishing water retention
PFxA > 25ppb PFHxA related substances sum > 1000ppb	Draft restriction on PFHxA and related substances	Not yet published, planned release probably around Q1/2024	Various application-dependent transition periods, max. 12 year
PFAS in fire-fighting foams Total > 1000 ppb	Draft restriction on PFAS in firefighting foams	Not yet published, planned release probably around Q1/2024	Various application-dependent transition periods, max 10 years in advance
Universal PFAS restriction	Draft restriction on PFAS	Legislative process has just started. Will apply to gases as extinguishing agents	Planned publication Q4/ 2025

BVFA 2024

What should companies do?

The ban on fluorine-containing foam will have a positive impact on the environment and the health of humans and animals. However, companies and institutions that use firefighting installations must make significant adjustments and investments. It is important for organizations to take timely measures to comply with the new laws and regulations and to maintain effective firefighting capabilities.

Actions required due to the ban on fluorine-containing (PFAS) foam:

1.

Transition to alternative fire-fighting agents.

Companies and institutions must switch to fluorine-free firefighting agents. The market for fluorine-free firefighting foam is continuously evolving. It is advisable to seek advice on the appropriate foam concentrate for each system.

2.

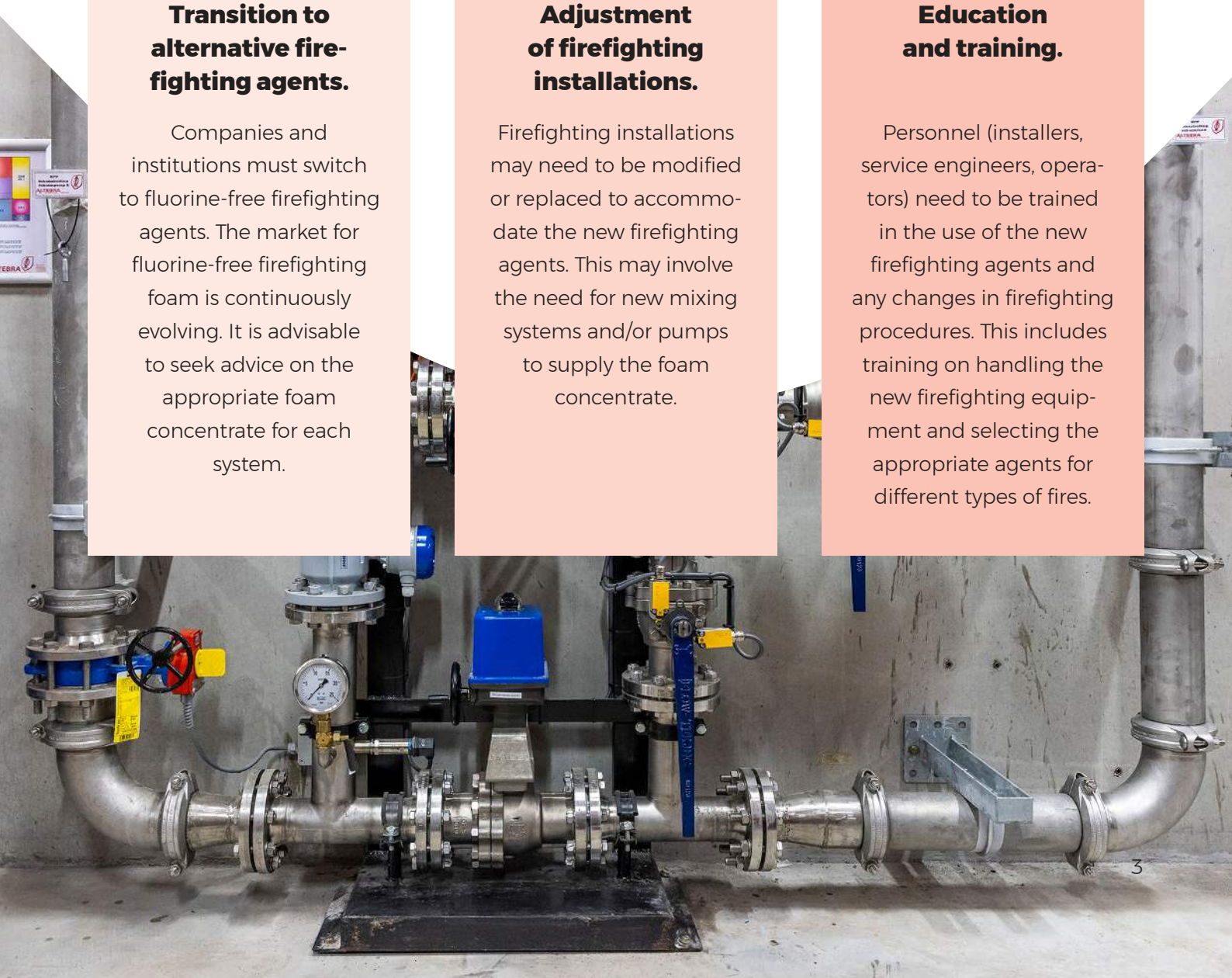
Adjustment of firefighting installations.

Firefighting installations may need to be modified or replaced to accommodate the new firefighting agents. This may involve the need for new mixing systems and/or pumps to supply the foam concentrate.

3.

Education and training.

Personnel (installers, service engineers, operators) need to be trained in the use of the new firefighting agents and any changes in firefighting procedures. This includes training on handling the new firefighting equipment and selecting the appropriate agents for different types of fires.



Consequences of Fluorine-Free Foam concentrate for Firefighting Installations

Fluorine-containing foam concentrate appears easily replaceable by fluorine-free foam concentrate (also known as SFFF or 3F). However, the "new" foam has several properties that affect existing firefighting installations.

High Viscosity

Viscosity refers to the thickness or stickiness of a liquid. Fluorine-free firefighting foam concentrate is "viscous," meaning it has high viscosity. The substance is thicker than fluorine-containing variants. It can be likened to ketchup rather than water: it is a stiffer substance to pump. Not all foam firefighting installations can handle this. Due to the resistance that occurs in the pipes, a pump with higher pressure is needed than when pumping fluorine-containing foam.

Specific Applications

Current fluorine-containing foam can extinguish any flammable liquid. This is not the case for fluorine-free foam. The foam concentrate manufactures try to develop the product so it as a wide as possible range of use. The experience showed that 3F´s are "fuel sensitive" meaning there is a chance that the performance is lower than with AFFF which has a much wider range.

The advantage of this is that this type of foam is more efficient in extinguishing fires caused by certain chemicals or in industrial environments. However, it may also mean that you need different variants of fluorine-free foam to cover a wide range of fire risks. Therefore, you need to know in advance which foam concentrate you are getting and what you can do with it. Advice on this is advisable because the market is continuously evolving, and many fluorine-free variants are still in the testing phase.

Different Mixing Ratios

To obtain firefighting foam, foam concentrate must first be mixed with water. The composition that results is called the premix. The premix will be discharged thru a discharge device which will generate the foam in the needed expansion ratio after coming in contact with air.

For fluorine-containing foam, the ratio for the premix is 1 or 3 percent foam concentrate and 99 or 97 percent water. Most firefighting installations are set to these amounts. However, for fluorine-free foam concentrate, a different ratio applies: usually 3 or 6 percent concentrate and 97 or 94 percent water. This requires a larger foam storage tank with higher capacity because more foam concentrate needs to be pumped. The consequence: an installation must be thoroughly modified or even completely replaced.

Expansion Ratio

The substance of the premix expands when it comes into contact with air. The degree to which this occurs is referred to as the expansion ratio. A higher expansion ratio means that the firefighting foam expands more after it has come out of the firefighting equipment, while a lower expansion ratio means that the foam blanked is more stable and provides a strong cover.

However, fluorine-free foam generally has a lower expansion capability than fluorinated foam. This is because fluorine-free foams often consist of alternative chemical components that allow for less expansion.
Suppose you use a foam type with an expansion ratio of 5:1. This means that one liter of premix fills an empty container of five liters with expanded foam after coming into contact with air. Now, suppose you switch to a fluorine-free foam with an expansion ratio of 7:1. If the firefighting system is designed for 5:1, you won't be able to extinguish a fire, with all the consequences that entails.

Different application rate

The "application rate" refers to the amount of foam concentrate needed to combat a particular fire. With fluorine-free foam, a different application rate might be needed to extinguish a fire of the same size compared to fluorinated foam. Most systems are designed based on the application rate of PFAS foam. For the new foam, you need to adjust the installation. This could involve a larger pump with greater capacity, larger pipes, more foam generators, and a larger foam storage tank.

Cleaning installation: why doesn't that suffice?

Consumers often think that it is sufficient to thoroughly clean a firefighting system before filling it with the new, fluorine-free foam concentrate. Unfortunately, fluorine compounds (especially PFAS compounds) are stubborn. It is difficult to remove them completely, and it is almost impossible to clean a fire protection system in such a way that there is truly nothing left of the original foam concentrate.
Even if you rinse the storage tanks that previously contained fluorinated foam concentrate thoroughly, there may be residues that "contaminate" the new foam concentrate. You can compare it to a sponge with dish soap: it takes a long time for the sponge to be completely free of soap, and even then, you don't know if all the particles are gone. This poses the risk of residual fluorine remaining in the new foam, above the specified threshold values.

"We always talk about the environmental impact of fluorinated firefighting foam. But consider fires that cannot be extinguished properly because the firefighting system does not meet the requirements. What impact does that have on nature?"

Aaron Johnson
Managing Director of Fire Lion Global

Which installations can accommodate fluorine-free foam?

X Mechanically operated Foam system

✓ Electrically operated Foam system

Broadly speaking, there are two types of firefighting systems: electronically operated and mechanical. An electronically operated firefighting system comprises electronic components such as sensors, control panels, and actuators that can detect, signal, and extinguish a fire.

A mechanical firefighting system relies on physical mechanisms like pressure sensors, thermal sensors, or mechanical activation to detect and extinguish fires. A well-known example is a sprinkler system, where the heat of the fire activates the sprinkler heads. One advantage of these systems is that they are less prone to malfunctions than electronically operated systems.
However, a drawback is that they often require human interaction to mix and activate firefighting agents. In contrast, electronically operated firefighting systems do this automatically: the system monitors and regulates the mixing based on easily adjustable settings and electronic fire detection.
If you have a mechanical installation, you will need to make adjustments when switching to fluorine-free foam. For instance, you may require a new water pump or a different dosing device since both may no longer be suitable.

Now what?

Action plan for companies and organizations:

1.

Assess whether your firefighting installations are adequately equipped for fluorine-free foam concentrate.

2.

Seek advice from reliable foam consultants in the market.

3.

Take timely measures before the government begins enforcing compliance with the regulations starting from 2025.

"Procrastination is in our nature. But if you don't make changes now, it could have consequences for your business. If your installations do not meet the legal requirements by 2025, the government may take action."

Aaron Johnson
Managing Director of Fire Lion Global

More Information

Would you like more information about possible solutions, and advice tailored to your situation and preferences? Then contact WB Firepacks. For industry associations like Federatie Veilig Nederland and BVFA (Germany), you can find information about the latest developments in the market.

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