APP203827 Proposal to amend the Fire Fighting Chemicals Group Standard 2017

Submission Reference no: 15

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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 Fire Fighting Foam Coalition Inc. (FFFC) appreciates the opportunity to provide input to the Environmental Protection Authority (EPA) on the Proposal to amend the Fire Fighting Chemicals Group Standard 2017. FFFC is a global association that represents manufacturers of firefighting foams and their chemical components on regulatory and legislative issues. FFFC members include the following companies: BeachEdge Consulting, Buckeye Fire, Dafo Fomtec, Dr. Sthamer, Dynax, Fire Service Plus, Johnson Controls (Ansul, Chemguard, Sabo, Williams) KV Fire, Oil Technics, Orchidee Europe, Perimeter Solutions (Auxquimia, Phos-Chek, Solberg), and Profoam. Together these companies provide a majority of the firefighting foam used in New Zealand. The foam manufacturers listed above sell both fluorinated and fluorine-free foams and support the use of both products for appropriate applications. At the same time, they understand that current-day fluorine-free foams do not provide an equivalent level of performance to AFFF agents for all class B applications and hazards. Accordingly, they do not support a phase out of modern fluorotelomer C6 AFFF. Most major national governments currently allow the sale and use of modern fluorotelomer C6 AFFF for high hazard class B applications, including Canada, European Union, Japan and the United States. EU 2017/1000 enters into effect in July 2020 and covers all 28 countries of the European Union. It allows the continued sale and use of C6 AFFF as long as the concentrate contains less than 25 ppb of PFOA and less than 1000 ppb of one or a combination of PFOA-related substances. A REACH restriction on short-chain PFAS that would encompass C6 AFFF is expected to be proposed in the European Union in December, and will likely take about two years to be completed. FFFC will be supporting the continued use of C6 AFFF for higher hazard flammable liquid events. The REACH restriction will include a complete risk assessment and technical/economic assessment. FFFC would urge the EPA at a minimum to wait until the REACH restriction process is complete before considering a phase out of C6 AFFF. Phasing out these products now would put New Zealand out of line with most major nations and with the conclusions of the Stockholm POPs. The Fire Fighting Foam Coalition Inc. (FFFC) appreciates the opportunity to provide input to the Environmental Protection Authority (EPA) on the Proposal to amend the Fire Fighting Chemicals Group Standard 2017. FFFC is a global association that represents manufacturers of firefighting foams and their chemical components on regulatory and legislative issues. FFFC members include the following companies: BeachEdge Consulting, Buckeye Fire, Dafo Fomtec, Dr. Sthamer, Dynax, Fire Service Plus, Johnson Controls (Ansul, Chemguard, Sabo, Williams) KV Fire, Oil Technics, Orchidee Europe, Perimeter Solutions (Auxquimia, Phos-Chek, Solberg), and Profoam. Together these companies provide a majority of the firefighting foam used in New Zealand. The foam manufacturers listed above sell both fluorinated and fluorine-free foams and support the use of both products for appropriate applications. At the same time, they understand that current-day fluorine-free foams do not provide an equivalent level of performance to AFFF agents for all class B applications and hazards. Accordingly, they do not support a phase out of modern fluorotelomer C6 AFFF. Most major national governments currently allow the sale and use of modern fluorotelomer C6 AFFF for high hazard class B applications, including Canada, European Union, Japan and the United States. EU 2017/1000 enters into effect in July 2020 and covers all 28 countries of the European Union. It allows the continued sale and use of C6 AFFF as long as the concentrate contains less than 25 ppb of PFOA and less than 1000 ppb of one or a combination of PFOA-related substances. A REACH restriction on short-chain PFAS that would encompass C6 AFFF is expected to be proposed in the European Union in December, and will likely take about two years to be completed. FFFC will be supporting the continued use of C6 AFFF for higher hazard flammable liquid events. The REACH restriction will include a complete risk assessment and technical/economic assessment. FFFC would urge the EPA at a minimum to wait until the REACH restriction process is complete before considering a phase out of C6 AFFF. Phasing out these products now would put New Zealand out of line with most major nations and with the conclusions of the Stockholm POPs

Clause
Do you wish to speak at a hearing?

Notes
At this time we would not expect to attend, however we would like to reserve the opportunity if possible. At this time we would not expect to attend, however we would like to reserve the opportunity if possible.

Clause
What is your preferred outcome of this consultation?
Notes
FFFC's preferred outcome of the consultation would be a decision by the Environmental Protection Authority to continue to allow the sale and use for emergencies of modern fluorotelomer C6 AFFF for high-hazard applications in New Zealand. FFFC supports the proposals to phase out the sale and use of legacy C8 AFFF in accordance with the Stockholm POPs schedule, and to restrict the use of PFAS foams for testing and training. The proposed justification for including modern fluorotelomer C6 AFFF in the phase out, that the Stockholm POPs Conference of Parties recommended against their use, is not valid. At the 19th Conference of Parties (COP) to the Stockholm Convention, the referenced statement was revised and no longer recommends against the use of short-chain C6 alternatives. This change reflected discussion during the COP about the differences in efficacy between fluorinated and fluorine-free foams, and the fact that the short-chain C6 fluorotelomer fluorosurfactants used in modern AFFF agents are not Persistent Organic Pollutants. They are generally considered to be low in toxicity and not bioaccumulative based on current regulatory criteria. Attached is an overview of data on the environmental impact of the short-chain PFAS used in firefighting foams. Below is the revised COP recommendation, which was also made for use of alternatives to PFOS: Encourages Parties and others to use alternatives to PFOA, its salts and PFOA-related compounds, where available, feasible and efficient, while considering that fluorine-based fire-fighting foams could have negative environmental, human health and socioeconomic impacts due to their persistency and mobility. FFFC's preferred outcome of the consultation would be a decision by the Environmental Protection Authority to continue to allow the sale and use for emergencies of modern fluorotelomer C6 AFFF for high-hazard applications in New Zealand. FFFC supports the proposals to phase out the sale and use of legacy C8 AFFF in accordance with the Stockholm POPs schedule, and to restrict the use of PFAS foams for testing and training. The proposed justification for including modern fluorotelomer C6 AFFF in the phase out, that the Stockholm POPs Conference of Parties recommended against their use, is not valid. At the 19th Conference of Parties (COP) to the Stockholm Convention, the referenced statement was revised and no longer recommends against the use of short-chain C6 alternatives. This change reflected discussion during the COP about the differences in efficacy between fluorinated and fluorine-free foams, and the fact that the short-chain C6 fluorotelomer fluorosurfactants used in modern AFFF agents are not Persistent Organic Pollutants. They are generally considered to be low in toxicity and not bioaccumulative based on current regulatory criteria. Attached is an overview of data on the environmental impact of the short-chain PFAS used in firefighting foams. Below is the revised COP recommendation, which was also made for use of alternatives to PFOS: Encourages Parties and others to use alternatives to PFOA, its salts and PFOA-related compounds, where available, feasible and efficient, while considering that fluorine-based fire-fighting foams could have negative environmental, human health and socioeconomic impacts due to their persistency and mobility.

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
Yes
Notes
AFFF agents are the most effective foams currently available to fight high-hazard flammable liquid fires in military, industrial, and aviation applications. Their unique film-forming and fuel repellency properties provide rapid extinguishment, burnback resistance and protection against vapor release, which help to prevent re-ignition and protect fire fighters working as part of rescue and recovery operations. Fire test results presented at international fire protection conferences in 2011, 2013, 2015, 2016 and 2019 all show that AFFF agents are more effective at extinguishing flammable liquid fires than fluorine-free foams. This includes preliminary results of independent foam testing being sponsored by the National Fire Protection Association (NFPA). Attached is an overview of the mechanics of film formation that provides additional information on the important properties that fluorosurfactants provide to firefighting foams. Fluorine-free foams can and do provide an alternative to fluorinated foams in some class B applications. Although the performance of fluorine-free foams has improved significantly over the last decade, they are not currently able to provide the same level of fire suppression capability, efficiency, flexibility, and scope of usage as fluorinated foams. Because they are inherently fuel attractive, fluorine-free foams can in some situations pick up fuel and degrade quickly. This can compromise their fire performance and limit their application. This may be especially true in the case of forceful application on fuel in depth fires, such as in a large tank fire, where the impact momentum from high-flow discharge devices typically employed on these fires can cause substantial submergence of the foam below the fuel surface. This submergence can lead to fuel contamination of the foam blanket and decrease extinguishing effectiveness. Because fluorine-free foams do not contain fluorosurfactants, their performance is more dependent on the quality of the foam blanket. Producing a high-quality foam blanket can in some cases require the use of an air-aspirated nozzle, which many foam users do not currently employ. Foam users should be aware that fluorine-free foams are not drop-in replacements for fluorinated foams and may require equipment and operational changes to successfully deploy. There are four US states that have passed laws prohibiting the manufacture and sale of modern fluorotelomer C6 AFFF: Colorado, New Hampshire, New York and Washington. All four states exempt certain high-hazard applications from the prohibition and continue to allow the sale of C6 AFFF for the following uses: • Use at Refineries and Chemical Plants that handle flammable liquids • Use at Storage Facilities, Tank Farms & Terminals for flammable liquids • Use at Airports • Use for Military applications FFFC would urge the EPA at a minimum to exempt the high-hazard applications listed above from the phase out of C6 AFFF in New Zealand. In addition, FFFC would ask the EPA to consider exempting the following important applications: • Use for Flammable liquids in transit by rail, pipeline or tankers • Use to recharge existing fixed foam systems to ensure design protection levels are maintained AFFF agents are the most effective foams currently available to fight high-hazard flammable liquid fires in military, industrial, and aviation applications. Their unique

film-forming and fuel repellency properties provide rapid extinguishment, burnback resistance and protection against vapor release, which help to prevent re-ignition and protect fire fighters working as part of rescue and recovery operations. Fire test results presented at international fire protection conferences in 2011, 2013, 2015, 2016 and 2019 all show that AFFF agents are more effective at extinguishing flammable liquid fires than fluorine-free foams. This includes preliminary 3 results of independent foam testing being sponsored by the National Fire Protection Association (NFPA). Attached is an overview of the mechanics of film formation that provides additional information on the important properties that fluorosurfactants provide to firefighting foams. Fluorine-free foams can and do provide an alternative to fluorinated foams in some class B applications. Although the performance of fluorine-free foams has improved significantly over the last decade, they are not currently able to provide the same level of fire suppression capability, efficiency, flexibility, and scope of usage as fluorinated foams. Because they are inherently fuel attractive, fluorine-free foams can in some situations pick up fuel and degrade quickly. This can compromise their fire performance and limit their application. This may be especially true in the case of forceful application on fuel in depth fires, such as in a large tank fire, where the impact momentum from high-flow discharge devices typically employed on these fires can cause substantial submergence of the foam below the fuel surface. This submergence can lead to fuel contamination of the foam blanket and decrease extinguishing effectiveness. Because fluorine-free foams do not contain fluorosurfactants, their performance is more dependent on the quality of the foam blanket. Producing a high-quality foam blanket can in some cases require the use of an air-aspirated nozzle, which many foam users do not currently employ. Foam users should be aware that fluorine-free foams are not drop-in replacements for fluorinated foams and may require equipment and operational changes to successfully deploy. There are four US states that have passed laws prohibiting the manufacture and sale of modern fluorotelomer C6 AFFF: Colorado, New Hampshire, New York and Washington. All four states exempt certain high-hazard applications from the prohibition and continue to allow the sale of C6 AFFF for the following uses: •Use at Refineries and Chemical Plants that handle flammable liquids •Use at Storage Facilities, Tank Farms & Terminals for flammable liquids •Use at Airports •Use for Military applications FFFC would urge the EPA at a minimum to exempt the high-hazard applications listed above from the phase out of C6 AFFF in New Zealand. In addition, FFFC would ask the EPA to consider exempting the following important applications: •Use for Flammable liquids in transit by rail, pipeline or tankers 4 •Use to recharge existing fixed foam systems to ensure design protection levels are maintained

Clause
What do you think of the practicality of these disposal provisions, in terms of the resources and costs involved?
Notes
When foam users make the switch from AFFF to a fluorine-free free foam, it is reasonable to require that foam equipment be thoroughly cleaned to remove any residual PFAS compounds. FFFC believes that a standard of “as far as reasonably practicable” is appropriate. FFFC would urge the EPA to outline a set of basic procedures to be followed by users rather than set a numerical value that must be met. As noted above, the resources and costs of transitioning to fluorine-free foam go beyond the cost of cleaning equipment and may include the purchase of new equipment or the complete replacement of a fixed system. FFFC’s best practice guidance recommends that foam concentrate be disposed of by high-temperature incineration and that firewater run-off also be disposed by high-temperature incineration or another suitable method. As such we are generally supportive of the disposal options outlined in the proposal. FFFC does have strong concerns about the cost and impact to users of having to export large quantities of foam for destruction and replace that foam and possibly equipment, all within a 2 to 5-year period. FFFC also has concerns about the potential environmental impact of this mandated transition if it is not carried out correctly. There is anecdotal evidence in some countries that the previous mandated phase out of PFOS-based foam stocks did not result in significant amounts of foam being sent for incineration. When foam users make the switch from AFFF to a fluorine-free free foam, it is reasonable to require that foam equipment be thoroughly cleaned to remove any residual PFAS compounds. FFFC believes that a standard of “as far as reasonably practicable” is appropriate. FFFC would urge the EPA to outline a set of basic procedures to be followed by users rather than set a numerical value that must be met. As noted above, the resources and costs of transitioning to fluorine-free foam go beyond the cost of cleaning equipment and may include the purchase of new equipment or the complete replacement of a fixed system FFFC’s best practice guidance recommends that foam concentrate be disposed of by high-temperature incineration and that firewater run-off also be disposed by high-temperature incineration or another suitable method. As such we are generally supportive of the disposal options outlined in the proposal. FFFC does have strong concerns about the cost and impact to users of having to export large quantities of foam for destruction and replace that foam and possibly equipment, all within a 2 to 5-year period. FFFC also has concerns about the potential environmental impact of this mandated transition if it is not carried out correctly. There is anecdotal evidence in some countries that the previous mandated phase out of PFOS-based foam stocks did not result in significant amounts of foam being sent for incineration

Clause
Would your business be able to contain all foam wastes?
Notes
FFFC’s best practice guidance recommends that users not train or test with actual class B foam, and instead use specifically designed training foams and surrogate fluids or methods for testing foam equipment. If class B foam must be used for training or testing because it is required by the authority having jurisdiction, then the foam should be fully contained and properly disposed. FFFC’s best practice guidance discusses some methods that can be used to minimize foam discharge to the environment during a fire emergency, however as noted in the proposal, it is not possible to fully contain the foam in these situations. FFFC’s best practice guidance recommends that users not train or test with actual class B foam, and instead use specifically designed training foams and surrogate fluids or methods for testing foam equipment. If class B foam must be used for training or testing because it is required by the authority having jurisdiction, then the foam should be fully contained and properly disposed. FFFC’s best practice guidance discusses some methods that can be used to minimize foam discharge to the environment during a fire emergency, however as noted in the proposal, it is not possible to fully contain the foam in these situations

Clause
If not, is this due to cost or practical difficulties?
Notes
FFFC's best practice guidance recommends that users not train or test with actual class B foam, and instead use specifically designed training foams and surrogate fluids or methods for testing foam equipment. If class B foam must be used for training or testing because it is required by the authority having jurisdiction, then the foam should be fully contained and properly disposed. FFFC's best practice guidance discusses some methods that can be used to minimize foam discharge to the environment during a fire emergency, however as noted in the proposal, it is not possible to fully contain the foam in these situations

Clause
Do you have any concerns about fluorine-free foams potentially containing other persistent, toxic and/or bioaccumulative compounds?
Notes
FFFC has no reason to believe that current-day fluorine-free foams contain chemicals that are persistent, toxic or bioaccumulative. However, there is extensive research currently underway on the development of fluorine-free foams. In an effort to increase the performance of these foams, researchers are testing a wide variety of chemicals as replacements for fluorosurfactants. These have included siloxanes and other chemicals that could possibly have environmental impacts. Accordingly, it is important for environmental regulatory authorities to have a way to assess the safety of proposed alternatives. In general foam manufacturers are not opposed to providing the EPA with the full composition of a foam product as long as that information is kept fully confidential. At the same time, foam manufacturers would also support the inclusion in the group standard of a requirement for a base set of toxicological and environmental data. Although FFFC is not prepared to make specific recommendations for required studies at this time, we would be interested in providing additional input as the amendments to the group standard are finalized. FFFC has no reason to believe that current-day fluorine-free foams contain chemicals that are persistent, toxic or bioaccumulative. However, there is extensive research currently underway on the development of fluorine-free foams. In an effort to increase the performance of these foams, researchers are testing a wide variety of chemicals as replacements for fluorosurfactants. These have included siloxanes and other chemicals that could possibly have environmental impacts. Accordingly, it is important for environmental regulatory authorities to have a way to assess the safety of proposed alternatives. In general foam manufacturers are not opposed to providing the EPA with the full composition of a foam product as long as that information is kept fully confidential. At the same time, foam manufacturers would also support the inclusion in the group standard of a requirement for a base set of toxicological and environmental data. Although FFFC is not prepared to make specific recommendations for required studies at this time, we would be interested in providing additional input as the amendments to the group standard are finalized.

Clause
Do you agree with phasing out C6 AFFF at the same timeframe as C8 AFFF?
Position
No - please tell us why
Notes
As outlined above, FFFC does not agree with phasing out C6 AFFF at the same timeframe as C8 AFFF. • C6 AFFF is still needed to protect life and high-value property against flammable liquid fires in applications that are critical to society such as aviation, military, and oil/gas production. • C6 AFFF is not considered to be a Persistent Organic Pollutant and the Stockholm POPs does not recommend against its use. • Most major national governments currently allow the sale and use of C6 AFFF for class B applications, including Canada, European Union, Japan and the United States. Even states that have passed laws prohibiting the sale of C6 AFFF have exemptions for high-hazard applications. As outlined above, FFFC does not agree with phasing out C6 AFFF at the same timeframe as C8 AFFF. Appendix B Overview of Environmental Impacts of Short-chain (C6) Fluorosurfactants The environmental impact of fluorosurfactants used in fluorinated foams has been extensively studied and a large body of data is available in the peer-reviewed scientific literature. The bulk of these data show that short-chain (C6) fluorosurfactants and their likely breakdown products are low in toxicity and not considered to be bioaccumulative or biopersistent according to current regulatory criteria. Groundwater monitoring studies have shown the predominant breakdown product of the short-chain (C6) fluorosurfactants contained in fluorotelomer-based AFFF to be 6:2 fluorotelomer sulfonate (6:2 1FTS). A broad range of existing data on 6:2 FTS indicates that it is not similar to PFOS in either its 2,3,4,5physical or ecotoxicological properties. Recent studies on AFFF fluorosurfactants likely to break down to 6:2 FTS show them to be generally low in acute, sub-chronic, and aquatic toxicity, and neither a genetic nor developmental toxicant. Both the AFFF fluorosurfactant and 6:2 FTS were significantly lower than PFOS when tested in biopersistence screening studies that provide a relative measure of biouptake 6and clearance. Aerobic biodegradation studies of 6:2 FTS in activated sludge have been conducted to better understand 7its environmental fate. These studies show that the rate of 6:2 FTS biotransformation was relatively slow and the yield of all stable transformation products was 19 times lower than 6:2 fluorotelomer alcohol (6:2 FTOH) in aerobic soil. In particular, it was shown that 6:2 FTS is not likely to be a major source of perfluorocarboxylic acids or polyfluorinated acids in wastewater treatment plants. Importantly neither 6:2 FTOH nor PFHpA (perfluoroheptanoic acid) were seen in these studies. 8A review of the properties, occurrence and fate of fluorotelomer sulfonates was published in 2017. PFHxA is a possible breakdown product and contaminant that may be found in trace quantities in fluorotelomer-based AFFF. Extensive data on PFHxA presented in 2006 and 2007 gave a very favorable 9,10,11initial toxicology (hazard) profile. Testing was done on four major toxicology end points: sub-chronic toxicity in rats, reproductive toxicity in rats, developmental toxicity in rats, and genetic toxicity. Results show that PFHxA was neither a selective reproductive nor a selective developmental toxicant. In addition, it was clearly shown to be neither genotoxic nor mutagenic. In 2011 results were published from a 24-month combined chronic toxicity and carcinogenicity study, which demonstrated that under 12the conditions of this study PFHxA was not carcinogenic in rats and its chronic toxicity was low. An 13updated review of data on PFHxA presented in 2018 is shown in Figure 1. In 2014 an independent report was published that

assessed several short-chain (C6) fluorinated 14chemicals with regard to the criteria used to define persistent organic pollutants (POPs). The report assessed these chemicals based on the four criteria that must be met to be considered a POP under the Stockholm Convention: persistence, bioaccumulation, potential for long-range transport, and adverse effects (toxicity and ecotoxicity). It concludes that none of the chemicals meets all the criteria to be considered a POP, and at most they only meet one of the four criteria. The report also concludes that the three short-chain (C6) fluorotelomer intermediates and PFHxA "are rapidly metabolized and eliminated from mammalian systems. None of these materials appear to bioaccumulate or biomagnify based on laboratory data and available field monitoring data, and none show severe toxicity of the types that would warrant designation as POP." An update of this report was published in 2016. An extensive compilation of peer-reviewed and other relevant available data on short-chain PFASs can be found at the following link: https://fluorocouncil.com/resources/research Appendix B 1 Quantitative Determination of Fluorotelomer Sulfonates in Groundwater by LC MS/MS, Melissa M. Schultz, Douglas F. Barofsky and Jennifer Field, Environmental. Sci. Technol. 2004, 38, 1828-1835 2 DuPont 2007a. H-27901: Static, Acute 96-Hour Toxicity Test with Rainbow Trout, Oncorhynchus mykiss. Unpublished report, DuPont-21909 3 DuPont 2007b. H-27901: Static, Acute 48-Hour Toxicity Test with Daphnia magna. Unpublished report, DuPont-21910 4 DuPont 2007c. H-27901: Static, 72-Hour Growth Inhibition Toxicity Test with the Green Alga, Pseudokirchneriella subcapitata. Unpublished report, DuPont-22048 5 DuPont 2007d. H-27901: Early Life-Stage Toxicity to the Rainbow Trout, Oncorhynchus mykiss. Unpublished report, DuPont 22219 6 Serex, T. et al, 2008. Evaluation of Biopersistence Potential Among Classes of Polyfluorinated Chemicals using a Mammalian Screening Method. SOT 2008 Poster #958 7 6:2 Fluorotelomer sulfonate aerobic biotransformation in activated sludge of waste water treatment plants, Ning Wang, Jinxia Liu, Robert C. Buck, Stephen H Korzeniowski, Barry W. Wolstenholme, Patrick W. Folsom, Lisa M. Sulecki, Chemosphere 2011, 82(6), 853-858 8 Jennifer A. Field & Jimmy Seow (2017): Properties, occurrence, and fate of fluorotelomer sulfonates, Critical Reviews in Environmental Science and Technology, DOI:10.1080/10643389.2017.1326276 9 Chengalis, C.P., Kirkpatrick, J.B., Radovsky, A., Shinohara, M., 2009a A 90-day repeated dose oral gavage toxicity study of perfluorohexanoic acid (PFHxA) in rats (with functional observational battery and motor activity determinations). Reprod. Toxicol. 27, 342-351 10 Chengalis, C.P., Kirkpatrick, J.B., Myers, N.R., Shinohara, M., Stetson, P.I., Sved, D.W., 2009b Comparison of the toxicokinetic behavior of perfluorohexanoic acid (PFHxA) and nonafluorobutane -1-sulfonic acid (PFBS) in monkeys and rats. Reprod. Toxicol. 27, 400-406 11 Loveless, S.E., Slezak, B., Serex, T., Lewis, J., Mukerji, P., O'Connor, J.C., Donner, E.M., Frame, S.R., Korzeniowski, S.H., Buck, R.C., Toxicological evaluation of sodium perfluorohexanoate. Toxicology 264 (2009) 32–44 12 A 24-Month Combined Chronic Toxicity/Carcinogenicity Study of Perfuorohexanoic Acid (PFHxA) in Rats, H. Iwai, M. Shinohara, J. Kirkpatrick, J.E. Klaunig, Poster Session, Society of Toxicologic Pathology, June 2011 and Evaluation of the Chronic Toxicity and Carcinogenicity of Perfluorohexanoic Acid (PFHxA) in Sprague-Dawley Rats, James E. Klaunig, Motoki Shinohara, Hiroyuki Iwai, Christopher P. Chengelis, Jeannie B. Kirkpatrick, Zemin Wang, and Richard H. Bruner; Toxicologic Pathology, 43: 209-220, 2015 13 S. Korzeniowski, Per- and Poly-Fluorinated Products, Structure, Classification, Properties and Analytical ndChallenges,The Toxicology Forum 42 Annual Winter Meeting, January 29-31 2018 Washington, DC 14 Assessment of POP Criteria for Specific Short-Chain Perfluorinated Alkyl Substances, Environ International Report, January 2014, Update published in December 2016 Overview of the Mechanics of Film Formation of AFFF • Aqueous film-forming foam (AFFF) generally contains mixtures of hydrocarbon and fluorocarbon surfactants as the major surface-active components. • This class of fire-fighting foams has the capability to spread and form a thin, uniform aqueous duplex µfilm (10-30 m thick) on low-surface tension organic liquids such as volatile hydrocarbons and fuels. • The formation of an aqueous layer spread over the fuel surface provides an effective fuel vapor barrier in addition to the cooling and blanketing effect of the foam. This fuel vapor barrier also helps to protect the foam matrix from excessive degradation in the presence of liquid fuel and its vapor. • It is also known that the spontaneously spreading aqueous layer augments the fire-extinguishing efficiency of the foam. The presence of the aqueous film improves burnback stability of the foam by its spontaneous re-spreading and "repair" mechanism. • The spontaneous spreading property of AFFF is derived mainly from the high surface activity (low surface tension) of the fluorocarbon surfactants at the solution/air interface (15-20 dynes/cm). • This low surface tension, coupled with the low interfacial tension (1-5 dynes/cm) at the solution/substrate interface, allows the AFFF solution, as a result of a positive spreading coefficient, to spread spontaneously on many liquid hydrocarbons and fuels (20-30 dynes/cm). • The hydrocarbon surfactants preferentially adsorb at the solution/hydrocarbon substrate interface because of the mutual phobicity between the hydrocarbon and fluorocarbon surfactants, and therefore they are largely responsible for the low interfacial tension. • The conventional spreading coefficient concept used as a specification (e.g. mil-spec) for qualification purposes is based on the equilibrium surface and interfacial tension. This "static" spreading coefficient is not sufficiently useful to understand the dynamics (rate) of spreading. In fact, erroneous predictions can be made based on this value as to the effectiveness of the fire fighting foam. Dynamic (time-dependent) surface and interfacial tensions and hence the "dynamic" spreading coefficient concept need to be used to better understand the relationship between the film formation phenomena and the effectiveness of firefighting. • The rate of spreading of the aqueous film is related to the film thickness, which in turn affects the extinguishment and burnback performance of an AFFF agent. • The second most important role of fluorosurfactants in AFFF is the phenomena of "fuel shedding." Because of their inherent oleophobicity (i.e. oil repellency), fluorosurfactants repel fuel (oil) thus preventing or reducing the "fuel pickup" problem. In contrast, hydrocarbon surfactants "attract" fuel thus turning the foam flammable. During the firefighting application, foam gets mixed up with the fuel and the presence of fluorosurfactants in the foam reduces/prevents (depending on concentration) the fuel contamination of the foam, which can lead to "burning" foam. Fuel contamination or fuel pickup is a serious problem because it compromises not only the speed of extinguishment but also burnback effectiveness.

Clause
Which is your preferred option?
Position
Grant permissions to continue to use C6 foams
Notes
FFFC's preferred option would be a phase out of C8 AFFF in accordance with the Stockholm POPs recommendations along with appropriate restrictions on training and testing with class B foams, while continuing to allow the sale and use of C6 AFFF for high-hazard applications. FFFC's preferred option would be a phase out of C8 AFFF in accordance with the Stockholm POPs

recommendations along with appropriate restrictions on training and testing with class B foams, while continuing to allow the sale and use of C6 AFFF for high-hazard applications.

Clause
What are your reasons?
Notes
Phasing out the sale and use of legacy C8 AFFF and restricting the use of class B foam for testing and training has the potential to significantly reduce the environmental impact from foam use, while at the same time continuing to have available for fire emergencies the best performing foams possible. C6 AFFF is still needed to protect life and high-value property against flammable liquid fires in applications that are critical to society such as aviation, military, and oil/gas production. •C6 AFFF is not considered to be a Persistent Organic Pollutant and the Stockholm POPs does not recommend against its use. •Most major national governments currently allow the sale and use of C6 AFFF for class B applications, including Canada, European Union, Japan and the United States. Even states that have passed laws prohibiting the sale of C6 AFFF have exemptions for high-hazard applications. Phasing out the sale and use of legacy C8 AFFF and restricting the use of class B foam for testing and training has the potential to significantly reduce the environmental impact from foam use, while at the same time continuing to have available for fire emergencies the best performing foams possible

Appendix B

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

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

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

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

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

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

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

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

Appendix B

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FFFC Response to New Zealand Proposed Phaseout of PFAS Foams

1. What is the reason for making the submission?

The Fire Fighting Foam Coalition Inc. (FFFC) appreciates the opportunity to provide input to the Environmental Protection Authority (EPA) on the Proposal to amend the Fire Fighting Chemicals Group Standard 2017. FFFC is a global association that represents manufacturers of firefighting foams and their chemical components on regulatory and legislative issues. FFFC members include the following companies: BeachEdge Consulting, Buckeye Fire, Dafo Fomtec, Dr. Sthamer, Dynax, Fire Service Plus, Johnson Controls (Ansul, Chemguard, Sabo, Williams) KV Fire, Oil Technics, Orchidee Europe, Perimeter Solutions (Auxquimia, Phos-Chek, Solberg), and Profoam. Together these companies provide a majority of the firefighting foam used in New Zealand.

The foam manufacturers listed above sell both fluorinated and fluorine-free foams and support the use of both products for appropriate applications. At the same time, they understand that current-day fluorine-free foams do not provide an equivalent level of performance to AFFF agents for all class B applications and hazards. Accordingly, they do not support a phase out of modern fluorotelomer C6 AFFF.

Most major national governments currently allow the sale and use of modern fluorotelomer C6 AFFF for high hazard class B applications, including Canada, European Union, Japan and the United States. EU 2017/1000 enters into effect in July 2020 and covers all 28 countries of the European Union. It allows the continued sale and use of C6 AFFF as long as the concentrate contains less than 25 ppb of PFOA and less than 1000 ppb of one or a combination of PFOA-related substances.

A REACH restriction on short-chain PFAS that would encompass C6 AFFF is expected to be proposed in the European Union in December, and will likely take about two years to be completed. FFFC will be supporting the continued use of C6 AFFF for higher hazard flammable liquid events. The REACH restriction will include a complete risk assessment and technical/economic assessment. FFFC would urge the EPA at a minimum to wait until the REACH restriction process is complete before considering a phase out of C6 AFFF. Phasing out these products now would put New Zealand out of line with most major nations and with the conclusions of the Stockholm POPs.

2. Do you wish to speak in a hearing?

At this time we would not expect to attend, however we would like to reserve the opportunity if possible.

3. What is your preferred outcome of this consultation?

FFFC's preferred outcome of the consultation would be a decision by the Environmental Protection Authority to continue to allow the sale and use for emergencies of modern fluorotelomer C6 AFFF for high-hazard applications in New Zealand.

FFFC supports the proposals to phase out the sale and use of legacy C8 AFFF in accordance with the Stockholm POPs schedule, and to restrict the use of PFAS foams for testing and training.

The proposed justification for including modern fluorotelomer C6 AFFF in the phase out, that the Stockholm POPs Conference of Parties recommended against their use, is not valid. At the 19^{th} Conference of Parties (COP) to the Stockholm Convention, the referenced statement was revised and no longer recommends against the use of short-chain C6 alternatives. This change reflected discussion during the COP about the differences in efficacy between fluorinated and fluorine-free foams, and the fact that the short-chain C6 fluorotelomer fluorosurfactants used in modern AFFF agents are not Persistent Organic Pollutants. They are generally considered to be low in toxicity and not bioaccumulative based on current regulatory criteria. Attached is an overview of data on the environmental impact of the short-chain PFAS used in firefighting foams.

Below is the revised COP recommendation, which was also made for use of alternatives to PFOS:

Encourages Parties and others to use alternatives to PFOA, its salts and PFOA-related compounds, where available, feasible and efficient, while considering that fluorine-based fire-fighting foams could have negative environmental, human health and socioeconomic impacts due to their persistency and mobility.

4. Do you consider there are any applications for which fluorine-free foams are not suitable or do not have relevant approvals?

AFFF agents are the most effective foams currently available to fight high-hazard flammable liquid fires in military, industrial, and aviation applications. Their unique film-forming and fuel repellency properties provide rapid extinguishment, burnback resistance and protection against vapor release, which help to prevent re-ignition and protect fire fighters working as part of rescue and recovery operations. Fire test results presented at international fire protection conferences in 2011, 2013, 2015, 2016 and 2019 all show that AFFF agents are more effective at extinguishing flammable liquid fires than fluorine-free foams. This includes preliminary results of independent foam testing being sponsored by the National Fire Protection Association (NFPA). Attached is an overview of the mechanics of film formation that provides additional information on the important properties that fluorosurfactants provide to firefighting foams.

Fluorine-free foams can and do provide an alternative to fluorinated foams in some class B applications. Although the performance of fluorine-free foams has improved significantly over the last decade, they are not currently able to provide the same level of fire suppression capability, efficiency, flexibility, and scope of usage as fluorinated foams. Because they are inherently fuel attractive, fluorine-free foams can in some situations pick up fuel and degrade quickly. This can compromise their fire performance and limit their application. This may be especially true in the case of forceful application on fuel in depth fires, such as in a large tank fire, where the impact momentum from high-flow discharge devices typically employed on these fires can cause substantial submergence of the foam below the fuel surface. This submergence can lead to fuel contamination of the foam blanket and decrease extinguishing effectiveness.

Because fluorine-free foams do not contain fluorosurfactants, their performance is more dependent on the quality of the foam blanket. Producing a high-quality foam blanket can in some cases require the use of an air-aspirated nozzle, which many foam users do not currently employ. Foam users should be aware that fluorine-free foams are not drop-in replacements for fluorinated foams and may require equipment and operational changes to successfully deploy.

There are four US states that have passed laws prohibiting the manufacture and sale of modern fluorotelomer C6 AFFF: Colorado, New Hampshire, New York and Washington. All four states exempt certain high-hazard applications from the prohibition and continue to allow the sale of C6 AFFF for the following uses:

- Use at Refineries and Chemical Plants that handle flammable liquids
- Use at Storage Facilities, Tank Farms & Terminals for flammable liquids
- Use at Airports
- Use for Military applications

FFFC would urge the EPA at a minimum to exempt the high-hazard applications listed above from the phase out of C6 AFFF in New Zealand.

In addition, FFFC would ask the EPA to consider exempting the following important applications:

- Use for Flammable liquids in transit by rail, pipeline or tankers

- Use to recharge existing fixed foam systems to ensure design protection levels are maintained

5. What do you think of the practicality of these cleaning requirements, in terms of the resources and costs involved?

When foam users make the switch from AFFF to a fluorine-free free foam, it is reasonable to require that foam equipment be thoroughly cleaned to remove any residual PFAS compounds. FFFC believes that a standard of "as far as reasonably practicable" is appropriate. FFFC would urge the EPA to outline a set of basic procedures to be followed by users rather than set a numerical value that must be met.

As noted above, the resources and costs of transitioning to fluorine-free foam go beyond the cost of cleaning equipment and may include the purchase of new equipment or the complete replacement of a fixed system.

6. What do you think of the practicality of these disposal provisions, in terms of the resources and costs involved?

FFFC's best practice guidance recommends that foam concentrate be disposed of by high-temperature incineration and that firewater run-off also be disposed by high-temperature incineration or another suitable method. As such we are generally supportive of the disposal options outlined in the proposal.

FFFC does have strong concerns about the cost and impact to users of having to export large quantities of foam for destruction and replace that foam and possibly equipment, all within a 2 to 5-year period. FFFC also has concerns about the potential environmental impact of this mandated transition if it is not carried out correctly. There is anecdotal evidence in some countries that the previous mandated phase out of PFOS-based foam stocks did not result in significant amounts of foam being sent for incineration.

7. Would your business be able to contain all foam wastes?
8. If not, is this due to cost or practical difficulties?

FFFC's best practice guidance recommends that users not train or test with actual class B foam, and instead use specifically designed training foams and surrogate fluids or methods for testing foam equipment. If class B foam must be used for training or testing because it is required by the authority having jurisdiction, then the foam should be fully contained and properly disposed. FFFC's best practice guidance discusses some methods that can be used to minimize foam discharge to the environment during a fire emergency, however as noted in the proposal, it is not possible to fully contain the foam in these situations.

9. Do you have any concerns about fluorine-free foams potentially containing other persistent, toxic and/or bioaccumulative compounds?

FFFC has no reason to believe that current-day fluorine-free foams contain chemicals that are persistent, toxic or bioaccumulative. However, there is extensive research currently underway on the development of fluorine-free foams. In an effort to increase the performance of these foams, researchers are testing a wide variety of chemicals as replacements for fluorosurfactants. These have included siloxanes and other chemicals that could possibly have environmental impacts. Accordingly, it is important for environmental regulatory authorities to have a way to assess the safety of proposed alternatives.

10. Which option for addressing these concerns do you prefer and why?

In general foam manufacturers are not opposed to providing the EPA with the full composition of a foam product as long as that information is kept fully confidential. At the same time, foam manufacturers would also support the inclusion in the group standard of a requirement for a base set of toxicological and environmental data. Although FFFC is not prepared to make specific recommendations for required studies at this time, we would be interested in providing additional input as the amendments to the group standard are finalized.

11. Do you agree with phasing out C6 AFFF at the same timeframe as C8 AFFF?

As outlined above, FFFC does not agree with phasing out C6 AFFF at the same timeframe as C8 AFFF.

12. Which is your preferred option?

FFFC’s preferred option would be a phase out of C8 AFFF in accordance with the Stockholm POPs recommendations along with appropriate restrictions on training and testing with class B foams, while continuing to allow the sale and use of C6 AFFF for high-hazard applications.

13. What are your reasons?

- C6 AFFF is still needed to protect life and high-value property against flammable liquid fires in applications that are critical to society such as aviation, military, and oil/gas production.
- C6 AFFF is not considered to be a Persistent Organic Pollutant and the Stockholm POPs does not recommend against its use.
- Most major national governments currently allow the sale and use of C6 AFFF for class B applications, including Canada, European Union, Japan and the United States. Even states that have passed laws prohibiting the sale of C6 AFFF have exemptions for high-hazard applications.

Phasing out the sale and use of legacy C8 AFFF and restricting the use of class B foam for testing and training has the potential to significantly reduce the environmental impact from foam use, while at the same time continuing to have available for fire emergencies the best performing foams possible.

14. Can you estimate the cost to your business of phasing out C6 AFFF?

15. Do you have any other comments to make about the proposed amendments?

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.

Overview of the Mechanics of Film Formation of AFFF

- Aqueous film-forming foam (AFFF) generally contains mixtures of hydrocarbon and fluorocarbon surfactants as the major surface-active components.

- This class of fire-fighting foams has the capability to spread and form a thin, uniform aqueous duplex film (10-30 μm thick) on low-surface tension organic liquids such as volatile hydrocarbons and fuels.

- The formation of an aqueous layer spread over the fuel surface provides an effective fuel vapor barrier in addition to the cooling and blanketing effect of the foam. This fuel vapor barrier also helps to protect the foam matrix from excessive degradation in the presence of liquid fuel and its vapor.

- It is also known that the spontaneously spreading aqueous layer augments the fire-extinguishing efficiency of the foam. The presence of the aqueous film improves burnback stability of the foam by its spontaneous re-spreading and “repair” mechanism.

- The spontaneous spreading property of AFFF is derived mainly from the high surface activity (low surface tension) of the fluorocarbon surfactants at the solution/air interface (15-20 dynes/cm).

- This low surface tension, coupled with the low interfacial tension (1-5 dynes/cm) at the solution/substrate interface, allows the AFFF solution, as a result of a positive spreading coefficient, to spread spontaneously on many liquid hydrocarbons and fuels (20-30 dynes/cm).

- The hydrocarbon surfactants preferentially adsorb at the solution/hydrocarbon substrate interface because of the mutual phobicity between the hydrocarbon and fluorocarbon surfactants, and therefore they are largely responsible for the low interfacial tension.

- The conventional spreading coefficient concept used as a specification (e.g. mil-spec) for qualification purposes is based on the equilibrium surface and interfacial tension. This “static” spreading coefficient is not sufficiently useful to understand the dynamics (rate) of spreading. In fact, erroneous predictions can be made based on this value as to the effectiveness of the fire fighting foam. Dynamic (time-dependent) surface and interfacial tensions and hence the “dynamic” spreading coefficient concept need to be used to better understand the relationship between the film formation phenomena and the effectiveness of firefighting.

- The rate of spreading of the aqueous film is related to the film thickness, which in turn affects the extinguishment and burnback performance of an AFFF agent.

- The second most important role of fluorosurfactants in AFFF is the phenomena of "fuel shedding." Because of their inherent oleophobicity (i.e. oil repellency), fluorosurfactants repel fuel (oil) thus preventing or reducing the "fuel pickup" problem. In contrast, hydrocarbon surfactants "attract" fuel thus turning the foam flammable. During the firefighting application, foam gets mixed up with the fuel and the presence of fluorosurfactants in the foam reduces/prevents (depending on concentration) the fuel contamination of the foam, which can lead to "burning" foam. Fuel contamination or fuel pickup is a serious problem because it compromises not only the speed of extinguishment but also burnback effectiveness.