October 10, 2018

Secretariat of the Stockholm Convention
Attn: POPs Review Committee
United Nations Environment Programme
Geneva, Switzerland

I am writing on behalf of the Fire Fighting Foam Coalition (FFFC) to respond to IPEN 2018/POPRC-14, Fluorine-free firefighting foams (3F), Viable alternatives to fluorinated aqueous film-forming foams (AFFF) and to statements made by IPEN-sponsored panel members at the recent POPRC meeting in Rome. The IPEN paper contains numerous inaccuracies, omissions and misleading statements. The foam manufacturers listed below, all of whom sell both fluorinated and fluorine-free foams (FFF), do not agree with many of the conclusions contained in the IPEN paper on the efficacy and environmental impact of firefighting foams. They specifically reject the conclusion that current-day FFF can provide an equivalent level of performance to AFFF agents for all class B applications and hazards, and thus the use of AFFF agents is no longer necessary and can be phased out.

FFFC is a non-profit trade association whose members are manufacturers of firefighting foam agents and their chemical components, and include the following foam manufacturers: Angus International (Angus Fire, National Foam, Eau & Feu, Kerr Fire), Buckeye, Dafo Fomtec, Dr. Sthamer, Fire Service Plus, Fire Safety Devices, Johnson Controls (Ansul, Chemguard, Sabo, Williams), KV Fire, Oil Technics, Orchidee Europe, Perimeter Solutions (Auxquimia), Profoam and Solberg. Together these companies provide a majority of the firefighting foam used worldwide.

Foam Standards and Efficacy

The IPEN paper states that FFFs are capable of meeting all standard firefighting certifications applicable to AFFF other than the US military specification. This statement omits important context on the differences in testing protocols and use parameters between AFFF agents and FFF within some of these standards. In addition, FFFC is not aware of any class B fluorine-free foam being approved for use in China (CCCF) or India (BIS).

The UL 162 standard encompasses many class B foam applications in the United States. Under the UL 162 standard the test protocol for FFF includes an increased application rate and application density such that it requires 15 gallons of FFF to achieve the same level of extinguishment as 6 gallons of AFFF. The net result is that while both AFFF agents and FFFs can claim to be UL 162 listed, the testing criteria for topside hydrocarbon fire tests are substantially different.

The US military specification (milspec) is one of the most rigorous and respected standards for fire fighting foams in the world. It is more difficult to meet than other standards such as EN and UL, and there are many foam products that meet the performance requirements of those standards but do not meet the performance requirements of the milspec. Unlike the ICAO foam standard that is based on the results of a single fire test, the milspec requires foam to pass multiple fire tests using both fresh and salt water. Included in those fire tests is the requirement to pass one of the tests at half strength to account for potential problems with the operation of proportioning equipment in the field. No other foam standard includes this rigorous half-strength requirement.

The milspec includes a requirement that foams contain fluorochemicals as a conformance test to ensure the foam contains the active ingredients it did when it was approved. The IPEN paper suggests that FFF can meet the performance requirements of the milspec and it is only this fluorochemical requirement that keeps them from being approved. This is not correct. The Naval Research Labs (NRL) has published and presented multiple testing results showing that FFFs are currently unable to pass the required milspec fire tests. NRL continues to support research on the development and performance of FFF, and the US Navy has stated that if a FFF is developed that can meet milspec performance they will revise the specification to eliminate the fluorochemical requirement.

The Federal Aviation Administration (FAA) Reauthorization Act of 2018 that recently passed Congress contains an amendment that FAA change its standards to no longer require the use of fluorinated foam. One of the key reasons that FAA cited for requiring the use of milspec AFFF in ARFF vehicles at US airports is that all milspec AFFF agents are compatible. Compatibility with the other concentrates allows mutual aid and resupply from many sources in times of emergency or competitive bids, ensures performance, prevents foam mixing and storage issues, and avoids potential operational problems. Current-day FFFs are incompatible with AFFFs and with other FFF agents. As such FFFC believes it is possible that even if FAA changes its requirements to allow for the use of FFF, they will continue to recommend that all US airports use milspec AFFF.

All of the companies listed above that manufacture and sell fluorine-free foams support their use for appropriate applications. Yet none of these companies promote or sell fluorine-free foams as equivalent to fluorinated foams because fire testing and the experience of their customers provides clear evidence that they are not equivalent.

Because they are inherently oleophillic (fuel attractive), the performance of FFF often depends on the quality of the foam blanket. Producing a high quality foam blanket usually requires the use of an air-aspirated discharge nozzle. While most foam specification testing is performed with air aspirated nozzles, many firefighters in the field are not using air-aspirated nozzles and this can impact their ability to successfully deploy FFF. Reduced stream range is one outcome that could place firefighting teams closer to the fire. The IPEN paper does not adequately address the potential changes in equipment and procedures that can be required to successfully transition to the use of FFF, which are currently being evaluated by NFPA and UL. Enclosed is an appendix that provides additional information on the differences in performance between AFFF agents and FFF.

Environmental Impact

PFAS is a term used to describe a broad category of fluorochemicals (polymers and non-polymers) of different carbon chain lengths, physical and toxicological properties, and environmental impacts. It includes long-chain PFAS such as PFOS and PFOA that are considered to be persistent, bioaccumulative and toxic (PBT). It also includes short-chain PFAS such as the C6 fluorotelomer fluorosurfactants used in current-day AFFF agents. Short-chain (C6) fluorosurfactants do not contain or breakdown in the environment to PFOS or PFOA and are currently considered lower in toxicity and have significantly reduced bioaccumulative potential than long-chain PFAS. (Foams made with only short-chain fluorosurfactants likely contain trace quantities of PFOA and PFOA precursors as an unavoidable byproduct of the manufacturing process.)

The IPEN paper incorrectly states that all AFFF agents contain fluorosurfactants that are toxic and bioaccumulative. It does not acknowledge the clear differences in environmental impact between legacy AFFF agents that contain long-chain fluorosurfactants and current-day AFFF agents that contain only short-chain fluorosurfactants. It also omits mention of PFAS regulations in the European Union, Canada and the United States that ban or restrict the sale of products containing long-chain PFAS while allowing for the continued sale of products containing short-chain PFAS. Enclosed is an appendix that provides additional information on the environmental impact of AFFF agents.

Legacy contamination from the use of firefighting foams in certain locations may largely be the result of past practices by users where foam was discharged uncontrolled to the environment during training and testing of foam equipment. Current best practice calls for the containment and treatment of foam discharges and the use of non-fluorinated fluids and methods for testing and training. As fires are rare (yet potentially catastrophic), implementing best management practices for all foam users has the potential to significantly reduce discharges of fluorochemicals to the environment from foam. The IPEN paper does not acknowledge the significant efforts made by foam users over the last decade to implement best practices and reduce discharges of foam to the environment, or the impact these changes in practices are likely to have on the potential for future environmental contamination from foam.

The IPEN paper states that remediation of PFAS contamination, especially short-chain PFAS, is difficult if not impossible. In fact there are peer-reviewed publications showing that PFAS found in AFFF can be extracted or destroyed using existing treatment technologies (Baudequin et al, 2011 and 2014). Industrial scale remediation techniques for short-chain PFAS are already available.

Existing Stocks of Foam with Long-chain Content

The European Union and Canada banned the use of existing stocks of PFOS-based foams in 2011 and 2013, respectively. Most other countries do not have restrictions on the use of existing stocks of PFOS-based foams. FFFC would support the elimination of the exemption under the Stockholm Convention for the production and use of PFOS-based foams.

The recently published REACH regulation on PFOA and PFOA-related substances does not ban the use of existing stocks of fluorotelomer-based foams with long-chain fluorosurfactant content, and FFFC supports this approach. These foams were not made with PFOA or PFOA-related products and contain only trace quantities as a byproduct of the manufacturing process. In addition, existing stocks of fluorotelomer-based AFFF agents contain a high percentage of short-chain fluorosurfactant content that does not breakdown in the environment to PFOA or PFOA-related substances. A ban on the use of existing stocks of fluorotelomer-based foam with long-chain fluorosurfactant content would require more than 90% of the existing foam stocks in the world to be removed from service. FFFC has serious concerns that such a requirement could result in a significant increase in discharges of fluorochemicals from foam to the environment.

Conclusion

The POPRC is evaluating the need for an exemption for production and use of PFOA and PFOA-related compounds in class B firefighting foams. Foam users currently have available to them two alternatives to the use of PFOA and PFOA-related products: Modern fluorinated foams such as AFFF that contain only short-chain (C6) fluorotelomer fluorosurfactants and fluorine-free foams. Foam manufacturers support the use of both of these products in appropriate applications and feel strongly that both products are necessary to adequately provide for the fire protection needs of society.

FFFC concludes that safe and effective alternatives to the use of PFOA and PFOA-related long chain compounds in firefighting foams are readily available worldwide, and therefore a specific exemption is not needed.

Please let us know if you have any questions or would like to discuss these issues in more detail.

Sincerely,

Thomas Cortina
Executive Director

Enclosures

Appendix A

Overview of the Efficacy of Fluorinated and Fluorine-free Foams

At the 2016 American Chemical Society Symposium, the United States Naval Research Laboratories (NRL) presented test data comparing AFFF agents to fluorine-free foams[1]. In pool fire tests, an AFFF agent achieved extinguishment in less than half the time (18 seconds) compared to fluorine-free foam (40 seconds). In foam degradation tests, fluorine-free foam degraded after 1-2 minutes while AFFF lasted 35 minutes before degrading. Similar results from a series of foam degradation tests on AFFF agents and fluorine-free foams were published in International Fire Fighter in 2012[2].

Fluorine-free foams are inherently oleophilic (fuel attractive). In the absence of oleophobic (fuel-repelling) fluorosurfactants, fluorine-free foam can easily pick up fuel and the contaminated foam degrades quickly and becomes flammable. This fuel contamination problem compromises the fire performance and severely limits the application of fluorine-free foams.

Previous testing by NRL in 2011 showed that extinguishment times for AFFF agents on pool fires were on average 77% faster for gasoline and 70% faster for heptane when compared to fluorine-free foam[3]. Both the 2016 and 2011 NRL testing confirm that fluorine-free foams are unable to pass the fire tests necessary to meet the requirements of the US military specification (milspec). Foam agents must meet the requirements of the milspec in order to be listed on the US Department of Defense qualified products database (QPD) and used for military applications[4]. The Federal Aviation Administration requires all US airports to carry AFFF agents that meet the milspec and are listed on the QPD[5]. In addition, many national authorities in Europe require the use of AFFF agents that meet the milspec.

In July 2016 the Singapore Aviation Academy (SAA) and the International Aviation Fire Protection Association (IAFPA) jointly organized a firefighting foam seminar[6]. The major focus of the seminar was on the advantages and disadvantages of fluorine-free foam versus short-chain (C6) AFFF agents. During this seminar, Spanish foam manufacturer Auxquimia presented results from a series of new fire tests run on five commercially available short-chain (C6) AFFF agents and five commercially available fluorine-free foams. The presentation was subsequently published in Industrial Fire Journal[7]. The tests were run with four different fuels: gasoline, heptane, Jet A1, and diesel. The results showed that AFFF agents performed significantly better than fluorine-free foams on all fuels except diesel. None of the fluorine-free foams were able to extinguish the Jet A1 fire, which is the fuel used in the ICAO fire tests that determine the acceptability of foams for airport use in many countries.

In a recent article published in Fire & Rescue, fluorine-free foams were found to require a certain foam quality (expansion) below which they do not perform in UL-162 tests, whereas fluorinated foams do not have the same limitations[8].

Appendix A

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Appendix B

Overview of Environmental Impacts of Short-chain (C6) Fluorosurfactants

The environmental impact of fluorosurfactants used in fluorinated foams has been extensively studied and a large body of data is available in the peer-reviewed scientific literature. The bulk of these data show that short-chain (C6) fluorosurfactants and their likely breakdown products are low in toxicity and not considered to be bioaccumulative or biopersistent according to current regulatory criteria.

Groundwater monitoring studies have shown the predominant breakdown product of the short-chain (C6) fluorosurfactants contained in fluorotelomer-based AFFF to be 6:2 fluorotelomer sulfonate (6:2 FTS)[1]. A broad range of existing data on 6:2 FTS indicates that it is not similar to PFOS in either its physical or ecotoxicological properties[2,3,4,5]. Recent studies on AFFF fluorosurfactants likely to break down to 6:2 FTS show them to be generally low in acute, sub-chronic, and aquatic toxicity, and neither a genetic nor developmental toxicant. Both the AFFF fluorosurfactant and 6:2 FTS were significantly lower than PFOS when tested in biopersistence screening studies that provide a relative measure of biouptake and clearance[6].

Aerobic biodegradation studies of 6:2 FTS in activated sludge have been conducted to better understand its environmental fate[7]. These studies show that the rate of 6:2 FTS biotransformation was relatively slow and the yield of all stable transformation products was 19 times lower than 6:2 fluorotelomer alcohol (6:2 FTOH) in aerobic soil. In particular, it was shown that 6:2 FTS is not likely to be a major source of perfluorocarboxylic acids or polyfluorinated acids in wastewater treatment plants. Importantly neither 6:2 FTOH nor PFHpA (perfluoroheptanoic acid) were seen in these studies.

A review of the properties, occurrence and fate of fluorotelomer sulfonates was published in 2017[8].

PFHxA is a possible breakdown product and contaminant that may be found in trace quantities in fluorotelomer-based AFFF. Extensive data on PFHxA presented in 2006 and 2007 gave a very favorable initial toxicology (hazard) profile[9,10,11]. Testing was done on four major toxicology end points: sub-chronic toxicity in rats, reproductive toxicity in rats, developmental toxicity in rats, and genetic toxicity. Results show that PFHxA was neither a selective reproductive nor a selective developmental toxicant. In addition, it was clearly shown to be neither genotoxic nor mutagenic. In 2011 results were published from a 24-month combined chronic toxicity and carcinogenicity study, which demonstrated that under the conditions of this study PFHxA was not carcinogenic in rats and its chronic toxicity was low[12]. An updated review of data on PFHxA presented in 2018 is shown in Figure 1[13].

In 2014 an independent report was published that assessed several short-chain (C6) fluorinated chemicals with regard to the criteria used to define persistent organic pollutants (POPs)[14]. The report assessed these chemicals based on the four criteria that must be met to be considered a POP under the Stockholm Convention: persistence, bioaccumulation, potential for long-range transport, and adverse effects (toxicity and ecotoxicity). It concludes that none of the chemicals meets all the criteria to be considered a POP, and at most they only meet one of the four criteria. The report also concludes that the three short-chain (C6) fluorotelomer intermediates and PFHxA "are rapidly metabolized and eliminated from mammalian systems. None of these materials appear to bioaccumulate or biomagnify based on laboratory data and available field monitoring data, and none show severe toxicity of the types that would warrant designation as POP." An update of this report was published in 2016.

An extensive compilation of peer-reviewed and other relevant available data on short-chain PFASs can be found at the following link: https://fluorocouncil.com/resources/research

Appendix B

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