EUROFEU-Submission:

F-Gases under the Universal PFAS restriction

20 September 2023

Foreword

The goal of this input is to explain why we highly recommend to exclude PFMP - Perfluor(2-methyl-3-pentanon) "FK5-1-12" for fire extinguishing applications from PFAS restrictions.

In the text we use ***FK5-1-12*** for PFMP - Perfluor(2-methyl-3-pentanon) aka Dodecafluor-2-methylpentan-3-on CF3CF2C(O)CF(CF3)2 as short name following EN 15004-2 standard

Arguments

- There exist no other fire extinguishing system with the same properties, which makes the FK5-1-12 indispensable for certain applications
- There are no ideas or proposals, that we are aware of, to develop a fire extinguishing system with the same properties. Also if there was
  an idea just right now it will take minimum 11-12 year to start go to market
- FK5-1-12 and its ODP 0 and GWP 1 is the only alternative to Halon and HFC fire extinguishing systems
- FK5-1-12 systems are mainly used to protect critical infrastructure and sensitive equipment which is the interest of the whole community
- to keep this infrastructure in service or reduce the downtime to minimum
- Based on studies fact shows that FK5-1-12 and it´s decomposition products are not bio accumulative, mobile or toxic.
- Fire in a technical environment create a lot of very dangerous decomposition products (e.g. Dioxins, Furans). The produced amount depend on how fast and effective a fire is extinguished
- The discharge rate of FK5-1-12 at fire extinguishing installations is very low approx. 3 % of the annually installed amount of FK5-1-12
- Fire extinguishing systems using FK5-1-12 have an automatic leak monitoring.

Foreword

- Destruction of the not biodegradable decomposition product TFA is possible using waste incineration plants with operation temperatures above 1100 °C
- Restriction of FK5-1-12 for fire extinguishing systems in EU will have a negative impact on EU community compared to countries where it is possible to stay with FK5-1-12

This input does not follow commercial interests of our association members. For many applications our manufacturer have alternative extinguishing systems in their portfolio and restriction of FK5-1-12 fire extinguishing agent has no negative effect on their business.
Our input is in the interest of the community to avoid reduction of protection level.
This does also reflect our finding, that the impact of FK5-1-12 and similar F-gas fire extinguishing agents on global environment is very low.

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1. Benefits of FK5-1-12 and similar F-Gas systems

Benefits of Fire extinguishing systems using FK5-1-12 :

- Very fast discharge and very fast extinguishing of fires at a very early stage which reduce level of fire damage and reduce amount of toxic fire products (e.g. Dioxins, Furans) to a minimum. Some of this toxic products are also very persistant

- Safe for people if for some reason people can´t leave the flooded area (e.g. to operate critical infrastructure) (CO2,-and Aerosol – Nitrogen Generators are very harmful for people, also Inert gases may require additional safety measures)

- Nonconductive (important for ongoing operation of critical infrastructure also in case of extinguishant release)

- No residue and also no contaminated water which reduce downtime and reduce risk of contamination

- Much smaller storage space as Intergases (most of preplacement, of existing HFC system, necessary due to their global warming potential, can be done only by using FK/HFO agents

- Lower CO2 footprint than Inertgas extinguishing systems with Nitrogen (base 485 g CO2 /kWh production)

  FK5-1-12 GWP / kg =1 EN 15004 class A 5,6% = 0,83 kg/m³ plus Energy need for 1m³ protected volume for manufacturing (180l steel cylinder) approx. 2,4 kW/h =GWP 1,16/ m³

  FK5-1-12 GWP / m³ protected volume = 2,0

  Inertgas GWP/kg = 0 = 0kg/m3 plus Energy need for 1m³ protected volume for manufacturing (140l steel cylinder) approx. 7,8 kW/h = GWP 3,78 /m³

  Inertgas GWP / m³ protected volume = 3,8

- Refillable on site

- Recyclable

2. Main applications of FK5-1-12 and similar F-Gases

Main Applications:

IT Rooms / Data Center / Data storage
To protect sensitive electronic equipment and data storage devices (e.g. Hospital, Bank, Energy production, Energy distributor, Internet provider, Telecom ..). All other extinguishing systems has a slower extinguishing time or risk of damage sensitive equipment

Control rooms
Evacuation of some Control rooms in case of fire is not possible and beside very fast extinguishing there is a need for a safe extinguishing agent which his safe for people (e.g Airport tower, Power plants, Energy distribution)

Archives/Museum/Storage area
To reduce risk of damage by to slow fire extinguishing or damage by the extinguishing agent itself

Small electronic racks
In or beside some small electronic racks / cabinets/ boxes there is often no space for the storage of other clean agent extinguishing systems

Technical rooms
Buildings become more controlled by computer and such “smart buildings” need high level of protection for their control systems.

Machine/ Generator/ Control- Technical rooms on ships
Beside the personal safety level and fast extinguishing space, weight and a possible refill on site are very important topics for extinguishing system on ships (River/Sea going Vessels)

Areas with limited space in general
Replacement with Inertgas extinguishing system (the closest alternative) is often not possible because of missing space for storage of needed much higher amount of extinguishing agent cylinder

3. New development status / Comparison with other fire extinguishing system

New developments

To see **if there is a new idea / invention** of a new molecule we check

- current patent submissions
- Announcements for new extinguishing technologies / system
- If there is an idea or plan for new extinguishing agents with similar properties of FK5-1-12 by main manufacturer

Result was **negative.**

Also if somebody show up with a new molecule it will take minimum 11-12 years to bring a new molecule which passed first test inside laboratories to the market as part on an approved fire extinguishing system.

But for a new development the questions are

- Is it possible to create a non PFAS molecule with very similar properties as FK5-1-12
- Is somebody willing to invest millions of Euros into this development for a very small market (also the global market is very small related to the investment for a fire extinguishing agent only)
- Is somebody willing to invest millions of Euros with a high risk to fail or fall under future restriction because of later noted negative effects of his new molecule (history show that all of this type of agents become issues (halon 1301, Halon 1211, HFC-23, HFC-ea, FK5-1-12, Blend 55 and some more)

Comparison with other fire extinguishing systems

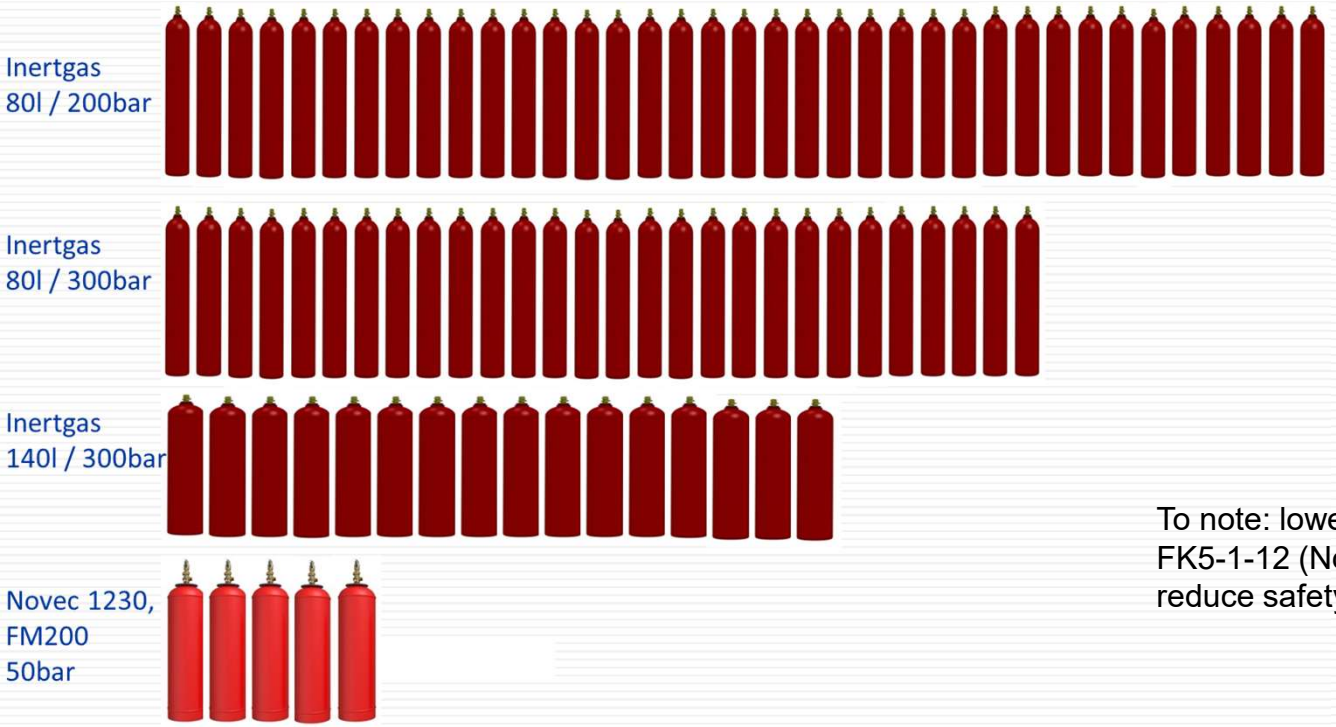
In Annex C you will find an overview and comparison of extinguishing systems. **None of them is a 100 % replacement of FK 5-1-12** extinguishing systems.

Inertgas systems using Nitrogen (IG 100), Argon (IG01), Nitrogen+Argon (IG55), Nitrogen+Argon-Co2 (IG541), are so called clean agents which come closest to the properties of FK5-1-12 systems. We estimate that **approx. 65 % of total flooding clean agent system can be done with Intergases and for the rest the customers need a FK5-1-12** or similar system.

With the next pages we show the differences between Inertgas and FK5-1-12 system

4. Comparison with Inertgas clean agent fire extinguishing system – storage space

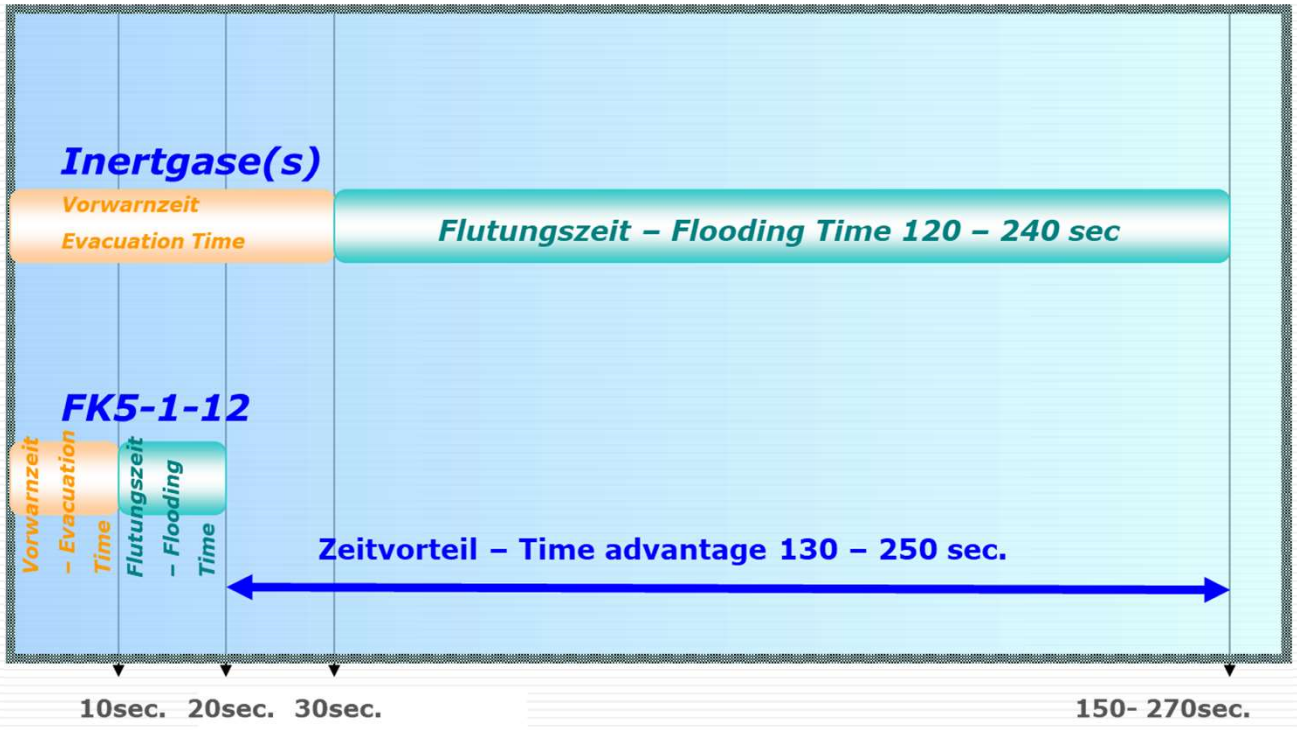
Spacing for extinguishing agent cylinder for 1000m³ protected building volume acc. EN/ISO design concentration „higher class A“



To note: lower cylinder pressure of FK5-1-12 (Novec1230) systems reduce safety risk potential

5. Comparison with Inertgas clean agent fire extinguishing system – extinguishing time

Discharge time follow EN 15004 Standard



6. Comparison with Inertgas clean agent fire extinguishing system – Safety

Minimum Design Concentration related to NOAEL and LOAEL

ISO 14520 Name	ISO14520-Part#	NOAEL	LOAEL	Surface Class A	Class B	Higher Class A
CF3I	2	0,2	0,4	min. 4,6	4,6	9,3
FK-5-1-12	5	10	>10	5,3	5,9	5,6
HCFC Blend A	6	10	>10	7,8	13,0	12,4
HFC-125	8	7,5	10	11,2	12,1	11,5
HFC-227ea	9	9	10,5	7,9	9,0	8,5
HFC-23	10	30	>30	16,3	16,4	16,3
HFC-236a	11	10	15	8,8	9,8	9,3
IG01	12	43	52	41,9	51,0	48,4
IG55	14	43	52	40,3	47,5	45,1
IG541	15	43	52	39,9	41,2	39,9
IG100	13	43	52	40,3	43,7	41,5
FC-2-1-8[1]	3	30	>30	n.a	9,5	9,1
FC-3-1-10[1]	4	40	>40	6,5	7,7	7,4
HCFC-124[1]	7	1	2,5	n.a	8,7	8,3
Further Systems						
CO2[2]	ISO 6183	0,5	5	62	35	47
Permanent Inerting[3]	VdS 3527	43	52	13,1-14,0	14,6-15,6	14,9

Most of IT/technical/Data rooms fall under Higher Class A
Minimum Designkoncentration is above or close to NOAEL

to note
- different local occupational safety laws have higher limits
- You can not use half cylinders to adjust agent concentration
- Protected Volume is calculated by empty volume and components reduce the volume

So Intergas systems have a higher risk to harm people who stay inside the room

NOAEL: No Observed Adverse Effect Level
LOAEL: Lowest observed effect level

7. Scientific Opinion FK5-1-12 Environmental fate and long-term effects

To determine the environmental fate of perfluoro(2-methyl-3-pentanone) PFMP and define its potential long-term effects in the environment, this Scientific Opinion evaluates classification drivers of ecotoxicity, such as absence of degradability, mobility, and potential for bioaccumulation as well as ecotoxiological information on short or chronic aquatic toxicity. The intrinsic properties of PFMP and the degradation products, perfluoropropionic acid (PFPA) and trifluoroacetic acid (TFA), are presented using key parameters.

This Scientific Opinion shows that there is good evidence for PFMP that it should not be classified and should be excluded as a specific PFAS from the scope of ECHA's proposal (ECHA 2022).

Details see Annex A

8. Scientific Opinion Complete mineralization of Trifluoro-acetic acid, TFA

The substance under evaluation is TFA, a fully fluorinated derivate of acetic acid. Besides its use as a precursor for many other fluorinated compounds, TFA is also considered to be the main degradation product of PFMP. Considering that TFA is persistent and not readily biodegradable, it is important to discuss possible methods for complete mineralisation of TFA, i.e. biodegradation, thermal degradation, photolysis, chemical degradation, enzymatic degradation, plasma treatment, or electrochemical degradation. Data summaries from recognised peer-reviewed sources or published reliable test data provide a sufficient level of information (and validity of data) regarding TFA mineralisation.
Based on these results, incineration is currently considered the most effective method. However, sonolysis and photolysis provide also promising results and could represent much more economically rewarding methods in the future.

In conclusion, this Scientific Opinion" Complete mineralization of Trifluoroacetic acid, TFA" shows that that FK5-1-12 (TFA can be fully mineralized by Hazardous waste incineration plants with operation temperatures above 1100 °C are state of the art.

Details see Annex B

9. Recycling and disposal

Recycling
This type of extinguishant have a very long life time (inside a extinguishing container pressurized with Nitrogen approx. > 30 years) and is common to recycle such expensive extinguishant instead dispose them.
Reycling start with chemical analysis and depending on the results next steps are filtering and cleaning.
If the extinguishant pass the EN 15004 limits it can be use to fill or refill extinguishing systems.
Recycling have a benefit for the environment

Disposal
extinguishants outside EN 15004 purity limits should be disposed by
- Incineration by local Hazardous waste incineration plants with operation temperatures above 1100 °C
- Recycling or disposal by the manufacturer of the extinguishants

We propose that the local government in EU support the recycling and disposal by reduction of the administration and transport/handling restrictions for this kind of extinguishant. Missing such support during the Halon ban a lot of systems are discharged by "accident".

10. Release of TFA by fire extinguishing F gases EU

Most of the installed system have an automatic leak supervisory systems to detect leaks and show that the system is out of service.
It is in the interest of the operator/owner to solve this leaks immediately and bring the system back to service.
The release of FK5-1-12 by such leaks is very very small.

To avoid discharge by fail alarm the majority of this systems need two alarm signals to activate the fire extinguishing system.
If only one fire detector show alarm this is not enough to discharge the fire extinguishing agent.
It is also state of the art to have a manual release function, but based on our experience this function is not often used.
Most of the discharges base on alarm of 2 independent fire detectors which reduce the risk of an fail discharge of fire extinguishing agent.

For detail of the amount of installed system and releases please see Annex D