APP203827 Proposal to amend the Fire Fighting Chemicals Group Standard 2017

Submission Reference no: 16

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Submitter Type: Not specified
Source: Email
Overall Position: I oppose some of the proposals

Overall Notes:

Clause
What is the reason for making the submission?
Notes
The reason for making this submission is to assist in guiding the EPA in their decision making, avoiding negative outcomes for the public, for end users of foam firefighting products and the fire protection industry. I believe my position within the industry and my knowledge and study of matters relating to firefighting foam products, specifically environmental effects in relation to portable and mobile fire extinguishers and fixed fire protection systems on mobile equipment will enable me to give some additional insight to the EPA. From a financial point of view, me, my company, and many of my colleagues could have much to gain from the application of the group standard in its current form. However it is my belief that it is currently broad brush in its approach shows a lack of understanding in the differences in chemistry, capabilities and uses of different types of foam, will create health and safety problems for first responders (both professional and members of the public using hand operated equipment or systems) that does not correspond to any appropriate environmental benefit, will create significant and wide ranging compliance issues in the current regulatory framework that does not correspond to an appropriate environmental benefit, and will create significant financial costs that will fall disproportionately and unexpectedly on certain industries. Further refinement is required for this change to be effective and reasonable, and I hope this document and the submissions of others will assist the EPA with this. The reason for making this submission is to assist in guiding the EPA in their decision making, avoiding negative outcomes for the public, for end users of foam firefighting products and the fire protection industry. I believe my position within the industry and my knowledge and study of matters relating to firefighting foam products, specifically environmental effects in relation to portable and mobile fire extinguishers and fixed fire protection systems on mobile equipment will enable me to give some additional insight to the EPA. From a financial point of view, me, my company, and many of my colleagues could have much to gain from the application of the group standard in its current form. However it is my belief that it is currently broad brush in its approach shows a lack of understanding in the differences in chemistry, capabilities and uses of different types of foam, will create health and safety problems for first responders (both professional and members of the public using hand operated equipment or systems) that does not correspond to any appropriate environmental benefit, will create significant and wide ranging compliance issues in the current regulatory framework that does not correspond to an appropriate environmental benefit, and will create significant financial costs that will fall disproportionately and unexpectedly on certain industries. Further refinement is required for this change to be effective and reasonable, and I hope this document and the submissions of others will assist the EPA with this. Thank you for the opportunity to submit on the EPAs proposed amendment to the firefighting chemicals group standard. My family and I run a small business serving Christchurch and the greater Canterbury area with servicing, inspection, maintenance and sales and installation of fire extinguishers and automatic fire suppression systems, mainly for vehicles. I have taken an interest in the long-term sustainability of these two market areas, and have spent considerable time researching, among other things, the way firefighting foams interact with the environment. While the quantity of firefighting foam both consumed and discharged into the environment by these two markets is small, it represents a large market value, and importantly an area in the industry where any proposed changes are likely to have a direct effect on the public. I am no expert on industrial or first response firefighting, but I hope that in this submission my experience and perspective from my part of the industry can assist the EPA to make effective, reasonable and beneficial decisions in this matter. I have serious concerns with some of the proposals discussed in this consultation document and the effects this would have on the environment, the industry and the public. I also have serious concerns that, from the information given in the consultation document, the EPA lacks a full and thorough understanding of the nuances of this complicated issue, and this will contribute to excessively restrictive regulations that will have little positive or even negative effects on the environment, as well as leading to greater risk exposure and the possibility of death or injury to first responders (both trained firefighters and members of the public using first aid equipment), greater property loss, and significant economic cost to the public, private businesses and government entities. In short, there is a very real potential that the costs will outweigh the benefits if the current proposal is accepted. It is worth noting, in its current form, this proposal is likely to be very profitable for our business and businesses similar to ours; my motivation for this submission is not for financial gain, but rather to present accurate

information to the EPA so the most accurate decisions can be made. My concerns mainly revolve around the following areas: PAGE 1 1.The questionable grouping of all Fluorinated firefighting chemicals together as PFAS, when evidence suggests that there are orders of magnitudes of difference in the environmental impact of the many chemicals in the PFAS group. 2.Following on from 1, disproportionate concern and restrictions surrounding modern, high purity C6 foams. 3.The effectiveness of current F3 foams in real world and test scenarios 4.Compliance and approval concerns for retrofitting extinguishers and systems with F3 foams 5.The apparent departure from international and industry established best practice and following in the footsteps of the strictest jurisdictions rather than the most effective jurisdictions 6.The elevation of absolute environmental protection from fluorinated chemicals above all other measures of sustainability, creating a false economy on which important decisions will be based.

Clause
Do you wish to speak at a hearing?
Notes
I have no specific need to be heard in a hearing, I believe this document outlines the concerns accurately. However, if you believe my perspective and position would be a valuable addition to any hearings, I would be willing to contribute. I have no specific need to be heard in a hearing, I believe this document outlines the concerns accurately. However, if you believe my perspective and position would be a valuable addition to any hearings, I would be willing to contribute.

Clause
What is your preferred outcome of this consultation?
Notes
The primary outcome from this consultation must be that the EPA listens to the feedback it receives and considers the evidence received makes its decisions based on this. I am certain you will receive thorough and detailed information from a range of sources with experience with firefighting foam products. I strongly expect many of these to be urging caution with the EPAs current approach. The primary outcome from this consultation must be that the EPA listens to the feedback it receives and considers the evidence received makes its decisions based on this. I am certain you will receive thorough and detailed information from a range of sources with PAGE 4 experience with firefighting foam products. I strongly expect many of these to be urging caution with the EPAs current approach.

Clause
Do you consider there are any applications for which fluorine-free foams are not suitable or do not have relevant approvals? If yes, please specifiy.
Position
No
Notes
There are many applications where fluorine free foams are unsuitable. The issue to be considered first is the definition of a fluorine free foam. Under the proposed definition of a fluorine free foam, that being: “fluorine free firefighting foam means a firefighting foam that does not contain PFAS (or perfluoroalkyl and polyfluoroalkyl substances)” absolutely zero PFAS Substances are permitted. However, in many, “high performance” F3 foams contain a small quantity of fluorosurfactants, usually <0.1%, and the technology to produce “pure F3 foams is still evolving” Jimmy Seow. Thus, the proposed restrictions would not permit many high performance F3 foams being used, or alternatively require ignorance to play a part in the application of this standard, something inconsistent with the principles of rule of law. Moving on, most F3 foams perform worse than their C6 counterparts in several areas: 1. Repelling liquid fuels 1. Burnback resistance 2. Film forming, or self-healing capabilities 3. Foam Collapse 4. Fire extinction performance Repelling liquid fuels - One of the key performance factors of an effective foam agent is its ability to repel liquid fuels from its surface. This is important because foam extinguishes fire by forming a foam ‘seal’ on top of the fuel source, excluding oxygen from the fuel, and cooling the fuel. Liquid fuel that finds its way on the top of the foam seal are exposed to oxygen and will resume combustion. F3 Foams have consistently been shown to be poor at repelling liquid fuel, particularly in liquid fuel fires of any significant depth. (A small addition of fluorosurfactants dramatically increases the repelling properties in a logarithmic fashion, but would not be permitted in the current standard). In practical terms, in the event of forceful application of F3 foam onto a hydrocarbon fire, as is the case in most emergency situations, F3 foams have been shown to be significantly less effective, or ineffective at controlling and extinguishing liquid fuel fires of depth (i.e. pooled liquids). This is evidently caused by the inherent high detergency needed for alternative surfactants in F3 foam which has a tendency to absorb fuels into the foam bubbles. In practical terms this means that extinction of the fire is slower and requires more agent (often resulting in bigger fires as they continue to burn), and sudden flashbacks, flare ups and reignition is possible, putting people at risk. Burnback Resistance - Burnback resistance is the measure of how resistant a foam is to destruction by fire, or burning back. This is important as it directly relates to the capability of the foam to contain a fire, and a fire that cannot be effectively contained is a fire that cannot be extinguished. Foam is only extinguishing agent capable of containing a liquid fuel fire. Modern C6 foams have excellent burnback resistance, comparable to or exceeding earlier C6> chemistries. F3 foams of many brands and types have consistently shown worse burnback resistance in comparison to C6 foams. This is apparently very difficult to avoid due to the hydrocarbon surfactants required to avoid the use of fluorocarbons. Once again, dramatic improvements have been demonstrated by adding small amounts (<0.1%) of C6 surfactants to F3 solutions, however this would be prohibited by the proposed standard. In practical terms this means fires are more difficult, or in extreme cases not possibly to contain and extinguish in an initial attack as the foam combusts at a rate faster than it can be applied safely. Additionally, in the event a fire has been contained in an initial attack, but remains burning, tests and experience have shown that reignition will occur significantly earlier with F3 foams in some situations. Film Forming - Another of the key attributes of an effective foam is its ability to form a flexible and self-healing film over the fuel. It is imperative that this film is consistent across the fuel source, has the ability to ‘flow’ around minor obstacles without direct application to these areas and to reseal over a liquid fuel source when disturbed (such as by a firefighter advancing across pooled liquid with foam applied). C6

Foams are generally thought to be the best product for these capabilities available that does not contain PFOS or have a >C6 chemistry, after all AFFF stands for Aqueous Film Forming Foam. F3 foams have once again often been shown to be inferior in this aspect, as they generally do not have this film forming ability. A lack of real-world experience with the range of F3 foams in real life situations has made it difficult to determine if they have sufficient film forming capabilities beyond pre-determined testing regimes. Foam Collapse - Foam is often applied in an aspirated form, creating a layer of bubbles. Like all detergent bubbles they are subject to deterioration and collapse. This is another area where many F3 foams perform worse than their C6 counterparts. Repeated tests have demonstrated the foam collapses quicker in many circumstances, this being a major contributing factor to the burn back resistance and film forming capabilities or lack thereof. This is also related to the lack of fuel repellant abilities currently available, as reignition of fuel on the foam itself further deteriorates the foam structure. Fire Extinction Performance - All the above 4 factors contribute to significantly poorer performance of F3 foams when compared to C6 foams. This results in longer burn times, significantly more agent application (many sources indicate 2-3 times as much agent), significantly more pollution from the continued burning of the fire (including PFAS emissions from the fire itself into the atmosphere and in firewater run off), higher exposure to risk for the public and firefighters, and greater loss to property. A clear, standardized example of this is in portable fire extinguishers. For aspirating extinguishers 9L is the only size generally produced and performance tested AS/NZS 1850. For many years C6 foams have held a 30B rating (the larger the number the bigger the fire), yet with the introduction of F3 foams, common ratings were initially 10B, with the most high-performance units achieving a 20B rating. In certain situations, the ratings were as low as 5B. Of course, not all F3 foams are completely unsuitable for the task at hand. In some of these areas mentioned above specific types of F3 foam may perform better than a C6 counterpart. However, there is yet to be a drop-in substitute that is equal to or better than C6 foam formulations for all of these areas to my knowledge. Those that display similar performance often require specialized preparation and are for specific equipment only (such a certain brand of aspirating foam extinguishers). Figure X : A comparative analysis of typical performance characteristics of AFFF (C6) and F3 foams. Credit: Wilson Consulting. There are certain specific applications where non-fluorinated foams are also generally poorly suited. The high performance F3 foams often require extensive mixing to emulsify the concentrate into a solution prior to use. This period is often temperature controlled and the mixing may have to go on for as long as 48 hours. The chemistry of these foams requires this to ensure the thick concentrates remain suitably emulsified in a solution ready for use. Many applications require what is known as a foam induction system, where the foam concentrate is mixed into the flow of water at the time of use. This is often for logistical reasons, it is impractical to store and transport 20, 30 or 100 times more water than concentrate to have a complete solution on hand rather than a tank of concentrate bought to an existing water source. These systems are the most common way of applying large quantities of foam. However, with a thick concentrate that needs days of preparation before use, it is obviously impossible to use these high-performance concentrates in induction systems, creating yet another design challenge for manufacturers. AR-AFFF or Alcohol Resistant AFFF is widely acknowledged as the most effective agent for dealing with polar solvent fires, such as methanol, and ethanol. This is also based on fluorocarbon surfactants and C6 versions are widely available. As it stands currently only some F3 foams are alcohol resistant, and the ones that are demonstrate significantly poorer performance than fluorinated AR foams. Until there is a comparable product, a prohibition on fluorinated foams increase the health, safety and property loss risks of those dealing with flammable polar solvents, including areas such as Motorsport where they are heavily dependent on these foams. New Zealand, like most other developed nations has rules and standards surrounding the construction and performance of fire extinguishers and fire suppression systems. Comprehensive and expensive product certification and approval processes are designed to ensure that all products supplied are of suitable quality and performance. Additionally, the fire protection industry works to a range of standards designed to keep the quality of work consistent and keep this equipment always ready to operate to the original manufacturers specification. With these factors in mind my message is simple. F3 foams are not suitable for any extinguisher or fire suppression system not explicitly engineered for use with F3 foams and approved as such, under the current testing and maintenance standards. As such, if the current proposal was to go ahead, strict adherence to the standards (specifically NZS 4503:2005 for hand operated firefighting equipment and AS 5062:2016 for mobile equipment suppression systems, etc) would mean the wholesale replacement of thousands of otherwise functional extinguishers and millions of dollars' worth of fire suppression systems either having to be extensively reengineered where possible or replaced in vehicles and other special hazard areas across NZ. This puts those in the industry in the awkward (although potentially profitable) position of replacing otherwise completely adequate equipment, while other less professional members of the industry could and will attempt to undercut others by 'bending' the rules. This is a separate issue that could be avoided and will be discussed later. Regardless, the proposed standard in its current for is unsuitable for will result in significant costs to the end users of foam extinguishers and systems. Due to the often-poorer performance of F3 foams compared to C6 foams the simple reality is they are potentially not suited for a range of situations where a high risk of a significant B class fire. Large industrial and transport facilities such as ports, fuel storage facilities, airports, defense facilities, industrial plants, factories, production facilities, mines and large agricultural facilities are all locations in New Zealand where the best protection possible is required for an effective fire response. Industrial firefighting is outside my area of expertise to I will not expand in this area any further. There are also innumerable smaller locations across New Zealand where foam fire extinguishers, both portable and mobile are the first line of defense against a class B fire. In many situations, after a risk assessment in accordance with the relevant regulations and standards, C3 extinguishers could be substituted with F3 extinguishers. However, in other higher hazard areas, extinguishers with F3 foam simply do not have high enough fire test ratings to be suitable for these risk areas in accordance with the relevant standards and regulations. For example, the Health and Safety at Work (Hazardous Substances) regulations require a certain number of extinguishers to be installed in the presence of certain quantities of hazardous substances. One of the performance criteria for this is the extinguisher having a 30B rating, and often a foam extinguisher is the only suitable or appropriate extinguisher. As discussed earlier, no F3 foam available are available with a 30B rating, and any that will in the foreseeable future will likely contain a small amount of C6 fluorosurfactants (<1%), and will be prohibited under the proposed standard. I feel strongly that the EPA is asking the wrong question here. The important question is not 'are there situations in which F3 foams are unsuitable', (the answer to that is yes) but rather 'In what circumstances would you consider the minor environmental benefits using F3 are outweighed by the performance restrictions of F3 foam". In all the above situations, the bottom line is there are few situations, in industrial and first response firefighting, in fire suppression systems and in extinguishers where F3 foam couldn't be used, however whether or not it is appropriate when all factors are considered, the health and safety risks to the operators and public, the potential for further property losses, the financial costs of properly converting extinguishers and systems to F3 foam, the environmental impacts C6 foam, the environmental impacts of increased burn time of fires and fire risk and the costs of proper disposal, is a different question that can only be answered by experienced personnel on a case by case basis. There are many applications where fluorine free foams are unsuitable. The issue to be considered first is the definition of a fluorine free foam. Under the proposed definition of a fluorine free foam, that being: “fluorine free firefighting foam means a firefighting foam that does not contain PFAS (or perfluoroalkyl and polyfluoroalkyl substances)” absolutely zero PFAS Substances are permitted. However, in many, “high performance” F3 foams contain a small quantity of fluorosurfactants, usually <0.1%, and the technology to 1,2produce “pure F3 foams is still evolving”. Thus, the proposed restrictions would not permit many high performance F3 foams being used, or alternatively require ignorance to play a part in the application of this standard, something inconsistent with the principles of rule of law. 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In some of these areas mentioned above specific types of F3 foam may perform better than a C6 counterpart. However, there is yet to be a drop-in substitute that is equal to or better than C6 foam formulations for all of these areas to my knowledge. Those that display similar performance often require specialized preparation and are for specific equipment only (such a certain brand of aspirating foam extinguishers). Figure 1 : A comparative analysis of typical performance characteristics of AFFF (C6) and F3 foams. Credit: Wilson Consulting. There are certain specific applications where non-fluorinated foams are also generally poorly suited. The high performance F3 foams often require extensive mixing to emulsify the concentrate into a solution prior to use. This period is often temperature controlled and the mixing may have to go on for as long as 48 hours. The chemistry of these foams requires this to ensure the thick concentrates remain suitably emulsified in a solution 11 ready for use. Many applications require what is known as a foam induction system, where the foam concentrate is mixed into the flow of water at the time of use. This is often for logistical reasons, it is impractical to store and transport 20, 30 or 100 times more water than concentrate to have a complete solution on hand rather than a tank of concentrate bought to an existing water source. These systems are the most common way of applying large quantities of foam. However, with a thick concentrate that needs days of preparation before use, it is obviously impossible to use these high-performance concentrates in induction systems, creating yet another design challenge for manufacturers. AR-AFFF or Alcohol Resistant AFFF is widely acknowledged as the most effective agent for dealing with polar solvent fires, such as methanol, and ethanol. This is also based on fluorocarbon surfactants and C6 versions are widely available. As it stands currently only some F3 foams are alcohol resistant, and the ones that are demonstrate significantly 9poorer performance than fluorinated AR foams. Until there is a comparable product, a prohibition on fluorinated foams increase the health, safety and property loss risks of those dealing with flammable polar solvents, including areas such as Motorsport where they are heavily dependent on these foams. New Zealand, like most other developed nations has rules and standards surrounding the construction and performance of fire extinguishers and fire suppression systems. Comprehensive and expensive product certification and approval processes are designed to ensure that all products supplied are of suitable quality and performance. Additionally, the fire protection industry works to a range of standards designed to keep the quality of work consistent and keep this equipment always ready to operate to the original manufacturers specification. With these factors in mind my message is simple. F3 foams are not suitable for any extinguisher or fire suppression system not explicitly engineered for use with F3 foams and approved as such, under the current testing and maintenance standards. As such, if the current proposal was to go ahead, strict adherence to the standards (specifically NZS 4503:2005 for hand operated firefighting equipment and AS 5062:2016 for mobile equipment suppression systems, etc) would mean the wholesale replacement of thousands of otherwise functional extinguishers and millions of dollars' worth of fire suppression systems either having to be extensively reengineered where possible or replaced in 12, 13 vehicles and other special hazard areas across NZ This puts those in the industry in the awkward (although potentially profitable) position of replacing otherwise completely adequate equipment, while other less professional members of the industry could and will attempt to undercut others by 'bending' the rules. This is a separate issue that could be avoided and will be discussed later. Regardless, the proposed standard in its current for is unsuitable for will result in significant costs to the end users of foam extinguishers and systems. Due to the often-poorer performance of F3 foams compared to C6 foams the simple reality is they are potentially not suited for a range of situations where a high risk of a significant B class fire. Large industrial and transport facilities such as ports, fuel storage facilities, airports, defense facilities, industrial plants, factories, production facilities, mines and large agricultural facilities are all locations in New Zealand where the best protection possible is required for an effective fire response. Industrial firefighting is outside my area of expertise to I will not expand in this area any further. There are also innumerable smaller locations across New Zealand where foam fire extinguishers, both portable and mobile are the first line of defense against a class B fire. In many situations, after a risk assessment in accordance with the relevant regulations and standards, C3 extinguishers could be substituted with F3 extinguishers. However, in other higher hazard areas, extinguishers with F3 foam simply do not have high enough fire test ratings to be suitable for these risk areas in accordance with the relevant standards and regulations. For example, the Health and Safety at Work (Hazardous Substances) regulations require a certain number of extinguishers to be installed in the presence of certain quantities of hazardous substances. One of the performance criteria for this is the extinguisher having a 30B rating, and often a foam extinguisher is the only suitable or appropriate extinguisher. As discussed earlier, no F3 foam available are available with a 30B rating, and any that will in the foreseeable future will likely contain a small amount of C6 fluorosurfactants (<1%), and will be prohibited under the proposed standard. I feel strongly that the EPA is asking the wrong question here. The important question is not 'are there situations in which F3 foams are unsuitable', (the answer to that is yes) but rather 'In what circumstances would you consider the minor environmental benefits using F3 are outweighed by the performance restrictions of F3 foam". In all the above situations, the bottom line is there are few situations, in industrial and first response firefighting, in fire suppression systems and in extinguishers where F3 foam couldn't be used, however whether or not it is appropriate when all factors are considered, the health and safety risks to the operators and public, the potential for further property losses, the financial costs of properly converting extinguishers and systems to F3 foam, the environmental impacts C6 foam, the environmental impacts of increased burn time of fires and fire risk and the costs of proper disposal, is a different question that can only be answered by experienced personnel on a case by case basis.

Clause
What do you think of the practicality of these disposal provisions, in terms of the resources and costs involved?
Notes
For all C6 foams these requirements are a needless complication. The reality is for all foams the actual proportion of PFAS in concentrate is so low it is of little concern overall. In most if not all 6% C6 concentrates there is <5% volume of fluorocarbon surfactants. The actual number is likely lower; however, the exact ratios are often trade secrets. <5% of whatever residue left over I'm a System in my opinion simply is not worth worrying about for C6 foams given they are not toxic, or bioaccumulative and they are water soluble. It's even less of an issue in premixed solutions forum in systems and extinguishers, where the concentrate itself only makes usually only 6% of the total agent, the other 94% being potable water. In that situation, the fluorosurfactants only make up 0.3% of the total agent volume. 0.3% of the residual amount of solution left in a container that is nontoxic, and not bioaccumulative is simply of no benefit to specifically remove through an approved process when compared against the effort and expense. C8 foams may be a different story, they are far more environmentally damaging, being known and demonstrated to degrade into POPs, and will require more thorough processing. Only substances known to contain POPs in significant quantities should be required to be disposed of in accordance with the Basel Convention. For all C6 foams these requirements are a needless complication. The reality is for all foams the actual proportion of PFAS in concentrate is so low it is of little concern overall. In most if not all 6% C6 concentrates there is <5% volume of fluorocarbon surfactants. The actual number is likely lower; however, the exact ratios are often trade secrets. <5% of whatever residue left over I'm a System in my opinion simply is not worth worrying about for C6 foams given they are not toxic, or bioaccumulative and they are water soluble. It's even less of an issue in premixed solutions forum in systems and extinguishers, where the concentrate itself only makes usually only 6% of the total agent, the other 94% being potable water. In that situation, the fluorosurfactants only make up 0.3% of the total agent volume. 0.3% of the residual amount of solution left in a container that is nontoxic, and not bioaccumulative is simply of no benefit to specifically remove through an approved 14,15,16 process when compared against the effort and expense. C8 foams may be a different story, they are far more environmentally damaging, being known and demonstrated to degrade into POPs, and will require more thorough processing. Only substances known to contain POPs in significant quantities should be required to be disposed of in accordance with the Basel Convention

Clause
Would your business be able to contain all foam wastes?
Position
No
Notes
No. And I strongly disagree that there is any mandate for doing so with all foam wastes. Once again there is an insufficient graduation between F3 foams, C6 foams, and >C6 foams. All >C6 foam wastes should be contained as they contain POPs and

precursors to POPs in quantities well above international thresholds. C6 foams should only be required to be contained where practical. Certain activities such as testing, use of systems and extinguishers to extinguish fires, required discharge tests particularly on suppression systems, and specific training requirements that require fluorinated C6 foams (for example AR-AFFF training). There is no reason F3 foam waste should be contained other than as required by the RMA and in accordance with any MSDS. F3 foams are completely biodegradable, and are nontoxic and not bioaccumulative (like C6 foams). They do have somewhat higher BOD and COD requirements than other foams so care should be used around discharges reaching freshwater. A code of practice would be sufficient to give guidance on correct methods of disposal. No. And I strongly disagree that there is any mandate for doing so with all foam wastes. Once again there is an insufficient graduation between F3 foams, C6 foams, and >C6 foams. All >C6 foam wastes should be contained as they contain POPs and precursors to POPs in quantities well above international thresholds. C6 foams should only be required to be contained where practical. Certain activities such as testing, use of systems and extinguishers to extinguish fires, required discharge tests particularly on suppression systems, and specific training requirements that require fluorinated C6 foams (for example AR-AFFF training). There is no reason F3 foam waste should be contained other than as required by the RMA and in accordance with any MSDS. F3 foams are completely biodegradable, and are nontoxic and not bioaccumulative (like C6 foams). They do have somewhat higher BOD and COD requirements than other foams so care should be used around discharges reaching freshwater. A code of practice would be sufficient to give guidance on correct 17 methods of disposal.

Clause
If not, is this due to cost or practical difficulties?
Position
Practical difficulties - please specify
Notes
Cost and practicality are two sides of the same coin; anything is practical if enough financial resources are willing to be expended. Practical difficulties are the primary problem. There is no practical way to catch all foam from a required test discharge of a suppression system on heavy machinery, particularly when it is in a remote location such as a forestry site. As outlined in 7, there is little reason at all why C6 and to a greater extent F3 foams should be contained at all. Cost and practicality are two sides of the same coin; anything is practical if enough financial resources are willing to be expended. Practical difficulties are the primary problem. There is no practical way to catch all foam from a required test discharge of a suppression system on heavy machinery, particularly when it is in a remote location such as a forestry site. As outlined in 7, there is little reason at all why C6 and to a greater extent F3 foams should be contained at all.

Clause
Do you have any concerns about fluorine-free foams potentially containing other persistent, toxic and/or bioaccumulative compounds?
Position
No
Notes
No. In my discussions with people within the industry this is the least of their worries with F3 foams, the bigger concerns being the poorer performance of F3 foams and the apparent belief of some regulatory bodies that F3 foams are a “silver bullet” for foam contamination issues. No. PAGE 11 In my discussions with people within the industry this is the least of their worries with F3 foams, the bigger concerns being the poorer performance of F3 foams and the apparent belief of some regulatory bodies that F3 foams are a “silver bullet” for foam contamination issues.

Clause
Do you agree with phasing out C6 AFFF at the same timeframe as C8 AFFF?
Position
No - please tell us why
Notes
No. Once again it is inferred that C6 chemistry and C8 and greater chemistry are similar and directly comparable thus needing a similar response from the EPA. They are not comparable in their environmental effects, high purity C6 is not toxic, is not bioaccumulative does not contain PFOS, and cannot degrade into PFOA. Additionally, the fire protection industry and firefighters are significantly more reliant on C6 foams as they have been developed as the alternative to C8 and greater foams. In many situations, like for like F3 foams simply do not exist, so performance compromises are necessary. It is my opinion there is no reasonable justification on the grounds of environmental protection and health concerns alone to phase out C6 foams completely. Industry studies have repeatedly come to the conclusion that C8 foams should be prohibited and destroyed, C6 foams should be used as alternatives to C8 and greater foams where required and F3 foams should be the gold standard to be used anywhere it is practical and safe to do so when all factors are considered. Instead of phasing out both C6 and C8 foams, the best outcome would be a phase out C8 foams immediately, restrict C6 foam for necessary practical uses as described in a comprehensive code of practice, and encourage F3 foams wherever practical on new equipment. No. Once again it is inferred that C6 chemistry and C8 and greater chemistry are similar and directly comparable thus needing a similar response from the EPA. They are not comparable in their environmental effects, high purity C6 is not toxic, is not 14, 15 bioaccumulative does not contain PFOS, and cannot degrade into PFOA. Additionally, the fire protection industry and firefighters are significantly more reliant on C6 foams as they have been developed as the alternative to C8 and greater foams. In many situations, like for like F3 foams simply do not exist, so performance compromises are 17 necessary. It is my opinion there is no reasonable justification on the grounds of environmental protection and health concerns alone to phase out C6 foams completely. Industry studies have repeatedly come to the conclusion that C8 foams should be prohibited and destroyed, C6 foams should be used as alternatives to C8 and greater foams where required and F3 foams should be the gold standard to be used anywhere it is practical and safe to do so when all factors are considered. Instead of phasing out both C6 and C8 foams, the best outcome

would be a phase out C8 foams immediately, restrict C6 foam for necessary practical uses as described in comprehensive code of practice, and encourage F3 foams wherever practical on new equipment.

Clause
Which is your preferred option?
Notes
Neither. In my opinion both options are deeply flawed and are likely to cause more harm than good when all factors are considered. Neither. In my opinion both options are deeply flawed and are likely to cause more harm than good when all factors are considered.

Clause
What are your reasons?
Notes
While F3 foam technology is highly valuable and will continue to progress, C6 foams are at times, currently a necessary and safe tool to use in fighting fires. In this consultation document the EPA fails to demonstrate an understanding of this fact and the proposed changes are likely to result in more harm than good. How will the EPA answer if someone is killed and a contributing factor is found to be an inability to source effective firefighting foam? While F3 foam technology is highly valuable and will continue to progress, C6 foams are at times, currently a necessary and safe tool to use in fighting fires. In this consultation document the EPA fails to demonstrate an understanding of this fact and the proposed changes are likely to result in more harm than good. How will the EPA answer if someone is killed or injured and a contributing factor is found to be an inability to source effective firefighting foam?

Clause
Can you estimate the cost to your business of phasing out C6 AFFF?
Position
No
Notes
No. The reality is in our situation the end user always pays and unfortunately any costs will have to be passed on to our customers, however indirect costs are difficult to estimate. Costs for disposing of Foam concentrates in an “approved manner” will depend on what that approved manner is. I am not familiar with the costs of disposal methods required by the Basel Convention. We are a small sized company with a small customer base; however, I could see costs in the hundreds of thousands of dollars collectively for our customers, with most of the costs falling in the rural communities and on heavy equipment operators. No. The reality is in our situation the end user always pays and unfortunately any costs will have to be passed on to our customers, however indirect costs are difficult to estimate. Costs for disposing of Foam concentrates in an “approved manner” will depend on what that approved manner is. I am not familiar with the costs of disposal methods required by the Basel Convention. We are a small sized company with a small customer base; however, I could see costs in the hundreds of thousands of dollars collectively for our customers, with most of the costs falling in the rural communities and on heavy equipment operators.

Clause
Do you have any other comments to make about the proposed amendments?
Notes
I have deep concerns that the EPA has a lack of understanding of the difference in environmental impacts of C8 and C6 foams, how low the environmental impact of modern high purity C6 foams, the differences in practical terms between PFAS, PFOS and PFOA and their relationship to the environment, the shortcomings of F3 foams, the approval and testing process for fire extinguishers and fire systems, existing regulatory requirements surrounding extinguishers and fire systems. I have deep concerns that the EPA has a lack of understanding of the difference in environmental impacts of C8 and C6 foams, how low the environmental impact of modern PAGE 13 high purity C6 foams, the differences in practical terms between PFAS, PFOS and PFOA and their relationship to the environment, the shortcomings of F3 foams, the approval and testing process for fire extinguishers and fire systems, existing regulatory requirements surrounding extinguishers and fire systems. The Importance of Environmental Protection We only have one environment that we must all share, and it goes without saying we should protect it from pollution and contamination. However, the extent that we go to protect the environment cannot be absolute, it must be relative to other factors. After all, the reason we protect the environment in the first place is to try and ensure positive outcomes for people, both now and in the future. If the level to which we expend our resources to protect one aspect of environment results in too much cost to people or too much cost to other areas of the environment, the results will be net negative. Like all things, protection of the environment has costs and benefits and the factors that contribute to these costs and benefits must be carefully considered. A concerning feature of the EPAs consultation document, and one that commentators and submitters also found concerning in the consultation for and subsequent change of similar regulations in other jurisdictions, is the inferred philosophy that there is no sustainable or acceptable level of risk to the environment and that protection of the aspect of the environment under consideration is the primary and highest priority in any decision making. This negates the simple truth that protection of the environment is one of several factors incorporated in the ideas of sustainability and the wellbeing of a society. By reasoning solely or with too much emphasis on a single metric, we develop tunnel vision, lose our perspective on the influence our decisions have in wider areas, and paint ourselves towards a false economy where the decisions we make will inevitably be poor. For the EPAs revision of this group standard to bring better outcomes for both the environment and New Zealand, it is imperative that the current absolutist position is moved away from, and that wider factors outlined in these submissions are listened to and considered. PAGE 15 The Difference Between PFAS, PFOS and PFOA The fluorinated compounds PFOS and PFOA have become well known compounds in recent times, owing to a series of serious, high profile

cases of contamination in a range of countries. PFAS is also a name commonly associated with these events. However, it is important that we correctly understand the nature of these three terms to make effective decisions on their use. I find it concerning that the EPA (possibly following the lead of the Nordic 18Report) uses PFAS as a catchall phrase to describe fluorinated foam compounds that are associated with PBT characteristics and that are responsible for these contamination incidents. Whether this is intentional or not, it is confusing for the public and not representative of the reality of these substances or the environmental hazards presented by them. It is approaching a fallacy of composition. Figure 2: Classification of per- and poly-fluoroalkyl substances according to the OECD, with the relevant locations of PFOS, PFOA and C6 Fluorotelomers located within their appropriate subgroups. Credit: NZFS, additions by myself. The family of nightshade plants could be used as an example to illustrate. We know from evidence that deadly nightshade is a very hazardous plant for human PAGE 16 consumption. But it would be inaccurate to suggest that all nightshades are unfit for human consumption and must be avoided. Why? Because tomatoes and potatoes are both common plants in the nightshade family that, when used correctly provide benefits to us. Likewise, PFOS and PFOA are well known to be PBT substances, but it is incorrect to assert that because of this, all PFAS compounds must also be PBT substances and therefore must have the same controls imposed upon them. PFAS only refers to the group of chemicals that includes, not exclusively, PFOS and PFOA. In short, all PFOS and PFOA are PFAS compounds, but not all PFAS compounds are PFOS and PFOA. Like tomatoes and potatoes, there are PFAS compounds that in the right circumstances have a safe 15and useful function. (See figure 2) Because of this many products contain and emit PFAS compounds that aren't PBT substances.19 Firefighting foams are no different. There are many important foam products that do not contain any or only trace amounts of PFOS or PFOA. It is imperative that the EPA makes a clear delineation between these three terms. Figure 3: Comparative chemical structures of PFOA (top left), PFOS (top right) and a C6 fluorotelomer (bottom). Credit: NZFS The comparative environmental impact of different foam substances Once there is a clear delineation between the terms PFAS, PFOS and PFOA, it is important to understand how this relates to the different types of foam chemistries PAGE 17 available, and the comparative environmental impacts of these chemistries. There are radical differences, of orders of magnitude in these substances based on the best current evidence. Certain foams today and in years past contained or degraded into significant quantities of PFOS and PFOA. There were two reasons for this 1). The use of ECF techniques to form the fluorinated compounds which is a somewhat random and uncontrollable process, leading to the production of incidental PFOS compounds as process contaminants, 2). The use of PFOA as a manufacturing product or additive and 3). The degradation of these compounds in the environment leading 17,20 to the formation of PFOS and PFOA. However, in recent decades, technological advances and a desire to move away from foams that contain or produce PBT substances have led to more refined techniques that have greatly lowered the environmental impact of some fluorinated foams. The first of these techniques is to do with the formation of the fluorocarbon surfactants. Instead of using ECF techniques, much more controllable process known as telomerisation was developed. This allows the formation of even carbon numbered perfluoroalkyl iodides that can then be used as fluorosurfactants. These compounds are in a different subgroup within PFAS substances, to PFOS and PFOA. By using telomerisation, incidental creation of 20 PFOS is avoided (unlike ECF) and are not manufactured from PFOA.Most of the foams using this process are based on what is known as C6 chemistry (see definition). (C6 will be used to refer to chemistries utilising 6 and less fully fluorinated carbon atoms in their makeup). These C6 fluorotelomers cannot degrade to produce PFOA by bio transformation. Both PFOS and PFOA are octonary organic molecules, meaning they are based on 8 fluorinated carbon atoms. As C6 fluorotelomers only contain 6 fluorinated carbon atoms it is impossible for these substances to degrade into either PFOS or any more than 21 trace amounts PFOA (many producing less than 15ppt). These C6 foams are not made from PFOA and contain 30 - 60% less fluorine than PFOS based products. In the past, trace amounts of PFOA were present as contaminants in these telomerised foams, however in recent years with the advances bought about by the voluntary US EPA PFOA stewardship program has resulted in the development of high purity foams that has virtually eliminated 22,23 PFOA in these foams.I am not an expert in the degradation of fluorinated compounds however Jimmy Seow et al have compiled extensive reports that, while acknowledging that there is much research still to be carried out on fluorotelomer foams, consistently shows C6 foams in the environment are significantly less of a concern than older foam PAGE 18 formulations that have created the contamination issues we are dealing with 24today. Consistently they are found to be very different from Legacy long chain foams because they are: - Not bioaccumulative - Not toxic to aquatic organisms and mammals - Not carcinogenic - Not mutagenic - Not genotoxic - Not developmental or reproductive toxins - Not Shown to be harmful to human health And therefore, cannot qualify for being considered a POP, as at least 2 of the 4 14 criteria have been found to not be met. Figure 4: A comparison of the half-lives of various PFAS substances in mammalian bodies. Caution should be exercised with these foam concentrations as we do not know the full and final effects these chemistries will have on the environment; however, an outright ban is overly restrictive and the benefits simply do not outweigh the . costs of this approachPAGE 19 Examples in other jurisdictions In the consultation document, it is stated that "The EPA...is of the view that the proposed amendments reflect best international practice". However, when the regulations of other jurisdictions are considered it becomes apparent that the proposed regulation is not reflective of international best practice, but rather an imitation of the most extreme international practice. Only one jurisdiction, South Australia, has implemented policies as strict as the proposed regulations. It should be noted that in Australia, there is no consensus that their regulations were either justified, necessary or beneficial. True international best practice would mean the rapid phaseout of C8 and greater foams, and other foams containing PFOS and significant quantities of PFAS, permitting the use of high purity C6 foams where the performance characteristics of fluorinated foams are reasonably required on a case by case basis in the opinion of industry professionals, and F3 foams or low fluorine foams (with a small amount of C6 fluorosurfactants permitted, <1%) to be used in all other applications with reduced containment and disposal requirements. Similarities to Ozone Protection Legislation There are striking similarities between the proposed group standard and its likely effects and the effects of ozone protection legislation on fire protection. Like the PFOS and PFOA, halon was a common and effective firefighting agent that had well understood, significant negative environmental effects, but significant firefighting benefits. In the case of Halon, the valid concerns were with destruction of the ozone layer, with Halon agents having an ozone depletion 25potential (ODP) of between 4 and 10 depending on the specific formulation. Like the problem foams, the industry was aware of the environmental issues and worked to find alternatives, while regulators sought to legislate the restriction of these substances. One of the most effective replacement agents developed was named Halotron 1, a formulation mainly consisting of HCFC-123. This was a breakthrough moment in the retirement of Halon. Like Halon, Halotron 1 was a clean agent, that being an PAGE 20 agent that leaves no residue after discharge, it did not displace oxygen or obscure vision, and was effective on A, B and E class fires. It also had very comparable performance for a given quantity, particularly in hand held extinguishers, and several benefits over halon, such as an ODP of 0.012 (between 0.3 and 0.12% of Halon) and a GWP (global warming potential) of just 77 (between 1.5 and 5% that 26 of Halon) and was much safer for human exposure. In much the same way, high purity C6 foams have been developed to replace legacy long chain foam, with significant environmental improvements, with comparable (and in some cases superior) performance, filling an important role in fire protection. However, the enthusiasm of governments around the world to act on their Halon problems came to be the demise of Halotron 1. Many governments, including in NZ had a crackdown on any and all substances that had any ODP. While this seemed like forward progress at the time, there was a significant negative impact on fire protection. The strictness of the new regulations meant that, although Halotron 1 had an ODP of 0.012, it was now a controlled substance and could only be imported for extinguishers with the explicit permission of the EPA on a case by case basis, when it could be clearly demonstrated that it was absolutely necessary for life safety. In practical terms this meant this product was all but impossible to import into the country. This had several unintended effects. Immediately the local aviation sector was without both access to Halon and any effective substitute, and were forced to accept more dangerous substitutes. In the wider fire protection industry, there was now no clean agent that was safe for use on both class A fires and Class E fires. Because of the difficulty of importing Halotron 1, it was not commercially viable to get extinguisher models approved to revised New Zealand standards, essentially making it impossible to meet the regulatory requirements surrounding pressure vessels. Several other consequences then followed. Despite the outlawing of halon and subsequent amnesties, members of the public were reluctant to relinquish their halon extinguishers as they knew they could not get a substitute replacement. Overtime, many of these extinguishers were used or slowly leaked, admitting halon to the atmosphere, and people ran the risk of their extinguishers not working in the event of a fire as Halon extinguishers could not be serviced or tested. Often out of desperation, halon extinguishers would be illegally imported in aircraft for use in general aviation. Over time alternatives to both Halon and Halotron 1 were developed for fixed suppression systems, the most common two substances being FM200 and FE-PAGE 21 36. Attempts have been made to incorporate these substances into handheld extinguishers but performance testing indicated they were not well suited for this application, FE-36 being the better performer of the two. While these HFC based products have zero ODP, they have extraordinarily high GWP, FM200 being 3200, 27and FE-36 being as high as 9000 (CO2 has a GWP of 1). For decades now these substances have been used and discharged into the atmosphere in the event of a system activation, which begs the question, what substances actually had the lower environmental impact? Additionally, throughout the last several decades, the public have not had access to a valuable firefighting tool and this too has consequences. Although essentially uncalculatable, there would've undoubtedly been significant property losses at times due to the unavailability of a Halotron 1 like agent, and people also having been put at elevated risk, particularly those in marine and aviation environments. Quite frankly I believe the only reason that, to my knowledge, use of a non-clean agent extinguisher in an aircraft has not been attributed to a crash yet is simply luck and the sill widespread use of Halon, or alternatively the difficulty in ascertaining the causes of light aircraft crashes. What is the Halotron 1 equivalent for foam? It might be high purity C6 formulations or it might be low-fluorine foam formations (an F3 base with a small amount of C6 chemistry added). Either way a regulatory approach that is too strict and inflexible will imitate the same mistakes, and therefore will create the same problems the fire protection industry has been grappling with since the introduction of Ozone protection legislation. Proposed Adjustments to Achieve Better Outcomes I would like to recommend several adjustments to the proposed standards to ensure net positive outcomes are obtained and as many problems as possible are avoided. These can be briefly summarised as the following: 1.Taking a graduated approach to the regulation of PFAS chemicals and firefighting foams, rather than the "line in the sand" approach being proposed. 2.Investigate the creation of a category of "low-fluorine" foams as an intermediate step between fully fluorinated foams and true F3 foams. 3.The creation of a licensing scheme or a similar process by which the importation, sale and use of various fluorinated foams is controlled by competent industry professionals who can apply their expertise and judgement on a case by case basis, PAGE 22 while still being accountable to the EPA and working within the framework prescribed. 4.Assistance from the EPA to ensure that current industry standards and guidelines can be changed to accurately reflect the new regulatory environment and ensure fair competition and clarity in the wider market. A GRADUATED APPROACH The current proposed approach of the EPA is very rigid and does not align with international or industry best practice, as outlined previously, or correspond accurately to the comparative environmental and performance costs and benefits. As an alternative I propose a graduated approach is adopted. The idea of this is to promote the use of F3 foams where ever practical and ensuring the most hazardous PFAS compounds are not used and are prohibited, while leaving a middle ground for the less hazardous modern C6 chemistries to be able to be used where required in the opinions of competent industry professionals. The three regulatory categories for foams would be: Fluorine Free – Foam formulations that do not contain any PFAS compounds. No additional restrictions on use, importation, discharge, and disposal. The recommended foam formulation. PAGE 23 High Purity C6 – Foam formulations based on high purity C6 chemistry (with limits set for the amount of contaminants present). To be used when, in the opinion of industry professionals (perhaps following a risk assessment), currently available or accessible F3 formulations are not appropriate. Shall only be disposed of through waste water networks or similar, and training use is not permitted unless specifically necessary. Low Purity C6 – Foam formulations based on C6 formulations with contaminant levels above the levels specified for High Purity C6. Only to be used when no high purity C6 foam is available and is absolutely necessary. Must be disposed of in an approved manner, and use for training is prohibited unless it can be fully contained. Prohibited Foams – All foam concentrations that are legacy PFOS formulations, or legacy FT formulation. Cannot be imported, discharged or used in systems. Only to be disposed of in accordance with the Basel Convention. This reflects agreed industry best practice as outlined by many industry bodies internationally, such as the FPA Australia, and FPA NZ . LOW FLUORINE CATEGORY Other industry professionals will be much better qualified than me to comment on this particular aspect, however I will put it forward nonetheless. Following on from the above, and bearing in mind the significant performance benefits obtained from small additions of C6 fluorosurfactants to F3 formulations, it may be beneficial to create another category of low-fluorine foams, as they could often be used as an alternative to C6 formulations. As to whether this is economically feasible, other people are in a better position to accurately answer this. LICENCING To avoid the problem facing the industry with Halotron 1, where every individual import requires a specific exemption from the EPA, a licencing scheme or a similar scheme should be introduced to aid in the importation and distribution of permitted PFAS foams. This would be administered by the EPA and could have two categories: PAGE 24 1.Licensed Importer – a person or organisation approved to import PFAS containing foams. A licensed imported may only sell to a... 2.Licensed Retailer – an industry professional or organisation suitably qualified in their area of expertise to carry out accurate risk assessments involving foam firefighting equipment. They are expected to have a thorough understanding of the environmental impacts of different foams, and may only sell the foam products to end users if, in their professional opinion, a PFAS containing foam is necessary. Only licensed retailers would be permitted to sell any PFAS containing foam. The guidance for these license holders would be given in an EPA produced Code of Practice, in much the same way approved fillers of pressure vessels are regulated. Failure to abide by the code of practice could then result in a license revocation or penalties. INDUSTRY ASSISTANCE FROM THE EPA This primarily relates to portable fire extinguishers, however people with expertise in other areas of the industry may have similar requirements. Currently there are restrictions outlined in the industry standard for the installation, servicing and maintenance of fire extinguishers surrounding the refilling of fire extinguishers. NZS 4503:2005, 6.4.6 states "Any fire extinguisher . . . shall be recharged in accordance with the manufacturers instructions," and "[Extinguishers] must only be recharged with the manufacturers specified extinguishant". Arguably (and some will argue the point ad nauseum) it is currently ambiguous as to whether or not this would permit refilling of C6 extinguishers with F3 foam, however I believe the intent of the clause is that like for like shall be used in recharging, of which F3 often is not comparable to C6. In the event restrictions are placed on the availability of C6 foam (with which the vast majority of in-service extinguishers are intended to use) many extinguishers will either have to be replaced, or be refilled with an F3 formulation. To assure industry consistency in the wake of changes bought about by the EPA, one of two things must happen: 1.If it is the intent of the EPA that the PFAS containing foam extinguishers currently in service are replaced with new F3 units, a clear statement from the EPA in association with the FPA of New Zealand must be made stating that C6 extinguishers are to be replaced, not refilled with F3 concentrate. (The possibility for an exception could be made, for example if a risk assessment suggests there is little additional risk to the site, or there is a signed waiver from the client). 2.If it is the intent of the EPA that the PFAS containing extinguisher are refilled with F3 foam, a donation to the amendment of NZS 4503 should me made to cover the costs of such an amendment, costs that otherwise must be met privately. 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Jho C, 2012 – You Tube Video "Flammable firefighting foams!" – Laboratory testing to verify fuel pickup of F3 foams www.youtube.com/watch?v=IuKRU-HudSU 6.Angus Fire, 2013 – You Tube Comparative video tests "AFFF v fluorine free foam", evidence slower extinction and poorer burnbacks without short-chain C6 fluorosurfactant additives, www.youtube.com/watch?v=3MG2fogNfdQ 7.Wilson Consulting; (2018) Submission to Joint Standing Committee on Foreign Affairs, Defence and Trade Parliamentary Inquiry: Management of PFAS in and around Defence Bases, p26. 8.https://www.youtube.com/watch?v=IuKRU-HudSU 9.https://www.flamestop.com.au/ 10.www.bfifire.com.au 11.Berki-Cold Preparation Guidelines 12.NZS 4503:2005 Section 6 13.AS 5062:2016 14.Wilson Consulting; (2018) Submission to Joint Standing Committee on Foreign Affairs, Defence and Trade Parliamentary Inquiry: Management of PFAS in and around Defence Bases, p22. PAGE 26 15.Dr Seow, Jimmy; (2013) Fire Fighting Foams with Perfluorochemicals - Environmental Review, p.19 16.Seaguard C6 Concentrate MSDS 17.NZFS; (2017) ENVIRONMENTAL ASSESSMENT OF EXISTING FIREFIGHTING FOAMS IN USE BY NEW ZEALAND FIRE SERVICE 18.Nordic Council of Ministers; (2019), THE COST OF INACTION - A socioeconomic analysis of environmental and health impacts linked to exposure to PFAS. 19.Wilson Consulting; (2018) Submission to Joint Standing Committee on Foreign Affairs, Defence and Trade Parliamentary Inquiry: Management of PFAS in and around Defence Bases, p7. 20.Dr Seow, Jimmy; (2013) Fire Fighting Foams with Perfluorochemicals - Environmental Review, p.10-19 21..Dynax Corporation, 2018 – Advert "All green for REACH 2020 ...3 years early!" confirming Environmentally More Benign foams achieved with ≥C6 concentrates and 22.Dr Seow, Jimmy; (2013) Fire Fighting Foams with Perfluorochemicals - Environmental Review, p.12 23.Wilson Consulting; (2018) Submission to Joint Standing Committee on Foreign Affairs, Defence and Trade Parliamentary Inquiry: Management of PFAS in and around Defence Bases, p9. 24.Dr Seow, Jimmy; (2013) Fire Fighting Foams with Perfluorochemicals - Environmental Review, p.19 - 21 25.https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances 26.Amerex Halotron 1 Product Information 27.https://www.gov.uk/guidance/calculate-the-carbon-dioxide-equivalent-quantity-of-an-f-gas

Clause

Do you have any comments about the workability of the draft amendments shown in the revised Group Standard in the Appendix? Please include the relevant clause and sub clause number in providing any feedback.

Notes

There are several areas of concern beyond the general issues outlined elsewhere in this submission: 1). Schedule 2, interpretation - small fire extinguisher - this is defined as "a fire extinguisher with a capacity of less than 90L and includes a hand held and mobile fire extinguisher". This has the potential to cause confusion and not achieve the outcomes desired by the EPA. A common size for mobile foam extinguishers is 100L; is it the intent of the EPA to exclude these extinguishers from this definition? Or does the use of the term "and includes" rather than "that is either" meant to indicate that any and every hand held and mobile fire extinguisher meets the definition, regardless of size? 2). Schedule 2, interpretation - fluorine free foam - This is defined as "a firefighting foam that does not contain PFAS". Is it the intent of the EPA to prohibit the use of high-performance foams branded as that contain small quantities (<0.5%) of C6 surfactants? 3). Schedule 2, 5 (2) - What will the term "reasonably practical" entail? 4). Schedule 2, 7 (1,b) - Why would Substances that are known to be unable to qualify as POPs be required to be disposed of as if they were POPs? Is that reasonable? 5). Schedule 3, interpretation - firefighting chemical- this includes the description of a foam being a product that is applied directly to the flame of a fire to extinguish the fire. One of the many benefits of firefighting foam is that is can be effective by being applied away from a flame to provide either a defensive or offensive means of firefighting. An example of this is laying down foam in the event of a fuel spill or applying foam in a manner that it is 'floated' towards a fire. There are several areas of concern beyond the general issues outlined elsewhere in this submission: 1). Schedule 2, interpretation - small fire extinguisher - this is defined as "a fire extinguisher with a capacity of less than 90L and includes a hand held and mobile fire extinguisher". This has the potential to cause confusion and not achieve the outcomes desired by the EPA. A common size for mobile foam extinguishers is 100L; is it the intent of the EPA to exclude these extinguishers from this definition? Or does the use of the term "and includes" rather than "that is either" meant to indicate that any and every hand held and mobile fire extinguisher meets the definition, regardless of size? 2). Schedule 2, interpretation - fluorine free foam - This is defined as "a firefighting foam that does not contain PFAS". Is it the intent of the EPA to prohibit the use of high-performance foams branded as that contain small quantities (<0.5%) of C6 surfactants? 3). Schedule 2, 5 (2) - What will the term "reasonably practical" entail? 4). Schedule 2, 7 (1,b) - Why would Substances that are known to be

unable to qualify as POPs be required to be disposed of as if they were POPs? Is that reasonable? 5). Schedule 3, interpretation - firefighting chemical- this includes the description of a foam being a product that is applied directly to the flame of a fire to extinguish the fire. One of the many benefits of firefighting foam is that is can be effective by being applied away from a flame to provide either a defensive or offensive means of firefighting. An example of this is laying down foam in the event of a fuel spill or applying foam in a manner that it is ‘floated’ towards a fire.


Photo Source: Stuff.co.nz

Submission on the Proposal to amend the Fire Fighting Chemicals Group Standard 2017

Connor Higgs | Firewatch Canterbury Ltd | 1/12/2019

Introduction

Thank you for the opportunity to submit on the EPAs proposed amendment to the firefighting chemicals group standard.

My family and I run a small business serving Christchurch and the greater Canterbury area with servicing, inspection, maintenance and sales and installation of fire extinguishers and automatic fire suppression systems, mainly for vehicles. I have taken an interest in the long-term sustainability of these two market areas, and have spent considerable time researching, among other things, the way firefighting foams interact with the environment.

While the quantity of firefighting foam both consumed and discharged into the environment by these two markets is small, it represents a large market value, and importantly an area in the industry where any proposed changes are likely to have a direct effect on the public.

I am no expert on industrial or first response firefighting, but I hope that in this submission my experience and perspective from my part of the industry can assist the EPA to make effective, reasonable and beneficial decisions in this matter.

I have serious concerns with some of the proposals discussed in this consultation document and the effects this would have on the environment, the industry and the public. I also have serious concerns that, from the information given in the consultation document, the EPA lacks a full and thorough understanding of the nuances of this complicated issue, and this will contribute to excessively restrictive regulations that will have little positive or even negative effects on the environment, as well as leading to greater risk exposure and the possibility of death or injury to first responders (both trained firefighters and members of the public using first aid equipment), greater property loss, and significant economic cost to the public, private businesses and government entities. In short, there is a very real potential that the costs will outweigh the benefits if the current proposal is accepted.

It is worth noting, in its current form, this proposal is likely to be very profitable for our business and businesses similar to ours; my motivation for this submission is not for financial gain, but rather to present accurate information to the EPA so the most accurate decisions can be made.

My concerns mainly revolve around the following areas:

1. The questionable grouping of all Fluorinated firefighting chemicals together as PFAS, when evidence suggests that there are orders of magnitudes of difference in the environmental impact of the many chemicals in the PFAS group.
2. Following on from 1, disproportionate concern and restrictions surrounding modern, high purity C6 foams.
3. The effectiveness of current F3 foams in real world and test scenarios
4. Compliance and approval concerns for retrofitting extinguishers and systems with F3 foams
5. The apparent departure from international and industry established best practice and following in the footsteps of the strictest jurisdictions rather than the most effective jurisdictions
6. The elevation of absolute environmental protection from fluorinated chemicals above all other measures of sustainability, creating a false economy on which important decisions will be based.

Contents

Definitions

BOD – Biological Oxygen Demand, a measure of the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample.
C6 - Foam concentrates made with fluorosurfactants with no more than 6 fully fluorinated carbon atoms.
C8 - Foam concentrates made with fluorosurfactants with no less than 8 fully fluorinated carbon atoms, that by their chemical nature often contain or degrade to POPs like PFOS, and PFOA
ECF – Electro Chemical Fluorination, a production technique for the formation of fluorocarbon-based compounds, using electrolysis as a key step in the synthesis of these compounds.
EPA - Environmental Protection Authority
F3 - Foam concentrates and/or solutions branded as Fluorine Free
PBT - Environmentally persistent, bioaccumulative and toxic, the criteria for a substance to be considered a persistent organic pollutant.
PFAS - Per and poly-fluoroalkyl Substances, a group of synthetic chemicals present in a range of manufactured goods. Two chemicals within this group, and within further subgroups are PFOS and PFOA, however many significantly less harmful compounds exist in this group.
PFOA - Perfluorooctanoic acid, a chemical found in, among other things C8 and greater foams, as a degradation product of C8 and greater foams, and in trace amounts as a production by product in other low purity foams. It has PBT characteristics.
PFOS - Perfluorooctanesulfonic Acid, a POP found in, among other things C8 and greater foams, and part of the PFAS family of chemicals.
POP - Persistent Organic Pollutant, as defined under the Stockholm Convention

Responses to Consultation Questions

1. WHAT IS THE REASON FOR MAKING A SUBMISSION?

The reason for making this submission is to assist in guiding the EPA in their decision making, avoiding negative outcomes for the public, for end users of foam firefighting products and the fire protection industry.

I believe my position within the industry and my knowledge and study of matters relating to firefighting foam products, specifically environmental effects in relation to portable and mobile fire extinguishers and fixed fire protection systems on mobile equipment will enable me to give some additional insight to the EPA.

From a financial point of view, me, my company, and many of my colleagues could have much to gain from the application of the group standard in its current form. However it is my belief that it is currently broad brush in its approach shows a lack of understanding in the differences in chemistry, capabilities and uses of different types of foam, will create health and safety problems for first responders (both professional and members of the public using hand operated equipment or systems) that does not correspond to any appropriate environmental benefit, will create significant and wide ranging compliance issues in the current regulatory framework that does not correspond to an appropriate environmental benefit, and will create significant financial costs that will fall disproportionately and unexpectedly on certain industries.

Further refinement is required for this change to be effective and reasonable, and I hope this document and the submissions of others will assist the EPA with this.

2. DO YOU WISH TO SPEAK IN A HEARING?

I have no specific need to be heard in a hearing, I believe this document outlines the concerns accurately. However, if you believe my perspective and position would be a valuable addition to any hearings, I would be willing to contribute.

3. WHAT IS YOUR PREFERRED OUTCOME OF THIS CONSULTATION?

The primary outcome from this consultation must be that the EPA listens to the feedback it receives and considers the evidence received makes its decisions based on this. I am certain you will receive thorough and detailed information from a range of sources with experience with firefighting foam products. I strongly expect many of these to be urging caution with the EPAs current approach.

4. DO YOU CONSIDER THERE ARE ANY APPLICATIONS FOR WHICH FLUORINE-FREE FOAMS ARE NOT SUITABLE OR DO NOT HAVE RELEVANT APPROVALS?

There are many applications where fluorine free foams are unsuitable.

The issue to be considered first is the definition of a fluorine free foam. Under the proposed definition of a fluorine free foam, that being:

"fluorine free firefighting foam means a firefighting foam that does not contain PFAS (or perfluoroalkyl and polyfluoroalkyl substances)"

absolutely zero PFAS Substances are permitted. However, in many, "high performance" F3 foams contain a small quantity of fluorosurfactants, usually <0.1%, and the technology to produce "pure F3 foams is still evolving".[1,2] Thus, the proposed restrictions would not permit many high performance F3 foams being used, or alternatively require ignorance to play a part in the application of this standard, something inconsistent with the principles of rule of law.

Moving on, most F3 foams perform worse than their C6 counterparts in several areas:

1. Repelling liquid fuels
2. Burnback resistance
3. Film forming, or self-healing capabilities
4. Foam Collapse
5. Fire extinction performance

Repelling liquid fuels - One of the key performance factors of an effective foam agent is its ability to repel liquid fuels from its surface. This is important because foam extinguishes fire by forming a foam 'seal' on top of the fuel source, excluding oxygen from the fuel, and cooling the fuel. Liquid fuel that finds its way on the top of the foam seal are exposed to oxygen and will resume combustion.

F3 Foams have consistently been shown to be poor at repelling liquid fuel, particularly in liquid fuel fires of any significant depth. (A small addition of fluorosurfactants dramatically increases the repelling properties in a logarithmic fashion,[2] but would not be permitted in the current standard). In practical terms, in the event of forceful application of F3 foam onto a hydrocarbon fire, as is the case in most emergency situations, F3 foams have been shown to be significantly less effective, or ineffective at controlling and extinguishing liquid fuel fires of depth (i.e. pooled liquids).[3] This is evidently caused by the inherent high detergency needed for alternative surfactants in F3 foam which has a tendency to absorb fuels into the foam bubbles.[4,5]

In practical terms this means that extinction of the fire is slower and requires more agent (often resulting in bigger fires as they continue to burn), and sudden flashbacks, flare ups and reignition is possible, putting people at risk.[3]

Burnback Resistance - Burnback resistance is the measure of how resistant a foam is to destruction by fire, or burning back. This is important as it directly relates to the capability of the foam to contain a fire, and a fire that cannot be effectively contained is a fire that cannot be extinguished. Foam is only extinguishing agent capable of containing a liquid fuel fire.

Modern C6 foams have excellent burnback resistance, comparable to or exceeding earlier C6> chemistries. F3 foams of many brands and types have consistently shown worse burnback resistance in comparison to C6 foams.[3,6] This is apparently very difficult to avoid due to the hydrocarbon surfactants required to avoid the use of fluorocarbons.

Once again, dramatic improvements have been demonstrated by adding small amounts (<0.1%) of C6 surfactants to F3 solutions, however this would be prohibited by the proposed standard.[2]

In practical terms this means fires are more difficult, or in extreme cases not possibly to contain and extinguish in an initial attack as the foam combusts at a rate faster than it can be applied safely. Additionally, in the event a fire has been contained in an initial attack, but remains burning, tests and experience have shown that reignition will occur significantly earlier with F3 foams in some situations.

Film Forming - Another of the key attributes of an effective foam is its ability to form a flexible and self-healing film over the fuel. It is imperative that this film is consistent across the fuel source, has the ability to 'flow' around minor obstacles without direct application to these areas and to reseal over a liquid fuel source when disturbed (such as by a firefighter advancing across pooled liquid with foam applied).

C6 Foams are generally thought to be the best product for these capabilities available that does not contain PFOS or have a >C6 chemistry, after all AFFF stands for Aqueous Film Forming Foam. F3 foams have once again often been shown to be inferior in this aspect, as they generally do not have this film forming ability.

A lack of real-world experience with the range of F3 foams in real life situations has made it difficult to determine if they have sufficient film forming capabilities beyond pre-determined testing regimes.[7]

Foam Collapse - Foam is often applied in an aspirated form, creating a layer of bubbles. Like all detergent bubbles they are subject to deterioration and collapse. This is another area where many F3 foams perform worse than their C6 counterparts. Repeated tests have demonstrated the foam collapses quicker in many circumstances, this being a major contributing factor to the burn back resistance and film forming capabilities or lack thereof. This is also related to the lack of fuel repellant abilities currently available, as reignition of fuel on the foam itself further deteriorates the foam structure.[8]

Fire Extinction Performance - All the above 4 factors contribute to significantly poorer performance of F3 foams when compared to C6 foams. This results in longer burn times, significantly more agent application (many sources indicate 2-3 times as much agent), significantly more pollution from the continued burning of the fire (including PFAS emissions from the fire itself into the atmosphere and in firewater run off), higher exposure to risk for the public and firefighters, and greater loss to property.[7]

A clear, standardized example of this is in portable fire extinguishers. For aspirating extinguishers 9L is the only size generally produced and performance tested AS/NZS 1850. For many years C6 foams have held a 30B rating (the larger the number the bigger the fire), yet with the introduction of F3 foams, common ratings were initially 10B, with the most high-performance units achieving a 20B rating. In certain situations, the ratings were as low as 5B.[9,10]

Of course, not all F3 foams are completely unsuitable for the task at hand. In some of these areas mentioned above specific types of F3 foam may perform better than a C6 counterpart. However, there is yet to be a drop-in substitute that is equal to or better than C6 foam formulations for all of these areas to my knowledge. Those that display similar performance often require specialized preparation and are for specific equipment only (such a certain brand of aspirating foam extinguishers).

Foam Property	Advantage	AFFF	F3
Fuel Repellency *	Yes	Yes	No
Fuel Shedding	High	High	Low
Fuel Pickup	Low	Low	High
Film Formation*	Yes	Yes	No
Foam spreading on fuel*	Yes	Yes	No
Fuel spreading on foam*	No	No	Yes
Fuel emulsification	Low	Low	High
Flammability of contaminated foam	Low	Low	High
Degradation of contaminated foam	Low	Low	High
Heat resistance of foam	High	High	Low

*Fundamental differences between AFFF and F3 foams

Figure 1 : A comparative analysis of typical performance characteristics of AFFF (C6) and F3 foams. Credit: Wilson Consulting.

There are certain specific applications where non-fluorinated foams are also generally poorly suited. The high performance F3 foams often require extensive mixing to emulsify the concentrate into a solution prior to use. This period is often temperature controlled and the mixing may have to go on for as long as 48 hours. The chemistry of these foams requires this to ensure the thick concentrates remain suitably emulsified in a solution ready for use. [11]

Many applications require what is known as a foam induction system, where the foam concentrate is mixed into the flow of water at the time of use. This is often for logistical reasons, it is impractical to store and transport 20, 30 or 100 times more water than concentrate to have a complete solution on hand rather than a tank of concentrate bought to an existing water source. These systems are the most common way of applying large quantities of foam. However, with a thick concentrate that needs days of preparation before use, it is obviously impossible to use these high-performance concentrates in induction systems, creating yet another design challenge for manufacturers.

AR-AFFF or Alcohol Resistant AFFF is widely acknowledged as the most effective agent for dealing with polar solvent fires, such as methanol, and ethanol. This is also based on fluorocarbon surfactants and C6 versions are widely available. As it stands currently only some F3 foams are alcohol resistant, and the ones that are demonstrate significantly poorer performance than fluorinated AR foams.[9] Until there is a comparable product, a prohibition on fluorinated foams increase the health, safety and property loss risks of those dealing with flammable polar solvents, including areas such as Motorsport where they are heavily dependent on these foams.

New Zealand, like most other developed nations has rules and standards surrounding the construction and performance of fire extinguishers and fire suppression systems. Comprehensive and expensive product certification and approval processes are designed to ensure that all products supplied are of suitable quality and performance. Additionally, the fire protection industry works to a range of standards designed to keep the quality of work consistent and keep this equipment always ready to operate to the original manufacturers specification.

With these factors in mind my message is simple. F3 foams are not suitable for any extinguisher or fire suppression system not explicitly engineered for use with F3 foams and approved as such, under the current testing and maintenance standards. As such, if the current proposal was to go ahead, strict adherence to the standards (specifically NZS 4503:2005 for hand operated firefighting equipment and AS 5062:2016 for mobile equipment suppression systems, etc) would mean the wholesale replacement of thousands of otherwise functional extinguishers and millions of dollars' worth of fire suppression systems either having to be extensively reengineered where possible or replaced in vehicles and other special hazard areas across NZ.[12, 13]

This puts those in the industry in the awkward (although potentially profitable) position of replacing otherwise completely adequate equipment, while other less professional members of the industry could and will attempt to undercut others by 'bending' the rules. This is a separate issue that could be avoided and will be discussed later.

Regardless, the proposed standard in its current for is unsuitable for will result in significant costs to the end users of foam extinguishers and systems.

Due to the often-poorer performance of F3 foams compared to C6 foams the simple reality is they are potentially not suited for a range of situations where a high risk of a significant B class fire. Large industrial and transport facilities such as ports, fuel storage facilities, airports, defense facilities, industrial plants, factories, production facilities, mines and large agricultural facilities are all locations in New Zealand where the best protection possible is required for an effective fire response. Industrial firefighting is outside my area of expertise to I will not expand in this area any further.

There are also innumerable smaller locations across New Zealand where foam fire extinguishers, both portable and mobile are the first line of defense against a class B fire. In many situations, after a risk assessment in accordance with the relevant regulations and standards, C3 extinguishers could be substituted with F3 extinguishers. However, in other higher hazard areas, extinguishers with F3 foam simply do not have high enough fire test ratings to be suitable for these risk areas in accordance with the relevant standards and regulations. For example, the Health and Safety at Work (Hazardous Substances) regulations require a certain number of extinguishers to be installed in the presence of certain quantities of hazardous substances. One of the performance criteria for this is the extinguisher having a 30B rating, and often a foam extinguisher is the only suitable or appropriate extinguisher. As discussed earlier, no F3 foam available are available with a 30B rating, and any that will in the foreseeable future will likely contain a small amount of C6 fluorosurfactants (<1%), and will be prohibited under the proposed standard.

I feel strongly that the EPA is asking the wrong question here. The important question is not 'are there situations in which F3 foams are unsuitable', (the answer to that is yes) but rather 'In what circumstances would you consider the minor environmental benefits using F3 are outweighed by the performance restrictions of F3 foam". In all the above situations, the bottom line is there are few situations, in industrial and first response firefighting, in fire suppression systems and in extinguishers where F3 foam couldn't be used, however whether or not it is appropriate when all factors are considered, the health and safety risks to the operators and public, the potential for further property losses, the financial costs of properly converting extinguishers and systems to F3 foam, the environmental impacts C6 foam, the environmental impacts of increased burn time of fires and fire risk and the costs of proper disposal, is a different question that can only be answered by experienced personnel on a case by case basis.

5. WHAT DO YOU THINK OF THE PRACTICALITY OF THESE CLEANING REQUIREMENTS, IN TERMS OF THE RESOURCES AND COSTS INVOLVED?

For all C6 foams these requirements are a needless complication. The reality is for all foams the actual proportion of PFAS in concentrate is so low it is of little concern overall. In most if not all 6% C6 concentrates there is <5% volume of fluorocarbon surfactants. The actual number is likely lower; however, the exact ratios are often trade secrets. <5% of whatever residue left over I'm a System in my opinion simply is not worth worrying about for C6 foams given they are not toxic, or bioaccumulative and they are water soluble. It's even less of an issue in premixed solutions forum in systems and extinguishers, where the concentrate itself only makes usually only 6% of the total agent, the other 94% being potable water. In that situation, the fluorosurfactants only make up 0.3% of the total agent volume. 0.3% of the residual amount of solution left in a container that is nontoxic, and not bioaccumulative is simply of no benefit to specifically remove through an approved process when compared against the effort and expense. [14,15,16]

C8 foams may be a different story, they are far more environmentally damaging, being known and demonstrated to degrade into POPs, and will require more thorough processing.

Only substances known to contain POPs in significant quantities should be required to be disposed of in accordance with the Basel Convention.

6. WHAT DO YOU THINK OF THE PRACTICALITY OF THESE DISPOSAL PROVISIONS, IN TERMS OF THE RESOURCES AND COSTS INVOLVED?

Once again, all fluorinated foams are treated as similar and there is insufficient graduation between types that corresponds to their environmental and health effects.

>C6 foams should absolutely be disposed of in a manner that prevent their total escape into the environment as they are known to contain and be precursors to POPs.

Foams using less than or equal to C6 chemistry only should not have the same restriction imposed upon them because they are not POPs, as they are not toxic or bioaccumulative. Waste water disposal should be sufficient for these foams. Only substances known to contain POPs in significant quantities should be required to be disposed of in accordance with the Basel Convention.[14, 15]

Additionally, investigations should be made into the feasibility of using activated carbon filtration techniques to adsorb the fluorocarbons from foam solutions as is done overseas to some success.

7. WOULD YOUR BUSINESS BE ABLE TO CONTAIN ALL FOAM WASTES?

No. And I strongly disagree that there is any mandate for doing so with all foam wastes. Once again there is an insufficient graduation between F3 foams, C6 foams, and >C6 foams.

All >C6 foam wastes should be contained as they contain POPs and precursors to POPs in quantities well above international thresholds.

C6 foams should only be required to be contained where practical. Certain activities such as testing, use of systems and extinguishers to extinguish fires, required discharge tests particularly on suppression systems, and specific training requirements that require fluorinated C6 foams (for example AR-AFFF training).

There is no reason F3 foam waste should be contained other than as required by the RMA and in accordance with any MSDS. F3 foams are completely biodegradable, and are nontoxic and not bioaccumulative (like C6 foams). They do have somewhat higher BOD and COD requirements than other foams so care should be used around discharges reaching freshwater. A code of practice would be sufficient to give guidance on correct methods of disposal. [17]

8. IF NOT, IS THIS DUE TO COST OR PRACTICAL DIFFICULTIES?

Cost and practicality are two sides of the same coin; anything is practical if enough financial resources are willing to be expended.

Practical difficulties are the primary problem. There is no practical way to catch all foam from a required test discharge of a suppression system on heavy machinery, particularly when it is in a remote location such as a forestry site.

As outlined in 7, there is little reason at all why C6 and to a greater extent F3 foams should be contained at all.

9. DO YOU HAVE ANY CONCERNS ABOUT FLUORINE-FREE FOAMS POTENTIALLY CONTAINING OTHER PERSISTENT, TOXIC AND/OR BIOACCUMULATIVE COMPOUNDS?

No.

In my discussions with people within the industry this is the least of their worries with F3 foams, the bigger concerns being the poorer performance of F3 foams and the apparent belief of some regulatory bodies that F3 foams are a “silver bullet” for foam contamination issues.

10. WHICH OPTION FOR ADDRESSING THESE CONCERNS DO YOU PREFER AND WHY?

This is not my area of expertise, and other people are better qualified to accurately answer this question. However, my concern with option 2 is that foam manufacturer and/or importers are not going to want to explicitly divulge the specific composition of their F3 foams as it is highly commercially sensitive information. The result could be an unavailability of certain concentrates as companies refuse to specify the makeup of their product.

11. DO YOU AGREE WITH PHASING OUT C6 AFFF AT THE SAME TIMEFRAME AS C8 AFFF?

No.

Once again it is inferred that C6 chemistry and C8 and greater chemistry are similar and directly comparable thus needing a similar response from the EPA. They are not comparable in their environmental effects, high purity C6 is not toxic, is not bioaccumulative does not contain PFOS, and cannot degrade into PFOA. [14, 15]

Additionally, the fire protection industry and firefighters are significantly more reliant on C6 foams as they have been developed as the alternative to C8 and greater foams. In many situations, like for like F3 foams simply do not exist, so performance compromises are necessary. [17]

It is my opinion there is no reasonable justification on the grounds of environmental protection and health concerns alone to phase out C6 foams completely. Industry studies have repeatedly come to the conclusion that C8 foams should be prohibited and destroyed, C6 foams should be used as alternatives to C8 and greater foams where required and F3 foams should be the gold standard to be used anywhere it is practical and safe to do so when all factors are considered.

Instead of phasing out both C6 and C8 foams, the best outcome would be a phase out C8 foams immediately, restrict C6 foam for necessary practical uses as described in a comprehensive code of practice, and encourage F3 foams wherever practical on new equipment.

12. WHICH IS YOUR PREFERRED OPTION?

Neither. In my opinion both options are deeply flawed and are likely to cause more harm than good when all factors are considered.

13. WHAT ARE YOUR REASONS?

While F3 foam technology is highly valuable and will continue to progress, C6 foams are at times, currently a necessary and safe tool to use in fighting fires. In this consultation document the EPA fails to demonstrate an understanding of this fact and the proposed changes are likely to result in more harm than good. How will the EPA answer if someone is killed or injured and a contributing factor is found to be an inability to source effective firefighting foam?

14. CAN YOU ESTIMATE THE COST TO YOUR BUSINESS OF PHASING OUT C6 AFFF?

No. The reality is in our situation the end user always pays and unfortunately any costs will have to be passed on to our customers, however indirect costs are difficult to estimate. Costs for disposing of Foam concentrates in an "approved manner" will depend on what that approved manner is. I am not familiar with the costs of disposal methods required by the Basel Convention.

We are a small sized company with a small customer base; however, I could see costs in the hundreds of thousands of dollars collectively for our customers, with most of the costs falling in the rural communities and on heavy equipment operators.

15. DO YOU HAVE ANY OTHER COMMENTS TO MAKE ABOUT THE PROPOSED AMENDMENTS?

I have deep concerns that the EPA has a lack of understanding of the difference in environmental impacts of C8 and C6 foams, how low the environmental impact of modern high purity C6 foams, the differences in practical terms between PFAS, PFOS and PFOA and their relationship to the environment, the shortcomings of F3 foams, the approval and testing process for fire extinguishers and fire systems, existing regulatory requirements surrounding extinguishers and fire systems.

16. DO YOU HAVE ANY COMMENTS ABOUT THE WORKABILITY OF THE DRAFT AMENDMENTS SHOWN IN THE REVISED GROUP STANDARD IN THE APPENDIX? PLEASE INCLUDE THE RELEVANT CLAUSE AND SUB-CLAUSE NUMBER IN PROVIDING ANY FEEDBACK.

There are several areas of concern beyond the general issues outlined elsewhere in this submission:

1). Schedule 2, interpretation - small fire extinguisher - this is defined as “a fire extinguisher with a capacity of less than 90L and includes a hand held and mobile fire extinguisher”.

This has the potential to cause confusion and not achieve the outcomes desired by the EPA. A common size for mobile foam extinguishers is 100L; is it the intent of the EPA to exclude these extinguishers from this definition? Or does the use of the term “and includes” rather than “that is either” meant to indicate that any and every hand held and mobile fire extinguisher meets the definition, regardless of size?

2). Schedule 2, interpretation - fluorine free foam - This is defined as “a firefighting foam that does not contain PFAS”. Is it the intent of the EPA to prohibit the use of high-performance foams branded as that contain small quantities (<0.5%) of C6 surfactants?

3). Schedule 2, 5 (2) - What will the term “reasonably practical” entail?

4). Schedule 2, 7 (1,b) - Why would Substances that are known to be unable to qualify as POPs be required to be disposed of as if they were POPs? Is that reasonable?

5). Schedule 3, interpretation - firefighting chemical- this includes the description of a foam being a product that is applied directly to the flame of a fire to extinguish the fire. One of the many benefits of firefighting foam is that is can be effective by being applied away from a flame to provide either a defensive or offensive means of firefighting. An example of this is laying down foam in the event of a fuel spill or applying foam in a manner that it is ‘floated’ towards a fire.

The Importance of Environmental Protection

We only have one environment that we must all share, and it goes without saying we should protect it from pollution and contamination.

However, the extent that we go to protect the environment cannot be absolute, it must be relative to other factors. After all, the reason we protect the environment in the first place is to try and ensure positive outcomes for people, both now and in the future. If the level to which we expend our resources to protect one aspect of environment results in too much cost to people or too much cost to other areas of the environment, the results will be net negative. Like all things, protection of the environment has costs and benefits and the factors that contribute to these costs and benefits must be carefully considered.

A concerning feature of the EPAs consultation document, and one that commentators and submitters also found concerning in the consultation for and subsequent change of similar regulations in other jurisdictions, is the inferred philosophy that there is no sustainable or acceptable level of risk to the environment and that protection of the aspect of the environment under consideration is the primary and highest priority in any decision making.

This negates the simple truth that protection of the environment is one of several factors incorporated in the ideas of sustainability and the wellbeing of a society. By reasoning solely or with too much emphasis on a single metric, we develop tunnel vision, lose our perspective on the influence our decisions have in wider areas, and paint ourselves towards a false economy where the decisions we make will inevitably be poor.

For the EPAs revision of this group standard to bring better outcomes for both the environment and New Zealand, it is imperative that the current absolutist position is moved away from, and that wider factors outlined in these submissions are listened to and considered.

The Difference Between PFAS, PFOS and PFOA

The fluorinated compounds PFOS and PFOA have become well known compounds in recent times, owing to a series of serious, high profile cases of contamination in a range of countries. PFAS is also a name commonly associated with these events. However, it is important that we correctly understand the nature of these three terms to make effective decisions on their use.

I find it concerning that the EPA (possibly following the lead of the Nordic Report)[18] uses PFAS as a catchall phrase to describe fluorinated foam compounds that are associated with PBT characteristics and that are responsible for these contamination incidents. Whether this is intentional or not, it is confusing for the public and not representative of the reality of these substances or the environmental hazards presented by them. It is approaching a fallacy of composition.

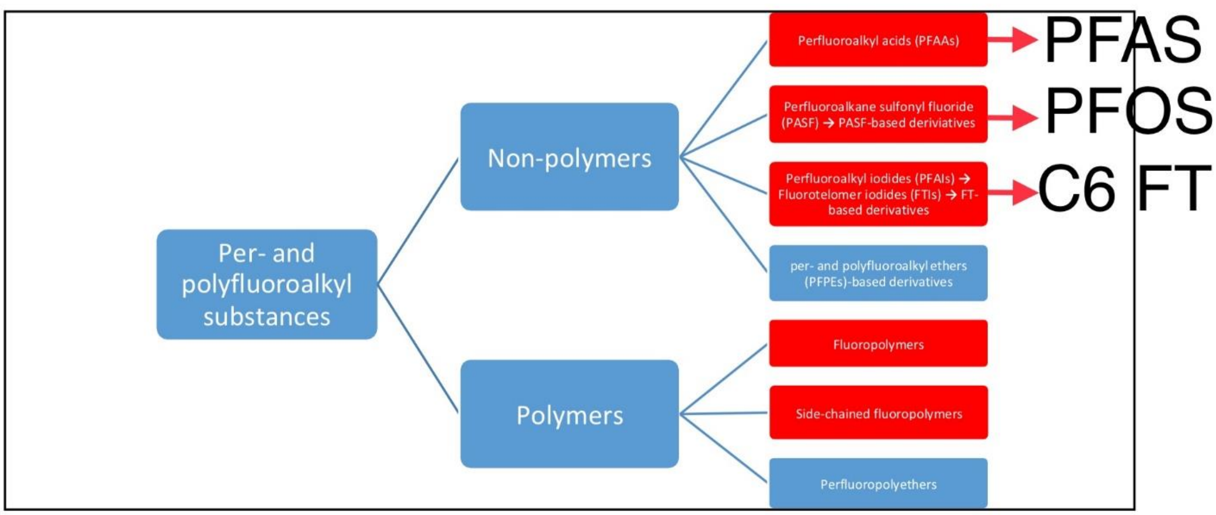

Figure 2: Classification of per- and poly-fluoroalkyl substances according to the OECD, with the relevant locations of PFOS, PFOA and C6 Fluorotelomers located within their appropriate subgroups. Credit: NZFS, additions by myself.

The family of nightshade plants could be used as an example to illustrate. We know from evidence that deadly nightshade is a very hazardous plant for human consumption. But it would be inaccurate to suggest that all nightshades are unfit for human consumption and must be avoided. Why? Because tomatoes and potatoes are both common plants in the nightshade family that, when used correctly provide benefits to us. Likewise, PFOS and PFOA are well known to be PBT substances, but it is incorrect to assert that because of this, all PFAS compounds must also be PBT substances and therefore must have the same controls imposed upon them. PFAS only refers to the group of chemicals that includes, not exclusively, PFOS and PFOA. In short, all PFOS and PFOA are PFAS compounds, but not all PFAS compounds are PFOS and PFOA. Like tomatoes and potatoes, there are PFAS compounds that in the right circumstances have a safe and useful function.[15] (See figure 2)

Because of this many products contain and emit PFAS compounds that aren't PBT substances.19 Firefighting foams are no different. There are many important foam products that do not contain any or only trace amounts of PFOS or PFOA. It is imperative that the EPA makes a clear delineation between these three terms.

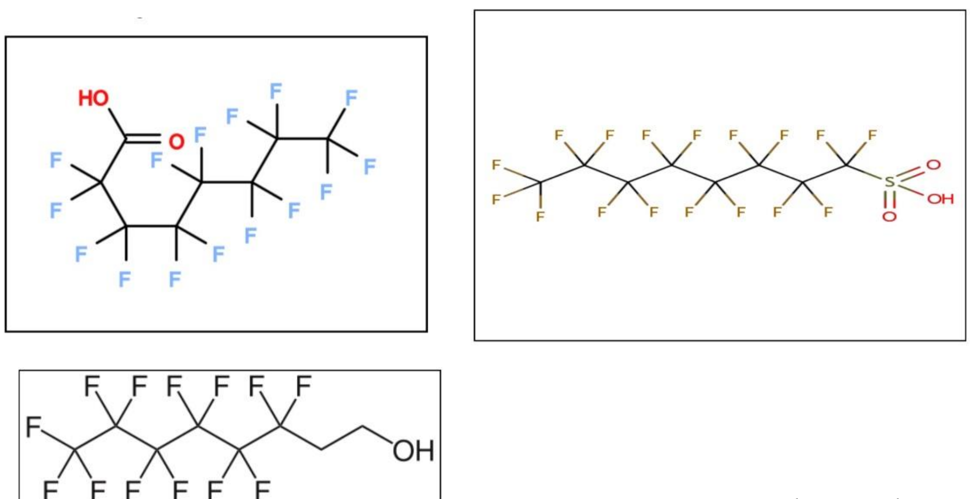

Figure 3: Comparative chemical structures of PFOA (top left), PFOS (top right) and a C6 fluorotelomer (bottom). Credit: NZFS

The comparative environmental impact of different foam substances

Once there is a clear delineation between the terms PFAS, PFOS and PFOA, it is important to understand how this relates to the different types of foam chemistries available, and the comparative environmental impacts of these chemistries. There are radical differences, of orders of magnitude in these substances based on the best current evidence.

Certain foams today and in years past contained or degraded into significant quantities of PFOS and PFOA. There were two reasons for this 1). The use of ECF techniques to form the fluorinated compounds which is a somewhat random and uncontrollable process, leading to the production of incidental PFOS compounds as process contaminants, 2). The use of PFOA as a manufacturing product or additive and 3). The degradation of these compounds in the environment leading to the formation of PFOS and PFOA. [17,20]

However, in recent decades, technological advances and a desire to move away from foams that contain or produce PBT substances have led to more refined techniques that have greatly lowered the environmental impact of some fluorinated foams. The first of these techniques is to do with the formation of the fluorocarbon surfactants. Instead of using ECF techniques, much more controllable process known as telomerisation was developed. This allows the formation of even carbon numbered perfluoroalkyl iodides that can then be used as fluorosurfactants. These compounds are in a different subgroup within PFAS substances, to PFOS and PFOA. By using telomerisation, incidental creation of PFOS is avoided (unlike ECF) and are not manufactured from PFOA.[20]

Most of the foams using this process are based on what is known as C6 chemistry (see definition). (C6 will be used to refer to chemistries utilising 6 and less fully fluorinated carbon atoms in their makeup). These C6 fluorotelomers cannot degrade to produce PFOA by bio transformation. Both PFOS and PFOA are octonary organic molecules, meaning they are based on 8 fluorinated carbon atoms. As C6 fluorotelomers only contain 6 fluorinated carbon atoms it is impossible for these substances to degrade into either PFOS or any more than trace amounts PFOA (many producing less than 15ppt). [21]

These C6 foams are not made from PFOA and contain 30 - 60% less fluorine than PFOS based products. In the past, trace amounts of PFOA were present as contaminants in these telomerised foams, however in recent years with the advances bought about by the voluntary US EPA PFOA stewardship program has resulted in the development of high purity foams that has virtually eliminated PFOA in these foams.[22,23]

I am not an expert in the degradation of fluorinated compounds however Jimmy Seow et al have compiled extensive reports that, while acknowledging that there is much research still to be carried out on fluorotelomer foams, consistently shows C6 foams in the environment are significantly less of a concern than older foam formulations that have created the contamination issues we are dealing with today.[24] Consistently they are found to be very different from Legacy long chain foams because they are:

- Not bioaccumulative
- Not toxic to aquatic organisms and mammals
- Not carcinogenic
- Not mutagenic
- Not genotoxic
- Not developmental or reproductive toxins
- Not Shown to be harmful to human health

And therefore, cannot qualify for being considered a POP, as at least 2 of the 4 criteria have been found to not be met.[14]

Measurement	PFOS (ECF)	PFHxS (ECF)	PFOA (ECF), [reaction trace in FT]	PFHxA [FT]
Half life in rats	3mths	7 days	1-6 days	1-2 hrs
Half life in monkeys	3-6mths	4mths	3 Wks	1-2 days
Half life in **humans**	5.4yrs	8.5 yrs	3.8yrs	Av. 32 days

NB: (ECF) = ElectroChemical Fluorination process
[FT] = FluoroTelomer process

Sources:
Russell 2013, Elimination Kinetics Perfluorohexanoic Acid in Humans & comparison rats & monkeys;
Rotander 2015, Novel fluorinated surfactants tentatively identified in firefighters by controlled approach;
Environ Int'l 2014, Assessment of POP criteria for specific short-chain perfluorinated Alkyl substances;
Olsen 2007, Half-life serum elimination of PFOS, PFHxS, PFOA in retired fluorochemical production workers;
OECD 2013 - Synthesis of PFCs

Figure 4: A comparison of the half-lives of various PFAS substances in mammalian bodies.

Caution should be exercised with these foam concentrations as we do not know the full and final effects these chemistries will have on the environment; however, an outright ban is overly restrictive and the benefits simply do not outweigh the costs of this approach.

Examples in other jurisdictions

In the consultation document, it is stated that “The EPA...is of the view that the proposed amendments reflect best international practice”.

However, when the regulations of other jurisdictions are considered it becomes apparent that the proposed regulation is not reflective of international best practice, but rather an imitation of the most extreme international practice. Only one jurisdiction, South Australia, has implemented policies as strict as the proposed regulations.

It should be noted that in Australia, there is no consensus that their regulations were either justified, necessary or beneficial.

True international best practice would mean the rapid phaseout of C8 and greater foams, and other foams containing PFOS and significant quantities of PFAS, permitting the use of high purity C6 foams where the performance characteristics of fluorinated foams are reasonably required on a case by case basis in the opinion of industry professionals, and F3 foams or low fluorine foams (with a small amount of C6 fluorosurfactants permitted, <1%) to be used in all other applications with reduced containment and disposal requirements.

Similarities to Ozone Protection Legislation

There are striking similarities between the proposed group standard and its likely effects and the effects of ozone protection legislation on fire protection.

Like the PFOS and PFOA, halon was a common and effective firefighting agent that had well understood, significant negative environmental effects, but significant firefighting benefits. In the case of Halon, the valid concerns were with destruction of the ozone layer, with Halon agents having an ozone depletion potential (ODP) of between 4 and 10 depending on the specific formulation.[25] Like the problem foams, the industry was aware of the environmental issues and worked to find alternatives, while regulators sought to legislate the restriction of these substances.

One of the most effective replacement agents developed was named Halotron 1, a formulation mainly consisting of HCFC-123. This was a breakthrough moment in the retirement of Halon. Like Halon, Halotron 1 was a clean agent, that being an agent that leaves no residue after discharge, it did not displace oxygen or obscure vision, and was effective on A, B and E class fires. It also had very comparable performance for a given quantity, particularly in hand held extinguishers, and several benefits over halon, such as an ODP of 0.012 (between 0.3 and 0.12% of Halon) and a GWP (global warming potential) of just 77 (between 1.5 and 5% that of Halon) and was much safer for human exposure. [26]

In much the same way, high purity C6 foams have been developed to replace legacy long chain foam, with significant environmental improvements, with comparable (and in some cases superior) performance, filling an important role in fire protection.

However, the enthusiasm of governments around the world to act on their Halon problems came to be the demise of Halotron 1. Many governments, including in NZ had a crackdown on any and all substances that had any ODP. While this seemed like forward progress at the time, there was a significant negative impact on fire protection. The strictness of the new regulations meant that, although Halotron 1 had an ODP of 0.012, it was now a controlled substance and could only be imported for extinguishers with the explicit permission of the EPA on a case by case basis, when it could be clearly demonstrated that it was absolutely necessary for life safety. In practical terms this meant this product was all but impossible to import into the country.

This had several unintended effects. Immediately the local aviation sector was without both access to Halon and any effective substitute, and were forced to accept more dangerous substitutes. In the wider fire protection industry, there was now no clean agent that was safe for use on both class A fires and Class E fires. Because of the difficulty of importing Halotron 1, it was not commercially viable to get extinguisher models approved to revised New Zealand standards, essentially making it impossible to meet the regulatory requirements surrounding pressure vessels.

Several other consequences then followed. Despite the outlawing of halon and subsequent amnesties, members of the public were reluctant to relinquish their halon extinguishers as they knew they could not get a substitute replacement. Overtime, many of these extinguishers were used or slowly leaked, admitting halon to the atmosphere, and people ran the risk of their extinguishers not working in the event of a fire as Halon extinguishers could not be serviced or tested. Often out of desperation, halon extinguishers would be illegally imported in aircraft for use in general aviation.

Over time alternatives to both Halon and Halotron 1 were developed for fixed suppression systems, the most common two substances being FM200 and FE-

36. Attempts have been made to incorporate these substances into handheld extinguishers but performance testing indicated they were not well suited for this application, FE-36 being the better performer of the two. While these HFC based products have zero ODP, they have extraordinarily high GWP, FM200 being 3200, and FE-36 being as high as 9000 (CO_2 has a GWP of 1).[27] For decades now these substances have been used and discharged into the atmosphere in the event of a system activation, which begs the question, what substances actually had the lower environmental impact?

Additionally, throughout the last several decades, the public have not had access to a valuable firefighting tool and this too has consequences. Although essentially uncalculatable, there would've undoubtedly been significant property losses at times due to the unavailability of a Halotron 1 like agent, and people also having been put at elevated risk, particularly those in marine and aviation environments. Quite frankly I believe the only reason that, to my knowledge, use of a non-clean agent extinguisher in an aircraft has not been attributed to a crash yet is simply luck and the sill widespread use of Halon, or alternatively the difficulty in ascertaining the causes of light aircraft crashes.

What is the Halotron 1 equivalent for foam? It might be high purity C6 formulations or it might be low-fluorine foam formations (an F3 base with a small amount of C6 chemistry added). Either way a regulatory approach that is too strict and inflexible will imitate the same mistakes, and therefore will create the same problems the fire protection industry has been grappling with since the introduction of Ozone protection legislation.

Proposed Adjustments to Achieve Better Outcomes

I would like to recommend several adjustments to the proposed standards to ensure net positive outcomes are obtained and as many problems as possible are avoided. These can be briefly summarised as the following:

1. Taking a graduated approach to the regulation of PFAS chemicals and firefighting foams, rather than the "line in the sand" approach being proposed.
2. Investigate the creation of a category of "low-fluorine" foams as an intermediate step between fully fluorinated foams and true F3 foams.
3. The creation of a licensing scheme or a similar process by which the importation, sale and use of various fluorinated foams is controlled by competent industry professionals who can apply their expertise and judgement on a case by case basis,

while still being accountable to the EPA and working within the framework prescribed.

4. Assistance from the EPA to ensure that current industry standards and guidelines can be changed to accurately reflect the new regulatory environment and ensure fair competition and clarity in the wider market.

A GRADUATED APPROACH

Class B foam products

Legacy PFOS	Legacy fluorotelomer	'Modern' fluorotelomer	Fluorine-free foams
• Aqueous film-forming foam • Manufactured from 1960's to 2002 • Contain: ○ perfluorooctanesulfonic acid (PFOS) – classified as a POP ○ perfluorooctanoic acid (PFOA) – classified as a POP in May 2019 ○ perfluorohexanesulfonic acid (PFHxS) – expected to be classified as a POP in 2021	• Aqueous film-forming foam • Manufactured from 1970's to 2016 • Contain some long-chain PFAS (C8[2]) • Can contain PFOA-related compounds (C8) recently added as a POP in the Stockholm Convention	• Aqueous film-forming foam • Currently in manufacture • Contain almost exclusively short-chain PFAS (C6) • Not listed as a POP in the Stockholm Convention. • Conference of Parties of Stockholm Convention in May 2019 recommended against replacing C8 foam products with C6 foam products.	• Referred to as F3. • Do not form an aqueous film-forming foam • Free of persistent fluorosurfactants (PFAS) • Some F3 products available that are considered viable alternatives to fluorinated foams. • Most foam manufacturers now produce Class B F3, and performance specifications continue to improve.

The current proposed approach of the EPA is very rigid and does not align with international or industry best practice, as outlined previously, or correspond accurately to the comparative environmental and performance costs and benefits. As an alternative I propose a graduated approach is adopted. The idea of this is to promote the use of F3 foams where ever practical and ensuring the most hazardous PFAS compounds are not used and are prohibited, while leaving a middle ground for the less hazardous modern C6 chemistries to be able to be used where required in the opinions of competent industry professionals.

The three regulatory categories for foams would be:

Fluorine Free – Foam formulations that do not contain any PFAS compounds. No additional restrictions on use, importation, discharge, and disposal. The recommended foam formulation.

High Purity C6 – Foam formulations based on high purity C6 chemistry (with limits set for the amount of contaminants present). To be used when, in the opinion of industry professionals (perhaps following a risk assessment), currently available or accessible F3 formulations are not appropriate. Shall only be disposed of through waste water networks or similar, and training use is not permitted unless specifically necessary.

Low Purity C6 – Foam formulations based on C6 formulations with contaminant levels above the levels specified for High Purity C6. Only to be used when no high purity C6 foam is available and is absolutely necessary. Must be disposed of in an approved manner, and use for training is prohibited unless it can be fully contained.

Prohibited Foams – All foam concentrations that are legacy PFOS formulations, or legacy FT formulation. Cannot be imported, discharged or used in systems. Only to be disposed of in accordance with the Basel Convention.

This reflects agreed industry best practice as outlined by many industry bodies internationally, such as the FPA Australia, and FPA NZ .

LOW FLUORINE CATEGORY

Other industry professionals will be much better qualified than me to comment on this particular aspect, however I will put it forward nonetheless.

Following on from the above, and bearing in mind the significant performance benefits obtained from small additions of C6 fluorosurfactants to F3 formulations, it may be beneficial to create another category of low-fluorine foams, as they could often be used as an alternative to C6 formulations.

As to whether this is economically feasible, other people are in a better position to accurately answer this.

LICENCING

To avoid the problem facing the industry with Halotron 1, where every individual import requires a specific exemption from the EPA, a licencing scheme or a similar scheme should be introduced to aid in the importation and distribution of permitted PFAS foams. This would be administered by the EPA and could have two categories:

1. Licensed Importer – a person or organisation approved to import PFAS containing foams. A licensed imported may only sell to a…
2. Licensed Retailer – an industry professional or organisation suitably qualified in their area of expertise to carry out accurate risk assessments involving foam firefighting equipment. They are expected to have a thorough understanding of the environmental impacts of different foams, and may only sell the foam products to end users if, in their professional opinion, a PFAS containing foam is necessary. Only licensed retailers would be permitted to sell any PFAS containing foam.

The guidance for these license holders would be given in an EPA produced Code of Practice, in much the same way approved fillers of pressure vessels are regulated. Failure to abide by the code of practice could then result in a license revocation or penalties.

INDUSTRY ASSISTANCE FROM THE EPA

This primarily relates to portable fire extinguishers, however people with expertise in other areas of the industry may have similar requirements.

Currently there are restrictions outlined in the industry standard for the installation, servicing and maintenance of fire extinguishers surrounding the refilling of fire extinguishers. NZS 4503:2005, 6.4.6 states "Any fire extinguisher . . . shall be recharged in accordance with the manufacturers instructions," and "[Extinguishers] must only be recharged with the manufacturers specified extinguishant". Arguably (and some will argue the point ad nauseum) it is currently ambiguous as to whether or not this would permit refilling of C6 extinguishers with F3 foam, however I believe the intent of the clause is that like for like shall be used in recharging, of which F3 often is not comparable to C6.

In the event restrictions are placed on the availability of C6 foam (with which the vast majority of in-service extinguishers are intended to use) many extinguishers will either have to be replaced, or be refilled with an F3 formulation. To assure industry consistency in the wake of changes bought about by the EPA, one of two things must happen:

1. If it is the intent of the EPA that the PFAS containing foam extinguishers currently in service are replaced with new F3 units, a clear statement from the EPA in association with the FPA of New Zealand must be made stating that C6 extinguishers are to be replaced, not refilled with F3 concentrate. (The possibility for an exception could be made, for example if a risk assessment suggests there is little additional risk to the site, or there is a signed waiver from the client).
2. If it is the intent of the EPA that the PFAS containing extinguisher are refilled with F3 foam, a donation to the amendment of NZS 4503 should me made to cover the costs of such an amendment, costs that otherwise must be met privately.

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