OILTECHNICS
FIRE FIGHTING PRODUCTS

OIL TECHNICS, UK

Response to Public Consultation on SEAC Draft Opinion of Proposed PFHxA Restrictions.

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Executive Summary

Oil Technics appreciates this opportunity to make a submission to ECHA, regarding the SEAC (Socio-Economic Assessment Committee) draft opinion on the proposed restriction of PFHxA, a short chain C6 PFAS and its related substances. This submission provides detailed evidence around 5 critical points affecting the Offshore Sector:

- Persistence is not a hazard, so does not justify such disproportionate restrictions.
- Alternative Fluorine Free Foams (F3) fire performance is not proven equivalent to C6-AFFFs.
- Major costs in re-design/re-engineering for existing firefighting foam systems have not been adequately considered.
- Detailed design standards are not currently available for F3s.
- It is therefore requested that Offshore platforms receive the same derogation as Storage tank and bunded areas, exceeding 400m^2 fire area for emergency use of C6 AFFFs with a 12-year extension to cover the reduced anticipated lifespan of these platforms.

Persistence issues

A major reason for concern regarding this proposal is due to these substances persistence in the environment, being claimed as a cause for severe restriction. Persistence is not defined as a hazard and seems not to qualify under REACH as a justification for such disproportionate and severe restrictions. Particularly when both SEAC and the Dossier submitter accept that PFHxA and its related substances are not considered bioaccumulative nor toxic. It is also concerning when there is no firm evidence that PFHxA is harmful to human health, even in occupationally exposed workers. Research confirms PFHxA has a human half-life averaging 32 days and is excreted in urine, preventing blood serum levels rising to levels that may be of future concern, even during repeated exposures. This is in direct contrast to already severely restricted legacy long-chain C8 PFAS substances, confirmed as Persistent, Bioaccumulative and Toxic, which have typical human half-lives of 3.5 years (PFOA), 5.4 years (PFOS) and 8.5 years (PFHxS - defined by UN OECD as a long-chain PFAS). PFOS and PFOA are already listed under the Stockholm Convention as Persistent Organic Pollutants (POPs), with PFHxS already under the POP listing process. PFHxA and its related substances behave very differently from legacy long-chain C8 PFAS chemicals which have already been widely prohibited from use by ECHA and EU regulation 2017/1000.

SEAC's draft opinion confirms acceptance (p16) "***For PFHxA, considerably lower half-life values are reported in comparison to the half-lives of PFOA and PFHxS. The Dossier Submitter assessed this and concluded that PFHxA does not fulfil the Bioaccumulation criterion of Annex XIII to REACH***". Further acceptance follows (p17) that "*The Dossier Submitter concludes that PFHxA by far exceeds the vP criterion,* ***while the data on bioaccumulation and ecotoxicity***

are not sufficient to identify PFHxA as a PBT or vPvB substance*. …**Additionally, the Dossier Submitter notes that PFHxA is neither classified as carcinogenic, mutagenic, or toxic for reproduction. Overall, PFHxA is not considered a PBT/vPvB substance, …”.*** This confirmation by SEAC and the Dossier submitter confirms that PFHxA and related substances do NOT meet the REACH criteria for being defined as hazardous substances, and should not be severely restricted as misleadingly proposed.

Why if it is non-hazardous as confirmed, is it being subjected to disproportionate and unreasonable restrictions? This is particularly important when life-saving products like C6-AFFF-LF, critical for ensuring life safety offshore in low winter temperatures are being proposed for ‘prevention from use’ during fire emergencies offshore. This similarly affects other sectors including Aviation, Defence, and major industrial hazard facilities where catastrophic flammable liquid fires also cannot be adequately and reliably controlled by un-proven alternative non-fluorinated alternatives.

F3 alternatives not proven ‘equivalent’ to C6-AFFF-LF

SEAC’s draft opinion recognises (p29) “…***that the performance level of the alternatives available is not sufficient currently, and the quality of their products would deteriorate if the alternatives were introduced now, causing considerable losses****.* *… It was stated in many comments that the cost of the alternatives is not the issue****, but performance is.***”

High performance is fundamentally critical in saving lives, especially in the Offshore Sector where ‘evacuation to safety’ is rarely an option – workers are ‘trapped’ on these platforms when fire strikes, entirely reliant on effective rapid extinguishment.

NFPA-RF[4] conducted 165 comparative fire tests under basic UL162 protocols, which confirmed “*F3s did well against heptane but struggled against some of the scenarios conducted with IPA* [Isopropyl Alcohol] *and gasoline (both MILSPEC and E10* [gasoline with 10% Ethanol added]*), especially when the foam was discharged with a lower foam quality/aspiration*.” … “*During the Type III* [forceful application] *tests* [most relevant offshore]*, F3s required between* ***3 - 4 times*** *the extinguishment density of the AR-AFFF for regular MILSPEC gasoline and between* ***6 - 7 times*** *the density of AR-AFFF on E10 gasoline*”. This was noted by SEAC (p40), but “*SEAC could not verify robustness of these estimates.”* The evidence Reports[4,5] are provided in this submission and its reference list to enable SEAC’s verification and robustness of these findings.

Yet SEAC and the Dossier Submitter seem to ‘assume’ an ‘equivalency of fire performance’ to C6 AFFFs by Fluorine Free Foams (F3s), based on small-scale approval testing usually with freshwater only, although UL normally requires fresh and seawater testing. These approvals (eg. EN1568-3, ISO7203-1, UL162, FM5130, Lastfire, IMO) are all conducted using heptane as the test fuel, not the more onerous and widely used gasoline (nor crude oil), so they do not tell the real story from an emergency perspective. AFFFs exhibit very similar fire performance on heptane and gasoline (hence why it has been used for over 50 years), but this is not the case with non-fluorinated foams like leading modern F3s.These approvals should therefore be considered quite misleading, particularly regarding F3s, without the critical fluorocarbon surfactants which repel fuel and provide chemical vapour sealing, present in C6 AFFF, but absent from all F3 alternatives.

Still we have seen no significant large scale repeatable fire testing for industrial applications to establish new safety factors, reliable and effective application rates under realistic worst-case emergency conditions on gasoline/crude oil, or using seawater, before C6AFFF/AR-AFFFs become severely restricted from being effectively used in fire emergencies. Significant major fires where F3s were used (using freshwater), delivering unexpectedly disastrous outcomes, have also not been adequately considered by SEAC, the Dossier Submitter, nor the Wood 2020 report, so are included in this submission as evidence[8-22] (see p14-18).

Major costs in system re-design/re-engineering

Re-engineering challenges of existing fixed foam systems have not been adequately considered by SEAC. These are immense offshore and huge in most major hazard facilities.

Increased weight loadings and space allocations are likely requirements of any move to F3s where higher application rates and larger storage volumes are expected, which are at a premium offshore (hence the focus on space saving 1% concentrates). Higher F3 aspiration require device changes, larger pumping capacities, shorter reach, likely increasing F3 vulnerability to wind effects, all challenges requiring re-design, additional cost allocation and exotic materials. Potential F3 viscosity differences, proportioning accuracy (more variable in winter), poorer mixing ability (particularly prevalent in cold conditions), storage stability, corrosion effects, clean-out procedures, down time to install, are all additional important costly and time-consuming pre-requisites for any transition, which have not been adequately considered for offshore platforms, or other Major Hazard Facilities.

Why are we considering deliberately exposing worker's safety to disproportionate risks, by compromising future fire perfromance of their offshore platforms?

Let's not forget so many other items on these platforms will contain and release PFAS under fire emergencies (not just firefighting foams), so it is a ubiquitous and inevitable run-off component from any platform fires, even if less effective F3s were to be used.

Design standards not available for F3s

Substantial variability and vulnerability of F3s to gasoline was established beyond doubt by two important, comprehensive and rigorous comparative fire test studies. The 2020 US National Fire Protection Association – Research Foundation (NFPA-RF) Report[4] and a separate independent comparative 2019 study by US Naval Research Laboratory (NRL)[5], neither of which has been adequately recognised by ECHA, SEAC or the Dossier Submitter. These verify unacceptable F3 fire performance for offshore sector applications. The NFPA-RF report concluded F3s are not 'drop-in replacements' for existing AFFF systems, and leading F3 fire capabilities varied so significantly "*it was difficult to develop* *any 'generic' F3 design standards*", which are still missing from the latest NFPA11:2021 Foam system design standard. It seemingly abdicates its responsibility by handing effective system design recommendations over to foam manufacturers, although NFPA11:2021[6] refers foam users to a new Annex H with a summary of this NFPA-RF Report's findings and Lastfire testing, as 'guidance'.

The NRL Report[5] also revealed that four leading commercial F3s tested required **between 2.5 times more and over 6 times more F3 than the benchmark C6AFFF** when required to extinguish gasoline fires in 60 secs. **These differences widened as extinction speeds became faster**. Speed is usually critical when protecting lives and minimising damage from fast-spreading fires like gasoline and crude oil. Seconds count in saving lives.
The important evidence presented in this submission, justifies re-consideration of the offshore sector joining storage tanks and bunded areas in the 12year derogation for large fires over 400m^2, already supported in SEAC's draft opinion. P87 also recognises "***SEAC notes that a similar derogation might be needed also for other types of installations than tank farms. SEAC however considers that inclusion of further types of installations would make the derogation a lot wider and the information available does not allow to estimate the related impacts. <u>Information could be submitted in the consultation on the SEAC draft opinion</u>***." Such detailed evidence is included in this submission, to justify SEAC's re-consideration of extending this derogation to include offshore platforms.

The socio-economic implications and consequences of these NFPA-RF and NRL findings in real fires are immense, but not adequately considered by SEAC. SEAC has recognised and confirmed for Storage Tanks, and bunded areas over 400m^2 (bottom p85) that ***"****According to the Background Document,* ***alternatives are currently not available which results in unacceptable risks for human health and the environment in the restriction scenario. <u>Costs of large fires that cannot be stopped could be enormous both in terms of economics, environment and potentially human suffering</u>."*** But these same 'unacceptable risks' also apply to offshore platforms, and most major hazard facility large fire situations.

This signals an unjustifiable, unsustainable and disproportionate waste of existing resources, duplicating already spent huge replacement costs on high purity C6-AFFF-LFs to meet EU regulations, with no clear benefits and no guarantees that worker safety is not being compromised.

These proposed restrictions should be re-viewed at the highest levels *before* catastrophic consequences eventuate that everyone subsequently regrets.

Offshore platforms request same 12-year Derogation as Storage tanks and bunded areas.
Delivering reliable, fast, effective, and efficient emergency system activation is considered critical for protecting life safety and minimising smoke, leaked oil

spread (and pollution), PFAS (from other platform sources) and other polluting discharges - without endangering lives or the platform. This goes a long way to ensuring offshore obligations are met, and disproportionate losses of lives and damaged infrastructure are minimised, should a subsequent major fire occur. The evidence provided in this submission supports this view, confirming that this is not currently possible by using alternative Fluorine Free Foams (F3s).

SEAC endorses this view in its overall proportionality section (bottom p57/58), confirming "***However, when considering reasonable worst-case consequences on human health and the environment arising from the restriction due to the lower performance of currently available alternatives (e.g.*** *less effective products such as PPE or* ***not being able to effectively extinguish large fires), it might be necessary to act first by granting a derogation for certain uses to prevent possibly disproportionate irreversible consequences for human health and the environment."***

There would seem to be no credible alternative in the light of this compelling body of evidence, which **has not so far been adequately considered by SEAC, but <u>requires re-consideration to extend the recommended 12year Storage tank and bunded areas over 400m2 derogation, to include C6 AFFF emergency use for Offshore platforms (and potentially other Major Hazard Facilities).</u>**

<u>IS life safety now being relegated from being our highest priority, by these proposed restrictions, …or not?</u>

NB: References are defined with red superscript number[4], listed under Section 4 (p31).

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Background

Oil Technics Firefighting Foam Ltd is the leading manufacturing supplier of AFFF firefighting foam, to the UK Offshore (Continental Shelf) Oil and Gas sector, and has been so for over 35 years. It is also the only Scottish manufacturer of AFFF Firefighting Foams, plus a range of other products dedicated to offshore applications.

Based in Aberdeenshire it has played a pivotal role in the industry's development and high performance standards. It has also played a significant part in the development of leading high performance products and the industry's changeover from legacy long-chain C8 foams, to high purity short-chain C6 based firefighting foams (particularly C6 AFFF -LFs for low freeze applications Offshore). This has enabled the industry to retain conformance with the US EPA 2010/15 PFOA stewardship programme, and current European Union regulation 2017-1000 requirements.

1. General Concerns

We have noticed numerous inaccuracies and information missing from the Dossier Submitter's Background Document, which may have acted to mislead SEAC in some areas, particularly regarding Firefighting Foams. Therefore, we greatly appreciate this opportunity to highlight specific areas which seem not to have received adequate consideration in SEAC's assessment, so far. We request SEAC to re-consider their opinion in the light of the evidence presented within this submission, to avoid disproportionate costs of large fires that cannot be stopped. These could be enormous both in terms of economics, environment and potentially human suffering.

1.1. Proof of Hazard: absent

The Dossier Submitter (DS) in its Background Document (p9) refers to PFHxA having "*unpredictable and irreversible adverse effects over time*" without any clear evidence. Such assumptions do not constitute a demonstration of unacceptable risk as required by REACH, nor a sufficient basis upon which to justify the use of the 'precautionary principle'.

SEAC's draft opinion under 'Effects on the environment' (p15) confirms there is no concern over the hazard of aquatic toxicity, by stating "***Standard laboratory studies on aquatic organisms show no adverse effects of PFHxA at environmentally relevant concentrations***."

Persistence (P), and Mobility (M) are not intrinsic hazards. They do not cause or imply an adverse effect. Only when coupled with proven hazards like Bioaccumulation (B) and Toxicity (T), do they add potential complexity, duration and extent to those hazards, as is the case with legacy long-chain C8 PFAS, which have already been restricted by ECHA and listed by the Stockholm Convention as POPs (Persistent Organic Pollutants). Modern short-chain C6 PFAS and their related substances are not POPs, cannot qualify to be listed as POPs and therefore, cannot become covered in future under the Stockholm Convention.

SEAC in its section 'Effects on human health' (p15), fails to define any adverse human effects, while indirectly accepting the very short PFHxA human half-life averaging 32 days and excreted through urine, as a key reason that prevents potential bodily build-up over time or from repeated exposures, as Russell and his team's thorough 2013 study[1] explains. This urine excretion is why PFHxA rarely shows up in human serum studies. It is prevented from concentrating over time, because of its rapid excretion in urine. Even if exposure from eating affected plants or drinking water were to occur, effective excretion through urine would prevent high levels of potential concern building up in the human body. Acknowledged by SEAC in its draft opinion (p16) confirming "…*the Dossier Submitter concludes that standardised risk assessments can be carried out, and that they suggest that the current exposure does not pose a risk for human health*."

This represents a dramatic contrast to long-chain C8 PFAS, which Olsen et al, 2007[2] confirmed exhibited half-lives of many years, so repeated exposure could build high blood serum levels of concern and potential longer term harm. Hence they are already restricted and POP listed. Such severe restrictions do not seem justified or applicable to PFHxA and its related substances. This situation seems accepted by SEAC (p16) "***For PFHxA, considerably lower half-life values are***

reported in comparison to the half-lives of PFOA and PFHxS. The Dossier Submitter assessed this and concluded that PFHxA does not fulfil the Bioaccumulation criterion of Annex XIII to REACH". Followed by acceptance that (p17) "*The Dossier Submitter concludes that PFHxA by far exceeds the vP criterion,* ***while the data on bioaccumulation and ecotoxicity are not sufficient to identify PFHxA as a PBT or vPvB substance****.*

"Additionally, the Dossier Submitter notes that PFHxA is neither classified as carcinogenic, mutagenic, or toxic for reproduction. Overall, PFHxA is not considered a PBT/vPvB substance, …". Therefore, PFHxA and related substances do NOT meet the REACH criteria for hazardous substances, and should not be severely restricted as misleadingly proposed.

SEAC confirms (p15) that the Dossier Submitter has "*a concern that PFHxA is an endocrine disruptor*", without recognising the clear evidence this is not the case under World Health Organisation (WHO) criteria. This was confirmed in the landmark 2018 study by Borghoff et al[3], which considered a 'weight-of-evidence analysis' to evaluate potential endocrine activity of PerFluoroHexanoic Acid [PFHxA]'. This study's clear conclusion determined that "***Based on this WoE*** [weight of evidence] ***endocrine analysis, PFHxA exposure did not cause adverse effects associated with alterations in endocrine activity in these models, as such would not be characterized as an endocrine disruptor according to the WHO definition****."*

From our perspective, ECHA's job is already done by restricting long-chain C8 PFAS which have shown to be potentially hazardous, harmful to human health and the environment.

The evidence confirms (and is agreed by SEAC and Dossier Submitter) that high purity short-chain C6 PFAS, including PFHxA and its related substances, behave very differently. They are not categorised as hazardous, harmful to human health or the environment. SEAC accepts these C6 PFAS do not qualify as PBT substances, so cannot warrant such stringent and disproportionate restrictions, as those proposed. Especially when they are required to provide life safety duties in fire emergencies in major hazard facilities like Offshore platforms, and other high risk applications.

We consider it is misleading to imply or attempt to justify the restriction of substances without proving that they represent unacceptable hazards, with high levels of harm and associated high risks of occurrence, particularly when their use is now only focussed on rare use in fire emergencies to save lives, prevent unnecessary destruction and minimise environmental emissions of other more dangerous, known carcinogenic substances in smoke and breakdown products of the fire.

1.2 Assumed 'equivalency' of Fluorine Free Foams (F3s): Incorrect

SEAC confirms under Firefighting Foam Alternatives (p82) that *"According to the dossier, several fluorine-free firefighting foams (FFF)* ***meeting the requirements of Class-B standard firefighting performance certifications as alternatives to AFFF*** *were developed in the recent years."*

This relies upon the 'assumption' from small scale approval testing that F3s are 'equivalent' to AFFFs because they can achieve 1A,1A hydrocarbon ratings under EN1568-3 fire testing and are UL listed at comparable 0.10gals/min/ft2 design application rates as AFFFs, but **these approvals tests do not tell the real story - they are misleading**.

Most of these small scale fire test approval standards including EN1568-3, UL162, FM5130, Lastfire, ISO7203-1, IMO, ALL use heptane as their repeatable test fuel. Some approvals are valid for freshwater use only. Heptane is a tight specification hydrocarbon fuel which does not vary seasonally or geographically like the more extensively stored, used and volatile gasoline, so is ideal for comparative testing. It was noticed during AFFF development in the 1960's that heptane delivered similar fire performance to gasoline when AFFFs were used, without seasonal specification variations. It therefore became widely accepted as an effective repeatable surrogate test fuel, but it is not widely used by anyone, unlike gasoline which is ubiquitous and used virtually everywhere.

This has been recognised by SEAC under 'transition period' (p29) that "*SEAC also highlights that* ***there are numerous actors in many industry sectors that stated in the consultation on the Annex XV report <u>that the performance level of the alternatives available is not sufficient currently, and the quality of their products would deteriorate if the alternatives were introduced now, causing considerable losses</u>.*** *… It was stated in many comments that the cost of the alternatives is not the issue****, <u>but performance is</u>.***" High performance is fundamentally critical in saving lives, especially in the Offshore sector where 'evacuation to safety' is rarely an option. Workers are 'trapped' on these platforms when fire strikes, entirely reliant on effective rapid extinguishment, for their safety.

The substantial vulnerability of F3s to gasoline was established beyond doubt by two important, comprehensive and rigorous comparative fire test studies, described in the 2020 NFPA – Research Foundation Report (NFPA-RF)[4] and a separate independent comparative 2019 study by US Naval Research Laboratory (NRL)[5], which has not been adequately recognised by ECHA and SEAC. These verify unacceptable F3 fire performance for offshore sector applications.

Similarly, the implications and consequences of these NFPA-RF and NRL findings in real fires are immense, but not adequately considered. SEAC has recognised this importance for Storage tanks (bottom p85) confirming ***"****According to the Background Document,* ***alternatives are currently not available which results in unacceptable risks for human health and the environment in the restriction scenario. <u>Costs of large fires that cannot be stopped could be enormous both in terms of economics, environment and potentially human suffering</u>."***

Oil Technics agrees SEAC's assessment, BUT these unacceptable risks are not confined to storage tanks and their bunded areas, they similarly apply to most Major Hazard Facilities (MHFs), including Refineries, chemical/pharmaceutical plants, tank farms, distribution terminals, bulk fuel transportation, airports, Defence and existing fixed foam systems, where transition without major re-design could compromise safety. It is also particularly important in the Offshore sector, for those workers isolated and potentially 'trapped' on offshore platforms when fire breaks out, justifying SEAC's re-consideration of the offshore sector (and MHFs) joining Storage tanks and bunded areas in the 12year derogation for large fires over 400m^2, which has been supported by SEAC's draft opinion. Such a modified extension to this restriction proposal could achieve improved risk and safety outcomes at reduced costs and with a smoother transition for foam users across the EU and UK.

The environmental release potential is small, because foam is 'locked-up' in fixed systems offshore (as elsewhere in most MHFs) and only used during rare emergencies for fast, effective, reliable control and extinguishment to protect lives, minimise damage and reducing toxic breakdown products from the fire in smoke and firewater runoff entering the environment, to an absolute minimum. Many MHFs also require bunded containement areas so foam discharges are not released to the environment. It should also be remembered that even if less effective F3s were used, more PFAS from ubiquitous uses in office furnishings, accommodation areas, computer control equipment, valve seals, cabling, weatherproof clothing, even mobile phones would enter the environemnt, from demonstrated slower fire control and extinguishment if consumed by fire. Fast action to control the fire and reduce spread is critcally important in protecting lives and minimising environemntal pollution from any potentially catastrophic, major flammable liquid fire.

The NFPA-RF report[4] concluded F3s are not 'drop-in' replacements for existing AFFF systems, and leading F3 fire capabilities varied so significantly "*it was difficult to develop any 'generic' F3 design standards*".
It conducted 165 comparative fire tests under basic UL162 protocols, which confirmed "F3s *did well against heptane but struggled against some of the scenarios conducted with IPA* [Isopropyl Alcohol] *and gasoline (both MILSPEC and E10* [gasoline with 10% Ethanol added]*), especially when the foam was discharged with a lower foam quality/aspiration*." … "*During the Type III* [forceful application] *tests, F3s required between **3 - 4 times** the extinguishment density of the AR-AFFF for regular MILSPEC gasoline and between **6 - 7 times** the density of AR-AFFF on E10 gasoline*". This is noted by SEAC on p40, but "*SEAC could not verify robustness of these estimates."* The evidence Reports[4,5] are provided in the reference list specifically to enable SEAC's verification.

Higher F3 expansions (7-8:1) delivered superior fire performance over lower expansions (3-4:1) which required 25-50% more F3 to achieve equivalent extinguishment. Higher expansion ratios usually mean reduced reach, placing firefighters closer to the flames. Much of the equipment and training in place today is based on lower expansion use of C6 AFFF & C6 AR-AFFF performance, with change-out a major issue that has not been adequately addressed.

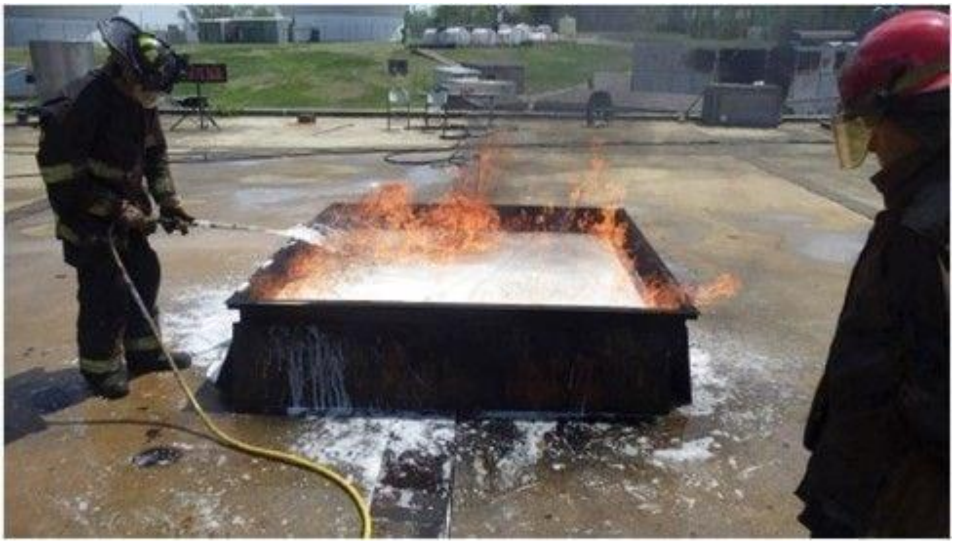


Fig.1: ***AR-F3 unable to contain gasoline vapours and appearing to react with the foam blanket causing bubbles to break at lower 3-4:1 expansion ratio. 3-4:1 required up to 50% more AR-F3 to extinguish, compared to 7-8:1 expansion ratio use.*** *Reproduced with permission from Fire Protection Research Foundation, Evaluation of the fire protection effectiveness of fluorine free firefighting foams[4], Copyright© 2020, Fire Protection Research Foundation, Quincy, MA, USA. All rights reserved.*

This NFPA study[4] confirmed a likely inability to use F3s for existing fixed foam systems without major re-design and modifications. It may even require single source F3 products 'locked-in' to future designs which may prevent new improved F3 development upgrade use, without further modifications. Such issues along with viscosity and proportioning difficulties noted, plus higher aquatic toxicity, lower performance at high temperatures and corrosivity highlight those vulnerabilities of reliance on F3s for emergencies.

The US Naval Research Laboratory (NRL) 2019 comparative fire testing Report[5] also independently confirmed "*... a divergence in extinction effectiveness of F3 formulations when the pool fire fuel is heptane vs gasoline*." AFFFs are similarly effective on both heptane and gasoline …BUT F3s evidently are NOT. **Requiring extinguishment of gasoline in 60 secs revealed four leading commercial F3s required between 2.5 times more and over 6 times more F3 than the benchmark C6AFFF**. **These differences widened as extinction speed became faster**. Speed is usually critical when protecting lives and minimising damage from fast-spreading fires like gasoline and crude oil. Seconds count to save a life, particularly those workers isolated and potentially 'trapped' on offshore platforms or helicopters when fire breaks out, which justifies re-consideration of the offshore sector joining storage tanks and bunded areas in the 12 year derogation for large fires over $400m^2$ supported by SEAC's draft opinion (see also Special Concern: Offshore Sector – p20).

SEAC accepts the storage tank derogation should include bunded areas, and that similar derogations maybe necessary for other types of major installations like Offshore platforms, by confirming (p87) that *"**Based on the points mentioned above, SEAC considers that the derogation should cover tanks with a surface area >400 m2 plus their bunded areas. …SEAC notes that a similar derogation might be needed also for other types of installations than tank farms. SEAC however considers that inclusion of further types of installations would make the derogation a lot wider and the information available does not allow to estimate the related impacts. Information could be submitted in the consultation on the SEAC draft opinion."***

It is important to consider that offshore platforms, like storage tank farms, gather large volumes of flammable liquids in close proximity, essentially combining a high individual fire risks with similarly high risks of rapid escalation, particularly problematic, if C6-AFFF-LFs were prevented from fire emergency use.

These concerns that such derogation extension is made wider, should be offset by their rare occurrences, and the resultant reduced risks to lives and critical infrastructure from allowing higher performance product usage, while also protecting the environment from excessive smoke, oil and gas leaks plus other undesirable substances in firewater runoff. This would help prevent SEACs overall proportionality concerns (bottom p57/58) "***However, when considering reasonable worst-case consequences on human health and the environment arising from the restriction due to the lower performance of currently available alternatives (e.g.** less effective products such as PPE or **not being able to effectively extinguish large fires), it might be necessary to act first by granting a derogation for certain uses to prevent possibly disproportionate irreversible consequences for human health and the environment."***

Factual information and the evidence base submitted within this document (*see detailed Reference list p*) justifies such derogation extensions - particularly for the offshore sector, to prevent adverse consequences and suffering to human health for people trapped on these platforms, and the receiving environment, which has been horrifically polluted from such historic offshore disasters like Pemex's 1979 Ixtoc oil well spill, Iran's 1983 Nowruz Platform disaster and BP's 2010 Gulf of Mexico Deepwater Horizon tragedy, widely regarded as the worst ever oil spill in the industry's history[7].

It should be noted that most MHF applications are also legally required to provide secondary containment in bunded areas or on paved areas, specifically to almost completely contain the resulting firewater run-off and prevent its excessive escape to the environment, so the risks are low, but the benefits derived are high. Such effective containment was recognised and accepted by SEAC under its 'Firefighting Emissions section' (p86) ***"**It was stated during the consultation on the Annex XV report (comment 2992) that **in the oil industry, all facilities for storage, filling, production, handling and usage of flammable and water hazardous substances are situated in retention basins***

(secondary containment) or on paved surfaces <u>so that resulting fire-fighting water can almost completely be contained</u>.”

Why are there such significant fire performance differences on volatile fuels like gasoline and crude oil? NRL[5] conducted further work to establish the cause of these dramatically different results. It found F3s were attacked by 4 key aromatics in gasoline. The hardest to extinguish being TriMethylBenzene (TMB), then Xylene, Toluene and Benzene. Some F3s were more vulnerable than others, but all suffered significant adverse effects. These 4 aromatics are also found in crude oils, and at lower quantities in Jet A/JetA1, which may also explain why F3s often struggle on these aviation fuels.

Still we have seen no significant large scale repeatable fire testing for industrial applications to establish new safety factors, reliable and effective application rates under realistic worst-case emergency conditions on gasoline/crude oil, before C6AFFF/AR-AFFFs become severely restricted from being rarely, but effectively, used in fire emergencies.

1.3. Learnings from major F3 fires: dismissed

It is disturbing to find that neither the Background Document, nor ECHA-EC (Wood 2020) Report, nor SEAC's draft opinion adequately considers warnings and learnings from recent major fires where Fluorine Free Foams (F3s) have been used. There are several instances where significant problems and disastrous outcomes have resulted, which could be attributable to poorer firefighting performance and the absence of often critical fuel repelling and chemical vapour sealing characteristics uniquely provided by low levels (1-2%) fluorochemical content in C6AFFFs. Such performance differences can be the difference between life and death in major fires. Two fires are particularly noteworthy, due to the stark contrast in outcomes when compared to very similar events where alternative fluorinated foams were successfully used (extracts taken from informative July 2019 JOIFF Catalyst article[8], with the author's permission and referencing links).

1.3.1 August 2016 – Boeing 777 engine detachment, Dubai.

This Boeing 777 engine detachment, in Dubai during an “attempted go-around” manoeuvre in 48 °C heat, with difficult wind-shear conditions occurred in August 2016.

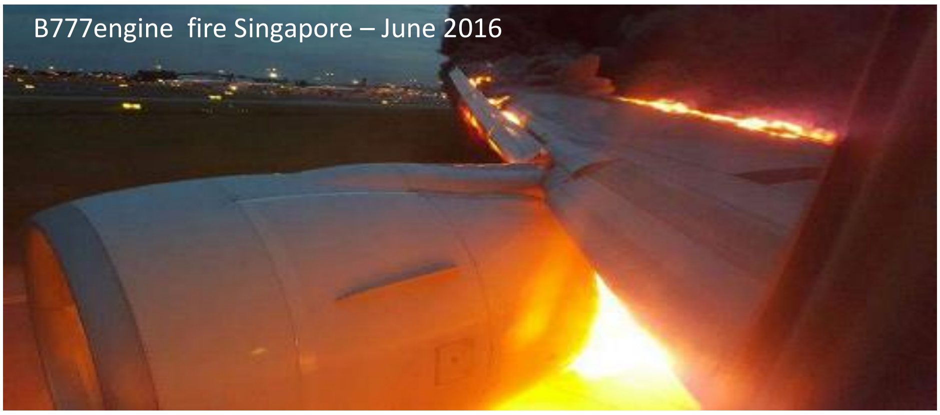
The detached right engine caused structural damage and a subsequent fire. Miraculously all 300 passengers and crew were safely evacuated in 6 minutes**,** ***before*** the fuel fire took hold.


Boeing 777 detachment, Dubai –Aug 2016

Foam was applied trying to suppress the fire, but a brave firefighter tragically died after 9 minutes, when the right fuel tank exploded. Extensive foam application confirmed by the final Aircrash Investigation Report[9] as Fluorine Free Foam (F3), continued. **Full control of the fire was not achieved until 16 hours after impact** ...leaving the plane completely destroyed. 3 years later the final investigation report failed to explain the cause(s) of this firefighting failure? Knowing could potentially help save future lives.

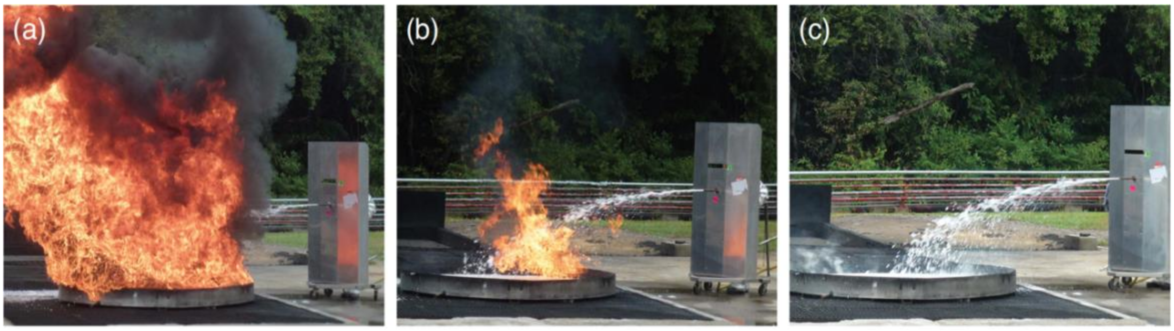
1.3.2 June 2016 – Singapore Boeing 777 engine fire

A few weeks earlier than the Dubai fire another Boeing 777 suffered a large engine fire involving much of the wing with leaking fuel igniting upon landing[10]. Application of the thrust reversers intensified the fire through the core of the engine, which was quickly extinguished using ICAO Level B approved AFFF & FFFP foam in just 3 minutes. All 241 passengers and crew were safely disembarked using regular mobile stairways, 15minutes ***after*** the fire was extinguished. No emergency chutes were deployed, no injuries were sustained. Minimal disruption resulted. A quick, safe and well executed response, without destroying the aircraft.


B777engine fire Singapore – June 2016

1.3.3 July 2016 – F3 demo, replaced by more robust C6 AFFF, Singapore

Interestingly - a month later in Singapore[11] (where temperatures vary only a few degrees during the year, an F3 agent was intended as an Aviation Conference highlight – an ICAO Level B fire demonstration *"showcasing its effectiveness"* in 32°C heat. Last minute, this F3 was replaced by a high purity C6 AFFF. ***Why?*** - **because *"too many environmental factors were not under our control to do F3"*** said the leading F3 manufacturer operating the demo! It was too hot, yet F3 is being used by Airservices Australia at all main airports continent-wide, Dubai and others under hotter conditions …which raises more important questions. **The author has confirmed he attended this Aviation Conference and gained permission from the organisers to write this article about the event[11].**



Effective ICAO Level B Fire test demo using C6 AFFF at Singapore Fire Conference, July 2016.
(a) pre-burn; (b) ≤C6 AFFF fire control; (c) ICAO Level B ≤C6 AFFF extinguishment

The C6 AFFF worked quickly, effectively with no flashbacks and no re-ignition, yet the F3 failed this demo twice the day before at 32°C, reportedly also igniting the training area's fuel separator, indicating virtually no fire control. Several delegates had not appreciated ICAO Level B fire tests require conducting at typically much cooler 15 °C conditions. Fuel volatility usually increases with rising ambient temperatures, while foam quality usually decreases; making fires harder to extinguish under warmer ambient conditions[11]. *Shouldn't there be sufficient safety margin built-in, to expect foams to still operate effectively in summer temperatures of 30-35°C?* It does for C6 foams …why not F3s? Could this Singapore demonstration failure be suggesting why the Dubai Boeing 777 fire could not be extinguished? Could very high ambient temperatures be eroding the foam's effectiveness under major fire conditions?

1.3.4 August 2018 – Footscray Chemical Factory Fire, Melbourne Australia.

This was a 1.4 ha site, crowded with chemical drums, in a residential suburb - the largest Melbourne fire in decades. Over 100 firefighters attended the blaze. Billowing thick black smoke for days, caused 50 school closures and warnings for residents to stay indoors. It reportedly took 17 hours to bring this large fire under control & 5 days to fully extinguish all hot spots. Access was reported as difficult[12]. Some areas were heavily shielded from effective foam attack. EPA Victoria confirmed only Fluorine Free Foam (F3) was used in this incident[13].

Footscray Chemical Factory Fire –Aug.2018

Yet PFOS and PFOA were detected by EPA Victoria in the creek, 16 times above the permitted recreational water quality guidelines downstream of the fire[14]. Presumably emanating from fluorinated containing materials on site - clearly not from F3. Diverse and ubiquitous other products and applications use materials which also contain PFAS, presumably also involved in the fire.

EPA Victoria's water quality sampling confirmed PFOS and PFOA remained at elevated levels for 2 weeks following this incident[14]. Melbourne Water pumped 55million litres of contaminated runoff from the creek by day 3, plus 170million cubic metres of contaminated sediment removed from Stony Creek by 24th Sept[15]. Clearly dispelling suggestions by some that "*F3 use prevents any costly incident clean-up*". EPA Victoria's Chief Environmental Scientist confirmed this incident was "…***probably as bad as it could be*** **…the chemicals from the fire have had a '*massive* impact' on the creek system. *We've had more than 2,000 fish killed*.**"[16] EPA Victoria confirms remediation of the creek was still on-going, nearly a year later[17]. Remember F3s are also an order of magnitude higher in aquatic toxicity, when higher amounts are usually needed for most incidents. A subsequent disturbing November 2019 investigation report[18] **confirmed that 30 Footscray firefighters were still experiencing severe illnesses 14 months later.** The symptoms were disparate, puzzling and extreme: *breathing problems, constant headaches, dizziness, vertigo, fainting, memory loss, extreme insomnia or fatigue, pneumonia, coughing up blood*. One firefighter recounted having up to six nose-bleeds a day. Hanging over all these brave Footscray firefighters is a question that no one can answer: what are the long-term effects of exposure to a chemical cocktail that nobody has yet been able to identify? They can't get answers from general practitioners, neurologists or other medical experts. The diagnoses ranged from "unknown" to "chemical meningitis" to patronising references to "psychological" problems[18]. Could this be the result of multi-day attendances perhaps delivering excessive exposure to toxins from smoke and breakdown products of this long burning fire? Will they ever recover their health?

1.3.5 1996 – Chemical Fire, Avonmouth UK.

This 6.8ha site was surrounded by another chemical complex, fuel storage depots, Bristol docks, industrial units, 2 villages and a congested residential area all within a 2.5km radius[19].


1996 Chemical Fire, Avonmouth UK

A 20 tonne road tanker was delivering when an explosion caused this major fire. Truck driver and 7 plant operatives "*observed a large white vapour cloud around the tanker and vessel, …on hearing a pressure-release valve operate, evacuated the area*". They basically ran to safety, while sounding alarms and starting plant shut-downs. **The 2,400m^2 fire area was quickly extinguished after 4 hours using fluorotelomer based AR-FFFP foam[19].**

Miraculously there were no fatalities, but 6 firefighters were hospitalised with smoke inhalation. Fast, reliable, efficient fire control & extinction of this complex escalating fire protected life safety, communities, critical infrastructure. Dangerous escalation was prevented[19]. All realistic expectations were fully met, without resulting in environmental disaster.

1.3.6 14 June, 2021 – Chemtool (Lubrizol) chemical fire, Rockton, Illinois, USA.

During this recent chemical plant fire at Chemtool, a Lubrizol subsidiary in Illinois, the company justified its choice of fluorinated firefighting foam use "*in the early stages of firefighting efforts for a limited time given the heightened risk of letting the fire burn and spread, …* ***Fluorinated foam is twice as effective as non-fluorinated foam in suppressing a fire like the one we experienced and offered the best chance to control the fire in the shortest amount of time[20]***."

Lubrizol confirmed the foam was sprayed only on one portion of the site. Before it was applied, they and their specialist fire contractor, dug trenches around the property to capture foam and diluting firewater run-off, while being vacuumed up and stored in tanks for appropriate disposal, to avoid escape to the nearby Rock river[20]. This showed a great duty of care to saving lives, minimising fire escalation and damage, while also protecting the environment from polluting discharges from this fire. Something that many Major Hazard Facilities could emulate in future, if a derogation were extended to allow them to continue using these higher performing C6 foams.

We also should not forget a lesson learned half a century ago in **1967's USS Forrestal aircraft carrier disaster.** Tragically 134 servicemen died, 161 injured, 21 planes destroyed and 40 more were damaged. A Fluorine free foam was used, which just like the latest leading F3s, had no fuel shedding capability nor chemical vapour sealing to suppress the fire, although nothing better was available back then. The fire spread rapidly, setting off armaments on the flight deck and in confined spaces below deck[21]. It brought carnage to what should have been a safe haven, and accelerated AFFF developments meeting a tough US Mil Spec AFFF test, which verified future robust fire performance. This has ensuring such tragedies would not happen again, which with few exceptions has been the case due to small 1-2% fluorochemical content (historically this sometimes increased to around 5%). Let's not reverse such noble objectives, by preventing the use of critical C6 AFFF-LF agents offshore, and in other vital MHFs applications. US Senator John McCain a survivor of this tragedy, wrote in 2018 "***We must never relent in the quest to improve our standards and protect those putting their lives on the line for our freedom***[22]."

1.4. Landfills and wastewater treatment: No strict PFAS restrictions

We find it very surprising that similarly tight regulation as that proposed for PFHxA, is not already in place for PFAS more generally at landfill sites and Waste Water Treatment Plants (WWTPs), to avoid their on-going daily emissions from leachate, waste water treatment emissions and their associated biosolids over recent decades. These are frequently shown to contain significant annual discharges of PFAS and many other undesirable substances on an annual basis amounting to several tonnes/annum as evidenced by a 2009 research study by Pistocchi and Loos[23], concluding that "*…* ***PFOS and PFOA discharges along the whole European river network to coastal areas in Europe have been estimated for the year 2007 to be in the order of 20 and 30 tons per year, respectively***."

We find this particularly perplexing, when it seems evident there are several commercially available cost-effective technologies capable of removing C6 and legacy C8 fluorotelomer chemistry (PFOS, PFOA, PFHxS, and their related substances) including PFHxA and its related substances (as defined in the restriction proposal), from water and soil, yet this is still not tightly regulated. Extensive recent research and case studies have shown technologies are commercially available, as summarised in 2018 and 2020 documentation from an Australian specialist firefighting consultant[24,25]. It is clearly misleading and inappropriate for the Background Document to rely on outdated 2014 research, to suggest otherwise.

1.5 Non-essential use restrictions: Accepted

While we accept sensible restrictions which avoid the unnecessary emissions of PFHxA and related substances from firefighter training, system calibration and routine testing usage. SEAC should find this has already been widely and voluntarily implemented by the extensive use of Fluorine Free Foams (F3s) for these non-emergency applications, across most sectors of the fire industry – including the Offshore Sector. F3s are also widely used for smaller Municipal Fire Brigade fires which usually deliver dispersive emissions to prevent unnecessary use of PFAS foams. High application rates are usually delivered by such applications, providing adequate fire control, but this has not shown to be the case on large fires. It seems clear such disproportionately severe restrictions as those proposed (without clear evidence of harm), preventing life-saving emergency use applications in major potentially catastrophic flammable liquid fires, particularly offshore where many workers are living on top of, or adjacent to, processing and oil extraction facilities on a continuous 24hour, 365day basis.

Any small incident offshore, can rapidly escalate if not quickly controlled and extinguished. It therefore seems unjustified, and could potentially deliver unacceptable consequences and implications for public safety, if more environmentally benign high purity C6 AFFF-LF (low freeze versions approved for offshore use) delivering high fire performance, were prevented from continued use during fire emergencies offshore, to save lives.

2. Special Concerns: Offshore Sector

ECHA and SEAC are asked to consider that the offshore sector has major similarities with Naval vessels, where up to 200 people are living within a defined metal structure in the North Sea. They are trapped there, unless transported by helicopter, or during emergency are able to reach a liferaft position. Their on-going safety from major fires relies on the high perfromance of the C6-AFFF-LF agents only activated when the dedicated fixed foam system 'double knock' (to minimise risk of false alarms) detection senses fire. When large volummes of flammable fules are adjacent to work and accommodation areas, speed, relaibility and effectiveness are critical …***its literally a matter of life of death***.

The US Department fo DefenseStrategy for addressing PFAS (slide 15) confirms an "*exemption of the planned AFFF prohibition for shipboard use*"[26], accepting no compromises on MilsSpec C6-AFFF foams being critical for continued use on all US Naval vessels. The similarities with storage tanks are also evident, when essentially high individual fire risks in each tank are combined with high risk of rapid escalation from tank to tank or bund(s) to tank(s). We therefore strongly urge SEAC to consider extending the 12year storage tank and bunded areas over 400m^2 derogation, to include Offshore platforms and potentially other similarly deserving potentially catastrophic flammalbe liquid fires in most Major Hazard Facilities. The risk of emissions is very low because the incidence of fire emergencies is very rare, but when needed, only the highest perfroming C6-AFFFs have the capability to maximise life safety and avoid compromising designed fire protections.

2.1 Times have changed

Rapid former growth in offshore oil and gas (in Europe at least) is widely accepted as having passed its peak some years back, with many European giants, like BP and Shell, banking their future on a world that is shifting aggressively away from oil and gas and are vowing to invest more in renewables, to profit off that transition[27]. A Nature article by J Murray back in 2012 confirmed "***The UK government has embedded by parliamentary statute a commitment to decrease carbon dioxide emissions by 80% by 2050 compared with 1990 levels***[28]*.*"

This position was supported and endorsed at the June 2021 G7 summit in Cornwall, UK. Signatories included the UK, leading EU Governments of Germany, France and Italy, USA, Japan and Canada. Extra developed guest nations South Korea, South Africa, Australia and European Commission were also invited during these important discussions.

The resulting White House G7 Communiqué (issued 13th June 2021)[29] clearly committed to deep carbon emission cuts this decade "*In our energy sectors, we will increase energy efficiency, accelerate renewable and other zero emissions energy deployment, reduce wasteful consumption, leverage innovation all whilst maintaining energy security.* ***Domestically, we commit to achieve an overwhelmingly decarbonised power system in the 2030s and to* [take] *actions to accelerate this. Internationally, we commit to*** *aligning official international financing with* ***the global achievement of net zero GHG emissions no later than 2050 and for deep emissions reductions in the 2020s****. We will phase out new direct government support for international carbon-intensive fossil fuel energy as soon as possible".*

This G7 document[29] also confirmed a transition to zero-emission vehicle technologies "*In our transport sectors,* ***we commit to sustainable, decarbonised mobility and to scaling up zero emission vehicle technologies, including buses, trains, shipping and aviation. …We commit to accelerate the transition away from new sales of diesel and petrol* [gasoline] *cars to promote the uptake of zero emission vehicles****. In our industrial and innovation sectors we will take action to decarbonise areas such as iron and steel, cement,* ***chemicals, and petrochemicals****, in order to reach net zero emissions across the whole economy. …****We will focus on accelerating progress on electrification and batteries, hydrogen,*** *carbon* *capture, usage and storage, **zero emission aviation and shipping**, and for those countries that opt to use it, nuclear power.*"

2.1.1 Governments and Business: 'ramp-up' action

The Nov.2020 UK Government's 10 point 'green industrial revolution' plan[30], re-inforces action, stating "*From 2030 we will end the sale of new petrol and diesel cars and vans*" and "*We will invest £1.3 billion to accelerate the roll out of charging infrastructure*".

The International Energy Agency in March 2021[31] forecasts the world's thirst for gasoline isn't likely to return to pre-pandemic levels, suggesting 2019 hit a peak. It said an **accelerating global shift toward electric vehicles (EV),** along with increasing fuel efficiency among gasoline-powered fleets, will more than outweigh demand growth from developing countries. This forecast comes as General Motors announces it will cease gasoline-powered vehicles by 2035. Volvo in Sweden also claims to be all-electric by 2030. The public evidently support such actions. 1st half 2020 EV sales jumped 34% in EU compared to 2019[32], with Renault/Peugeot leading Tesla, VW, Nissan, and Audi, all pivoting to boost their EV fleets. Electrified vehicles now account for 87.3% of all new-car sales in Norway[33], buoyed by generous tax incentives and predominantly zero emissions hydro-electric power generation for charging, according to figures released by the country's Information Council for Road Traffic (OVF)[33]. Responses to COVID-19 have seen increased working from home and business transactions increasingly using on-line pathways. Resulting transport volumes declined sharply. Such fundamental changes are expected to contribute significantly to reduced vehicle and oil usages, possibly sooner rather than later.

The European Commission is proposing 'Euro 7' emissions legislation on cars, vans and trucks, which could potentially amount to a 'combustion engine ban' as early as 2025[34], in an effort to meet its European 'Green Deal' emissions targets. Such policies would drive a rapid decline in fossil fuel demands for vehicle propulsion, possibly spreading globally.

2.2 Consequences for UK Offshore Sector

Some estimates suggest up to 50% of all the oil currently extracted from UK's offshore oil fields is used to manufacture vehicle fuels - petrol (gasoline), diesel, aviation fuel and lubricating oils.

The UK offshore oil and gas sector is estimated to include around 150 platforms. Accessible oil reserves are being used up, infrastructure is ageing with an increasing likelihood of platforms being de-commissioned from 2030 onwards, as the industry seems set to shrink in response to rapid renewable energy growth and focus on EV usage.

Many now see the offshore sector facing a shorter 10-15year lifespan, neither predicted, nor expected. The cause - hastening reductions in vehicle fuel demands (extensively provided by offshore platforms), driven by booming renewable energy and electric vehicle (EV) demands, coinciding with IPCC warnings that time is 'fast running out' for strong reductions in our global carbon emissions, seen as necessary to ensure our planet retains liveable conditions into the future.

The recent August 2021 IPCC (Intergovernmental Panel on Climate Change) Report (summary for Policymakers)[35] also makes stark reading, emphasising this urgency to reduce fossil fuel usage. The 'race' for cost-effective, reliable renewable alternatives, cutting 50% from greenhouse gas emissions by 2035, is 'hotting up'. The outcome of the UN Climate Change COP26 (Conference of the Parties) in November 2021, will be crucial in determining and formalising these outcomes.

UK Government energy trend data[36] confirmed a 30% reduction in oil demand and 25% drop in petroleum products demand in Q1 2021 compared to Q1 2020, largely due to reduced transportation fuel demands and pressures from renewable energy generation. Offshore oil production fell by 19% on Q1 2020 levels, which had already dropped from 2019 to near 2018 levels. With EU's largest producer Denmark, announcing a cessation of offshore oil and gas exploration[37], plus France 's commitment to phase out fossil fuel production by 2050[37], new exploration licences and subsequent development seem increasingly unlikely to be issued or undertaken.

2.3 Investing heavily in unproven F3 alternatives: seems reckless

Some are calling for UK's offshore sector to follow Norway's Equinor (formerly Statoil), by investing heavily in an 8-12year program to move to alternative F3 developments with testing and full operation of F3s, on all its offshore platforms.

What are the safety implications, when effectiveness of F3s on large fires (particularly using seawater), still seems unproven. This signals an unjustifiable, unsustainable and disproportionate waste of existing resources, duplicating already spent huge replacement costs on high purity C6-AFFF-LFs to meet EU regulations, with no clear benefits and no guarantees that worker safety is not being compromised. The consequences and suffering burdens this could bring to worker safety on the estimated 150 offshore oil and gas installations on UK's Continental shelf[38] would seem unjustifiable. Particularly when the UK Offshore sector pro-actively invested heavily, replacing all legacy C8 AFFF-LF foams, with more environmentally benign but similarly effective high purity C6 AFFF-LF alternatives in 2015, to meet changes in EU regulation 2017/1000, and which are not proven harmful. Any C6 AFFF-LF use is already tightly controlled and would only be used for emergency firefighting operations to save lives.

Training, calibration and system testing are already being conducted wherever possible using F3 training foams, to indicate adequate foaming characteristics of critical C6 AFFF-LF front-line agents, and ensure swift system readiness for effective action during any emergency. Isn't this the best approach to ensure lives, critical infrastructure and our environment, are best protected? Avoiding potential failures and related high socio-economic consequences of these proposed unproven restrictions?

All these UK platforms currently rely on leading fast, effective, efficient more environmentally benign short-chain C6 PFAS based AFFF-LF (Low Freeze Aqueous Film Forming Foam) seawater compatible technology, to meet UK HSE (Health and Safety Executive) objectives by protecting lives and critical infrastructure from fire hazards ever-present, even in winter (when temperatures regularly experienced can drop to -18ºC), when handling highly flammable UK Sector crude oils (eg. Brent, Forties, Buzzard, Ninian, Clair etc). Emissions potential offshore is small, because the foam is 'locked up' in storage tanks, only rarely being activated by a fire emergency, when the benefits derived from fast action and life safety, far outweigh any drawback from minimal targeted (not indiscriminate) release of non-hazardous substances. Particularly when restriction from PFHxA related substances should cover training and testing, (unless collected and disposed of safely) where the majority of foam is used each year.

What tangible benefits are provided for another foam replacement without proven and 'guaranteed' effective fire performance, requiring costly extra weight loading on platforms, unnecessary clean-out and disposal costs, also costly re-engineering of potentially every offshore fixed foam system (estimated at tens of thousands) to accommodate likely higher application rates and higher expansion ratios necessary, which would be more prone to the effects of wind, reduce throw distances onto hazards, representing disproportionate costs, without any guarantees that worker safety will not become compromised?

Eurofeu in its previous May 2020 comments on the PFHxA restriction report[39] (p5) confirmed from their multi-decade experience in high level fire protection that at least a 10 year transition period was necessary, based on the substantial complexity of the task "*Fluorine free foam agents show a significantly more intense interaction with liquid fuels, do not form an aqueous film suppressing vapors and fuel-pick-up, and can only extinguish as a physical foam blanket. Given the complexity of this undertaking and that a total reinvention of foam-based firefighting technology is required, as well as based on the general assumption that a decrease of fire safety is not acceptable, a minimum of ten years is considered necessary.*"

It seems that lives are unjustifiably being placed at unnecessarily increased risk without sound reasons – simply to prevent the use of small amounts (typically 1-2% in foam concentrates) of PFHxA related substances, which ECHA accepts are not harmful to human health, not bioaccumulative, not toxic, but are persistent and 'may one day become a problem'. This could be said of many other unrestricted chemicals without proof of harm widely used today and tomorrow. Yet regulators are taking no similarly severe restrictive actions to limit or prevent substantial annual emissions of PFAS from landfill sites and Water treatment works in effluent and bio-solids, being freely distributed into our environment relentlessly every day of every year for decades, without capture - when commercially available and effective treatments to do so are available, but ignored.

This seems an unacceptable double standard.

2.4 Are we storing up Catastrophes?

Placing lives at risk by restricting use of a unique and unequalled life-saving technology – C6AFFF, whose restriction should be re-viewed at the highest levels *before* catastrophic consequences eventuate that everyone subsequently regrets. Particularly in the light of evidence presented of comparative fire incident outcomes, volatile fuel, seawater and wind vulnerabilities.

How do you explain an offshore platform or Boeing 777 plane load of corpses to grieving relatives when the most appropriate agent was prevented from use…because 'it might harm someone one day'. NOT using it may have just signed the death warrant for perhaps 200 innocent people working on a platform or up to 300 travelling on that plane, when some (perhaps all?) could possibly have survived, **IF only** faster acting agents had been effectively used.

Imagine the legal implications, consequences, responsibilities and socio-economic impacts that could result from such a catastrophe. **Sadly, this outcome looks increasingly likely in Offshore, Civil aviation, Defence applications or potentially catastrophic major industrial fires, IF inferior fire performance becomes acceptable and people die … just because 'it might harm someone one day'.**

…It might also save lives today, …and tomorrow, …and the next day.
…Seconds count when saving people's lives – that's precisely why AFFFs were developed in the first place!
IS life safety now being relegated from being our highest priority?

Continued use of existing seawater approved C6 AFFF-LF foams is an essential requirement to deliver safe and effective platform operation, generally requiring minimal volumes (and therefore weight), for proven effective non-aspirated applications which minimise adverse effects of frequent high winds experienced. It also ensures sufficient reach and hazard coverage is reliably achieved, year round. Oscillating monitor spray nozzles are widely required to adequately protect helidecks for all personnel transport to and from platforms, as well as protecting key processing and accommodation areas. Effectiveness may be compromised, along with life safety if a premature change to F3 becomes regulated. All these important factors contained in this ECHA submission are calling for a re-assessment, and specific extension to the proposed 12-year derogation for storage tanks and bunded areas over 400m^2, so that continued C6-AFFF-LF usage is included for all offshore platforms. However it is also important that SEAC's opinion makes clear that any C6 foam derogations are accompanied by a derogation allowing continued importation and production of the specific fluorochemicals (PFHxA related substances) used to make these C6 firefighting foams, including our specific C6 AFFF-LF products.

Evidence presented suggests such critical high performance and reliability necessary offshore, are widely considered un-realistic using F3s, where critical fuel shedding and vapour sealing additives are absent.

2.5 Comprehensive fire testing: confirms unacceptable F3 behaviour

It is widely recognised by the US National Fire Protection Association's Research Foundation (NFPA-RF)[4], US Naval Research Laboratory (NRL)[5] and others that alternative Fluorine Free Foams (FFFs or F3s) do not offer equivalency of fire performance to C6 AFFF, particularly at lower 3-4:1 expansion ratios and on more volatile fuels containing aromatics, like gasolines and crude oils. This is explained in Section 1.2 above (p 9). Existing small scale test standards like International Civil Aviation Organisation (ICAO) may not be adequately reflecting real world conditions, thereby providing a false sense of security[40].

NFPA-RFs comprehensive 2020 report[4] covering 165 fire tests confirmed "*FFFs* [F3s and AR-F3s] *are not a "drop in" replacement for AFFF." … "The **FFFs required between 2-4 times both the rates and the densities** of the AR-AFFF to produce similar results against the IPA fires conducted with the Type II* [gentle) *test configuration. During the Type III* [forceful – more representative of offshore application) *tests, the **FFFs required between 3-4 times the extinguishment density** of the AR-AFFF for the tests conducted with MILSPEC gasoline **and between 6-7 times the density** of the AR- AFFF for the tests conducted with E10 gasoline*."

Regarding low 3-4:1 expansion ratios (simulating non-aspirated application widely used offshore) NFPA-RF confirmed[4] "***In many cases, a 25% to 50% increase in the flow rate/discharge density of lower aspirated foam* [3-4:1 expansion] *was required to match the capabilities of higher aspirated foam* [7-8:1]**." These tests used freshwater. Greater differentials are expected, had seawater been used. NFPA-RF concluded "*To summarize the results, **the baseline C6 AR-AFFF demonstrated consistent/superior firefighting capabilities through the entire test program under all test conditions***."

Further NFPA-RF[4] findings highlighted *"FFFs have only the foam blanket to seal-in the vapors. As a result, the capabilities of FFFs will be highly dependent on the characteristics of the foam blanket (which depend on the associated discharge devices as well as the foam type itself). The film produced by AFFF has provided an additional level of protection for systems and discharge devices that do not produce aspirated foam."* ie. non-aspirated foam spray devices widely used offshore.

Costly adaptation of existing foam systems to very different F3 performance requirements, without known effectiveness in major fires and without reliance on fuel repellency and reduced vapour sealing capabilities, provided by C6AFFF-LFs, would be problematic[42,45]. This proven inability for F3s to 'drop-in' existing system designs without significant costly re-engineering and equipment changes adds complexity, implications, substantial disproportionate costs and consequences, beyond many users and Regulators expectations. Consideration should also be given to increased risk of incident escalation and fire burnback, without fuel shedding and vapour sealing capabilities currently relied upon from small amounts of C6 fluorosurfactants present in these C6 AFFF-LFs.

2.6 Aromatics in gasoline (and crude oil/Jet A1): attack F3s

2019 comparative fire testing research by US Naval Research Laboratory (NRL)[5] endorsed these NFPA-RF[4] results as confirmed in Section1.2 above (p9). To extinguish gasoline in 60 secs confirmed the best F3 tested required 2.5times more, the worst 6.25times more foam agent respectively, than the baseline C6 AFFF. These differences increased further with faster extinguishment requirements.

NRL concluded four key aromatics (TriMethylBenzene, Xylene, Toluene, Benzene) present in gasoline, crude oil (and Jet A1 at lower concentrations) attacked F3s[5], causing significantly higher F3 application rate demands compared to regular foam approval tests using heptane (eg. EN1568-3, UL162, Lastfire etc), while also significantly reducing F3s burnback ability.

Even the US National Fire Protection Association in its world recognized Foam Standard, NFPA 11 has not made any firm recommendations or addressed most fluorine free issues in their most recent 2021 edition[6], abdicating responsibility to foam manufacturers to recommend design application rates for Class B hazards where F3s are concerned. The US Department of Defence (DoD), US Federal Aviation Administration (US FAA) also both acknowledge that F3s have not met their performance requirements. Underwriter's Laboratories (UL) in its world leading UL162 Firefighting Foam fire test Standard, is still studying how to make recommendations for a safe transition to F3 in its current revision discussions, when fire test results are specific to individual products and fuels, without any consistent or reliable 'generic' fire capability.

Separate independently verified approval listings on the fuels in use at specific offshore platforms, and at larger scale now seems essential - to avoid compromising offshore safety, and before any transition should even be considered. Unlike AFFFs, where realistic large scale F3 fire testing was conducted/summarised by Scheffey's team in 1994[41], we still lack verification of F3 effectiveness on large scale major fires. The evidence seen so far in sections 1.3.1 – 1.3.6 above (p14-18) is not encouraging and underlines the disproportionate nature of this restriction proposal.

2.7 Re-engineering challenges: Immense Offshore

Higher F3 application rates, extra storage, different hydraulics, potentially larger pipe diameters/pressures, also need to be factored in, often made from exotic high performance materials to avoid corrosion issues particularly offshore[42]. Additionally increased weight loadings and space allocations are likely requirements of any move to F3s, which are at a premium offshore, hence the reason why expensive high performance 1% foams are commonplace offshore in preference to regular 3% alternatives, because of weight and space saving benefits delivered. Performance with seawater and higher F3 aspiration requirements usually mean device changes, larger pumping capacities, shorter reach (missing target hazard), likely increasing F3 vulnerability to wind effects, all challenges requiring additional consideration and cost allocation for exotic materials. Potential F3 viscosity differences, proportioning accuracy (more variable in winter), poorer mixing ability (particularly prevalent in cold conditions), storage stability, corrosion effects, clean-out procedures[42,45], and compatibility with dry chemical powders (many F3 blankets are collapsed or impaired by dry chemicals) are all additional important costly and time-consuming pre-requisites for any transition, which have not been adequately considered for most MHFs, including offshore platforms.

Much of the offshore fire risk is covered by pre-installed fixed foam systems, individually designed, often complex and large, tailored in and around the plant design to deliver specific design requirements under fire conditions. Consequently, re-designing and re-engineering these systems to suit changing extinguishing agents and performance characteristics, hydraulic requirements and dynamic properties, application rates and delivery nozzle devices to avoid compromising safety can be extremely complicated, time consuming and costly, particularly when special corrosion resistant and exotic materials are usually required offshore.

Add to this alternative stand-by protection or platform ‘shut-down’during such ‘system modifications’ and clean-out, which could cost Millions of Euros for multi-day shut-downs (potentially weeks for whole platforms), to allow such F3 re-engineering and transition to be completed across the 650 offshore platforms in EU, UK and Norway[43,44], without clear benefits - only costly drawbacks, which simply cannot be justified[42,45]. Many agree C6 AFFF-LFs deliver more reliable and effective outcomes - without such disproportionate and costly re-engineering, clean-out and disposal.

Why are we considering deliberately exposing worker’s safety to disproportionate risks, by compromising future fire perfromance of their Offshore platforms? Why would they renew contracts knowing their safety is being compromised?

Let’s not forget so many other items on the platform (not just firefighting foams) will contain and release PFAS under fire emergencies, so it is a ubiquitous and inevitable run-off component from any platform fires, irrespective of whether C6s or F3s are being used. When impacted by fire, PFAS can derive from valving, process systems, computerised equipment, medicines, cosmetics, waterproof clothing, furnishings in accommodation areas, cookware, food packaging, almost everything ...including smart phones!

2.8 Equinor costs: unjustified and disproportionate

The ECHA-EC (Wood 2020) Report[46] under cost of replacement (p134-5) confirms that Equinor alone replaced 1.1 million litres of foam at 5Euro/L totalling 5.5million Euros on their 40 offshore assets. Destruction costs of removed foam at 1Euro/L totalled 1.1 million Euros, plus support costs of 2,500 working hours during the changeover, estimated at an extra 360,000 euros. A staggering declared 'Total' of almost 7 million Euros. But this does not include huge costs for every one of the anticipated thousand or more system's requiring clean-out (estimated by SEAC [p41] as 12,300 Euros per fire truck decontamination, so potentially 12 million Euros), nor the excessive costs required for each system's re-design and re-engineering which are also likely to be very substantial, estimated at potentially 2-4 times more than the foam replacement costs. This could bring a disproportionate total sum of 30-40 million Euros for around 40 Equinor platforms[44], without huge platform shut-down costs necessary to conduct the transition, without any verification of effectiveness in large volatile fires, where seawater is extensively used. The UK and EU have over 600 offshore platforms combined[43], which could take this estimated total cost to 450-600million Euros, probably more. It is also understood that Equinor transitioned from legacy C8 AFFFs directly to F3s, requiring over 8 years to conduct this complex and costly process[46], but without any clear benefits, nor any publicly evident testing or proven assurances of reliability in large fires, involving crude oils and seawater, in harsh offshore environments.

The UK's Offshore sector has already spent millions of Euros in foam change-outs from legacy C8 foams to more environmentally benign and similarly effective high purity C6AFFFs to meet EU regulations. It is expected the EU offshore sector has similarly invested heavily in such a transition. It is therefore unreasonable and disproportionate to expect such massive further investments without any clear benefits. The potential for risks to life safety for worker's increases, particularly when they are likely to be 'trapped' on these platforms, desperate for the most effective agents to save their lives, or give them a chance to reach life-rafts. This is also at a time when the operational lifespan (explained earlier in Sections 2.1. and 2.2. [p21-22]) is expected to be time-limited to around 10-15 years maximum duration under more difficult operating conditions. Such socio-economic costs are therefore entirely disproportionate and unjustifiable.

2.9 Best Practice: endorsed

The offshore sector in UK and EU has undertaken far-reaching efforts to ensure that best practice standards for use of high performance Class B firefighting foams are followed to minimise its use, ensure its applications are justified in protecting lives, and its overall emissions are minimised. Four major organisations recommend C6 foam suitability for large fires in potentially catastrophic flammable liquid fires, while supporting F3 use for smaller fires, firefighter training and system testing and calibration.

Oil Technics as a leader in Offshore fire protection, endorses and supports these four organisational Guidance documents, with references attached: JOIFF in UK[47] (formerly Joint Oil Industry Fire Forum, now International Organisation for Industrial Emergency Services Management); FIA, UK[48] (Fire Industry Association); FFFC in USA[49] (FireFighting Foam Coalition); and FPA Australia (Fire Protection Association Australia) with its most recently updated May 2020 Information BulletinIB-06 v3 'Selection and Use of Firefighting Foams[50].

Delivering reliable, fast, effective, and efficient emergency system activation using seawater is considered critical to protecting life safety and minimising smoke, leaked oil spread (and pollution), PFAS (from other platform sources) and other polluting discharges - without endangering lives or the platform. This goes a long way to ensuring offshore obligations are met, and disproportionate losses of lives and damaged infrastructure are minimised, should a subsequent major fire occur.

UK's Environment Agency agrees its focus is on getting the fire out fast. From that single action many positive socio-economic benefits are derived. They concluded that …" *foam buyers primary concern should be* ***which foam is the most effective at putting out the fire****. All firewater and all foams present a pollution hazard*[51]*."* This was re-inforced by UK Environment Agency in 2017 confirming ***"The key to preventing worst pollution is have a response plan to clear potential fire hazards …All fire water runoff will be detrimental to the environment if allowed to enter water courses. … best technique is to prevent pollution from entering in the first place***[52]***."***

This includes harmful smoke, which some tend to ignore, but usually contains known carcinogens like benzene and benzo(a)pyrene, which could adversely affect health of platform personnel, even at low exposure levels, probably more so than any exposure to PFHxA and related substances.

3. Conclusions

The Offshore sector in UK and EU has undertaken far-reaching efforts to ensure that best practice standards for use of high performance Class B firefighting foams are followed to minimise its use, ensure its applications are justified in protecting lives, its overall emissions are minimised, and it meets EU

Regulations. The evidence presented highlights disproportionate areas for re-consideration by SEAC, which have not so far received adequate attention.

The evidence supports this view, confirming that reliable, effective, fast offshore fire protection is not currently possible by using leading alternative Fluorine Free Foams (F3s).

SEAC endorses this view in its overall proportionality section (bottom p57/58) by confirming "***However, when considering reasonable worst-case consequences on human health and the environment arising from the restriction due to the lower performance of currently available alternatives (e.g.*** *less effective products such as PPE or* ***not being able to effectively extinguish large fires), it might be necessary to act first by granting a derogation for certain uses to prevent possibly disproportionate irreversible consequences for human health and the environment."*** Offshore platforms is such a use deserving of derogation. There would seem to be no credible alternative in the light of th**is compelling body of evidence, which has not so far been adequately considered, but requires re-consideration by SEAC, to extend the 12year Storage tank and bunded areas over 400m^2 derogation, to include Offshore platforms.**

Speed becomes essential in preventing fire spread, limiting such harmful exposures, saving worker's lives, limiting critical platform infrastructural damage and limiting potentially enormous adverse environmental impacts – as evidenced by major catastrophes.

Please therefore re-consider SEAC's final opinion by adding Offshore platforms to the 12year derogation for over 400m^2 storage tanks and bunded areas, to reliably secure worker safety in both UK and EU Offshore sectors. Other defined Major Hazard Facilities may require similar consideration.

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