BY ELECTRONIC MAIL

November 19, 2019

Dr. Meredith Tipton
Chair
PFAS Task Force
17 State House Station
Augusta, ME 04333-0017

Re: Draft PFAS Task Force Report Outline

Dr. Tipton:

The Chemical Products and Technology Division of the American Chemistry Council (ACC/CPTD)[1] appreciates the opportunity to comment on task force's report on per- and polyfluoralkyl substances (PFAS). ACC/CPTD represents a number of companies with a strong interest in the science used to develop policies related to PFAS such as those proposed by the task force. These companies include PFAS manufacturers, current and former users of products containing these substances, and manufacturers of treatment technologies to remove PFAS from water. In addition to the comments provided below, ACC/CPTD supports the comments of ACC's FluoroCouncil submitted under separate cover.

ACC/CPTD supports the Task Force's recommendations to identify potential sources of PFAS releases and to prioritize sampling in those areas most likely impacted. Recent state-wide drinking water surveys conducted in the states of Michigan and Vermont provide further evidence that contamination resulting from historic uses of PFAS and PFAS-related products is limited geographically. ACC/CPTD also supports the emphasis in the task force report on education and outreach to affected communities to improve understanding of the steps being taken to reduce potential risks associated with exposure to PFAS.

The Report Should be Specific in Describing PFAS

[1] ACC represents the leading companies engaged in the business of chemistry. ACC members apply the science of chemistry to make innovative products and services that make people's lives better, healthier and safer. ACC is committed to improved environmental, health and safety performance through Responsible Care®, common sense advocacy designed to address major public policy issues, and health and environmental research and product testing. ACC's Chemical Products and Technology Division is composed of a wide range of more than 60 self-funded product and sector groups that are focused on specific chemistries and related technologies. Members participating in these groups include large and small manufacturers, formulators, downstream users, distributors, suppliers and other trade associations.

As a critical first step in the state's outreach, the report must be more specific in clarifying which PFAS are included in the various activities identified in the plan. Although the term PFAS refers to several thousand substances, most of the information available about the occurrence and potential hazards of PFAS is based on substances that are no longer manufactured - primarily perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS). Over the past two decades, manufacturing has shifted to shorter-chain PFAS that have very different physical, chemical, and toxicological properties that can significantly reduce their potential to bioconcentrate and to cause harm.

Related to the need for specificity in identifying the substances to be addressed by the report is the importance of focusing on validated testing method for the sampling activities recommended by the task force. While the number is likely to increase, the US Environmental Protection Agency's (EPA) Method 537.1 is applicable to only 18 PFAS in drinking water.[2] Validated methods do not currently exist for measuring these substances in other environmental media, moreover, but are likely to be available in the future. Whatever sampling is contemplated as part of the task force's report, it is critical that the state work closely with EPA, academic institutions, commercial laboratories, and others to ensure the validity and credibility of the data to be collected.

The Report Should Acknowledge Current Capacity Limitations

Where validated test methods are available, the capacity for commercial laboratories to conduct the testing recommended by the task force is limited and should be considered in discussing the timing of the activities to be recommended by the report. Although state and university lab capacity likely can be expanded, it will not be sufficient to address the demand for sample analysis – particularly as other states in the region implement similar sampling programs. Overstating the speed at which data can be generated may lead to public confusion and mistrust.

The report also should address the available capacity for disposal of PFAS-containing materials, particularly in light of the recommendation to establish a take-back program for Class B aqueous film forming foam (AFFF) containing legacy PFAS. Thermal destruction at high temperature (≥900 degrees Celsius) appears to be the only method for complete mineralization of fluorinated substances.[3] While ACC/CPTD supports the recommendation to collect legacy

[2] https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=NERL&dirEntryId=343042

[3] United Nations Environment Programme. Guidance on best available techniques and best environmental practices for the use of perfluorooctane sulfonic acid (PFOS) and related chemicals listed under the Stockholm Convention on Persistent Organic Pollutants (January 2017 Updated). http://chm.pops.int/Implementation/NIPs/Guidance/GuidanceonBATBEPfortheuseofPFOS/tabid/3170/

AFFF for disposal, national capacity for appropriate high-temperature destruction is limited. Consequently, implementation of a take-back program likely will require transportation of the material to other parts of the country for ultimate disposal.

The Report Should Indicate the Need to Establish Standards for Individual PFAS

Grouping multiple substances under a single standard, level, or guideline is only used when the substances are believed to result in a cumulative increase in the risk of health effects by the same mechanism of action.[4] This is clearly not the case for the class of substances included under the broad term PFAS. Although EPA's lifetime health advisories (LHAs) for PFOS and PFOA are based on developmental effects, the critical developmental endpoints identified by EPA for the two substances do not suggest a common mechanism.[5]

While the mechanisms of toxicity of PFAS have not been fully elucidated, there is strong evidence that some effects observed in rodents, such as hepatotoxicity, immunotoxicity, and developmental toxicity, involve the activation of the peroxisome proliferator-activated receptor-α (PPARα). The available scientific evidence indicates that humans are far less responsive to PPARα agonists than rodents.[6] As a result, careful consideration of the relevance of PPARα-mediated effects reported in rodent studies is critical in evaluating the toxicity of PFAS in drinking water.

The Report Should Not Recommend a Public Notification Level for PFAS in Advance of Federal Action

ACC/CPTD is very concerned about the recommendation to the legislature to require public notification by community water systems of results that exceed 10 parts per trillion (ppt) of any PFAS. As described above, applying a reporting threshold to any PFAS compound is not supported by the available science. Even for the two well studied substances – PFOS and PFOA – the task force has provided no rationale for the appropriateness of such a low level. If the task force wishes to recommend a notification level to the legislature, it should be no lower than the LHA of 70 ppt established by EPA.

---

4 EPA. Guidance for identifying pesticide chemicals and other substances that have a common mechanism of toxicity. Office of Pesticide Programs (January 26, 1999). https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/guidance-identifying-pesticide-chemicals-and-other

5 EPA. Health effects support documents for PFOs and PFOA (2016). https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos

6 Hall AP *et al.* Liver hypertrophy: a review of adaptive (adverse and non-adverse) changes—conclusions from the 3rd International ESTP Expert Workshop. *Toxicol Pathol* 40(7): 971–994 (2012). https://doi.org/10.1177/0192623312448935

Please do not hesitate to contact me at srisotto@americanchemistry.com or at 202-249-6727 if you questions about the above information.

Sincerely,

Steve Risotto

Stephen P. Risotto
Senior Director

From:	mailagent@thesoftedge.com on behalf of macac2013@gmail.com
To:	PFAS Taskforce
Subject:	Strengthen the Draft Report of the Maine Governor"s PFAS Task Force
Date:	Sunday, December 08, 2019 7:04:33 PM

Dear PFAS Task Force Members:

The draft report of the Governor's PFAS Task Force provides a solid foundation but it must be strengthened to protect public health and the environment. I would like to see the following improvements added to the report:

1. Investigate Historical Sludge-Spreading Sites and test Agricultural Products for PFAS Contamination: The Task Force should explicitly recommend that DEP develop an investigation plan and timetable for testing all sludge spreading sites to find any yet-undiscovered high-level PFAS contamination. Both the soil and the agricultural products from these farms should be assessed without further delay.

2. Establish Health-Based Risk Values to Inform Maine PFAS Standards: The Task Force should recommend that Maine Center for Disease Control and Prevention (CDC) adopt Maine-specific health risk levels for all PFAS compounds with sufficient data, based on the best available science. Those risk values should inform the proposed adoption of a Maine drinking water standard for total PFAS, as well as other relevant environmental public health standards.

3. Strengthen Safety Protections for Residential Drinking Water Wells: The Task Force should recommend funding for educational outreach and financial assistance to expand testing and treatment of residential well water to reduce exposure to PFAS.

Thank you for all your work.

Sincerely,

Angelique Collins
7 holman ave
Mexico , ME 04256

BERMAN & SIMMONS
TRIAL ATTORNEYS

Susan A. Faunce
(207) 784-3576
sfaunce@bermansimmons.com

December 5, 2019

Re: Frederick Stone, Laura Stone and Stoneridge Farms, Inc. v. 3M Company, et als.
Our File No.: 27926-01

Dear Members of the PFAS Task Force:

We submit the following commentary to the current draft of "Managing PFAS in Maine: Final Report from the Maine PFAS Task Force."

In November 2016, Fred and Laura Stone, owners of the Stoneridge Farm in Arundel, were notified by the Kennebunk, Kennebunkport, and Wells Water District (KKWD) that one of the wells located on the farm was contaminated with PFAS. Stoneridge Farm is a local dairy farm owned and operated by Fred Stone and his family for over 100 years. The discovery by KKWD led to a series of additional tests on the farm which revealed very high levels of PFOA and PFOS in the soil, water, and milk, which have been attributed to the land-spreading of industrial and municipal sludge at Stoneridge Farm from the early 1980s until the early 2000s. The Stones voluntarily reported their findings to their milk distributor, Oakhurst. As a result of PFAS contamination, the Stones have incurred thousands of dollars for testing, installation of a carbon filtration system, and other remediation efforts. The Stones continue to suffer as they are no longer able to continue their dairy business.

Under current Maine law, many individuals, business owners, and municipalities affected by PFAS contamination, including the Stone family, may be prevented from seeking a civil remedy. As you are aware, PFAS chemicals were widely produced and distributed for decades before their harmful effects became generally known. As a result, PFAS contamination due to land-spreading, landfill leachate, the use of fire-fighting foam, and other sources may have occurred decades before

any effected individuals became aware of the contamination or aware that contamination was harmful. However, Maine's current statute of limitations for personal injury and damage to real property is limited to six years. *14 MRSA § 752*. While there are some exceptions to this general rule, there is a risk that individuals who want to bring civil claims for PFAS contamination may encounter significant legal challenges from defendants claiming that the statute of limitations has expired.

We respectfully request that the Task Force include a recommendation in its final report that the Legislature pass legislation clarifying that the statute of limitations period for those who seek a civil remedy for harm or injury caused by PFAS contamination will not begin to run until the PFAS contamination has been discovered. This "discovery rule" will enable individuals, business owners, and municipalities to pursue civil remedies caused by contamination or exposure to PFAS chemicals that might otherwise have been barred, where such chemicals or their effects were unknown or undisclosed to the claimant for many years. (See proposed language, attached as Exhibit A).

Maine is currently in the substantial minority of states that do not have some type of "discovery rule" that applies in toxic tort cases. At least thirty-eight states recognize a discovery rule in cases where people or property are injured by substances with latent harmful effects, such as PFAS.[1]

Other states have taken steps to combat PFAS contamination through legislation that modifies the statute of limitations for civil actions. New York recently passed legislation to address the well-publicized PFAS contamination in Hoosick Falls,

---

[1] The States which recognize a "discovery rule" for toxic torts include Alabama, Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Vermont, Washington, West Virginia, Wisconsin, and Wyoming.

New York. That legislation allows individuals additional time to bring suit. (See *New York CPLR § 214-F*, attached as Exhibit B).[2]

The Task Force has already found that:

> *The State of Maine is expending significant funds to investigate and control PFAS exposures for Maine citizens, and substantial additional funding will be needed to continue this work.* ***Municipalities, drinking water and wastewater utility districts, farmers, businesses, property owners and other Maine citizens are also bearing direct and indirect costs from PFAS contamination.*** "Managing PFAS in Maine: Final Report from the Maine PFAS Task Force-DRAFT" p. 15 (emphasis added).

We have already seen businesses and municipalities struggle with the difficulties of remediation and other costs as a result of the State-mandated testing of wastewater treatment plant sludge. If the additional testing proposed in this Task Force's draft recommendations is enacted into law, many "municipalities, drinking water and wastewater utility districts, farmers, businesses, property owners and other Maine citizens" likely will discover that their land and businesses have been adversely impacted by PFAS contamination. Just as Fred and Laura Stone have experienced, these effected parties may incur substantial personal and financial hardships and losses.

A "discovery rule" will enable these effected parties the right to seek a private, civil remedy. Such a rule will provide no guaranty of success, as all claimants will still be required to prove the underlying case. That is, that some other party was responsible for the contamination; that the contamination caused harm or injury; and the extent of the damages. Should a claimant be able to satisfy the burden of proof on these issues, however, a private, civil remedy will, quite appropriately,

---

[2] The Hoosick Falls situation differs from the Stone property and other contamination cases in Maine in that it involves discharge from a single point-source, industrial textile plant, which directly impacted those in the immediate vicinity of the plant. Accordingly, the legislation adopted in New York which was well tailored to address that particular situation would not necessarily be appropriate to address issues in Maine which appear to be related to more diffuse areas of contamination from spreading of sludge.

shift the costs of paying for at least some of the harm away from the effected individuals and Maine taxpayers, to the companies that manufactured, promoted, distributed and profited from the sale of PFAS chemicals.

Without a discovery rule, effected individuals, businesses and municipalities will be left, unfairly, to bear the potentially devastating losses to their property and businesses, costs of remediation and impact on their personal health. Those who reaped enormous benefits and profits from the production and sale of PFAS chemicals—all while concealing the known "forever" properties of these chemicals and their risks to human and animal health—will seek refuge behind Maine's current six-year statute of limitations period in order to avoid taking any legal responsibility for the harm they have caused.

Very truly yours,

Susan A. Faunce

SAF/cms
1656041.doc

EXHIBIT A

A cause of action arising out of any harm or injury (to person, property or otherwise) caused by any per- or polyfluoroalkyl substance (PFAS) shall accrue when the plaintiff discovers such harm or injury.

Statement of Purpose:

Per- and polyfluoroalkyl substances (PFAS) are synthetic chemicals that have been manufactured, sold and used as additives in a wide range of industrial processes and consumer products. These chemicals have made their way through a number of channels into the environment, causing contamination of drinking water, land, livestock, other agricultural products and human blood and bodily organ tissues. Exposure to PFAS chemicals at certain levels has been found to be harmful to human health. PFAS chemicals have been called "forever" chemicals, because they persist in the environment and do not easily biodegrade. For many years, the properties and risks of PFAS chemicals were not known to the public. Extending the statute of limitations for actions arising out of PFAS contamination will provide appropriate access to civil claims for those who have been harmed or injured by these forever chemicals, but who only discovered the presence and/or risks of these forever chemicals after the expiration of other applicable limitations periods.

EXHIBIT B

New York CPLR § 214-F

Action to recover damages for personal injury caused by contact with or exposure to any substance or combination of substances found within an area designated as a superfund site. Notwithstanding any provision of law to the contrary, an action to recover personal damages for injury caused by contact with or exposure to any substance or combination of substances contained within an area designated as a superfund site pursuant to either Chapter 103 of Section 42 of the United States Code and/or section 27-1303 of the environmental conservation law, may be commenced by the plaintiff within the period allowed pursuant to section two hundred fourteen-c of this article or within three years of such designation of such an area as a superfund site, whichever is latest.

December 6, 2019

PFAS Task Force
Dr. Meredith Tipton, Chair
c/o ME Department of Environmental Protection
State House Station 17
Augusta, ME 04333-0017

Sent electronically (pfastaskforce@maine.gov)

Dear Chairperson Tipton and Task Force members:

Following are the comments from biosolids management stakeholders regarding the final draft of the Task Force PFAS Report. We appreciate how challenging, and yes at times how frustrating, this process has been. The effort has been admirable given the complexity of the issue and the ongoing introduction of new scientific information related to PFAS compounds as they impact public health and the environment.

Further, we appreciate the civil and thoughtful discussion that the Task Force has been engaged in since the outset of this process, with the respectful treatment of all points of view, and the ability to agree to disagree without acrimony. Hopefully this level of civility will continue with the final deliberations and the implementation of the final recommendations.

From the perspective of the biosolids management stakeholder, our only disappointment is the inordinate focus on biosolids recycling/utilization in the final draft report. Ostensibly, attention was drawn to the practice due to the milk contamination at the Arundel farm, however, other farms running well-managed residuals utilization programs have not experienced similar problems with the milk or crops they produce. Given the small percentage of farms utilizing biosolids, because of the limited availability of these materials, and because of the geographically remote use of biosolids recycling, the risk of PFAS contamination and associated health and environmental impacts from this practice is negligible. With the limited resources available for addressing the global PFAS issue, we find it unfathomable that the State of Maine would want to commit a significant portion of those resources to such a small component of the current concern, especially when biosolids and residuals recycling has the environmental benefits of nutrient recycling, carbon sequestration and the reduction of greenhouse gas generation.

That being said, we would like to start with a short cautionary statement and a recommendation for an approach to implementation. We would just like to encourage deference to deliberate and scientifically supported actions, while limiting the influence of emotion and politics so that we may proffer recommendations that will be substantive and impactful. In that light, we would suggest that these recommendations be evaluated with the SMART goals process often used in business and engineering to facilitate the success of a project.

Is the recommendation:

Specific – does it identify a tangible, focused task?

Measurable – is there a metric to determine if this task, when completed, is successful?

Achievable – can this task be completed with the resources available or potentially available?

Reasonable – can this task be completed without extraordinary efforts?

Time-bound – is the time to completion easily defined and is it reasonable (not excessive) to affect the desired impact?

With all this in mind, we offer the following comments on the draft report:

1. Identifying and Reducing Sources of PFAS

The Task Force recommends that the State of Maine require manufacturers to report the intentional use of all PFAS in manufacturing processes and in consumer products, and to require the use of safer alternatives when they are available. Legislation would be necessary to require this. **As written, this is too broad, and if implemented, would generate a deluge of reporting that would be impossible to effectively digest and draw conclusions from. Restricting the reporting to those compounds with identified health impacts might be more manageable and would facilitate the identification of safer alternatives.**

The Task Force supports the recommendations of the Firefighting Foam workgroup, included in Appendix D. This includes reporting discharges of Class B AFFF to the DEP and establishing a Class B AFFF take back and replacement program. **We would support this with the qualification that this references historical as well as future releases, both accidental and intentional.**

The Task Force recommends that State of Maine procurement guidelines should discourage the purchase of PFAS-containing products. **We feel this is too broad, as it**

would discourage the use of PFAS-containing products for which there are no known or perceived concerns.

2. Providing Safe Drinking Water

The Task Force recommends that all public water systems should be required to test for PFAS and to notify their customers if PFAS are detected. This is similar to the approach taken by the State of California. **We support the required testing; however we disagree with the need for mandatory notification based solely on detection. No other regulated drinking water contaminant requires such notification, unless an MCL is violated. Notification would make sense, perhaps, even if the only 'standard' is a health advisory. Further, these compounds are chronic and not acute in their impacts to health, so there is no immediacy that would suggest that notification is necessary, especially in the absence of MCLs.**

Task Force members disagreed about the level at which customers should be notified; Maine DWP recommended 10 ppt while some other members recommended notification at any level of detection. Maine has not, to-date, taken this approach with any other contaminants. For all other drinking water contaminants, Maine public water systems are only required to provide notice if concentrations exceed a maximum contaminant level (MCL). Legislation would be required to establish a testing and notification requirement for PFAS. **We would recommend the status quo here.**

The Task Force also recommends that private drinking water should be tested for PFAS in areas where groundwater is likely to have been impacted by PFAS at unsafe levels, such as: 1) manufacturing locations that utilized PFAS chemistry; 2) unlined landfills; 3) areas where Class B AFFF has been discharged or stored; and 4) residuals land spreading sites. Some members recommended that the State should require PFAS testing of private wells at the time of real estate transfers. **We would support limited ongoing testing of potentially impacted private wells. We would, however, encourage more specificity in selecting sites to evaluate, and use preliminary testing to eliminate additional testing at sites where no impacts have been identified. With limited resources available, there should be a timeframe for sunsetting these sampling and analysis efforts.**

3. Protecting our Food Supply

Foods may contain PFAS in unsafe quantities due to contact with PFAS-containing materials (such as packaging or processing equipment), due to vegetative uptake into produce, due to livestock consumption of PFAS-containing feed, or due to other

environmental exposures. Regulation of contaminants in food is controlled almost exclusively by the U.S. Food and Drug Administration. (See Recommendation #6 for further discussion of federal actions.) **The literature on crop uptake of PFAS is not conclusive at the point in time and is certainly of only limited relevance to the type of agriculture in Maine wherein biosolids are used. The contamination of feed at the one farm in Arundel has not been fully evaluated and not completely understood and appears anomalous when compared to other farms utilizing biosolids in their feed production programs. There appears to be no recommendation herein to support or refute.**

The Task Force recommends that the State protect foods produced in Maine from PFAS adulteration through restrictions on PFAS uses, restrictions on the agronomic utilization and land application of PFAS-containing residuals, and through the investigation and remediation of PFAS contamination. **We don't support the inference that biosolids and residuals land application has contributed to food adulteration, especially in situations where a well-managed and state regulated and monitored use program has been implemented**

4. Responsible Waste Management

The State of Maine must take actions to prevent PFAS from entering Maine's environment, food supply, and drinking water. The Task Force supports legislation to amend Maine's Uncontrolled Sites law to include pollutants and contaminants, which would give the State authority to require the removal and treatment of PFAS when they are a danger to public health. **We would support this recommendation with one qualification, more firmly emphasizing that this would apply only to those PFAS compounds that have been conclusively identified as risks to public health.**

The Task Force recommends that DEP require regular testing of residuals for PFAS prior to land spreading or commercial distribution in Maine. The Task Force also recommends expanding existing requirements to include septage that is agronomically utilized or land applied. The Task Force supports legislation that would authorize the Board of Environmental Protection to update DEP's screening levels for individual PFAS and other constituents through routine technical rulemaking so those levels can be kept up to date. **We currently do not support this recommendation, at least not in perpetuity, as we currently disagree with the screening levels from Chapter 418 Beneficial Use of Solids Waste being applied to Agronomic Beneficial Use. The current situation at the Arundel farm suggests a different pathway than**

contamination of groundwater and third-party evaluations (Stone Environmental) have found the current screening levels to be overly conservative by a factor of 2 to 3 times. Until further evaluations of the screening levels are complete, ongoing testing may be a waste of resources. Finally, we would be hesitant to support authorizing the Board of Environmental Protection to consider updating screening levels as routine technical rulemaking. As we have seen with the current situation, there is nothing routine about this and a more open and higher level review would be warranted.

The Task Force also recommends the State continue efforts to sample for PFAS in prioritized locations, analyze sampling results for patterns, and refine models of PFAS fate and transport. **We fully support this recommendation.**

Maine DEP should investigate the availability of treatment and disposal technologies that minimize the potential for environmental PFAS contamination. Preference should be given to technologies with the demonstrated capacity to safely destroy PFAS. Additionally, the State of Maine should promote the development of infrastructure, on the scale necessary to meet the needs of the State, to manage PFAS-contaminated wastes safely and in a cost-effective manner. **This may be one of those recommendations that would fall outside the realm of a SMART goal. It is very open-ended and suggests that PFAS destruction is the only acceptable endpoint. While a noble thought, it ignores the fact that this is not a consideration for other chemical contaminants (arsenic, dioxin, mercury, etc.). Furthermore, there is no acknowledgement of the impact on energy consumption necessitated by this management option. When applied to biosolids and residuals, it fails to take into account the benefits of nutrient recycling, carbon sequestration, and reduced greenhouse gas emissions. While in concept we believe alternative management options need to be explored, we do not believe it rises to the level of a priority recommendation. If this is determined to be a priority recommendation, it must be tied to comprehensive cost-benefit analyses for all proposed management options.**

5. Public Education

Maine citizens, physicians, government officials and other professionals must have access to information regarding PFAS to guide their own decision making. The Task Force recommends that the State develop educational materials at the appropriate literacy level for their intended audience, to be provided through a variety of forums

such as webpages, training events, and fairs. Those audiences should include healthcare providers, farmers, drinking water and wastewater utility customers, fire fighters and students. **We support this recommendation as long as the content is factual and science-based and is absent of speculation and rhetoric about what is unknown. There should be a clear distinction between educating and unnecessarily alarming people.**

6. Demand for Federal Action

As mentioned in our last Task Force meeting, this should be tempered to suggest strong, urgent requests rather than demands. Further, these requests should focus on PFAS compounds of concern and not all forms, as this dilutes the request and undermines the Federal government's ability to respond.

The Maine PFAS Task Force demands that federal government agencies take prompt action to reduce harmful exposures of citizens to PFAS due to the widespread nature of PFAS uses and potential exposures. These actions should include:

a) Source reduction

The federal government should require manufacturers to reduce and eliminate the use of PFAS chemistry in non-essential applications, with particular focus on those uses with the highest potential for human exposure. Manufacturers (domestic and foreign) of consumer products should be required to report their use of PFAS compounds in products sold in the United States. **We would support this, essentially with respect to non-essential uses and the focus on the compounds with the highest potential for exposure and health risks.**

The Federal Aviation Administration and the Department of Defense should identify effective foams that do not contain PFAS and should eliminate requirements for firefighting foams to contain PFAS. **We would support this but would caution that there may be PFAS-based alternatives that may be acceptable.**

OSHA and NIOSH should adopt exposure limits for workers exposed to PFAS. These limits should also apply to firefighters and other emergency personnel supporting emergency response activities. **We would support this.**

The U.S. EPA should add PFAS to the hazardous substance list under CERCLA authority. **We would support this only if there were an exemption for water and wastewater utilities.**

b) Drinking Water

The U.S. EPA should establish a Maximum Contaminant Level for PFAS in drinking water, which should also apply to bottled water. **We would support this.**

c) Food supply

The U.S. FDA should establish PFAS adulteration levels for foods in order to minimize dietary exposures to all PFAS. **We would support this but would caution about the use of the word 'all'.**

The U.S. Department of Agriculture should establish additional sources of funding support for farmers impacted by PFAS contamination, similar to the Farm Service Agency's Dairy Indemnity Payment Program. **We are not sure if this is a widespread, significant need, but would be supportive on a case-by-case basis.**

d) Waste Management

ATSDR should finalize toxicity values for PFAS commonly found in environmental samples. The U.S. EPA should then update Regional Screening Levels to include additional screening level guidelines. The U.S. EPA should also certify additional laboratory methods to measure PFAS in various media (groundwater, wastewater, soils and other solids, ambient air). **We consider this to be one of the more relevant issues regarding data collection and evaluation. Although there has been significant improvement in consistency, and perhaps accuracy as well, there needs to be better validation of those data, such as what comes with an EPA-accepted or EPA-approved test method.**

7. Funding for State Actions

Funding is a complicated, yet important concern. Our only comment here is that the focus be on the identification of new funding. The wastewater industry and, by extension, the biosolids management industry, is seriously under-funded for routine infrastructure upkeep and replacement. Anything that would divert existing funding from these construction programs would be unacceptable. Clearly if an improvement project could address both current needs and PFAS

management needs, then that would be ideal. Unfortunately, that scenario is unlikely. The cost of this type of infrastructure project would be significant, not easily passed along to utility ratepayers, especially for the smaller utilities.

The State of Maine is expending significant funds to investigate and control PFAS exposures for Maine citizens, and substantial additional funding will be needed to continue this work. Municipalities, drinking water and wastewater utility districts, farmers, businesses, property owners and other Maine citizens are also bearing direct and indirect costs from PFAS contamination.

State funding

The Task Force recommends that funding from appropriate State of Maine accounts should be utilized, to the extent it is available, to fund sampling and treatment of drinking water supplies, and to fund the investigation of PFAS contamination that threatens Maine's citizens. State of Maine agencies must also be adequately staffed to conduct the work necessary to implement any and all of the Task Force's recommendations, which will cost many millions of dollars in the coming years.

Bond Initiative

The Task Force recommends that the State of Maine introduce a bond initiative to raise money for the State's costs for PFAS sampling, remediation, and drinking water treatment.

Damage Claims

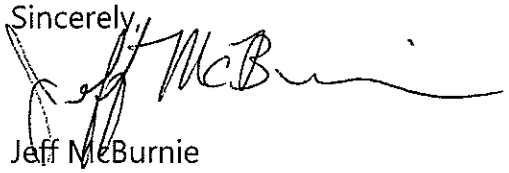
Many municipalities and states across the country are engaged in litigation against companies that manufactured PFOA and PFOS products, including claims for financial compensation. The Task Force recommends that the State of Maine fully consider available legal avenues to apply the costs of PFAS contamination in Maine to appropriate responsible parties who knowingly supplied products that are harmful to human health and the environment.

Regardless of the outcome of these deliberations, we would strongly encourage focusing on those needs or actions that have the most immediate importance; i.e. they directly remove a threat to public health and/or the environmental. Equally important is that the recommendations are reasonably achievable. Trying to be all things to all people only dilutes the effort and the final outcome. Without boundaries, we may wind

up achieving nothing. We have confidence that the final recommendations will embrace achieving the maximum benefit within the constraints of the State's limited resources.

Thank you for the opportunity to comment. We look forward to the release of the final report.

Sincerely,



Jeff McBurnie
Casella Organics
Biosolids Management Professionals Stakeholder Representative

December 6, 2019

PFAS Task Force
Dr. Meredith Tipton, Chair

Re: comments on the final report

Dear Dr. Tipton and task force members:

Thank you for the time you have put forth so that the professionals assembled could collaborate on this emerging concern of PFAS and finalize a report for Governor Mills. I feel very strongly that the wastewater and biosolids industry continues to be a major target in the PFAS contamination in our great State of Maine.

From the wastewater side, our number one priority is the protection of human health in which our facilities do without much fanfare or notice from the public. Our customers continue to use water without realizing what happens to the water once they are finished with it. The compounds they use on a daily basis maybe promulgating to the PFAS levels in our biosolids. Not only specific chemicals but everyday household items maybe delivering small traces of PFAS compounds. I feel the wsatewater industry is at a disadvantage due to the complexities with the overall water usage regarding the ultimate respect for our precious resource-water.

Wastewater facilities operate round the clock with massive amounts of assets worth millions of dollars. Some of these assets have been designed to help reduce the amount of biosolids produced therefore less biosolids being introduced to our environment. Wastewater facilities will always produce biosolids and must have safe viable options for disposal. It has been proven that the beneficial use program has saved municipalities tremendous amounts of money over the course of decades with a superior safe track record.

The Arundel Dairy farm appears to be an anomaly amongst land spreading programs. I feel I can state this as I was an operator who was working for the municipality who was spreading the biosolids. Never once did we fathom the idea that we were doing wrong. In fact, all of the farmers in our program were happy to have their hay production increase from the slow release of nitrogen and phosphorus within the biosolids. Ultimately less chemical fertilizer applied.

I have mentioned that we should focus on more household hazardous waste collection days. These events have proven to properly remove some of the PFAS chemicals in our households and businesses. If we do not have these events, there is a great risk our customers will release the chemicals down the drains which may affect the biosolids coming out of the facilities

I feel the task force has developed some great strategies to help solve the PFAS problem. We need to continue to educate and inform the issues associated with PFAS to the public. It is my opinion that we must let the science develop so we can fully understand complex issue with these “forever chemicals”.

Sincerely,

André Brousseau

From:	mailagent@thesoftedge.com on behalf of carrie.cianchette@gmail.com
To:	PFAS Taskforce
Subject:	Strengthen the Draft Report of the Maine Governor"s PFAS Task Force
Date:	Tuesday, November 26, 2019 3:16:40 PM

Dear PFAS Task Force Members:

The draft report of the Governor's PFAS Task Force provides a solid foundation but it must be strengthened to protect public health and the environment. I would like to see the following improvements added to the report:

1. Investigate Historical Sludge-Spreading Sites and test Agricultural Products for PFAS Contamination: The Task Force should explicitly recommend that DEP develop an investigation plan and timetable for testing all sludge spreading sites to find any yet-undiscovered high-level PFAS contamination. Both the soil and the agricultural products from these farms should be assessed without further delay.

2. Establish Health-Based Risk Values to Inform Maine PFAS Standards: The Task Force should recommend that Maine Center for Disease Control and Prevention (CDC) adopt Maine-specific health risk levels for all PFAS compounds with sufficient data, based on the best available science. Those risk values should inform the proposed adoption of a Maine drinking water standard for total PFAS, as well as other relevant environmental public health standards.

3. Strengthen Safety Protections for Residential Drinking Water Wells: The Task Force should recommend funding for educational outreach and financial assistance to expand testing and treatment of residential well water to reduce exposure to PFAS.

Thank you for all your work.

Sincerely,

Carrie Cianchette
8 Spruce Lane
Cumberland Foreside, ME 04110

From: Christine Turner
To: PFAS Taskforce
Subject: PFAS
Date: Friday, December 06, 2019 8:53:00 PM

Dear Gov. Mills and PFAS Task Force members,

We are the Turners and just moved to Corinna, Maine. We had initially bought our house in 2016. We had no knowledge of there being a closed landfill nearby, which had closed in 1998. They recently tested our water, which came back with high levels of PFAS. The town paid to have the DEP put a carbon filtration in. Since we found out about our contaminated water, we have been buying gallons of spring water every week to cook and drink. We have an 18-month-old grandson, Hunter, whom we adore and worry about because be was born low birth weight at full term. Every time we give him a bath, we worry about the water going into his mouth and eyes.

The bottom line: everyone deserves clean water. There should be laws in place to protect homeowners when buying a house near any potentially harmful landfill and we think these companies that dumped these chemicals should be liable, ex. Dupont. The prospective buyer has the right to know about this before purchasing any house. We just want everyone to know that our polluted water has impacted our lives. We urge you to recommend the state of Maine to do the right thing by maintaining responsibility for the water filtration system instead of putting the responsibility on the municipality. We need a 1 ppt maximum contaminant level (MCL) for total PFAS. This is the only standard that could be truly health protective for us, our grandson, and our state. We are asking the state to stop polluting people by holding the polluting companies accountable by having Maine's AG to sue the chemical companies that created PFAS on our behalf.

Thank you for considering these comments.

Sincerely,

The Turners

clf
conservation law foundation

For a thriving New England

CLF Maine 53 Exchange Street, Suite 200
Portland, ME 04101
P: 207.210.6439
F: 207.221.1240
www.clf.org

December 6, 2019

By Email (pfastaskforce@maine.gov)

Maine PFAS Task Force
c/o Maine Department of Environmental Protection
17 State House Station, 28 Tyson Drive
Augusta, ME 04330

Re: Comments of Conservation Law Foundation on Maine PFAS Task Force Draft Report

Dear Maine PFAS Task Force Members:

On behalf of Conservation Law Foundation (CLF), thank you for the opportunity to provide comment on the draft report prepared by the Governor's PFAS Task Force.[1] CLF appreciates the work of the Task Force in preparing the report, but it must be strengthened in order to protect public health and the environment from per- and polyfluoroalkyl substances (PFAS). CLF strongly supports the recommendations proposed by the Environmental Health Strategy Center for strengthening the report. CLF makes the following recommendations about how the draft report can be further strengthened:

1. **Develop a drinking water standard for the PFAS class of chemicals.**
   In order to protect the residents of Maine from exposure to PFAS compounds in drinking water, the Task Force should recommend that the Maine Department of Health and Human Services (DHHS) adopt a treatment technique drinking water standard for the PFAS class of chemicals. As CLF outlined in its December 2018 petition to DHHS for rulemaking for a drinking water standard (attached as *Exhibit 1*), DHHS has the authority to adopt a treatment technique standard, and such a standard is necessary to protect human health. In the alternative, the Task Force should recommend that DHHS adopt a maximum contaminant level (MCL) for the PFAS class or for each PFAS chemical.

2. **Test all public water systems for PFAS contamination.**
   The Task Force should recommend that DHHS's Drinking Water Program extend its 2019 PFAS sampling to all public water systems in Maine. Further, given the poor response rate to DHHS's recent PFAS sampling efforts, the Task Force should recommend that DHHS exercise its existing authority to require that all public water systems participate in the PFAS sampling.

[1] CLF is a non-profit, member-supported organization with offices located in Maine, Massachusetts, Vermont, Rhode Island and New Hampshire. CLF uses the law, science and the market to create solutions that protect public health, preserve natural resources and sustain a vibrant economy. CLF has been a leading advocate for healthy communities and safe drinking water in Maine and throughout New England and is engaged in numerous efforts to address the threat of emerging contaminants, including PFAS, throughout New England.

3. **Test all sites where historical sludge-spreading has occurred.**
   For decades, sludge has been spread over hundreds of properties in Maine, mostly farmland. PFAS contamination has already been identified at one of these sites, the Stoneridge Farm in Arundel. The Task Force should recommend that the Maine Department of Environmental Protection (DEP) test the soil and the agricultural products at all historical sludge-spreading sites for PFAS contamination.

4. **Test all farmers who may have been exposed to PFAS through sludge-spreading.**
   Earlier this year, blood tests performed on farmers at the Stoneridge Farm showed high levels of PFAS. In order to protect the health of farmers in Maine, the Task Force should recommend that all famers who may have been exposed to PFAS at sites where historical sludge-spreading occurred have their blood tested for PFAS.

5. **Perform testing of products in our food supply, including milk and fish.**
   In order to protect our food supply from PFAS contamination, the Task Force should recommend that DEP perform ongoing and frequent sampling of fish for PFAS contamination, and that the Department of Agriculture, Conservation and Forestry (DACF) perform ongoing and frequent sampling of milk for PFAS contamination.

6. **Provide public access to all information obtained during PFAS investigations.**
   To increase public education concerning PFAS in Maine, the Task Force should recommend that all information, including all test data, that has been, or will be, obtained during past, current or future PFAS investigations be reported and provided to the public.

7. **Take legal action against PFAS manufacturers.**
   Vermont, New Hampshire and other states have initiated legal actions against PFAS manufacturers, in part seeking to recover costs associated with PFAS cleanup. The Task Force should urge the Maine Attorney General to take similar legal action.

We look forward to working with the Governor's PFAS Task Force as it finalizes its report, and with the agencies responsible for implementing its recommendations, including the DEP, DHHS and DACF. Thank you for your service on the Task Force.

Sincerely,

Phelps Turner
Senior Attorney

Encl.: CLF Petition to DHHS for Rulemaking to Establish a Treatment Technique Drinking Water Standard for Per- and Polyfluoroalkyl Substances (December 19, 2018)

Exhibit 1

clf
conservation law foundation

For a thriving New England

CLF Maine 53 Exchange Street, Suite 200
Portland, ME 04101
P: 207.210.6439
F: 207.221.1240
www.clf.org

By email:

December 19, 2018

Bethany Hamm, Acting Commissioner
Maine Department of Health and Human Services
221 State Street
Augusta, ME 04333-0011
bethany.hamm@maine.gov

Subject: Petition for Rulemaking to Establish a Treatment Technique Drinking Water Standard for Per- and Polyfluoroalkyl Substances

Dear Commissioner Hamm:

Conservation Law Foundation (CLF) and Toxics Action Center hereby petition the Maine Department of Health and Human Services (Maine DHHS) to establish a drinking water standard for Per- and Polyfluoroalkyl Substances (PFAS) that is protective of public health.[1] Specifically, CLF petitions Maine DHHS to adopt a treatment technique drinking water standard for the PFAS class of chemicals in lieu of setting a maximum contaminant level (MCL) for specific PFAS. At a bare minimum, if Maine DHHS does not promulgate a treatment technique standard, Maine DHHS should adopt an MCL for the PFAS class or MCLs for each PFAS chemical that poses a risk to public water systems in Maine. As an interim step to protect public health, Maine DHHS should immediately adopt the Vermont Department of Public Health's Health Advisory for PFAS (PFAS Health Advisory) of 20 parts per trillion (ppt) for the PFAS Class as an MCL.[2]

PFAS have been found in drinking water sources across Maine and numerous studies have linked PFAS to significant health risks, including cancer. Although the State of Maine has taken some preliminary steps to limit exposure to this dangerous class of chemicals, Maine DHHS must take additional affirmative steps to protect Maine residents from PFAS.

CLF protects New England's environment for the benefit of all people. Founded in 1966, CLF is a non-profit, member-supported organization with offices located in Maine, Massachusetts, Vermont, Rhode Island, and New Hampshire. CLF uses the law, science, and the market to

[1] Pursuant to Maine's Administrative Procedure Act, codified at 5 M.R.S. § 8055, "[a]ny person may petition an agency for the adoption or modification of any rule."
[2] Although this petition has prioritized a drinking water standard for the PFAS class, there is also an urgent need to develop comprehensive standards for PFAS compounds, including but not limited to, surface water quality standards, pre-treatment standards for industrial users, and limits for land application of sludges.

clf

conservation law foundation

create solutions that protect public health, preserve natural resources, build healthy communities, and sustain a vibrant economy. CLF has been a leading advocate for clean water and safe drinking water in Maine and throughout New England, and is engaged in numerous efforts to address the threat of emerging contaminants like PFAS throughout New England.

Founded in 1987, Toxics Action Center works side-by-side with communities across New England to clean up and prevent pollution at the local level.

INTRODUCTION

Maine DHHS must immediately adopt a drinking water standard that protects the residents of Maine from exposure to all PFAS compounds. PFAS are persistent in the environment; bioaccumulative; highly mobile in water; found in hundreds of different products; and are toxic in very small concentrations. PFAS have been found at unsafe levels in drinking water in Maine, as well as in ground- and surface waters. Drinking water contaminated with PFAS is a significant source of exposure.[3] Without a drinking water standard, public water systems in Maine are not required to regularly monitor for PFAS compounds or to treat water with unsafe levels of PFAS.

DuPont, 3M, and other chemical manufacturers recklessly produced these dangerous chemicals for decades despite being aware of the significant health risks associated with PFAS. Furthermore, in 1981, 3M and DuPont were aware that ingestion of perfluorooctanoic acid (PFOA) caused birth defects in rats.[4] After receiving this information, DuPont tested seven children of pregnant workers: two had birth defects.[5] DuPont was also aware that at least one facility had contaminated local drinking water supplies with unsafe levels of PFOA by 1987, but failed to warn anyone.[6]

DuPont hid this vital health information from the public and the U.S. Environmental Protection Agency (EPA) while making billions of dollars in profits from continued production of PFOA.[7] Ultimately, DuPont was fined $16.5 million dollars in 2005 for failing to disclose information about toxicity and health risks caused by PFOA.[8]

---

[3] *See* Me. Ctr. for Disease Control and Prevention, *PFOA and PFOS in Private Well Water Questions and Answers*, March 2017, https://www.maine.gov/dep/spills/topics/pfas/PFOS_PFOA_Factsheet_March2017_Final.pdf

[4] Nathaniel Rich, *The Lawyer Who Became DuPont's Worst Nightmare*, N.Y. TIMES, Jan. 6, 2016, https://www.nytimes.com/2016/01/10/magazine/the-lawyer-who-became-duponts-worst-nightmare.html

[5] *Id.*

[6] *Id.*

[7] *Id.*

[8] Memorandum from Grant Y. Nakayama, Assistant Administrator, to Environmental Appeals Board Re Consent Agreement and Final Order to Resolve DuPont's Alleged Failure to Submit Substantial Risk Information Under the Toxic Substances Control Act (TSCA) and Failure to Submit Data Requested Under the Resource Conservation and

clf

conservation law foundation

Although PFOA and perfluoro-octane sulfonic acid (PFOS) have now been phased out of production in the U.S.,[9] these compounds will remain in our drinking water, ground- and surface waters, as well as our bodies, for decades. In addition, manufacturers have rushed to produce thousands of alternative PFAS that are likely to pose similar health risks given the similarities in chemical structure.[10] There are now over 3,000 different kinds of PFAS.

To make matters worse, EPA has failed to take meaningful action to protect the public from exposure to PFAS in drinking water. After becoming aware of contamination of drinking water supplies and the significant health risks posed by these dangerous chemicals, EPA gave manufacturers almost a decade to phase out production and use of PFOA and PFOS through a voluntary program.[11] Despite learning in 2015 that millions of Americans were, and continue to be, exposed to PFAS contaminated drinking water, EPA has not taken steps toward requiring public water systems to regularly monitor for PFAS and to treat unsafe water.[12] EPA even suppressed a scientific study suggesting that EPA's current health advisory for PFOA and PFOS does not protect public health. After widespread public outcry, EPA announced the possibility of setting drinking water standards for just two out of more than 3,000 PFAS, and even this limited action will take years.[13]

In addition, the federal government's capacity to set a standard protective of public health has been compromised by the staggering liabilities of the United States for releases of PFAS at federal facilities nationwide, including releases from federal facilities in Maine.

Recovery Act (RCRA) 3 (Dec. 14, 2005), https://www.epa.gov/sites/production/files/2013-08/documents/eabmemodupontpfoasettlement121405.pdf

[9] U.S. Envtl. Prot. Agency, *Assessing and Managing Chemicals Under TSCA, Fact Sheet: 2010/2015 PFOA Stewardship Program*, https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/fact-sheet-20102015-pfoa-stewardship-program#what

[10] *See, e.g.*, Stephen Brendel et al., *Short-Chain Perfluoroalkyl Acids: Environmental Concerns and a Regulatory Strategy under REACH* 30 ENVTL. SCI. EUR. 9, (2018), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5834591/pdf/12302_2018_Article_134.pdf

[11] *See, e.g.*, U.S. Env't Prot. Agency, *In the matter of: Premanufacture Notice Numbers: Dupont Company* (April 9, 2009), https://assets.documentcloud.org/documents/2746607/Sanitized-Consent-Order-P08-0508-and-P08-0509.pdf; Premanufacture Notification Exemption for Polymers; Amendment of Polymer Exemption Rule to Exclude Certain Perfluorinated Polymers, 75 Fed. Reg. 4295, 4296 (Jan. 27, 2010).

[12] David Andrews, *Report: Up to 110 Million Americans Could Have PFAS-Contaminated Drinking Water*, ENVTL. WORKING GROUP, May 22, 2018, https://www.ewg.org/research/report-110-million-americans-could-have-pfas-contaminated-drinking-water#.W6_7a2hKg2w

[13] *The Federal Role in the Toxic PFAS Chemical Crisis, Hearing on SD-342 Before the Subcommittee on Homeland Security & Governmental Affairs*, 115 Cong. (2018) (statement of Chairman Rand Paul and Ranking Member Gary C. Peters) https://www.hsgac.senate.gov/hearings/the-federal-role-in-the-toxic-pfas-chemical-crisis

clf

conservation law foundation

Maine can—and must—take the lead in the absence of federal safeguards. We will never be able to reverse the damage caused by chemical manufacturers and EPA's inaction, but Maine DHHS has broad authority to promulgate rules that limit additional exposure to unsafe levels of PFAS in drinking water.[14] In the absence of such rules, the public will remain at risk, and the most vulnerable among us – nursing infants and children in general, who consume higher volumes of water for their body weight and have greater developmental susceptibility – will be at the greatest risk.

Moreover, in the absence of such rules, homeowners on well-water and municipalities and other drinking water system operators will be stymied in their efforts to recover the costs of adopting filtration and other safeguards from responsible polluters.

For all these reasons, Maine DHHS should stop putting public health at risk and adopt a treatment technique drinking water standard that will protect Maine residents from the class of PFAS. As an interim step, Maine DHHS should immediately adopt Vermont's PFAS Health Advisory as a drinking water standard for public water systems.

I. BACKGROUND

A. PFAS are harmful to human health.

PFAS are a public health crisis "perfect storm" because PFAS compounds are extremely persistent in the environment, highly mobile in water, bioaccumulative, toxic in very small quantities, and found in hundreds of products. PFAS compounds are man-made substances that do not occur naturally, and they have been used in non-stick cookware, water-repellent clothing, stain resistant fabrics and carpets, cosmetics, firefighting foams, and other products that resist grease, water, and oil.[15] These chemicals are extremely strong and highly resistant to degradation.[16]

---

[14] *See* 22 M.R.S. § 2611 ("The [Maine DHHS] commissioner shall promulgate and enforce primary drinking water regulations which are necessary to protect the public health and which shall apply to all public water systems. . . .[s] Such regulations shall be no less stringent than the most recent National Primary Drinking Water Regulations in effect, as issued or promulgated by the United States Environmental Protection Agency. Regulations under this subsection may be amended from time to time, as necessary.").

[15] Seth Kerschner and Zachary Griefen, *Next Round of Water Contamination Suits May Involve CWA*, LAW 360 (October 5, 2017), https://www.law360.com/articles/970995/next-round-of-water-contamination-suits-may-involve-cwa

[16] New Jersey Dep't of Envtl Prot. Division of Science, Research, and Envtl. Health, *Investigation of Levels of Perfluorinated Compounds in New Jersey Fish, Surface Water, and Sediment*, June 18, 2018, https://www.nj.gov/dep/dsr/publications/Investigation%20of%20Levels%20of%20Perfluorinated%20Compounds%20in%20New%20Jersey%20Fish,%20Surface%20Water,%20and%20Sediment.pdf

clf
conservation law foundation

PFAS are toxic to humans in very small concentrations—in the *parts per trillion*.[17] PFAS are suspected carcinogens and have been linked to growth, learning and behavioral problems in infants and children; fertility and pregnancy problems, including pre-eclampsia; interference with natural human hormones; increased cholesterol; immune system problems; and interference with liver, thyroid, and pancreatic function.[18] PFAS have been linked to increases in testicular and kidney cancer in human adults.[19] The developing fetus and newborn babies are particularly sensitive to some PFAS.[20]

Alarmingly, epidemiological studies identify the immune system as a target of PFAS toxicity. Some studies have found decreased antibody response to vaccines, and associations between blood serum PFAS levels and immune system hypersensitivity (asthma) and autoimmune disorders (ulcerative colitis).[21] There are no medical interventions that will remove PFAS from the body.[22]

PFAS are very resistant to breakdown, bioaccumulate, and easily migrate. PFAS are persistent in the environment and have been "shown to bioaccumulate in wildlife."[23] A study by the U.S. Centers for Disease Control and Prevention (CDC) found four PFAS (PFOS, PFOA, perfluorohexane (PFHxS), and perfluorononanoic acid (PFNA)) in the serum of nearly all of the people tested, indicating widespread exposure in the U.S. population.[24] PFOA and PFOS were found in up to 99 percent of the U.S. general population between 1999 and 2012.[25] PFAS are found in human breast milk and umbilical cord blood.[26]

While a great deal of public attention has recently been paid to PFOA and PFOS, and Maine DHHS, through its Center for Disease Control and Prevention, adopted a Maximum Exposure

---

[17] Agency for Toxic Substances and Disease Registry, *Per- and Polyfluoroalkyl Substances (PFAS) and Your Health*, https://www.atsdr.cdc.gov/pfas/health-effects.html, Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Perfluoroalkyls*, https://www.atsdr.cdc.gov/toxprofiles/tp200.pdf, at 5–6.
[18] *Id.*
[19] *Id.* at 6; Vaughn Barry et al., *Perfluorooctanoic Acid (PFOA) Exposures and Incident Cancers among Adults Living Near a Chemical Plant*, 121 ENVTL. HEALTH PERSPECTIVES 11-12, 1313-18 (Nov.-Dec. 2013), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3855514/pdf/ehp.1306615.pdf
[20] U.S. Envtl. Prot. Agency, *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*, (May 2016) https://www.epa.gov/sites/production/files/2016-05/documents/pfoa_health_advisory_final_508.pdf at 10
[21] *Id.* at 39.
[22] Vermont Dep't of Health, *Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) in Drinking Water*, July 9, 2018, http://www.healthvermont.gov/sites/default/files/documents/pdf/ENV_DW_PFAS.pdf
[23] Me. Dept. of Envtl. Prot., *PFOA and PFOS: What is it?,* (Oct. 31, 2018, 4:33 PM), https://www.maine.gov/dep/spills/topics/pfas/index.html
[24] Ctr. for Disease Control and Prevention, *Per- and Polyfluorinated Substances (PFAS) Factsheet* (Apr. 7, 2017), https://www.cdc.gov/biomonitoring/PFAS_FactSheet.html
[25] U.S. Envtl. Prot. Agency, *Drinking Water Health Advisory for Perflourooctanoic Acid (PFOA)* (May 2016) at 9, https://www.epa.gov/sites/production/files/2016-05/documents/pfoa_health_advisory_final_508.pdf
[26] Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Perfluoroalkyls*, *supra* note 17, at 3.

Guideline (MEG) for Drinking Water of 70 ppt for PFOA and PFOS when both are present in drinking water,[27] EPA and other scientists have raised concerns that other chemicals in the PFAS class of compounds are similar in chemical structure and are likely to pose similar health risks.[28] For example, all PFAS share a strong carbon-flourine bond and "degrade very slowly, if at all, under environmental conditions."[29] Although some of the long-chain PFASs are being regulated or phased out, the most common replacements are short-chain PFASs with similar structures, or compounds with fluorinated segments joined by ether linkages. While some shorter-chain fluorinated alternatives seem to be less bioaccumulative, they are still as environmentally persistent as long-chain substances or have persistent degradation products.[30] In addition, because some of the shorter-chain PFASs are less effective, larger quantities may be needed to provide the same performance.[31] Thus, drinking water rules must protect the public health from unsafe exposure to all compounds in the PFAS class.

B. PFAS have been found in Maine drinking water, groundwater, and surface waters.

Not only are PFAS toxic in very small amounts (in the nanograms per liter or parts per trillion), they are highly mobile in groundwater and surface water, and have been found in waters throughout Maine.

1. Groundwater

In Aroostook County, Maine, near the former Loring Air Force Base, PFAS compounds have been found in groundwater and surface water.[32] The base has been closed since 1994, and was added to the EPA National Priorities List in 1990 due to contamination from waste oils, PCBs, and pesticides.[33] More recently, a preliminary assessment was conducted to identify areas of the former base where Aqueous Film Forming Foams (AFFFs) were historically used.[34]

---

[27] Me. Ctr. for Disease Control and Prevention, *Maximum Exposure Guidelines (MEGs) for Drinking Water*, Dec. 31, 2016, https://www.maine.gov/dhhs/mecdc/environmental-health/eohp/wells/documents/megtable2016.pdf

[28] *See, e.g.,* U.S. Envtl. Prot. Agency, *supra* note 11 (stating that, with respect to "GenX" compounds (chemical substances intended to replace long-chain (C8) PFAS used in Teflon), "EPA has concerns that these PMN substances will persist in the environment, could bioaccumulate, and be toxic ("PBT") to people, wild mammals, and birds.").

[29] Arlene Blum et al., *The Madrid Statement on Poly- and Perfluoroalkyl Substances (PFASs)*, ENVTL. HEALTH PERSPECTIVES, May 2015, https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.1509934

[30] *Id.*

[31] *Id.*

[32] U.S. Envtl. Prot. Agency, *Loring Air Force Base Limestone, ME; Cleanup Activities*, https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.cleanup&id=0101074

[33] *Id.*

[34] *Id.*

Groundwater, surface water, soil and sediment samples collected from this assessment identified the presence of PFAS chemicals – further investigation is to be conducted to determine the extent of contamination.[35]

A former Naval Air Station in Brunswick, Maine, has also been placed on the EPA Superfund program after PFAS levels were detected in nearby groundwater.[36] Most significantly, Building 653 of the site was historically struck by lightning, and a fire suppression system was activated in the surrounding area.[37] As a result, the PFOS and PFOA levels detected in the area around Building 653 were an astounding 24 parts per billion (ppb) and 0.63 ppb, respectively.[38] Of the 139 on-base monitoring wells tested, 70 wells showed the presence of PFAS above the EPA Health Advisory limits.[39]

Additional sites in Maine that detected PFAS contamination, most likely originating from historic use of AFFFs, on the property include:

- Sanford and York County, Maine, where in 2013 PFOS was detected at 290 ppt in groundwater testing. Possible sources include AFFF from the near Sanford Seacoast Regional Airport, previously the Naval Auxiliary Air Facility.[40]
- In Kittery, Maine, on-base monitoring well samples were taken in 2018. Of the four wells tested, one found PFAS compounds at a rate of 140 ppt. The suspected source of this PFAS contamination is AFFF used at the neighboring Portsmouth Naval Shipyard.[41]

In 2018 PFAS compounds of PFOS and PFOA were found in Cutler, Maine. The contamination levels detected from four on-base monitoring wells showed levels between 161-360 ppt. Once again, the source of this contamination is suspected to be the use of AFFF from the Navy VLF Transmitter Cutler.[42]

2. Drinking Water

---

[35] *Id.*
[36] U.S. Envtl. Prot. Agency, *Brunswick Naval Air Station Brunswick, ME; Cleanup Activities* https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.cleanup&id=0101073 Naval Facilities Eng'g Command, *Testing of Perfluorinated Compounds in Off-Base Drinking Water Wells: Former Naval Air Station Brunswick, Brunswick, Maine,* April 2016, https://www.maine.gov/dep/spills/topics/pfas/NASB_ResWell_PFC_FactSheet_April2016.pdf
[37] *Id.*
[38] *Id.*
[39] *Interactive Map Shows If Your Tap Water is Contaminated with PFCs*, ENVTL. WORKING GROUP (June 15, 2017) https://www.ecowatch.com/ewg-pfcs-drinking-water-2436908585.html (follow "Interactive Map" hyperlink; then search for the Brunswick, Maine contamination site).
[40] *Id.*
[41] *Id.*
[42] *Id.*

A 2017 investigation of well water near the Houlton International Airport revealed PFAS contaminants in drinking water above the EPA Health Advisory of 70 ppt.[43] The residents of a nearby Mobile Home Park were supplied with bottled water as a result of these findings.[44] The investigation of the well that serves the Mobile Home Park found PFAS contaminants at a level of 70.6 ppt, and another water sample tested in December of 2017 also found PFAS levels above 70 ppt.[45]

In the Spring of 2017 PFAS was detected in the Kimball Lane well in West Kennebunk.[46] Although the levels detected were below the EPA Health Advisory limit of 70 ppt, the district opted to err on the side of caution and shut down the well until June 8, 2018.[47] The District Superintendent, Norm Labbe, decided to be proactive in the protection of the residents in the district, adding that the EPA Health Advisory guidelines are based on the size of an adult and are not necessarily protective of the entire population.[48]

Following the 2013 findings of PFOS in groundwater near the Sanford Airport (previously the Naval Auxiliary Air Facility Sanford), public water supply testing was conducted in nearby Sanford.[49] The Sanford Water District testing from 2013-2016 showed PFOS contamination in 2 out of 16 samples collected.[50] The samples detected an average PFOS level of 33 ppt, with a maximum of 290 ppt detected in some testing.[51]

3. Surface Water

The suspected source of the Kennebunk contamination are byproducts from nearby Stoneridge Farm.[52] In the mid-1980s sludge from sewer districts and a paper mill were spread as soil

---

[43] Jen Lynds, *Houlton Mobile Home Park water not safe to drink*, THE COUNTY (February 6, 2018) https://thecounty.me/2018/02/06/news/houlton-mobile-home-park-water-not-safe-to-drink
[44] *Id.*
[45] *Id.*
[46] Donna Buttarazzi, *Water district took well offline after detecting contaminants, superintendent says*, BANGOR DAILY NEWS (February 4, 2018) https://bangordailynews.com/2018/01/19/news/york/water-district-took-well-offline-after-discovering-contaminants-official-says
[47] *Id.*; Kennebunk, Kennebunkport and Wells Water District, *Updated: Kennebunk River Well PFAS Information* (June 8, 2018) https://kkw.org/kennebunk-river-well-pfas-information
[48] Buttarazzi, *supra* note 46.
[49] *Interactive Map Shows If Your Tap Water is Contaminated with PFCs*, *supra* note 39 (follow "Interactive Map" hyperlink; then search for the Sanford "Public Water District" EPA Tap Water Detection).
[50] *Id.*
[51] *Id.*
[52] Buttarazzi, *supra* note 46; Donna Buttarazzi, *Dairy farm contaminated KKWWD's Kimball Lane well*, SEACOASTONLINE.COM (February 1, 2018) http://www.seacoastonline.com/news/20180201/dairy-farm-contaminated-kkwwds-kimball-lane-well

enhancers on the farm land.[53] The Kimball Lane well was tested after results showed more extensive contamination from the monitoring well on this nearby Stoneridge Farm property.[54]

The Stoneridge Farm well also presented PFAS compounds at 140 ppt during testing in 2016.[55] A data report from the Maine Department of Environmental Protection (Maine DEP) in February of 2017 showed the presence of PFAS compounds in various bodies of water on the Stoneridge Farm.[56] The extent of contamination on Stoneridge Farm is still being monitored by the Maine DEP, who notes that PFAS compounds can accumulate in milk from the dairy cattle when they are consuming nearby tainted surface waters.[57] Alarmingly, the milk tank on the farm was tested and uncovered PFAS contaminants at the rate of 690 ppt, nearly ten times in excess of the EPA Health Advisory limit.[58] Subsequent soil samples on the farm indicated PFAS readings as high as 896,200 ppt (although safe PFAS limits for soil are not held to the EPA Health Advisory limit of 70 ppt standard).[59]

II. Maine DHHS should establish a treatment technique drinking water standard for the PFAS class that is protective of human health.

In the absence of federal safeguards, Maine must act to protect drinking water and limit Maine residents' exposure to PFAS. As described below, setting MCLs on a chemical-by-chemical basis does not adequately protect the public from PFAS health impacts. Instead, a treatment technique drinking water standard for the class of PFAS is needed. This regulatory approach is authorized by law and technically feasible.

A. The chemical-by-chemical, MCL approach to regulating toxic chemicals is not protective of public health and the environment.

The current chemical-by-chemical regulatory framework for toxic chemicals is so inefficient it puts public health at risk. For example, even after the 2016 amendment to the Toxic Substances Control Act (TSCA), "it could take decades to evaluate the 80,000 chemicals already in commerce that have yet to be tested, let alone the 2,000 new

[53] *Id.*
[54] *Id.*
[55] Edsel Cook, *Pollution in the ground water: Well water in Maine is contaminated with PFAs, and it's compounding*, NATURAL NEWS (October 5, 2018) https://www.naturalnews.com/2018-10-05-pollution-in-the-ground-water-well-water-in-maine-is-contaminated-with-pfas.html
[56] *Id.*
[57] *Id.*
[58] *Id.*
[59] *Id.*

clf
conservation law foundation

chemicals introduced each year." [60] The EPA "still treats each chemical individually, continuing the saga in which similar, but slightly different, chemicals can be regrettably substituted."[61]

The "whack-a-mole" approach is especially troublesome when it comes to setting drinking water standards for emerging contaminants like PFAS, because it is time consuming and expensive to assess them, it is "technically and financially challenging to identify and reverse environmental and human exposure to PFASs[,]" and both of these issues are exacerbated by the continual introduction of new PFAS compounds.[62] There are at least 3,000 PFAS compounds in use currently[63] and regulators don't know the names of all PFAS compounds, much less where they are located in their state. Recently developed PFAS are regarded as trade secrets and closely-guarded confidential business information, so manufacturers often do not apply for patents or supply regulators with information about molecular structure or usage.[64]

In light of the thousands of PFAS that have been introduced into commerce, and more introduced each year, establishing MCLs for each PFAS compound is simply not sustainable. The regulators fall farther behind every year, putting our citizens in harm's way. Thus, Maine should adopt a treatment technique drinking water standard that protects Maine residents from exposure to unsafe levels of all chemicals in the PFAS class.

B. The current MEG for PFOA and PFOS does not protect Maine residents.

Maine's current MEG, which adheres to EPA's Health Advisory for PFOA and PFOS, does not protect Maine residents from exposure to unsafe PFAS levels in public water systems. Even though Maine DHHS's Center for Disease Control issued its MEG for PFOA and PFOS back in 2016, public water systems in Maine are not required to test for and treat unsafe concentrations of PFOA and PFOS because there is no federal or state drinking water standard for any of the PFAS compounds. While Maine DEP has been working to identify locations that show a presence of PFOA and PFOS in the environment, Maine DHHS has yet to adopt an MCL or

---

[60] Joseph Allen, *Stop playing whack-a-mole with hazardous chemicals*, WASH. POST (December 15, 2016), https://www.washingtonpost.com/opinions/stop-playing-whack-a-mole-with-hazardous-chemicals/2016/12/15/9a357090-bb36-11e6-91ee-1adddfe36cbe_story.html?utm_term=.ea468ed06c5e

[61] *Id.*

[62] Zhanyun Wang et al., *A Never-Ending story of Per- and Polyfluoroalkyl Substances (PFASs)*?, ENVTL. SCIENCE & TECH., (February 22, 2017), at 2511, https://pubs.acs.org/doi/pdf/10.1021/acs.est.6b04806

[63] KEMI Swedish Chemicals Agency, *Occurrence and use of highly fluorinated substances and alternatives; Report from a government assignment*, 6-78, 26 (August 9, 2009), https://www.kemi.se/en/global/rapporter/2015/report-7-15-occurrence-and-use-of-highly-fluorinated-substances-and-alternatives.pdf

[64] Zhanyun Wang et al., *supra* note 62. at 26.

establish an alternative drinking water standard for PFAS. This means that public water systems in Maine are not required to monitor for or treat unsafe concentrations of PFOA, PFOS, or any other PFAS chemical. Even if Maine's MEG for PFOA and PFOS was adopted as an MCL, it would not be protective of public health because it does not address the thousands of PFAS chemicals in the PFAS class.

C. A treatment technique drinking water standard is appropriate for PFAS.

Maine DHHS has broad authority to regulate unsafe chemicals in drinking water.[65] In this case, the unique nature of PFAS demands an alternative approach to chemical-by-chemical regulation through MCLs. Regulation of PFAS as a class and through a treatment technique standard is necessary. There are well-established drinking water treatment technologies that public water systems can install to remove unsafe levels of PFAS from drinking water. There is simply no excuse for Maine DHHS to delay the promulgation of a drinking water treatment technique standard for the PFAS class to address this public health crisis "perfect storm."

1. Maine DHHS has the authority to adopt a treatment technique drinking water standard.

Maine DHHS has authority to adopt a treatment technique drinking water standard for PFAS. The Legislature has mandated that Maine DHHS "shall promulgate and enforce primary drinking water regulations which are necessary to protect the public health and which shall apply to all public water systems." Neither Maine's statute nor Maine's Rules Relating to Drinking Water expressly provide for how Maine DHHS should establish water standards, but they do recognize that Maine DHHS's commissioner has broad authority to establish these drinking water regulations so long as they are "no less stringent than the most recent National Primary Drinking Water Regulations in effect, as issued or promulgated by the United States Environmental Protection Agency."[66]

"A treatment technique is an enforceable procedure or level of technological performance which public water systems must follow to ensure control of a contaminant."[67] Where a treatment technique is selected in lieu of an MCL, the treatment technique must "prevent known or anticipated adverse effects on the health of persons to the extent feasible."[68] EPA has adopted

---

[65] *See* 22 M.R.S. § 2611.
[66] *Id*. The State of Maine has primacy for the Safe Drinking Water Act in Maine and has adopted the authority of the Safe Drinking Water Act via rulemaking. Maine Department of Health and Human Services, *Rules Relating to Drinking Water*, 10-144 C.M.R. Ch. 231.
[67] U.S. Envtl. Prot. Agency, *How EPA Regulates Drinking Water*, https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants
[68] 42 U.S.C. § 300g-1(b)(7)(A).

several treatment technique drinking water standards in lieu of an MCL where EPA has determined that it is "not economically or technologically feasible to ascertain the level of [a] contaminant."[69] For example, the Lead and Copper Rule requires the use of a treatment technique.[70] This rule requires public water systems to test drinking water in the homes of consumers and undertake additional treatment measures to control lead if 10% of the samples exceed 15 ppb.[71] The Surface Water Treatment Rule also requires the use of a treatment technique. Under this rule, most public water systems that obtain water from surface water or groundwater under the direct influence of surface water must use filters and disinfectants to reduce pathogens.[72] In both cases, EPA had to establish a unique procedure to address the risks posed by a specific contaminant because an MCL would not have been practical or protective of public health due to the unique characteristics of the contaminants.

Similarly, the unique characteristics of the PFAS class pose a public health threat that cannot be adequately addressed with the establishment of an MCL for one or a few PFAS chemicals. Maine DHHS has the authority to develop a procedure that would require installation of specific drinking water treatment technologies under certain circumstances. Maine DHHS has multiple options to protect Maine residents from exposure to the PFAS class. For example, Maine DHHS could promulgate a rule that requires public water systems to install appropriate treatment technologies where (1) the sum of all measurable PFAS exceeds a conservative threshold level that is protective of public health and takes into account the cumulative impacts of all PFAS chemicals or (2) the presence of PFAS compounds is detected using "non-targeted" laboratory analysis.[73] Non-targeted analysis allows "researchers [to] rapidly characterize thousands of never studied chemical compounds in a wide variety of environmental, residential, and biological media."[74] An alternative option would be to require: 1) a robust source water assessment for PFAS and 2) treatment where PFAS may be present in the source water. Maine DHHS should determine a specific procedure for the drinking water standard through a robust stakeholder process as part of the rulemaking process.

---

[69] *Id.*
[70] U.S. Envtl. Prot. Agency, *How EPA Regulates Drinking Water Contaminants, supra* note 67
[71] U.S. Envtl. Prot. Agency, *Lead and Copper Rule*, https://www.epa.gov/dwreginfo/lead-and-copper-rule
[72] U.S. Envtl. Prot. Agency, *Surface Water Treatment Rules, https://www.epa.gov/dwreginfo/surface-water-treatment-rules*
[73] U.S. Envtl. Prot. Agency, *EPA Researchers Use Innovative Approach to Find PFAS in the Environment*, https://www.epa.gov/sciencematters/epa-researchers-use-innovative-approach-find-pfas-environment, Karl Leif Bates, *Duke Expert Helps Spearhead State's New Water-Testing Program*, DUKE TODAY (Aug. 8, 2018), available at https://today.duke.edu/2018/08/duke-expert-helps-spearhead-states-new-water-testing-program
[74] *Id.*

clf
conservation law foundation

2. Due to the unique characteristics of the PFAS class of compounds, a treatment technique is necessary to protect public health.

i. Regulation of PFAS chemicals as a class is necessary.

Even if Maine DHHS were to adopt the current MEG (or a lower ppt value) as an MCL, a combined limit for PFOA and PFOS would not protect Maine residents from the 3,000 or more other PFAS.[75]

First, there are likely many other PFAS in Maine, including for example PFHxS, PFHpA, PFNA, and PFBS, which other New England states have found to have "a very similar molecular structure to PFOS and PFOA" [76] but the State does not test for them. Furthermore, given the speed and secrecy with which chemical manufacturers have introduced these dangerous chemicals into commerce, there could be even more PFAS that Maine is simply not aware of yet.[77]

Second, as discussed above, PFAS are similar in chemical structure and some PFAS break down into each other.[78] While long-chain PFAS compounds may be decreasing in the environment due to voluntary phase-outs by manufacturers, "the most common replacements are short-chain PFAS with similar structures."[79] Third, these PFAS chemicals are often found together, and fourth, they are likely to have similar health effects as discussed in Section I.A.

EPA has applied similar concepts to establish an MCL for a group of chemicals. For example, EPA established an MCL for five haloacetic acid disinfection byproducts (HAA5) because it did not have sufficient information regarding (1) the occurrence of individual haloacetic acids; (2) how water quality parameters affect the formation of haloacetic acids; (3) how "treatment technologies control the formation of individual . . . [haloacetic acids];" and (4) toxicity information for some of the individual haloacetic acids.[80] In light of the unique challenges

---

[75] KEMI Swedish Chemicals Agency, *supra* note 63, at 6.
[76] *See* Mass. Dep't of Envtl Prot., *Office of Research and Standards Final Recommendation for Interim Toxicity and Drinking Water Guidance Values for Perfluorinated Alkyl Substances Included in the Unregulated Chemical Monitoring Rule 3*, June 8, 2018, https://www.mass.gov/files/documents/2018/06/11/pfas-ors-ucmr3-recs_0.pdf
[77] Environmental Working Group Comments on the Agency for Toxic Substances and Disease Registry (ATSDR) Draft Toxicological Profile for Perfluoroalkyls, ENVTL WORKING GROUP (August 20, 2018), https://cdn.ewg.org/sites/default/files/testimony/EWG%20Comments%20for%20ATSDR_Aug20..pdf?_ga=2.236461961.949885036.1539136763-1789323056.1527870942
[78] Section I(A): Maine DHHS should establish a treatment technique drinking water standard for the PFAS class that is protective of human health; The chemical-by-chemical, MCL approach to regulating toxic chemicals is not protective of public health and the environment.
[79] Blum, *supra* note 29.
[80] 63 Fed. Reg. 69390, 69409 (Dec. 16, 1998), https://www.gpo.gov/fdsys/pkg/FR-1998-12-16/pdf/98-32887.pdf#page=1

associated with regulation of these chemicals, EPA promulgated a group MCL even in the absence of complete information about each individual haloacetic acid in order to better protect public health.[81] For all these reasons, it is appropriate to regulate PFAS chemicals as a class.

ii. A treatment technique in lieu of an MCL is necessary.

A treatment technique in lieu of an MCL for specific PFAS chemicals or small groups of PFAS chemicals is necessary. As discussed previously, scientists suspect that PFAS chemicals in the class may have similar adverse health effects as the handful of PFAS compounds that have been studied more extensively.[82] EPA has only developed targeted test methods for 14 PFAS chemicals out of more than 3,000 compounds.[83] Thus, it is simply not economically or technically feasible to ascertain the level of each specific PFAS chemical in the PFAS class that pose a risk to Maine residents.

As Maine DHHS is well aware, establishing an MCL for one compound is resource intensive and time consuming. Adopting a treatment technique drinking water standard for the PFAS class in lieu of establishing MCLs for thousands of PFAS chemicals will require far fewer resources and will provide protection from exposure to unsafe levels of PFAS on a much shorter timeline. For these reasons, a treatment technique drinking water standard is necessary to protect Maine residents.

3. Treatment technologies are available to remove long- and short-chain PFAS.

There are both established and novel methods to remove and destroy PFAS. While long- and short-chain PFAS may be difficult to treat with any one traditional technology—some new technologies are in development— a "treatment train" of several technologies combining adsorption, separation, and destruction in sequence, for example, would be effective in treating drinking water and protecting public health.

Adsorption technologies such as Granular activated carbon (GAC) and ion exchange "are currently the most commonly encountered interim response measures to achieve immediate

---

[81] *Id.*
[82] KEMI Swedish Chemicals Agency, *supra* note 63.
[83] U.S. Envt. Prot. Agency, *Method 537: Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography /Tandem Mass Spectrometry* 537-2 (EPA/600/R-08/092) (Sep. 2009), http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=ED20973987CE8E7A0E0944E8E31D66BE?doi=10.1.1.645.8401&rep=rep1&type=pdf

compliance with drinking water standards and serve as the benchmark of practicality and effectiveness for other treatment technologies."[84]

While new adsorption technologies like organically modified silica adsorbents show promise,[85] GAC has long been used for adsorption of chemical pollutants, consistently removes PFOS with an efficiency of more than 90 percent,[86] and is the treatment technique specified in Safe Drinking Water Act for the control of synthetic organic chemicals:

> granular activated carbon is feasible for the control of synthetic organic chemicals, and any technology, treatment technique, or other means found to be the best available for the control of synthetic organic chemicals must be at least as effective in controlling synthetic organic chemicals as granular activated carbon.[87]

Separation technologies, including reverse osmosis, microfiltration, ultrafiltration and nanofiltration, are highly effective for PFAS removal and can remove PFAS at more than 99 percent effectiveness.[88] "Membrane filtration has several benefits including: achieving continuous separation, low energy consumption, ease of combination with other existing techniques, easy up-scaling, and low chemical costs."[89] Ozofractionation (a patented process by the company EVOCRA and available commercially as Ozofractionative Catalyzed Reagent Addition (OCRA) (Dickson 2013, 2014)) is a novel separation technology that shows high (>99.99 percent reduction) effectiveness for PFAS.[90]

Finally, novel destructive treatment technologies for PFAS are becoming available. Destructive technologies include sonochemical decomposition,[91] chemical/advanced photochemical oxidation,[92] and AECOM's DE-FLUORO™ technology.[93]

This treatment train solution will also confer significant co-benefits for public health, because the

---

[84] J. Horst et al., *Water Treatment Technologies for PFAS: The Next Generation, 38,* Groundwater Monitoring & Remediation (Spring 2018), at 15.
[85] *Id.* at 15–16.
[86] K.H. Kucharzyk et al., *Novel treatment technologies for PFAS compounds: a critical review* 204 JOURNAL OF ENVTL. MANAGEMENT (December 2017), at 759; 42 U.S.C. § 300g-1(b)(4)(D).
[87] 42 U.S.C. § 300g-1(b)(4)(D).
[88] Kucharzyk, *supra* note 86, at 759–60; Horst, *supra* note 84.
[89] V.A. Arias Espana et al., *Treatment technologies for aqueous perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA): A critical review with an emphasis on field testing*, 4 ENVIRONMENTAL TECHNOLOGY & INNOVATION (2015) 168, 177.
[90] Horst, *supra* note 84, at 17.
[91] Espana, *supra* note 89, at 174.
[92] *Id.* at 178.
[93] AECOM, *AECOM's Promising New PFAS Treatment Technology DE-FLUORO Shows Complete Destruction of PFAS*, https://www.aecom.com/content/wp-content/uploads/2018/04/PFAS-Treatment-Technology-DE-FLUORO_INFO-SHEET.pdf

same technologies that are effective in PFAS treatment are effective in removing a host of other dangerous chemicals. GAC adsorption filters alone, for example, are effective in removing dozens of harmful contaminants in addition to PFAS (including, but not limited to: RDX, arsenic, benzene, cryptosporidium, MTBE, mercury, perchlorate, tetrachloroethylene (Perc), and trichloroethylene (TCE)).[94] Other technologies that should be considered as components of the treatment train confer similar co-benefits; for example, membrane separation technologies like reverse osmosis not only treat PFAS but, without limitation, also treat 1,4-dioxane, alachlor, chromium, malathion, and nitrates.[95]

For all these reasons, CLF and Toxics Action Center urge Maine DHHS to initiate a rulemaking for a treatment technique drinking water standard for the PFAS class.

III. In the alternative, Maine DHHS should either adopt an MCL for the PFAS class or for each individual PFAS chemical.

Maine DHHS must take action to establish drinking water standards for PFAS in the absence of federal safeguards even if Maine DHHS does not establish a treatment technique standard. As discussed in Section II.C., Maine DHHS has the authority to regulate PFAS as a class or on a chemical-by-chemical basis. PFAS are present in Maine waters and are known to cause adverse health effects. Thus, at a bare minimum, Maine DHHS should either 1) adopt an MCL for the PFAS class, or 2) set a schedule for the adoption of an MCL for each individual PFAS chemical that has been identified and begin establishing MCLs immediately. Of course, as new PFAS chemicals are identified, the schedule of MCL adoption will need to be modified.

IV. Maine DHHS should immediately adopt Vermont's PFAS Health Advisory as a maximum contaminant level.

In the interim and until Maine DHHS establishes a treatment technique drinking water standard for PFAS, Maine DHHS should immediately adopt Vermont's PFAS Health Advisory of 20 ppt for the PFAS Class as an MCL.

CONCLUSION

For all the forgoing reasons, CLF and Toxics Action Center petition Maine DHHS to establish a drinking water standard for PFAS that is protective of public health. Specifically, Maine DHHS should adopt a treatment technique drinking water standard for the PFAS class. In the alternative, Maine DHHS should establish an MCL for the PFAS class or individual MCLs for each PFAS chemical that poses a risk to public water systems in Maine. As an interim step,

---

[94] U.S. Envtl. Prot. Agency, *Drinking Water Treatability Database*, *Granular Activated Carbon*, https://oaspub.epa.gov/tdb/pages/treatment/treatmentContaminant.do

[95] *Id.*

clf
conservation law foundation

Maine DHHS should immediately adopt Vermont's PFAS Health Advisory of 20 ppt for the PFAS Class as an MCL.

The significant threats posed to human health and the environment by the PFAS class of compounds are clear. These compounds have been found in Maine drinking water, groundwater, and surface waters. The dangers this class of chemicals pose to Maine residents demand immediate action to limit further exposure. Thank you for your consideration.

Sincerely,

Phelps Turner
Staff Attorney
Conservation Law Foundation

/s/ Sylvia Broude
Sylvia Broude
Executive Director
Toxics Action Center

CC:

Nancy Beardsley, Director, Maine CDC Division of Environmental Health (nancy.beardsley@maine.gov)
Michael Abbott, Director, Maine CDC Division of Environmental Health Drinking Water Program (michael.abbott@maine.gov)
Andrew Smith, State Toxicologist / Program Manager, Maine CDC Division of Disease Control (andy.e.smith@maine.gov)

From:	David Page
To:	PFAS Taskforce
Subject:	Comment on PFAS Taskforce Draft Report.
Date:	Wednesday, November 27, 2019 2:01:59 PM

TO:
PFAS Task Force
c/o Maine DEP
17 State House Station, 28 Tyson Drive
Augusta, Maine 04330

Dear Taskforce Members:

The Task Force should be congratulated on its timely and thorough report. There is one issue that I did not see addressed in the report. This is the importation of sewage sludge and biosolids from out of state sources that could be contaminated with PFAS. The recent incident with the Madison, ME landfill is an example of this problem. At the very least, the Task Force Report should address this issue by banning the importation of sewage sludge from out of state by Maine Landfills unless the material is tested and certified to meet interim PFAS standards.

Sincerely,

David S. Page, Bowdoin College Professor of Chemistry and Biochemistry Emeritus
29 Magean St
Brunswick, ME 04011 USA
Tel 207 729 4364 (Home)
207 522 3246 (Cell)
Email dpage@bowdoin.edu
https://www.bowdoin.edu/profiles/faculty/dpage/index.html

Managing PFAS in Maine

Final Report from the Maine PFAS Task Force
December 2019

Table of Contents

PFAS Task Force Members

Dr. Meredith Tipton
Chair

Amanda Beal, Commissioner
Department of Agriculture, Conservation and Forestry

Michael Belliveau
Environmental Health Strategy Center

Andre Brousseau
Certified Wastewater Treatment Plant Operator

Major General Doug Farnham
D*epartment of Defense, Veterans and Emergency Management*

Dr. Lani Graham
Maine Public Health Association

Charles Kraske
Pulp and Paper Industry

Norm Labbe
Public Drinking Water Professionals

Jeanne Lambrew, Commissioner
Department of Health and Human Services

Jeff McBurnie
Biosolids Management Professionals

Jerry Reid, Commissioner
Department of Environmental Protection

DRAFT

Guiding Principles

Governor Janet Mills created the Maine PFAS Task Force in March 2019 to review the extent of PFAS contamination in Maine and provide recommendations about how we can protect Maine residents from exposure.

The Maine PFAS Task Force reviewed information from a variety of sources, including results of sampling by State of Maine agencies and various health studies, and solicited input from stakeholders and other members of the public.

The varied viewpoints of Task Force members strengthened discussions about priorities for State action. These diverse perspectives helped us deliver more comprehensive recommendations that center around a shared set of priorities.

Summary of Recommendations

To be most protective of Maine citizens, now and in the future, we believe the following are of greatest importance:

1. **Identifying and reducing sources of PFAS;**
2. **Providing safe drinking water;**
3. **Protecting our food supply;**
4. **Responsible waste disposal and management;**
5. **Improving public education about PFAS;**
6. **Demanding federal action; and**
7. **Funding for state agencies to investigate, respond to and reduce exposure of Maine citizens to PFAS.**

PFAS is a health concern for Maine citizens and requires our attention. Nearly everyone is exposed to these chemicals from numerous sources. Our recommendations reflect a commitment to determine where PFAS contaminants exist in Maine and put in place strategic responses to protect people from exposure. The following report details recommendations the Task Force has identified as action items State of Maine agencies should implement.

DRAFT

PFAS Background

What is PFAS?

"PFAS" (per- and poly-fluoroalkyl substances) are a large group of manmade fluorinated chemicals. There have been ~~are~~ over 4,000 PFAS manufactured ~~compounds that have been identified as PFAS to-date~~.

The two most commonly used PFAS were PFOA (perfluorooctanoic acid) and PFOS (perfluorooctane sulfonate). These two compounds were used in households across the country in the non-stick, grease resistant convenience items of the 20th century. PFOA and PFOS have been used as~~are still required~~ components in a class of firefighting foam (Class B Aqueous Film Forming Foam (AFFF)) used to quickly extinguish petroleum-based fires. Some of the highest levels of PFOA and PFOS in Maine have been found at current or former military bases where Class B AFFF had been repeatedly discharged.

Chemical manufacturers in the U.S. phased out production of PFOA and PFOS in the early 2000's, but they were replaced with a wide variety of other PFAS. PFOA and PFOS are also still present in imported products, and many other PFAS break down in the environment into the more stable PFOA and PFOS compounds.

A wide variety of PFAS, many still unidentified as manufacturers claim their formulations to be proprietary information, are now used in consumer products that are stain, oil, heat, and water resistant, such as clothing, furniture fabric, food packaging, carpets, cookware, outdoor recreational items, and electronics. Because these chemicals are used so widely in consumer products, they are also present in our wastewater in septic tanks and at treatment plants.

The scientific understanding of how PFAS impacts people and the environment is still developing, and for thousands of PFAS compounds much remains unknown. Laboratories can still only accurately analyze for a small subset of PFAS.

State governments typically rely on the federal government to certify analytical methods for environmental contaminants, although they may set their own standards. At this time, the U.S. EPA has only formally certified one method for analysis of 18 PFAS in drinking water (Method 537.1, Document #EPA/600/R-18/352 (2018)), although other methods for groundwater, wastewater and soils have been accepted by the U.S. EPA and Department of Defense for remediation site cleanup decisions. Other states have wide-ranging levels of industrial activity and methods for managing wastes, which have resulted in varying levels of PFAS contaminants within their borders. Additionally, states have established, based on their own review of the science, a~~These differences among states are reflected in~~

Commented [PMM1]: "Identified as" implies there is a question to or process necessary to determine if a particular substance is PFAS – but that's inherently known when its manufactured.

Commented [PMM2]: Two of the most studied, not sure if actually most used?

Commented [PMM3]: Many AFFF today are "short-chain" and fluorine based foams are only "required" in some narrow circumstances (and those requirements are changing) – fluorine free foams are available for other uses – See separate letter.

Commented [SW4]: While this may be true, States are more and more starting to take action because of the inaction of the federal government and we should not rely too heavily on the feds on this issue. They are far behind the curve on this issue.

~~the~~ variety of standards and screening levels for PFAS ~~that other states have established~~ in the absence of federal action to respond to their own unique circumstances.

Human exposure to PFAS continues to be widespread because this chemistry is used in hundreds of products for a variety of applications. Manufacturers do not report their uses of PFAS so it is difficult to limit exposures. International studies have been supported by Maine-specific sampling to indicate that PFAS are present in our environment, and that the highest concentrations of PFAS exist in environmental media such as soil and groundwater in areas where materials containing PFAS were disposed. ~~–~~In 2019, Maine is similar to other states trying to manage a shifting landscape while keeping pace with changes in our knowledge of this emerging contaminant and protecting human health with limited resources and authority.

Health Concerns

Scientists are still learning about the possible health effects from exposure to PFAS chemicals. ~~Four specific PFAS chemicals – PFOA, PFOS, PFHxS and PFNA – have been studied more extensively than other PFAS.~~ According to the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), studies of people who have higher ~~PFOA or PFOS~~ levels of certain PFAS in their blood have shown that these chemicals may:[1]

- increase cholesterol levels;
- decrease how well the body responds to vaccines;
- increase the risk of thyroid disease;
- increase the risk of high blood pressure or pre-eclampsia in pregnant women;
- lower infant birth weights; however, the decrease in birth weight is small and may not affect the infant's health;
- increase risk of kidney cancer or testicular cancer.

Studies with laboratory animals exposed to high doses of one or more of these PFAS have shown changes in liver, thyroid, pancreatic function, and hormone levels, and increases in testicular, liver and pancreatic tumors.

Nearly everyone is exposed to PFAS chemicals. By measuring PFAS in blood serum it is possible to estimate the amount of PFAS that have entered people's bodies. Because some PFAS persist in our bodies for years, the levels in our blood serum at any time reflects exposure to these chemicals over the preceding several years. U.S. Centers for Disease Control (CDC) scientists have measured at least 12 PFAS in the blood serum of participants who have taken part in the National Health and Nutrition Examination Survey

[1] https://www.atsdr.cdc.gov/pfas/PFAS-health-effects.html

Commented [PMM5]: Don't think the variation in industrial activity and waste management methods cause the variation in PFAS screening levels as is implied here.

Commented [PMM6]: This is confusing in context with the next sentence. ATSDR looked at 14 different PFAS. While ATSDR did note limited data and a lot of data gaps, they note outcomes for others than just those four.

Commented [PMM7]: ATSDR's study wasn't limited to PFOA and PFOS – the summary page that list of effects comes from identifies the impact as "certain PFAS." The more complete report (see, for example, chapter 1 pages 5-6) identifies associations between other members of the class and some of these outcomes.

(NHANES) since 1999.[2] Four PFAS (PFOS, PFOA, PFHxS and PFNA) have been found in the blood serum of nearly all the people tested, indicating widespread exposure to these PFAS in the U.S. population. Notably, since 1999 the measured levels of PFOS and PFOA in the blood serum of NHANES participants have decreased by about 80 percent. The exposure pathway or pathways responsible for this decline remains unclear, though the timing does coincide with the declining use of these chemicals in the U.S.

For most people, diet is thought to be the primary source of exposure to PFAS.[1] The major types of dietary exposure for PFAS include either ingesting food contaminated with PFAS and eating food packaged in materials containing PFAS. Hand-to-mouth transfer from dust in households containing products treated with PFAS-containing stain protectants, such as carpets, is thought to be an important exposure pathway for infants and toddlers. Dermal exposure from water is thought to be a minor exposure pathway, and therefore bathing is not considered of concern.

For individuals drinking water with ~~even relatively low level~~ PFAS contamination (e.g., as low as 20 ppt), water consumption is likely their dominant exposure pathway.[2] Much of the early attention to PFAS nationally has been in response to contaminated drinking water supplies. Both community drinking water supplies and residential wells have been contaminated through past use of AFFF at military bases, as well as releases at chemical manufacturing facilities. Sizable population exposures to contaminated water have been reported in Colorado, Michigan, Minnesota, New York, New Hampshire, Pennsylvania, and Vermont.

Commented [PMM8]: Shouldn't editorialize that 20 ppt is "relatively low" – that would actually be in exceedance of NH's MCL and proposed MCLs in MI, etc.

More recent testing has shown drinking water may be contaminated by many different sources, such as landfills, residuals and septage spreading sites, air emissions from manufacturing facilities, and the discharge of AFFF for firefighting.

In 2016, the U.S. Environmental Protection Agency (EPA) issued a final Lifetime Health Advisory (LHA) informing state health agencies with regulatory authority over public water systems that, due to its adverse health effects, members of the public should not drink water where PFOA and PFOS individually or combined are measured above 70 parts per trillion (ppt). EPA Health Advisories are intended as informational resources for administrators of public water systems and agencies responsible for their oversight.

---

[2] National Report on Human Exposure to Environmental Chemicals – US CDC: https://www.cdc.gov/exposurereport/index.html

[1] Egeghy & Lorber. Journal of Exposure Science and Environmental Epidemiology (2011) 21, 150–168

[2] Need to check calculations on this, but latest NHANES blood serum levels and pharmacokinetic modeling suggests a typical daily intake for PFOS of around 28 ng/day. A typical adult person consumes a bit less than a liter per day of tap water. So at water levels above 20 ng/L, water is clearly the dominant exposure pathway.

Health Advisories are not regulations and do not represent legally enforceable standards. (EPA HA, 2016)

Since the release of the 2016 PFOA/PFOS health advisory, the ATSDR and several states have reviewed the toxicity information available for PFOA, PFOS (and some agencies have also reviewed information on PFHxS and PFNA) and proposed or developed their own toxicity values. Despite looking at ~~the~~ mostly the same toxicity information as EPA, nearly all of these agencies have adopted toxicity values as much as 10-fold lower (including ATSDR's – another federal agency - proposed values), with differences largely a consequence of divergent views on which animal studies and which toxic effects to rely on, as well as divergent views on the appropriate application of uncertainty factors.

Absent a federal drinking water standard (called a Maximum Contaminant Level or MCL), some states confronting significant community water contamination problems have proposed or adopted their own drinking water standards. These state specific standards are lower than EPA's Health Advisory, a consequence of both the aforementioned lower toxicity values but also differences in the modeling of exposure. EPA's Health Advisory is based on water consumption by a lactating woman, to be consistent with a toxicity value based on developmental toxicity resulting from in utero exposure. Some states have instead modeled water consumption by the formula-fed infant, ~~conservatively~~ assuming the infant has similar sensitivity to PFAS as the developing fetus. Recently a few states have modeled transgenerational exposure to PFAS in water that considers both exposure in utero from water consumption during pregnancy followed by exposure to the infant from breast feeding. While most states continue to rely on EPA's Health Advisory for making risk management decisions on water contamination (including Maine), a national consensus regarding appropriate guidelines for PFAS in water has not been achieved. Moreover, toxicity data is lacking for most PFAS and it would be practically impossible to obtain detailed toxicology data for all 4,000 or more class members.

Commented [PMM9]: Need to make clear that waiting for full tox data is not a viable or realistic solution.

Across the country, as well as here in Maine, PFOA, PFOS, and other PFAS are also being detected in soils, sediment, surface water, air, biosolids, septage, compost, fish, and some foods. With these discoveries, new exposure pathways become apparent, such as soil-to-groundwater and soil-to-plant. Yet models and data for some of these exposure pathways are limited, posing challenges for developing guidelines for these media. It is also becoming apparent that trace levels of PFAS can be found in soils and freshwater fish in locations with no known release of PFAS, indicating a possible role for atmospheric transport and deposition.[3]

[3] Reference VT background soil study.

PFAS in Maine

PFAS was first discovered in groundwater in Maine at former military installations. Those sites were already known to contain other contaminants and surrounding areas are served by public water supplies. The potential for more widespread PFAS impacts in Maine was not realized until PFAS was discovered in the Kennebunk, Kennebunkport, Wells Water District supply well, which led to the discovery of PFAS in a nearby dairy farm well, milk, hay and soil. This one incident raised a series of questions about the soil-to-groundwater pathway, agronomic exposure pathways, and whether this was an isolated or more common occurrence. Since that time, many State of Maine agencies have become involved in efforts to investigate, respond to, and reduce exposure of Maine citizens to PFAS.

Maine DEP, the Maine Department of Agriculture, Conservation and Forestry (DACF), and the Maine Drinking Water Program, in cooperation with the Maine Center for Disease Control (Maine CDC) continue to investigate sites and materials for possible PFAS compounds, including:

- Public water supplies near potential sources of PFAS
- Groundwater, surface water, and private water supplies around Maine DEP cleanup sites, landfills, sludge land application sites, and Superfund sites
- Retail milk supply
- Vegetation (corn and hay) associated with agricultural feed for the dairy industry
- Sludge and other residuals
- Fish tissue

Maine Department of Environmental Protection

As of October 2019, the Maine DEP has more than 30,000 records for PFAS at 244 locations across the State. The DEP follows a step-out approach to site investigation – if contaminants are found above screening levels at a sampling point, DEP evaluates environmental pathways for those contaminants and conducts testing at nearby locations where impacts may also be predicted. For example, DEP may investigate contamination along a bedrock fracture where groundwater is predicted to travel to drinking water wells. DEP's Remedial Action Guidelines, developed in collaboration with Maine CDC, recommend treatment or replacement of drinking water supplies where PFOA and PFOS exceed 70 ppt, or where all PFAS exceed 400 ppt. As a result of this approach, carbon

filtration drinking water treatment systems for PFAS have been installed on several private supplies near closed, unlined municipal landfills.

Commented [PMM10]: Can we get a specific count of locations?

Maine DEP, DACF, and Maine CDC are continuing efforts to refine modeling assumptions to ensure that decisions are made based on the best available science. Work is on-going or underway to:

- Assess historic records to determine extent of sludge spreading activities on farmland and determine appropriate next steps;
- Sample corn stalks growing on farm fields with extensive land spreading history that will be harvested for silage feedstock;
- Further evaluate the extent to which PFAS compounds transfer from soil to silage corn to animals and ultimately into the food chain;
- Communicate with other states and agencies to evaluate toxicological data that is the foundation of our modeling work.

All data is publicly available through Maine DEP's website in several formats, including:

- An interactive mapping tool that includes a visual map, the ability to search for sites, and all supporting data in a downloadable format
- For sludge land application sites, a table that includes information for all licensed sites as well as all available records of land application
- A copy of all PFAS test results for all site types included in Maine DEP's database

Commented [PMM11]: Links to the actual permits not yet available?

Recognizing the financial burden PFAS has placed on some of Maine's wastewater treatment facilities, in 2019 Maine DEP:

- Offered emergency dewatering grants to certain facilities that did not have a way to dispose of low-solids content wastewater sludge that cannot be land applied due to high PFAS levels
- Offered planning grants to assist these same facilities in planning for future wastewater sludge disposal.

Maine Drinking Water Program

Just over half (51%) of Maine citizens obtain their drinking water from private wells, which are not subject to federal or state regulation or testing requirements. The remaining 49% of Maine's population is served water by Community Water Systems, which are regulated under the federal Safe Drinking Water Act administered through Maine CDC's Drinking Water Program. Maine has approximately 378 regulated Community Water Systems

(water systems that serve people in their homes on a year-round basis). Community Water Systems must test for approximately 87 manmade and natural contaminants on a regular basis and take necessary steps to reduce detected contaminant levels to below drinking water standards established by EPA, known as Maximum Contaminant Levels (MCLs). Maine also has 375 Non-Transient Non-Community systems (these include schools and businesses); 1,151 Transient systems (these include restaurants and campgrounds); and 54 regulated bottled water sources. These systems are also subject to regulation, albeit less rigorous than the requirements for Community Water Systems.

Public water supplies are not required to monitor for or treat PFAS in drinking water. However, several public water supplies have been sampled for PFAS in Maine through an EPA-coordinated sampling program from 2013-2015 and two sampling rounds coordinated by the Maine CDC Drinking Water Program in 2017 and 2019. These programs were part of a data gathering effort to help evaluate the presence of PFAS in Maine's public water systems to inform future decisions on possible regulation of these chemicals as drinking water contaminants. The combined sampling efforts have resulted in analysis of drinking water samples for PFAS concentration in a total of 53 public water systems in Maine, mostly Community Water Systems. These systems represent more than 65% of the population served by Community Water Systems.

Maine CDC has advised public water systems testing for PFAS to use EPA's Health Advisory to guide decisions on whether to install filtration to reduce PFAS levels. The current Health Advisory for drinking water is a combined concentration of 70 ppt for two PFAS compounds, perfluorooctanoic acid (PFOA) and perfluoro octane sulfonate (PFOS). To date, only one public water supply was found to have combined PFOA and PFOS above the health advisory of 70 ppt. This is a small community system in Houlton, Maine (Houlton Mobile Home Park) serving approximately 140 people. This system is currently providing bottled water to their customers while considering installation of a treatment system and/or replacement of the water source. In addition, one public water supply in southern Maine (Kennebunk, Kennebunkport & Wells Water District) serving a population of approximately 34,250 elected to install a treatment system for PFAS in one of their well sources~~, although PFAS levels in the well did not exceed 70 ppt.~~

PFAS tested for have not frequently exceeded the standards used by Maine ~~Based on PFAS sampling~~ in ~~Maine's~~ public water systems tested -to-date~~, PFAS does not appear to be present in most public drinking water~~. Where detected, PFAS levels tend to be ~~very low (i.e., well~~ below EPA's Health Advisory~~)~~, with a couple of exceptions as noted above (although, as previously noted, other states have adopted levels up to 10x lower than EPA). Considering that all the systems included in the State-coordinated sampling

Commented [PMM12]: The testing data I have from Norm shows that the production well exceeded 70 on several tests, at least one while it was active from the looks of it. I believe this statement is, at best, somewhat misleading if not incorrect.

Commented [SW13]: While the water tested accounts for about 65% of the population on public water, I don't believe you can argue that it does not appear to be present in public drinking water. Just because it's not at 70 ppt, does not mean it's not present. And, there are over 300 community water systems that still need to be tested.

Commented [PMM14]: Should not editorialize that "very low" and "below EPA's HAL" are equivalent. Should also put in context with other state standards, not just the EPA

programs were selected due to their proximity to potential sources of PFAS contamination, these results indicate that Maine does not have widespread PFAS contamination of public drinking water. However, since PFAS is present in many consumer products, waste streams and industrial processes, a thorough assessment of potential risk to consumers served by Community Water Systems would need to include sampling of all 378 systems.

In Maine's most recent PFAS sampling round conducted in 2019, seventeen (17) of the thirty-six (36) public water systems included in the program declined to participate, in several cases stating that they wished to wait until testing was required rather than participating in the voluntary sampling program. Based on this result, it may be necessary to create a requirement for Community Water Systems to sample for PFAS to assess potential risks to all of Maine's citizens that receive their water from Community Water Systems. This would require action by the State Legislature to enact new laws requiring Community Water Systems to test for PFAS at specified intervals in addition to their regular monitoring requirements under the Safe Drinking Water Act. The Maine CDC recommends that public water systems continue to use EPA's Health Advisory to guide decision making on treatment and public notification when PFAS is detected until EPA's Health Advisory may be superseded by new MCLs established at the federal level.

Commented [PMM15]: Are updated numbers available given seeming confusion from some who declined?

Maine Department of Agriculture, Conservation and Forestry

DACF is responsible for ensuring the safety of Maine's food supply while providing support to farmers and food producers through a host of programs and resources. To date, DACF has concentrated its efforts on investigating potential contamination of PFAS in retail milk; however, it anticipates this scope to expand upon further data collection and assessment~~, additional scientific study, and the establishment of recognized PFAS standards for food.~~

Commented [PMM16]: We should not wait for standards to be testing

In late 2016, PFAS chemicals were found to be present at levels up to 1420 ppt in the milk of a Maine dairy farm that had historically applied biosolids and papermill residuals to its fields. These results exceeded the Action Threshold of 210 ppt for milk that was developed by the Maine Center for Disease Control & Prevention to determine when milk is considered adulterated.

To start an ~~determine the~~exploration of the safety of Maine's ~~current overall~~ milk supply, DACF surveyed ~~completed a state-wide~~ retail milk ~~survey~~ in June 2019. The limited survey focused on Maine-produced, fluid pasteurized milk that was: 1) bottled in-state; or 2) was bottled out of state but sold in Maine. Twenty-six samples were taken throughout the

state ~~to ensure broad geographic representation~~. All results were below the laboratory reporting level of 50 ppt (however PFAS was detected in many samples below the reporting level).

~~At the same time DACF~~DACF also tested milk from three commercial dairy farms, two with a~~n extensive~~ history of biosolid and/or paper mill residual applications and whose soil samples exceeded DEP's screening levels for PFOA and/or PFOS. The third farm was near the farm that had tested high for PFOS in 2016. The results from all three farms were also below the lab's reporting level of 50 ppt (but not necessarily above a limit of detection)~~.~~

Future testing of milk and other agricultural products will occur based on additional factors, including the careful review of historic records, assessment of emerging science (including improved testing methods), and with the establishment of PFAS thresholds for other foods. DACF is in the process of assessing historical records of where licensed residuals may have been applied on Maine farmland. These records must be vetted to fully understand past spreading activities (residual type(s), location(s), amount(s), and date(s)), the crops or livestock produced, soil characteristics, and other relevant data to assess potential risk and next steps.

DACF will work closely with any farmer whose products may be found to be adulterated by PFAS, with the goal of identifying mitigation strategies that could allow them to continue farming and producing safe agricultural products. DACF, in collaboration with DEP and DHHS, is prepared to help identify on-farm sources of PFAS contamination, design elimination strategies, and conduct ongoing testing and monitoring. It will further advocate for additional sources of funding to assist farmers who face financial hardship from lost production caused by PFAS contamination.

Maine Emergency Management Agency

The Maine Emergency Management Agency implements the Toxics Release Inventory (TRI) reports for the State. At the current time PFAS is not a TRI chemical but recommendations to the US EPA have been sent on behalf of Maine to include PFAS on the chemical list.

The AFFF working group was formed to establish a comprehensive inventory of Class B AFFF firefighting foam throughout Maine and to make recommendations to the Governors PFAS Task Force regarding the future use of Class B AFFF. The AFFF workgroup included the State Fire Marshal and representation from Maine DEP, MEMA, Maine Fire Chief's Association, Maine Professional Firefighters Association, Maine Department of

Commented [PMM17]: But PFAS were detected above the LOD

Commented [SW18]: I would argue we need to test more than three sites to say there has been state-wide testing.

Labor, Maine Fire Service Institute, Bangor International Jetport, Portland International Jetport, Sappi Fine Paper, Maine State Police, Irving Oil, Citgo Oil, Global Partners LP, Gulf Oil, State Emergency Response Commission, and the Maine Air National Guard. A formal letter of request from the State Fire Marshall along with a survey was developed and sent to all Maine fire departments and industry partners to collect Class B AFFF information on behalf of the Task Force. Additionally, working group members developed and emailed a Class B AFFF infographic to all fire service organizations and industry partners in the state. Out of 305 fire departments in the State only 60 responses were received and out of 20 industry partners only 8 were received. Response to these surveys has been disappointing, even after multiple requests. We are unaware of any mechanism that obligates response to these surveys. Maine DEP, MEMA and the State Fire Marshal's office will continue to encourage organizations to respond to these surveys and manage survey data for future use to ensure accurate information is available once an appropriate takeback and replacement program is established.

The AFFF workgroup submitted their recommendations to the Maine PFAS Task Force at their October 29, 2019 meeting. Those recommendations are included in Appendix D.

DRAFT

Recommendations

1. **Identifying and reducing sources of PFAS;**
2. **Providing safe drinking water;**
3. **Protecting our food supply;**
4. **Responsible waste management;**
5. **Improving public education about PFAS;**
6. **Demanding federal action; and**
7. **Funding for state agencies to investigate, respond to and reduce exposure of Maine citizens to PFAS.**

1. Identifying and Reducing Sources of PFAS

The Task Force recommends that the State of Maine require manufacturers to report the intentional use of all PFAS in manufacturing processes and in consumer products, and to require the use of safer alternatives when they are available. Legislation would be necessary to require this. In the interim, the Task Force recommends DEP maximize use of existing authorities under Title 38, Chapter 16-D to name PFAS as priority chemicals and require reporting under all applicable categories under the law.

The Task Force also recommends that existing authorities granted to DEP and POTW operators should be used to the greatest extent possible to identify and control commercial or industrial PFAS discharges to sewer systems.

The Task Force supports the recommendations of the Firefighting Foam workgroup, included in Appendix D, with the addition that existing alternatives to fluorinated foam have already been shown to be effective for many scenarios and should be rapidly deployed everywhere appropriate. This includes reporting discharges of Class B AFFF to the DEP and establishing a Class B AFFF take back and replacement program.

The Task Force recommends that State of Maine procurement guidelines should discourage the purchase of PFAS-containing products.

2. Providing Safe Drinking Water

The Task Force recommends that all public water systems should be required to test for PFAS and to notify their customers if PFAS are detected. This is similar to the approach taken by the State of California.

Task Force members disagreed about the level at which customers should be notified; Maine DWP recommended 10 ppt while some other members recommended notification at any level of detection. Maine has not, to-date, taken this approach with any other contaminants. For all other drinking water contaminants, Maine public water systems are only required to provide notice if concentrations exceed a maximum contaminant level (MCL). The Task Force recommends ll~~L~~egislation ~~would be~~to require~~d to~~ the State to establish a testing and notification requirement for PFAS.

Recognizing that updates to the EPA RfD and a federal MCL are likely years away, the Task Force recommends ~~and to set a~~ Maine set a ~~specific~~ health risk value and MCL informed by the ATSDR draft assessment and actions taken by New Hampshire and other impacted states.~~to inform PFAS standards and treatment decisions across the State.~~.

The Task Force also recommends that private drinking water should be tested at the state's cost for PFAS in areas where groundwater is likely to have been impacted by PFAS at unsafe levels, such as: 1) manufacturing locations that utilized PFAS chemistry; 2) unlined landfills; 3) areas where Class B AFFF has been discharged or stored; and 4) residuals land spreading sites. Additionally, the Task Force recommends funding for educational outreach and financial assistance to expand testing and treatment of all residential well water to reduce exposure to PFAS. Some members recommended that the State should require PFAS testing of private wells at the time of real estate transfers.

The Task Force recommends that we work to expand in-state laboratory capacity for PFAS testing, including exploring equipping the ~~the~~ State laboratory to perform PFAS testing. ~~should be required to offer PFAS testing for residential drinking water wells.~~

To both protect drinking water supplies and our natural environment, t~~T~~he Task Force also recommends that the State establish water quality criteria and effluent limits for PFAS, as well as establish an air deposition sampling program for a suite of PFAS.

3. Protecting our Food Supply

~~Foods may contain PFAS in unsafe quantities due to contact with PFAS-containing materials (such as packaging or processing equipment), due to vegetative uptake into produce, due to livestock consumption of PFAS-containing feed, or due to other environmental exposures. Regulation of contaminants in food is controlled almost~~

~~exclusively by the U.S. Food and Drug Administration. (See Recommendation #6 for further discussion of federal actions.)~~

Commented [PMM19]: This is background, not a recommendation and should be covered above

The Task Force recommends that the State protect foods produced in Maine from PFAS adulteration through restrictions on PFAS uses, restrictions on the agronomic utilization and land application of PFAS-containing residuals, and through the investigation and remediation of PFAS contamination. To jumpstart the investigation, the Task Force

~~We~~ recommends legislation to require testing of all agricultural~~farmland~~ sites where ~~historic~~ sludge spreading has taken place historically, as well as of the agricultural products produced at such sites, with a clear timetable for completion and prioritization, starting with the sites that received industrial sludge.~~.~~ In order to ensure farmers and landowners have access to legal remedies for PFAS contamination, ~~The~~the Task Force also recommends that the legislature ~~should also pass legislation to~~ change the statute of limitations for private actions to six years from date of discovery of problem.~~;~~

4. Responsible Waste Management

The State of Maine must take actions to prevent PFAS from entering Maine's environment, food supply, and drinking water. The Task Force supports legislation to amend Maine's Uncontrolled Sites law to include pollutants and contaminants, which would give the State authority to require the removal and treatment of PFAS when they are a danger to public health.

The Task Force recommends that DEP require regular testing of residuals for PFAS prior to land spreading or commercial distribution in Maine and prohibit the land application of residuals in exceedance of the screening levels. The Task Force also recommends expanding existing requirements to include septage that is agronomically utilized or land applied. The Task Force encourages Maine CDC to expeditiously finish its agronomic uptake model for PFAS and ~~The Task Force~~ supports legislation that would authorize the Board of Environmental Protection to update DEP's screening levels for individual PFAS and other constituents, including based on the agronomic model, through routine technical rulemaking so those levels can be kept up to date.

The Task Force also recommends the State continue efforts to sample for PFAS in prioritized locations, analyze sampling results for patterns, and refine models of PFAS fate and transport.

~~Maine DEP should investigate the availability of treatment and disposal technologies that minimize the potential for environmental PFAS contamination. Preference should be given to technologies with the demonstrated capacity to safely destroy~~

~~PFAS.~~ Additionally, the State of Maine should promote the development of infrastructure, on the scale necessary to meet the needs of the State, to manage PFAS-contaminated wastes safely and in a cost-effective manner.

Commented [PMM20]: Must be clear that there is NOT an endorsement of incineration.

5. Public Education

Maine citizens, physicians, government officials and other professionals must have access to information regarding PFAS to guide their own decision making. The Task Force recommends that the State develop educational materials at the appropriate literacy level for their intended audience, to be provided through a variety of forums such as webpages, training events, and fairs. Those audiences should include healthcare providers, farmers, drinking water and wastewater utility customers, fire fighters, teachers and students.

6. Demand for Federal Action

The Maine PFAS Task Force demands that federal government agencies take prompt action to reduce harmful exposures of ~~citizens~~ people to PFAS due to the widespread nature of PFAS uses and potential exposures. ~~–~~These actions should include:

a) Source reduction

The federal government should require manufacturers to reduce and eliminate the use of PFAS chemistry in non-essential applications, with particular focus on those uses with the highest potential for human exposure. EPA should suspend the approval of new PFAS. Manufacturers (domestic and foreign) of consumer products should be required to report their use of PFAS compounds in products sold in the United States.

The Federal Aviation Administration and the Department of Defense should identify effective foams that do not contain PFAS and should eliminate requirements for firefighting foams to contain PFAS.

OSHA and NIOSH should adopt exposure limits for workers exposed to PFAS. These limits should also apply to firefighters and other emergency personnel supporting emergency response activities.

The U.S. EPA should add PFAS to the hazardous substance list under CERCLA authority.

b) Drinking Water

The U.S. EPA should establish a Maximum Contaminant Level for PFAS in drinking water, which should also be adopted by the FDA for~~apply to~~ bottled water.

c) Food supply

The U.S. FDA should revoke authorization for PFAS in all food contact materials, expand its published testing methodologies for PFAS in food, include all measurable PFAS in its Total Diet Studies, as well as establish PFAS adulteration levels for foods in order to minimize dietary exposures to all PFAS.

The U.S. Department of Agriculture should establish additional sources of funding support for farmers impacted by PFAS contamination, similar to the Farm Service Agency's Dairy Indemnity Payment Program.

The EPA should amend land application regulations to require universal testing of PFAS in residuals and support the development of agronomic models of PFAS uptake from residual treated soils.

d) Waste Management

ATSDR should finalize toxicity values for PFAS commonly found in environmental samples. The U.S. EPA should then update Regional Screening Levels to include additional screening level guidelines. The U.S. EPA should also certify additional laboratory methods to measure PFAS in various media (groundwater, wastewater, soils and other solids, ambient air).

7. Funding for State Actions

The State of Maine is expending significant funds to investigate and control PFAS exposures for Maine citizens, and substantial additional funding will be needed to continue this work. Municipalities, drinking water and wastewater utility districts, farmers, businesses, property owners and other Maine citizens are also bearing direct and indirect costs from PFAS contamination.

State funding

The Task Force recommends that funding from appropriate State of Maine accounts should be utilized, to the extent it is available, to fund sampling and treatment of drinking water supplies, and to fund the investigation of PFAS contamination that threatens Maine's citizens. State of Maine agencies must also be adequately staffed to

conduct the work necessary to implement any and all of the Task Force's recommendations, which will cost many millions of dollars in the coming years.

Bond Initiative

The Task Force recommends that the State of Maine introduce a bond initiative to raise money for the State's costs for PFAS sampling, remediation, and drinking water treatment.

Damage Claims

Many municipalities and states across the country are engaged in litigation against companies that manufactured PFOA and PFOS products, including claims for financial compensation. The Task Force recommends that the State of Maine fully consider available legal avenues to apply the costs of PFAS contamination in Maine to appropriate responsible parties who knowingly supplied products that are harmful to human health and the environment.

Conclusion

These recommendations reflect a commitment to determine where contamination exists in Maine and to put in place strategic responses to protect people from exposure. Through our deliberations and review of data, we concluded that PFAS is a health concern for Maine citizens and requires our attention. We believe that these recommendations exemplify the sincerity of our work and the seriousness of this contamination issue.

December 6, 2019

Maine PFAS Task Force
VIA ELECTRONIC MESSAGE

RE: AFFF Alternatives and Draft Recommendations

Dear Dr. Tipton & Task Force Members:

This letter expands upon the general comments already provided by Mike Belliveau to the task force as to the use of PFAS containing aqueous film forming foams (AFFF) and related recommendations. The draft task force report currently calls for reporting any use of AFFF to DEP and the establishment of a buyback program. It also references and approves by reference the recommendations of the firefighting foam workgroup report. The workgroup report in turn notes, "Because Class B AFFF is vital for controlling and extinguishing petroleum-based fires, allow continued use of the currently available product until a suitable and effective replacement is identified to save life and critical infrastructure."

While we support the reporting of the use of AFFF and the creation of a buy-back program (although urge the burden be placed on manufacturers to accept the returns), the Environmental Health Strategy Center believes that it is mistaken to imply that there are not PFAS-free AFFF available that are more than adequate to serve as a "suitable and effective" replacement for PFAS-foams. Except where specifically required by Federal rules (i.e. airports), the task force should recommend legislation to require the replacement of all PFAS containing AFFF with PFAS-free foams on a very short timetable.

There is often confusion as to the standards which AFFF must meet and what formulations meet which standards. Although Congress has directed the Federal Aviation Administration (FAA) to update its rules, currently airports of a certain size must maintain a supply of AFFF that meets U.S. Military Specification for firefighting foams, MIL-PRF-23485F(SH) (MIL-SPEC). Currently, the only foams that meet the MIL-SPEC contain PFAS. **However, not all PFAS-containing foam actually meet the MIL-SPEC.** Many PFAS-containing foams, including some currently in the stockpiles of Maine fire departments based on the survey conducted, would not qualify as MIL-SPEC foams allowable for use at airports.[1]

While there are many other standards for AFFF, the most commonly referenced one in the United States is UL 162. This standard does NOT require PFAS, and several PFAS-free foams meet this standard. Therefore, many of the foams currently used in fire departments outside of airports in Maine could be replaced with a "suitable and effective" PFAS-free foam since **the PFAS-free foams are already meeting the same standard as these PFAS-foams.**

While we recognize that until federal standards are updated there may be reason for some PFAS foam at regulated facilities, and do not seek to prohibit the use of PFAS containing AFFF until a replacement alternative is on hand, it is also important to note that many other regulators have determined that this use is not essential for "saving life and critical infrastructure." In January 2018, the Australian state of Queensland became the first governmental body in the world to ban fluorinated firefighting foams, with no exemptions. In the United States, states have taken the lead in addressing fluorinated foam use. Washington State passed the first law in the nation restricting the sale of fluorinated foams in 2018 and prohibiting their use in training, with exemptions for oil terminals and refineries, chemical plants, and where required by federal law. Colorado, New York, and New

[1] List of those meeting the MIL-SPEC is available at https://qpldocs.dla.mil/search/parts.aspx?qpl=1910&param=QPL-24385&type=256

Hampshire passed similar laws in 2019. The states of Virginia, Kentucky, Minnesota, Georgia, and Arizona all passed laws in 2019 that ban the use of fluorinated foams in training but exempt other uses.

On the federal level, the U.S. FAA Reauthorization Act of 2018 directed the FAA to eliminate the requirement for civilian airports to use PFAS-containing firefighting foams, and congress is now considering the National Defense Authorization Act for fiscal year 2020, which contains provisions in both the House and Senate versions to end the military use of fluorinated foams.

PFAS-free foams are in widespread use around the U.S. and the world, including at airports and refineries. The Interstate Chemicals Clearinghouse commissioned a report on AFFF that identifies 100 products from 24 manufacturers.[2] In a July 2019 article in International Airport Review, Dr. Ian Ross listed 20 major international airports that have switched to fluorine free, including London Heathrow, Paris Charles de Gaulle, Copenhagen, Stuttgart, and Melbourne.[3] He states, "Environmental and public health concerns, regarding PFASs, developing since 2000, has stimulated significant innovation to create F3 foams, meaning that over the last 20 years, fire-fighting foams and their delivery systems have evolved to be far more effective, without a need for PFASs in most circumstances."

Major oil companies have had a program to actively test firefighting foams, including fluorine-free foams, for a number of years via the consortium known as LASTFIRE. LASTFIRE is, "A consortium of international oil companies developing best industry practice in storage tank Fire Hazard Management through operational feedback, networking, incident analysis, and research."[4] It currently includes 19 oil company members. The consortium tracks incidents and provides information on prevention and mitigation, and has created its own foam test specific to large atmospheric storage tanks. Most recently, it conducted tests showing fluorine-free foam using a compressed air foam (CAF) pourer, achieving extinguishment of a 40 m pan at half the NFPA application rate.[5] In 2016, the consortium issued a position paper on foam that details response strategies including defensive, controlled burn down, or offensive, with foam application through fixed systems or monitor equipment.

Given the fact that, outside of federally regulated applications, there is a broad range of proven PFAS-free alternatives that are both available and meeting the same standards as the PFAS containing AFFF, the task force should amend its recommendations to clearly establish a timeframe for the replacement of existing PFAS containing AFFF with PFAS-free alternatives.

Thank you for the opportunity to provide this comment. If you have any questions or concerns, please do not hesitate to contact Patrick MacRoy at 207-699-5796 or pmacroy@ourhealthyfuture.org.

Sincerely,

Patrick M MacRoy

Patrick MacRoy
Deputy Director

---

[2] New York Pollution Prevention Institute. "Per- and Polyfluorinated Substances in Firefighting Foam." 2018. Attached and Available at https://cswab.org/wp-content/uploads/2019/03/PFAS-in-Firefighting-Foam-New-York-State-Pollution-Prevention-Institute-Dec-2018.pdf

[3] Ross, I. "Is the burst of the AFFF bubble a precursor to long term environmental liabilities?" International Airport Review 2019.

[4] LASTFIRE. "LASTFIRE Public Presentation: Developing best practice guidance in storage tank Fire Hazard Management." Available at: http://www.lastfire.co.uk/uploads/LASTFIRE%20Public%20Presentation.pdf

[5] *Ibid.*

Strengthen the Draft Report of the Maine Governor's PFAS Task Force

The draft report of the Governor's PFAS Task Force provides a solid foundation, but must be strengthened to meet the Executive Order's charge to assess the extent of contamination, and recommend actions to protect public health and the environment, from per- and polyfluoroalkyl substances (PFAS). The Environmental Health Strategy Center recommends the following improvements:

1. **Investigate Historical Sludge-Spreading Sites with a Clear Plan and Timetable.** High-level PFAS pollution discovered at Stoneridge Farm exposed tens of thousands of consumers to PFAS in milk and drinking water, and catalyzed the formation of the Governor's PFAS Task Force. The Maine Department of Environmental Protection has compiled a list of nearly 500 other properties, mostly farmland, where sludge was spread over the last four decades. Yet, the draft report notes that only about three farms where sludge was recently spread have had their fields and agricultural products tested for PFAS. ***The Task Force should explicitly recommend that DEP develop an investigation plan and timetable for testing all sludge spreading sites to find any yet-undiscovered high-level PFAS contamination. Both the soil and the agricultural products from these farms should be assessed without further delay.***

2. **Test Agricultural Products for PFAS Contamination.** As noted in the report, most people's exposure to PFAS is driven by dietary exposures. Yet, the draft report does little to call for testing of agricultural products grown in PFAS- contaminated fields and seeks to shift responsibility to the U.S. Food and Drug Administration (FDA), which has a poor track record in preventing or responding to PFAS contamination. ***The Task Force should recommend that the state establish a timetable to proactively test agricultural products for PFAS contamination, with a continued state commitment to determine when PFAS results in adulteration of food without waiting for FDA.***

3. **Establish Health-Based Risk Values to Inform Maine PFAS Standards.** Maine continues to rely on a non-binding Health Advisory Level of 70 parts per trillion (ppt) for just two PFAS (PFOS and PFOA) in drinking water based on reference doses set by the U.S. Environmental Protection Agency (EPA), despite a draft finding by the U.S. Health and Human Services that the underlying risk values should be about ten times lower to protect human health. Many other states including New Hampshire, Vermont and Massachusetts are using the best available science to set action levels and/or drinking water standards that are far more protective than the EPA advisory level. Some independent scientists have recommended a limit of 1 ppt for total PFAS in drinking water. ***The Task Force should recommend that Maine Center for Disease Control and Prevention (CDC) adopt Maine-specific health risk levels for all PFAS compounds with sufficient data, based on the best available science. Those risk values should inform the proposed adoption of a Maine drinking water standard for total PFAS, as well as other relevant environmental public health standards.***

4. **Strengthen Safety Protections for Residential Drinking Water Wells.** Household wells supply water for drinking, cooking and bathing to about half our population, making Maine more dependent on well water than any other state in the country. Yet well water remains exempt from the legal health protections of the Safe Drinking Water Act. Many PFAS are extremely mobile in the environment, spreading quickly through ground water and the air, and extremely persistent, meaning they don't readily break down into less harmful substances. Therefore, appropriately, the draft report recommends universal testing of public water systems and testing of well water near known or

potential PFAS pollution sources. However, this leaves the vast majority of wells untested and unprotected. ***The Task Force should recommend funding for educational outreach and financial assistance to expand testing and treatment of residential well water to reduce exposure to PFAS.***

5. **Turn off the Tap through Optimal Use of Existing Source Reduction Authority.** PFAS pollution will continue in perpetuity unless all non-essential uses are replaced with safer alternatives. We support the legislative recommendation for universal disclosure of PFAS in products, yet DEP need not wait for legislative action. ***The Task Force should recommend that DEP use its existing authority under Title 38, including Chapter 16-D (Products) and Chapter 3 (Water), to require reporting of PFAS uses, and source reduction of PFAS discharges into sewage systems and rivers.***

6. **Phase Out the Use of Fluorinated Firefighting Foam.** The use of fluorinated Aqueous Film-Forming Foam (AFFF) for firefighting remains a major source of PFAS pollution. Washington State passed a law to replace all fluorinated AFFF not required by federal law and to require manufacturers to pay for take-back of existing stocks. Safer effective alternatives to fluorinated AFFF are already in elsewhere. ***The Task Force should recommend legislation similar to Washington State to phase out non-required uses of fluorinated AFFF with manufacturer take-back responsibility.***

7. **Adopt Ambient Water Quality Criteria and Effluent Limits for PFAS.** Maine surface water quality, fish and wildlife, and sludge management have been impaired by PFAS pollution. ***The Task Force should recommend that DEP adopt PFAS water quality standards to prevent pollution.***

8. **Phase Out Spreading of PFAS-Contaminated Sludge and Compost.** DEP has adopted a policy, with no legislative direction, that allows sludge exceeding PFAS screening levels to be spread on farmland if the farm is not already too polluted, and to be composted with unrestricted sale and distribution. Food and feed crops readily take up some PFAS, and dilution is not the solution to pollution. ***The Task Force should call for the end of any land application of material exceeding the screening levels.***

9. **Increase State Funding to Find, Assess and Prevent PFAS Pollution.** Clearly, more state resources are needed to solve the PFAS health threat. Existing state agency resources have been stretched thin in responding to known PFAS problems, which continue to grow. **The Task Force should recommend that the Legislature add funding to the state budget of for PFAS response.**

10. **Make the Polluters Pay - Recover Costs from PFAS Manufacturers.** The costs for damages to the state's natural resources and for PFAS cleanup at potentially hundreds of sites will tally in the tens or hundreds of millions of dollars. ***The Task Force should more forcefully recommend that Maine's Attorney General take legal action to seek cost recovery from PFAS manufacturers.***

11. **Extend the Statute of Limitations for Private Actions to Six Years from Date of Discovery.** Both public and private actions will be required to ensure that the many uncontrolled PFAS pollution sites are cleaned up and compensation paid for resulting harm. Yet Maine law appears inconsistent and unfair, allowing State government to initiate an action against a responsible party within six years of the *discovery* of PFAS pollution, but requiring a private party to initiative an action within six years of the *occurrence* of PFAS pollution. ***The Task Force should recommend that the Legislature extend the statute of limitations for private actions to six years of discovery of PFAS pollution.***

Per- and Polyfluorinated Substances in Firefighting Foam

New York State Pollution Prevention Institute
Rochester Institute of Technology
December 2018

Acknowledgements

Written by Kate Winnebeck, Senior Project Manager, New York State Pollution Prevention Institute

The New York State Pollution Prevention Institute (NYSP2I) carried out this project for the Interstate Chemicals Clearinghouse (IC2). Throughout most of the project duration, a subgroup of the IC2's Alternatives Assessment (AA) Workgroup held conference calls and worked collaboratively on the information contained in this report. Active subgroup members are listed below and their involvement was critical to the success of the project. NYSP2I and IC2 gratefully acknowledge the contributions of these members of the IC2 AA Workgroup.

Brian Penttila	Department of Ecology, State of Washington
Holly Davies	Local Hazardous Waste Management Program, King County, State of Washington
Liz Harriman	Toxics Use Reduction Institute
Shari Franjevic	Clean Production Action
Simona Balan	California Department of Toxic Substances Control
Topher Buck	Interstate Chemicals Clearinghouse / NEWMOA

Developed for the

http://theic2.org/

About the IC2

The Interstate Chemicals Clearinghouse (IC2) is an association of state, local, and tribal governments that promotes a clean environment, healthy communities, and a vital economy through the development and use of safer chemicals and products. The goals of the IC2 are to:

- Avoid duplication and enhance efficiency and effectiveness of agency initiatives on chemicals through collaboration and coordination
- Build governmental capacity to identify and promote safer chemicals and products
- Ensure that agencies, businesses, and the public have ready access to high quality and authoritative chemicals data, information, and assessment methods

The functions of the IC2 include:

- Supporting health and environmental agencies with development and implementation of programs to promote use of safer chemicals and products
- Supporting the development of alternatives assessment methods and identification of safer alternatives
- Sharing data and information on use, hazard, exposure, and alternatives
- Sharing strategies and outcomes on chemicals prioritization initiatives
- Building the capacity of agencies by sharing materials, strategies, and trainings
- Assisting agencies in meeting the relevant information needs of businesses, consumers, and the public

The IC2 is a program of the Northeast Waste Management Officials' Association (NEWMOA). For more information visit: http://theic2.org.

Disclaimer

The information contained in this paper is intended for general information purposes. Any opinions, results, findings, and/or interpretations of data contained herein are the responsibility of the Rochester Institute of Technology (RIT) and do not necessarily represent the opinions, interpretations, or policy of the State of New York. NEWMOA, the IC2, and the New York State Pollution Prevention Institute (P2I) at RIT have sought to ensure the accuracy of this information but make no guarantees, implied or expressed. The views expressed in this paper do not necessarily reflect the views of NEWMOA, the IC2, or their members. Mention of any company, process, or product name should not be considered an endorsement by P2I, NEWMOA, the IC2, or their members.

New York State Pollution Prevention Institute
Rochester Institute of Technology
111 Lomb Memorial Drive
Rochester, NY 14623
Web: www.nysp2i.rit.edu
Email: info@nysp2i.rit.edu
Phone: 585-475-2512

Funding Provided by the NYS Department of Environmental Conservation

Contents

Tables

Glossary

alternatives assessment: The process for identifying and comparing potential chemical and non-chemical alternatives that could replace chemicals of concern on the basis of their hazards, comparative exposure, performance, and economic viability.[1]

aqueous film-forming foam (AFFF): A synthetic firefighting foam developed for Class B fires consisting of a fluorochemical and hydrocarbon surfactants combined with high boiling point solvents and water. AFFF have low viscosity and spread rapidly across the surface of most hydrocarbon fuels, forming a water film beneath the foam to cool the fuel, smother the fire, and stop the formation of flammable vapors.

C6 foam: Short-chain, fluorinated firefighting foams that contain perfluorocarboxylic acids (PCAs) with carbon chain lengths of seven and lower, which include perfluorohexanoic acid (PFHxA) and perfluorosulfonic acids (PFSAs) with carbon chain lengths of five and lower, as well as perfluorobutanesulfonic acid (PFBS).

C8 foam: Long-chain, fluorinated firefighting foams that contain perfluorocarboxylic acids (PFCAs) with carbon chain lengths of eight and higher, which include perfluorooctanoic acid (PFOA) and perfluorosulfonic acids (PFSAs) with carbon chain lengths of six and higher, as well as perfluorohexane sulfonic acid (PFHxS) and perfluorooctane sulfonate (PFOS).

Class B fires: Any fire involving flammable liquid(s), such as gasoline, solvents, or other fuels, where blanketing and smothering for vapor suppression is needed.

F-34 fuel: Popularly known as “JP-8” or “JP8” (NATO code for "Jet Propellant 8") , F-34 is a jet fuel that is used widely by the U.S. military. It is specified by MIL-DTL-83133 and British Defence Standard 91-87, and is similar to Jet A-1, a commercial aviation fuel, but with the addition of corrosion inhibitor and anti-icing additives.

firefighting foam: A mixture of air, water, and a foam concentrate that fights fires by blanketing burning fuel, smothering the fire, separating flames from the fuel source, cooling the fuel and adjacent surfaces, and suppressing the release of flammable vapors that can mix with air. (See “water additives” entry for more on the use of the term “water additive(s)” in this report.)

fluorine-free foam: A firefighting foam or other water additive that is free of fluorinated surfactants and thereby containing no fluorine. (See “water additives” entry for more on the use of the term “water additive(s)” in this report.)

fluorosurfactant: Synthetic organofluorine chemical compounds that have multiple fluorine atoms and are made up of two parts: a polar hydrophilic head and a highly hydrophobic fluorocarbon tail. As surfactants, they are more effective at lowering the surface tension of water than comparable hydrocarbon surfactants.

fluorotelomer: Fluorocarbon-based oligomers, or telomers, that are synthesized by telomerization. Some fluorotelomers and fluorotelomer-based compounds are a source of environmentally persistent perfluorinated carboxylic acids, such as perfluorooctanoic acid (PFOA).

GreenScreen® for Safer Chemicals: A globally recognized tool that identifies hazardous and safer chemicals through a rigorous benchmarking scoring system. Products and substances can achieve certification through the assessment program, becoming GreenScreen Certified™.

[1] The Association for the Advancement of Alternatives Assessment uses this definition from the U.S. National Research Council, https://www.saferalternatives.org/about

per- and polyfluoroalkyl substances (PFAS): A group of synthetic chemicals used to make fluoropolymer coatings and products that are resistant to heat, water, and oil. PFAS have been used in a variety of industries since the late 1940s and include perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), which have historically been used in aqueous film forming foam (AFFF).

perfluorooctanoic acid (PFOA): A synthetic, fully fluorinated organic acid (where all hydrogens on all carbons have been replaced by fluorines) comprised of chains of eight carbons that is used in a variety of consumer products and in the production of fluoropolymers. The acid is generated as a degradation product of other perfluorinated compounds. Due to strong carbon-fluorine bonds, PFOA remains stable despite metabolic and environmental degradation. PFOA is a member of a large group of perfluoroalkyl substances (PFAS) that are used to make products more resistant to stains, grease, and water. These compounds have been widely found in consumer and industrial products, as well as in food items. Major U.S. manufacturers voluntarily agreed to phase out production of PFOA by the end of 2015.[2]

perfluorooctane sulfonate (PFOS): A synthetic, fully fluorinated organic acid (where all hydrogens on all carbons have been replaced by fluorines) comprised of chains of eight carbons that is used in a variety of consumer products. It occurs as a degradation product of other perfluorinated compounds. Due to strong carbon-fluorine bonds, PFOS remains stable despite metabolic and environmental degradation. PFOS is a member of a large group of perfluoroalkyl substances (PFASs) that are used to make products more resistant to stains, grease, and water. These compounds have been widely found in consumer and industrial products, as well as in food items. In 2002, the only major U.S. manufacturer voluntarily agreed to phase out production of PFOS.[3]

water additives: A liquid—such as foam concentrates, emulsifiers, and hazardous vapor suppression liquids and foaming agents—intended to be added to water for fire control and extinguishment.[4] While the term "water additive(s)" encompasses all types of products (not only foams) intended to be added to water to extinguish fire, the term "firefighting foam" is frequently used in its place. In this report, unless otherwise noted, "firefighting foam," or simply "foam," is used synonymously with "water additive(s)."

[2] U.S. EPA Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA), 2016, https://www.epa.gov/sites/production/files/2016-05/documents/pfoa_health_advisory_final-plain.pdf
[3] U.S. EPA Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS), 2016, https://www.epa.gov/sites/production/files/2016-05/documents/pfos_health_advisory_final_508.pdf
[4] NFPA 18 Standard on Wetting Agents

Acronyms

AFFF	aqueous film-forming foam
DoD	U.S. Department of Defense
FAA	U.S. Federal Aviation Administration
IC2	Interstate Chemicals Clearinghouse
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
ISO	International Organization for Standardization
MIL-SPEC	U.S. Military Specification for firefighting foams, MIL-PRF-23485F(SH)
NFPA	U.S. National Fire Protection Association
NYSP2I	New York State Pollution Prevention Institute
OECD	Organisation for Economic Co-operation and Development
PFAS	per- and polyfluoroalkyl substances
PFC	perfluorinated compound
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
UNEP	United Nations Environment Programme
U.S. EPA	U.S. Environmental Protection Agency

1. Executive Summary

This document summarizes the results of precursory work to assist with scoping an alternatives assessment of the use of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) in Class B aqueous film-forming foam (AFFF), also known as "firefighting foam." AFFF are used to fight fuel fires and typically contain per- and polyfluoroalkyl substances (PFAS). They are responsible for many incidents of contamination of groundwater and drinking water. The goal of the project is to a) help define the parameters for performance evaluation of firefighting foams, b) identify foams containing short-chain PFAS and fluorine-free foams, and c) further inform the scope of any future assessment work to develop alternatives to the use of per- and polyfluorinated substances in firefighting foams.

This work was a project of the Interstate Chemicals Clearinghouse (IC2), an association of state, local, and tribal governments that promotes a clean environment, healthy communities, and a vital economy through the development and use of safer chemicals and products. The project team was led by the New York State Pollution Prevention Institute (NYSP2I) and was carried out by a subgroup of the IC2's Alternatives Assessment Workgroup. The project team worked collaboratively and included IC2 members from state agencies, non-governmental organizations (NGOs), and agencies. Working together in this capacity allowed the team to pool resources and information to further the success of the project.

Notable Findings

Performance Specifications. The requirements of seven performance specifications are summarized and compared. These include U.S. MIL-SPEC and international standards, such as ISO and UL 162. The U.S. MIL-SPEC and International Maritime Organization (IMO) standards are the only ones that require PFAS to be included in the foam formulation. U.S. MIL-SPEC is the only standard that limits PFOA and PFOS content.

Current PFAS in firefighting foams restrictions. In January 2018, the Australian state of South Australia became the first government body in the world to ban fluorinated firefighting foams. This followed bans specifically on PFOA and PFOS by Queensland, its neighboring state to the northeast, in 2016 and by the Government of New Zealand in 2006. In the United States, the recent U.S. Federal Aviation Administration (FAA) Reauthorization Act of 2018 will eliminate the requirement that most U.S. airports use fluorinated firefighting foams within three years. Washington is the first U.S. state to pass a law prohibiting the sale of firefighting foams containing

A note on terminology

Water additives are liquids that are intended to be added to water for fire control and extinguishment. Examples include foam concentrates, emulsifiers, and hazardous vapor suppression liquids and foaming agents.

Firefighting foam is a mixture of air, water, and a foam concentrate that fights fires by blanketing burning fuel, smothering the fire, separating flames from the fuel source, cooling the fuel and adjacent surfaces, and suppressing the release of flammable vapors that can mix with air.

Fluorine-free foam is firefighting foam or other water additive free of fluorinated surfactants, therefore containing no fluorine.

While the term "water additive(s)" encompasses all types of products (not only foams) intended to be added to water to extinguish fire, the term "firefighting foam" is frequently used in its place. In this report, unless otherwise noted, "firefighting foam," or simply "foam," is used synonymously with "water additive(s)."

Funding Provided by the NYS Department of Environmental Conservation

fluorinated chemicals. The Washington ban will take effect in 2020—military, FAA-certified airports, petroleum refineries and terminals, and certain chemical plants will all be exempt from it.

Alternative Foams. Over 100 fluorine-free water additives from 25 manufacturers have been identified and tabulated with relevant data, including product and manufacturer name, country, performance specifications met, product application, product description, and the Chemical Abstracts Service (CAS) Registry Number, name, and percent of disclosed ingredients in the product. While this report focuses on fluorine-free foams, 14 manufacturers of AFFF containing short-chain PFAS, also referred to as "C6 foams," have been identified. There are many C6 foams available on the market as most manufacturers no longer offer eight-carbon chain AFFF (known as "C8 foams") because the industry has voluntarily abandoned those.

PFAS Research & Alternatives Assessment Work. A number of organizations are currently involved in researching PFAS, researching and synthesizing fluorine-free foams, and conducting alternatives assessments of products currently available on the market. Highlights include:

- The Organisation for Economic Co-operation and Development (OECD) / United Nations Environment Programme (UNEP) Global Perfluorinated Compound (PFC) Group released their updated New Comprehensive Global Database of PFAS and accompanying methodology report in May 2018. See the report here: http://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/
- The U.S. Department of Defense's (DoD) Strategic Environmental Research and Development Program and Naval Research Laboratory have active research projects to develop and characterize fluorine-free foams.
- A Petroleum Environmental Research Forum (PERF) research project aims to capture the state of knowledge of the fate, transport, and effects of short-chain, PFAS-based firefighting foams and fluorine-free foams, and to identify limitations of—and data gaps in—the current studies and data sets. A contract for this work was put out for bid in May 2018 and includes an alternatives assessment for fluorine-containing and fluorine-free foams. The project may use GreenScreen® assessments and may use the IC2 Alternatives Assessment (AA) methodology. The current plan is to include foam ingredient chemicals (as delivered) and their final degradates in the chemical hazard assessment.
- Clean Production Action (CPA) is collaborating with Toxic-Free Future and King County Local Hazardous Waste Management Program to reduce exposure to PFAS in firefighting foam in the State of Washington. The goals are to ensure PFAS-free products are safer and not regrettable substitutes, and to create a list of preferred PFAS-free products using GreenScreen Certified™.

Firefighting Foam Research Findings. Highlights include:

- A number of fluorine-free surfactants have been developed.
- Performance testing of fluorine-free foams is limited and the results of available tests show the performance of fluorine-free foams is not consistent across types.
- The ecotoxicity and impacts on human health of fluorine-free alternatives have not been adequately characterized or assessed. Many contain generic statements that fluorine-free alternatives are preferable because they do not contain fluorine, while some have aquatic and human-health information available on the product safety data sheet.
- Comprehensive papers expand on performance needs for suppressing Class B fires beyond those included in the Core Performance Standards in this report.

Conclusions, Research Needs, and Actions

From the review of firefighting foam performance standards, current and upcoming regulations, identification of fluorine-free foams, other researchers working in this area, and literature, the following conclusions, research needs, and actions have been identified:

1. **Three main information gaps need to be filled to characterize fluorine-free foams in order to promote them as safer alternatives to fluorinated foams:**
   a. **Performance data is uncertain and/or lacking.**
      Research need: Independent testing of fluorine-free foams to validate existing claims and test against others. The U.S. MIL-SPEC and IMO standards are the only performance specifications that require fluorinated surfactants. Performance testing of fluorine-free foams is needed to understand if the performance specifications can be met without the use of fluorinated surfactants. Some fluorine-free foams identified in this report indicate they meet performance specifications. There is some doubt in the firefighting foam industry that fluorine-free foams do in fact meet the standards. Independent performance testing to validate these claims would be beneficial. If foams cannot meet the specification, the testing process will identify exactly what parameter(s) is not being met. Performance testing fluorine-free foams is critical, as the FAA's Reauthorization Act of 2018 no longer requires major FAA airports to use fluorinated foams.
   b. **The makeup of foams is incomplete as many ingredients are protected as confidential business information. Many researchers and those in the firefighting foam industries have raised a concern about whether foams are truly fluorine-free or not.**
      Research need: Identify all fluorine-free foam ingredients and verify they are truly fluorine-free. Ingredients lists present on the safety data sheets of the fluorine-free foams identified in this study were reviewed. Many foams have incomplete lists, as ingredients are deemed confidential business information and excluded. Listing proprietary ingredients makes it impossible to characterize the fluorine-free alternatives to ensure promoted alternatives do not result in regrettable substitution, where one hazardous or toxic ingredient (in this case, fluorinated surfactants) is replaced with another ingredient possessing different hazard characteristics. There is some doubt within the firefighting foam industry that fluorine-free foams are truly free of fluorine. Analyzing a subset of foams would shed light on this concern and help to understand if the foams are completely free of fluorine or if they contain trace amounts.
      Research need: Achieve transparency of ingredients through credible third-party evaluation. Manufacturers may be amenable to an independent, third party evaluating confidential ingredients and formulations in order to report any hazard information without releasing proprietary ingredients and product formulations. This allows users to make informed decisions without releasing confidential business information.
   c. **The ecotoxicity and impacts on human health of most fluorine-free foams and their ingredients have not been characterized or assessed.**
      Research need: Characterize ecotoxicity and human-health impacts of fluorine-free foams, ingredients, and degradation products through third-party hazard and exposure evaluations. Most fluorine-free foams have generic statements that fluorine-free alternatives are preferable because they do not contain fluorine. Some of the fluorine-free foams identified in this report have aquatic toxicity and human-health information available on their safety data sheet. Safety data sheets could not be obtained for all products. Having complete ingredient lists or formulations disclosed to a third party for analysis is critical to ensure the whole formulation is

assessed. Again, characterizing alternative foams will help to eliminate regrettable substitutions.

2. **The use of performance standards across industries is not well understood and characterized.**
   Research need: Dig deeper into mapping performance specifications to applications. A cursory list of industries and situations to which each performance standard applies is included in this report. Reaching out to industry stakeholders, firefighters, and foam manufacturers to validate and expand this list would help to build an understanding of the performance needs for specific fire situations, which could then be used to determine the appropriate foam type for that need.

3. **It is unclear if gaps or discrepancies exist in the performance needs for extinguishing Class B fires and existing performance specifications.**
   Research need: Compare the performance needs and existing performance specifications. It is unclear if performance standards are too strict, not strict enough, or sufficient in all areas of fire suppression. Comparing the needs to standards, such as MIL-SPEC and UL 162, may identify gaps and discrepancies.

4. **Organizations are developing fluorine-free foams, characterizing them, and performing alternatives assessments. Washington is the first U.S. state to ban the sale of fluorinated foams.**
   Action: Monitor work by other organizations. The DoD's research to develop and characterize fluorine-free foams, PERF's alternatives assessment of fluorine-free foams, and CPA's work to develop a list of preferable PFAS-free foams are all notable and currently ongoing. The State of Washington is getting ready to implement their ban on the sale of fluorinated foams in 2020 and is currently working to assess alternatives. Their outcomes may be adopted by others and influence policy and product formulations. The landscape is rapidly changing and there may be other organizations in the near future doing similar work.

5. **There is no regulation preventing the use of fluorine-free foams by non-military users, including firefighting training centers, chemical manufacturers, oil refineries, and others.**
   Action: Assist training centers and other non-military users in switching to fluorine-free alternatives. Firefighting training centers do not have to follow the same performance standards as other users and typically use foams that are not certified to a performance standard. There is no regulatory roadblock for training centers to use fluorine-free foams.

2. Project Goals & Approach

The New York State Department of Environmental Conservation (NYSDEC) and many members of the IC2 Alternatives Assessment Workgroup are concerned about the potential or real impact of the use of fluorinated firefighting foams on human health and the environment. They are interested in promoting less toxic alternatives. This project brought these interested parties together through an IC2 subgroup that worked collaboratively to gather information necessary for scoping future alternatives assessment work.

PFAS is used routinely in firefighting water additives designed for Class B fires, typically referred to as "firefighting foams" or simply "foams." This project is focused on firefighting water additives designed for Class B fires that are free of long-chain (commonly referred to as C8) fluorosurfactants. Alternatives may include foams containing short-chain (or C6) fluorosurfactants or fluorine-free firefighting water additives.

The performance specifications and requirements for Class B firefighting suppressants are not well understood by the IC2 subgroup. Many state agencies have pulled together their own lists of fluorine-free foams, though a comprehensive worldwide search has not been performed. There is some uncertainty about whether or not fluorine-free foams are able to meet the same performance specifications as fluorinated foams. Therefore, the goals of the project are to

1. understand the performance needs and specifications of firefighting foams and the use of PFAS to meet them;
2. identify and characterize alternatives to long-chain (C8), fluorine-containing firefighting foams, including short-chain (C6), fluorinated foams and fluorine-free foams;
3. and identify agencies and researchers that are focused on the use of alternatives to PFAS in Class B firefighting foams, including short-chain (C6) fluorosurfactants and fluorine-free foams, and gather credible information that can be used in future alternatives assessment work.

This work is a precursor for an alternatives assessment of PFOA and PFOS in firefighting foam. The goal of an alternatives assessment is to replace chemicals of concern in products or processes with inherently safer alternatives, thereby protecting and enhancing human health and the environment. The National Academies of Sciences, Engineering, and Medicine's *A Framework to Guide Selection of Chemical Alternatives* [5] and the IC2's *Alternatives Assessment Guide,* [6] provide structured frameworks for completing an alternatives assessment. After the chemical of concern is identified (in this case, per- and polyfluorinated chemicals in firefighting foam), the next steps are scoping and problem formulation followed by identifying potential alternatives. The information gathered in this paper intends to help scope and formulate the problem by understanding the performance needs of firefighting foam. It provides ecotoxicity and human-health information to help determine which lifecycle stages should be included in an assessment. The C6 and fluorine-free firefighting foams identified in this paper serve as the potential alternatives identified in the frameworks. The intent is that this formation will be used by other practitioners to develop a robust alternatives assessment.

[5] National Academies Press, A Framework to Guide Selection of Chemical Alternatives, 2014, http://nap.edu/18872
[6] Interstate Chemicals Clearinghouse, Alternatives Assessment Guide, Version 1.1, 2017, http://www.theic2.org/article/download-pdf/file_name/IC2_AA_Guide_Version_1.1.pdf

3. History of PFAS in Firefighting Foam

PFAS are a group of synthetic chemicals that have been used in a variety of industries since the 1940s. The most well-known PFAS are PFOA and PFOS, and both were widely used to make carpets, clothing, furniture fabrics, and paper food packaging resistant to water and grease. PFOA and PFOS are very persistent in the environment and the human body and studies have indicated that they can cause reproductive and developmental, liver, kidney, and immunological effects as well as tumors in laboratory animals.[7] While the U.S. Environmental Protection Agency's (EPA) PFOA Stewardship Program successfully eliminated the manufacture of PFOA and PFOS in the United States, PFOA and PFOS are still produced internationally and can be imported.

PFAS chemicals are found in AFFF—a synthetic foam consisting of fluorochemical and hydrocarbon surfactants combined with high-boiling-point solvents and water—that was developed for use on Class B fires (e.g. flammable liquids or gases, such as gasoline or other fuels). Firefighting foam is made up of water, air, and a foam concentrate. The foam concentrate is available off the shelf and is mixed with water and air by firefighters during use. When the ingredients are mixed together, a foam blanket is formed that covers the burning fuel, smothers the fire, separates the flames from the fuel source, cools the fuel and adjacent metal surfaces, and suppresses the release of flammable vapors that can mix with air.[8]

The MIL-SPEC for firefighting foams dictates that fluorinated surfactants must be included in Class B foams. Therefore, a fluorine-free water additive cannot meet the MIL-SPEC performance requirements by definition, as it does not contain fluorinated surfactants. All branches of the U.S. military must use fluorinated firefighting foams on bases located in the United States and abroad. Prior to 2018, the FAA incorporated the military specification, requiring major U.S. airports to use fluorinated firefighting foams onsite. Local municipalities may also use and store AFFF onsite. In the U.S., 75% of all AFFF are used by the military, while the remaining 25% are used by municipal airports, refineries, fuel tank farms, and other industries.[9]

There are approximately 190 sites in 40 U.S. states currently known to be contaminated with PFAS[10] with more testing and analysis underway.[11] Training and emergency responses are major sources of groundwater PFAS contamination on military bases. There are concerns that PFAS-contaminated ground water on military bases may be affecting water quality in the surrounding areas, with the water in and around 126 military installations containing potentially harmful levels of PFAS.[12] The U.S. DoD is

[7] U.S. EPA, Basic Information on PFAS, https://www.epa.gov/pfas/basic-information-pfas
[8] Chemguard, General Foam Information, https://www.chemguard.com/about-us/documents-library/foam-info/general.htm
[9] FAQs Regarding PFASs Associated with AFFF Use at US Military Sites, August 2017, http://www.dtic.mil/dtic/tr/fulltext/u2/1044126.pdf
[10] Northeastern University, Per- and Polyfluoroalkyl Substances, https://pfasproject.com/pfas-contamination-site-tracker/, accessed October 2018
[11] Michigan (https://www.michigan.gov/pfasresponse/), New Jersey (https://www.nj.gov/dep/dsr/publications/Investigation%20of%20Levels%20of%20Perfluorinated%20Compounds%20in%20New%20Jersey%20Fish,%20Surface%20Water,%20and%20Sediment.pdf), New York (https://www.dec.ny.gov/chemical/108831.html), Washington State (https://www.doh.wa.gov/CommunityandEnvironment/Contaminants/PFAS), and Vermont (http://dec.vermont.gov/sites/dec/files/documents/PFAS%20Sampling%20Report%207.10.18%20FINAL.pdf), and are all actively monitoring for PFAS.
[12] DoD: At least 126 bases report water contaminants linked to cancer, birth defects, April 2018, https://www.militarytimes.com/news/your-military/2018/04/26/dod-126-bases-report-water-contaminants-harmful-to-infant-development-tied-to-cancers/

continuing to investigate the extent of PFAS contamination on military bases and surrounding communities.[13]

Historically, foams contained perfluorinated carbon chains that are eight carbons long (C8 foams). Under the 2015 EPA PFOA Stewardship Program, all U.S. foam manufacturers voluntarily reformulated their foams to contain perfluorinated carbon chains six or fewer carbons long (C6 foams) by the end of 2015. C8 fluorosurfactants are persistent, bioaccumulative, and toxic. While C6 fluorosurfactants are persistent, they are thought to be less bioaccumulative and toxic, even though less is known about these compounds and characteristics vary among the class. The toxicity of many C6 fluorosurfactants remains uncharacterized. There is no scientific consensus to conclude that C6 surfactants are preferable to their C8 counterparts.

A number of manufacturers have formulated firefighting foams to be fluorine free. Many of these alternative foams claim to perform as well as fluorinated ones while being completely free of fluorinated surfactants. To date, no independent testing has been performed to validate these claims of fluorine free.

[13] US Department of Veterans Affairs, Public Health, PFAS, https://www.publichealth.va.gov/exposures/pfas.asp, accessed October 2018

4. Firefighting-Foam and Water-Additive Performance Specifications

There are a number of performance specifications for firefighting foam with varying requirements. The standards in this section were compiled from internet searches and from those mentioned in foam product technical specifications. The initial list of about thirty standards was divided into two groups: 1) core standards, those that many products meet and many governments require, and 2) other standards, those to which products may conform but are not specifically related to firefighting performance or are difficult to find and not widely used. Comparisons and details of the core standards follow in this section and the other standards are described in "Appendix A: Additional Performance Standards" of this report.[14]

Table 1 below summarizes the core performance standards, including typical application(s), scope, and noteworthy attributes. More details, including specific performance requirements, are included in "Appendix B: Core Performance Standards Details."

Table 1. Summary of Core Film-Forming Foam Performance Standards

Standard	Application(s)	Scope	Noteworthy
Australian Government DEF (AUST) 5706 Guidelines for testing fixed Aqueous Film Forming Foam (AFFF) suppression systems Updated 2018	Australian military	• Offers general guidance in relation to testing, guidance for the commissioning tests, and requirements for storage, collection, treatment, and disposal of AFFF and AFFF wastewater. • These guidelines endorse and supplement the general testing provisions included in NFPA 11 (below).	• Criteria are similar to ISO 7203. • Guidelines endorse and supplement the general testing provisions included in NFPA 11.
European Standard EN 1568 Parts 1-4 Updated 2018 Available for purchase https://www.en-standard.eu/	The general-use standard developed by the European Union to replace the individual standards that each country had possessed.	• Includes foam extinguishment and burnback performance, expansion, and drainage. • Covers concentrate storage, use of sea water, aging and heat stability, and physical properties.	• Concentrates are given performance grades (Grade 1-4) for extinguishing performance and Grades A-D for burnback resistance. Grade 1A is the highest achievable grade. • Approved products are not conformance monitored after accreditation.
ICAO The International Civil Aviation Organization (ICAO) Airport Services Manual Updated 2014	International airports	• Includes foam extinguishment and burnback performance. • Covers concentrate physical properties.	• Manual developed by the aviation industry with a focus on rapid extinguishment. • It is primarily used in airports and developed to minimize potential danger to those on flights.

[14] A good review of foam, foam types, and specification standards can be found in a white paper from Solberg. This paper is from 2002 and is useful to help understand the lay of the land. Many or all of the specifications likely have since been updated. Dlugogorski, B., Kennedy, E., Schaefer, T., & Vitali, J. (n.d.). *What Properties Matter in Fire-Fighting Foams?* (Solberg). See: http://www.solbergfoam.com/getattachment/3fe1d44d-3b44-4714-89f4-4af37e381b5b/WP-WHAT-PROPERTIES-MATTER-IN-FIRE-FIGHTING-FOAMS.aspx

Standard	Application(s)	Scope	Noteworthy
			• It does not explicitly mention the need for foams to be fluorinated.
IMO International Maritime Organization (IMO) Guidelines for the Performance and Testing Criteria and Surveys of Foam Concentrates for Fixed Fire-Extinguishing Systems Updated 2009	foam concentrates for fixed fire-extinguishing systems onboard tankers and chemical tankers	• Includes foam extinguishment and burnback performance. • Covers concentrate storage, use of sea water, and physical properties.	• Guidelines focus on merchant ships. • They are required by many maritime administrations and classification bodies for foam concentrates to be used on board ships in international waters. It arose as part of the implementation of the SOLAS Convention (Safety of Life at Sea), 174 member states comply with the standard. • Criteria are similar to ISO 7203, largely focus on how to perform the tests, and explicitly calls out aqueous film forming concentrate as having fluorinated surfactants.
ISO 7203 Fire Extinguishing Media (Foam Concentrates) Updated 2011	A general-use standard with respect to foam performance; often required by maritime administrators and classification bodies for use on board ships.	• Includes foam extinguishment and burnback performance, expansion, and drainage. • Covers concentrate storage, use of sea water, aging and heat stability, and physical properties. • Criteria are similar to DEF (AUST) 5706.	• Standard has an international focus. • It was not developed with a singular, specific purpose.
LASTFIRE Hydrocarbon Storage Tanks Updated 2015	Used in general and light industry, it dictates foam concentrate procurement specifications by major international oil companies.	• Includes a “best practices” guide. • Has a focus on how foams will behave and degrade over a long period of time and less with rapid extinguishment.	• Standard was developed by a consortium of oil industry leaders. • Its ratings are based on a scale of 100% effectiveness.
NFPA 11 Standard for Low-, Medium-, and High-Expansion Foam Updated 2016	focus on fire fighting systems and atmospheric tank fires	• Focuses on suppression system components, system types, design, installation requirements, and acceptance. • Includes foam expansion and drainage. • Covers concentrate concentration determination.	• NFPA is a very different style of test. Foam is applied to the fuel surface and it is expected to travel across the fuel. NFPA is focused on the transit time of the foam, making it more ideal for tank fires.

Standard	Application(s)	Scope	Noteworthy
US MIL-SPEC US Military Specification MIL-PRF-23485F(SH) with Amendment 2, 7 Sept 2017 Updated 2017	Applies to all branches of the U.S. military and has been incorporated into FAA specification for major airports.	• Includes foam extinguishment and burnback performance, expansion, and drainage. • Covers concentrate storage, physical properties, corrosion, environmental impact, and fluorine content.	• Specification has focus on rapid extinguishment. • It was developed with the prevention of weapons discharge aboard U.S. Navy ships as the primary focus. • It was approved for use by all U.S. DoD departments and agencies. • It includes maximum PFOA and PFOS content, and requires foam concentrates to contain fluorocarbon surfactants. • There are eight MIL-SPEC-qualified foams.
UL 162 Standard for Foam Equipment and Liquid Concentrates Updated 2018	tank fires	• Requirements are based on the premise that foam equipment and specified types of foam liquid concentrates with which they are intended to be used are to be investigated for use with each other. • Focus on suppression system foam producing equipment, material compatibility, performance • Includes foam extinguishment and burnback performance. • Covers concentrate storage, physical properties, and concentration.	• Standard evaluates specific combinations of foam concentrates and foam equipment together. • It is a pass/fail test. • UL-listed products are monitored with samples sent to UL every three months for conformance testing.
US FAA The US Federal Aviation Administration Updated 2004	major U.S. airports	• States that AFFF agents must meet the requirements of MIL-PRF-24385F.	• Requires compliance with MIL-SPEC.

5. PFAS in Firefighting Foam Regulatory Overview

There has been significant regulatory activity regarding the use of fluorinated chemicals in firefighting foam over the last year. In January 2018, the Australian state of South Australia became the first government body in the world to ban fluorinated firefighting foams. This followed bans specifically on PFOA and PFOS by Queensland, its neighboring state to the northeast, in 2016 and by the Government of New Zealand in 2006. The U.S. FAA Reauthorization Act of 2018 eliminated the need for the majority of U.S. airports to use firefighting foams containing fluorinated chemicals. The first U.S. state to ban Class B fluorinated firefighting foams is Washington, where the sale of the foams will be prohibited as of July 2020. While the information presented here is up to date at the time of publication, the regulatory climate is changing quickly. The reader is advised that the content of this paper may be outdated by new developments as they occur.

5.1 Australia

South Australia was the first Australian state to ban fluorinated firefighting foams in January 2018. Clause 13A(4) of the Environment Protection (Water Quality) Policy 2015 states: "A person must not supply a firefighting foam product unless the producer's certification of its fluorine content is clearly displayed on a label or document provided with the product.[15]"

South Australia's Environment Protection Authority (EPA) provided guidance that further clarifies the requirement:

> The EPA will consider a certification from the producer to be a statement as follows (either clearly displayed on a label or document provided with the product):
>
> - This firefighting foam product does not contain fluorinated organic compounds.
> - Fluorine or fluorinated substances were not used in the manufacture of this firefighting foam product.
> - Equipment used to manufacture this firefighting foam product was either (a) not previously used to contain or manufacture fluorinated organic compounds; or (b) thoroughly cleaned to prevent residual fluorinated organic compounds from being included as contaminants in this firefighting foam product.[16]

Clause 13A(4) also states that "'prohibited firefighting foam product' means a firefighting foam product that contains a fluorinated organic compound or compounds, but does not include a firefighting foam product that is fluorine free."

The State of Queensland banned the use of PFOA and PFOS in firefighting foam in July 2016. The requirements that the state put into place are outlined in the 2016 publication *Operational Policy: Environmental Management of Firefighting*. It reads:

> 6.2.1 Foams containing PFOS (see Explanatory Notes §3, 3.1, 7.2, 7.4, 9.1) Use of foams that contain the fluorinated organic compound PFOS (perfluoro octane sulphonic acid) as well as its salts or any compound that degrades or converts to PFOS at a concentration of greater than that listed in Table

[15] South Australia Environmental Protection Authority (2018). *Environment Protection (Water Quality) Amendment Policy 2018, Clause 13A(4)*. Retrieved from https://www.legislation.sa.gov.au/LZ/V/POL/2018/ENVIRONMENT%20PROTECTION%20(WATER%20QUALITY)%20AMENDMENT%20POLICY%202018_30.1.2018%20P%20521/30.1.2018%20P%20521.UN.PDF

[16] Ibid. (2018). *Per- and Poly-fluoroalkyl substances (PFAS)*. Retrieved from https://www.epa.sa.gov.au/environmental_info/perfluorinated-compounds

6.2.2 A in foam concentrate must be withdrawn from service and replaced as soon as possible (taking into account related obligations under the Work Health and Safety Act 2011) and no longer used in any situation where they might be released to the environment, including legacy stocks.

6.2.2 Foams containing PFOA & PFOA precursors to be withdrawn (see EN §3.2, 7.2, 7.4) Firefighting foams that contain PFOA, PFOA precursor compounds or their higher homologues, where the total organic fluorine content equivalent to PFOA and higher homologues exceeds that listed in Table 6.2.2 A in foam concentrate must be withdrawn from service as soon as practicable and any held stocks (and any other related wastes) must be secured pending disposal. These materials are to be managed and disposed of as regulated waste.

Table 6.2.2 A – Fluorinated organic compounds limits in concentrates

Compound(s)	Limit (mg/kg)
PFOS (Perfluoro-octane sulfonic acid) and PFHxS (perfluorohexane sulfonate).	10 (sum)
PFOA (Perfluoro-octanoic acid) and higher homologues, PFOA precursors and higher homologous PFCs as the sum of the total oxidisable precursor assay for C7 to C14 compounds (TOPA C7-C14).	50 (as fluorine)

PFOA precursor compounds and their higher homologues include any compounds that potentially degrade or convert to PFOA, such as 8:2 fluorotelomer derivatives, or the higher homologous perfluoroalkyl carboxylic acids (PFCAs) as well as precursors, such as C7 to C14 carbon-chain or similar fluorotelomer derivatives.

6.2.4 Foams containing short-chain fluorotelomers (see Explanatory Notes §7, 7.1–7.5) Foam containing short-chain fluorotelomers (C6 or shorter perfluorinated moieties) can be used if it is found to be the only viable option, after firefighting effectiveness, short and long-term health, safety and environmental risks and property protection characteristics have all been appropriately considered, however, the following requirements must be met:

- The foam must be C6 purity compliant foam (see Definitions).
- No releases directly to the environment (e.g. to unsealed ground, soakage pits, waterways or uncontrolled drains).
- All releases must be fully contained on site.
- Containment measures such as bunds and ponds must be controlled, impervious and must not allow firewater, wastewater, runoff and other wastes to be released to the environment (e.g. to soils, groundwater, waterways stormwater, etc.).
- All firewater, wastewater, runoff and other wastes must be disposed of as regulated waste to a facility authorised to accept such wastes.

5.2 New Zealand

PFOS and PFOA are banned from firefighting foam in New Zealand. They were excluded from the Firefighting Chemicals Group Standard in 2006, effectively banning their import, manufacture, and use in firefighting foams. For more information, visit New Zealand's Ministry of the Environment at http://www.mfe.govt.nz/land/pfas-and-poly-fluoroalkyl-substances

5.3 U.S. Airports

Current FAA regulations require major U.S. airports to use MIL-SPEC-qualified fluorinated firefighting foams. The FAA outlines in *Title 14, Code of Federal Regulations (CFR)* [Part 139] that, in order to issue airport-operating certificates, an airport must

- serve scheduled and unscheduled air-carrier aircraft with more than 30 seats, or

- serve scheduled air-carrier operations in aircraft with more than nine seats but fewer than 31 seats;

Operators of Part 139 airports must also provide aircraft rescue and firefighting (ARFF) services during air-carrier operations that require a Part 139 certificate. Performance requirements for Aircraft Fire Extinguishing Agents includes the following statement:

> AFFF agents must meet the requirements of Mil-F-24385F. It is important to note that if one vendor's foam is mixed with another vendor's foam in the re-servicing process, there must be compatibility between foams to prevent gelling of the concentrate.

The FAA Reauthorization Act of 2018 will no longer require the use of fluorinated chemicals to meet performance standards.[17] Specifically, the legislation states:

> SEC. 332. AIRPORT RESCUE AND FIREFIGHTING.
>
> (a) Firefighting Foam.—Not later than 3 years after the date of enactment of this Act, the Administrator, using the latest version of National Fire Protection Association 403, "Standard for Aircraft Rescue and Fire-Fighting Services at Airports", and in coordination with the Administrator of the Environmental Protection Agency, aircraft manufacturers and airports, shall not require the use of fluorinated chemicals to meet the performance standards referenced in chapter 6 of AC No: 150/5210–6D and acceptable under 139.319(l) of title 14, Code of Federal Regulations.

5.4 Washington State

Washington is the first U.S. state to ban certain firefighting foams containing perfluorinated compounds. A state law, RCW 70.75A,[18] was passed there in early 2018. Highlights include:

- It prohibits the use of PFAS containing Class B firefighting foam for training purposes starting July 1, 2018;
- It prohibits the manufacture, sale, and distribution of PFAS-containing Class B firefighting foam starting July 1, 2020. Military, FAA-certified airports, petroleum refineries and terminals, and certain chemical plants are all exempt from this requirement.
- Manufacturers and sellers of firefighting personal protective equipment have had to notify purchasers in writing if their products contain PFAS and the reasons for using the chemicals as of July 1, 2018.

[17] The FAA Reauthorization Act of 2018 [H.R.302] became public law in October 2018. It is available online here: https://www.congress.gov/bill/115th-congress/house-bill/302/

[18] See RCW 70.75A here: http://app.leg.wa.gov/RCW/default.aspx?cite=70.75A&full=true

6. Fluorine-Free Firefighting Water Additives and Short-Chain PFAS Foams

A key purpose of this report is to identify firefighting water additives that do not contain PFOA and PFOS—including products that contain short-chain (C6) PFAS and those that are fluorine free. In the U.S. and Europe, there are firefighting water additives for Class B fires that are free of PFOA and PFOS, including those made with short-chain PFAS currently on the market. While some organizations have identified alternative products or chemistries, there is a need for a comprehensive, up-to-date list to help identify alternatives for specific foam applications. To meet this need, a worldwide search for alternative fluorine-free and C6 products/chemistries was done. The results of this research were then organized in one accessible location. The outcome of this work, a list of available short-chain (C6) foams and fluorine-free foams, is below.[19]

Information on fluorine-free and short-chain (C6) foams was compiled from a number of sources, including:

1. **IC2 Alternatives Assessment Workgroup members**. Many workgroup members had compiled their own lists of fluorine-free foams. Members provided these lists and they were reconciled. Throughout the project duration, workgroup members regularly added to the list of alternatives.
2. **NYSP2I's previous work to identify fluorine-free foams**. In *Supply Chain Assessment of Class B Firefighting Foams for New York State Dept. of Environmental Conservation* (January 2018), NYSP2I identified a number of fluorine-free and C6 foams, as well as foam manufacturers.
3. **Organizations working to develop and research fluorine-free foams**. Many organizations have identified fluorine-free or C6 foams; they are listed in "Research Groups & Agencies involved in Firefighting Foam Work" [Section 7] of this report.
4. **An online search for patents was done to identify fluorine-free firefighting foams and surfactants.** Findings are included in "Firefighting Foam Research" [Section 8] of this report.
5. **Online searches for fluorine-free foam products.**
6. **The U.S. DoD Qualified Products Database** was used to identify products qualified under MIL-PRF-24385. All of the products are short-chain (C6) fluorochemicals, since fluorine is required to meet the MIL-SPEC requirements.[20]

6.1 Fluorine-Free Class B Firefighting Water Additives

Over 100 products from 24 manufacturers have been identified. Pertinent information on the products are tabulated and include product and manufacturer name, country, performance specifications met, product application, product description, and the CAS, name, and percent of disclosed ingredients in the product. The main source of product information was manufacturer websites. Ingredient information is collected from product safety data sheets (SDSs), commonly available on manufacturer websites. Where SDSs were not accessible online, they were requested from the manufacturer. All SDSs found online, made available to NYSP2I staff, and other information, including technical data sheets and/or results of performance tests, were reviewed.

A list of fluorine-free foams is found in Table 2 on the following page. A spreadsheet containing links to product information on manufacturer websites, product application and description, SDSs (where available), and ingredients (where available) is available for download on the IC2 website at http://www.theic2.org.

[19] The list is also available for download from the IC2's website (http://www.theic2.org).
[20] Access the database here: http://qpldocs.dla.mil/

Table 2. Fluorine-Free Class B Firefighting Water Additives

Manufacturer	Location	No.	Product Name	Type
3F Company	United Kingdom	1	FREEDOL SF	FF[a]
		2	FREEFOR SF 1	FF
		3	FREEFOR SF 2	FF
		4	HYFEX SF 1	FF, Hi-Ex[b]
		5	HYFEX SF 3	FF, Hi-Ex
		6	HYFEX SF 6	FF, Hi-Ex
Aberdeen Foam (Oil Technics Fire Fighting Products)	Scotland, United Kingdom	7	Aberdeen Foam 1% F3	FF
		8	Aberdeen Foam 1% F3-LF	FF, LT[c]
		9	Aberdeen Foam 3% F3	FF
		10	Aberdeen Foam 3% F3-LF	FF, LT
		11	Aberdeen Foam 6% F3	FF
		12	Aberdeen Foam 2% HI-EX	FF, Hi-Ex
		13	Aberdeen Foam 3x3% AR-F3	FF, AR[d]
		14	Aberdeen Foam 3x6% AR-F3	FF, AR
		15	Aberdeen Foam 1x3% F3	FF, AR
Angus Fire (Angus International: Angus Fire, National Foam and Eau et Feu.)	United Kingdom	16	Expandol (a.k.a. Expandol 1-3)	FF, Hi-Ex
		17	Expandol LT (a.k.a. Expandol 1-3LT)	FF, Hi-Ex, LT
		18	Syndura (6% fluorine-free foam)	FF
		19	HiCombat A	FF
		20	Jetfoam 1%	FF
		21	Jetfoam 3%	FF
		22	Jetfoam 6%	FF
		23	Respondol ATF 3-3%	FF
		24	Respondol ATF 3-6%	FF
Auxquimia (ICL Performance Products)(Phos-Chek Fire Retardant)	Spain	25	Phos-Chek 1% Fluorine free	FF
		26	Phos-Chek 3×6 Fluorine free (a.k.a. UNIPOL-FF 3/6)	FF, AR
		27	H-930 synthetic multiexpansion foam concentrates	FF
		28	SF-60L synthetic multiexpansion foam concentrates	FF
Bio-ex	France	29	BIO FOAM 5	FF
		30	BIO FOAM 15	FF, LT
		31	ECOPOL	FF, Hi-Ex
		32	ECOPOL F3 HC	FF
		33	ECOPOL PREMIUM	FF, AR
		34	ECOPOL A 3%/6%	FF
Buckeye Fire Equipment Company	NC, United States	35	Buckeye High Expansion Foam (BFC-HX) (a.k.a. Hi-Ex 2.2)	FF
		35	Buckeye High Expansion Foam (BFC-HX) (a.k.a. Hi-Ex 2.2)	FF
ChemGuard	TX, United States	36	ECOGUARD	FF
Chemguard	WI, United States	37	3% AFFF Foam Concentrate (C303)	FF
		38	3% Low Temp AFFF (C3LT)	FF, LT
		39	6% AFFF Foam Concentrate (C603)	FF
		40	6% Low Temp AFFF (C6LT)	FF, LT
Dafo Fomtec AB	Sweden	41	Enviro 3% ICAO	FF
		42	Enviro 3x3 Plus	FF, AR

Manufacturer	Location	No.	Product Name	Type
		43	Enviro 3x3 Ultra	FF, AR
		44	Enviro 3x6 Plus	FF, AR
		45	Enviro 6x6 Plus	FF, AR
		46	Enviro USP	FF
		47	LS xMax	FF
		48	LS aMax	FF
		49	MB -20	FF, LT
		50	P 3%	FF
		51	P 6%	FF
Denko	NY, United States	52	6% AFFF	FF
		53	3% AFFF	FF, LT
		54	1% AFFF	FF, LT
		55	Alcohol AFFF 3%-6% Single or Double Strength	FF, LT, AR
		56	High Expansion Foam, Class A or B	FF, Hi-Ex
Fire Safety Devices Pvt. Ltd.	NY, United States	57	Fluorine-free Foam, 1%, 3%, 6%	FF
Fire Services Plus	GA, United States	58	FireAde	FF
		59	FireAde AR AFFF	FF, AR
		60	FireAde MIL-SPEC 6	FF, MIL-SPEC
		61	FireAde MIL-SPEC 3	FF, MIL-SPEC
Fire Suppression Products	MI, United States	62	FIRE CAP PLUS AR-AFFF 1% x 3%	FF, AR
		63	FIRE CAP PLUS	FF
FireFreeze Worldwide, Inc.	NJ, United States	64	Coldfire	FF
FireRein	Canada	65	Eco-Gel	FF
Genius Group	Germany	66	PyroBubbles	FF
Hazard Control Technologies, Inc.	GA, United States	67	F-500	FF
Orchidee Fire	Belgium	68	Orchidex BlueFoam 1x3	FF
		69	Orchidex BlueFoam 3x3	FF
		70	Orchidex BlueFoam 3x6	FF
		71	Orchidex BlueFoam 6x6	FF
Pyrocool Technologies	VA, United States	72	Pyrocool FEF 0.4% Multiclass Foam Concentrate	FF
R. Nickeson Enterprises	MA, United States	73	Novacool UEF Foam	FF
Sthamer	Germany	74	FOAMOUSSE 3% F-15 #5301	FF
		75	vaPUREx LV 1% F-10 #7141	FF
		76	STHAMEX-SV/HT 1% F-5 #9142	FF, LT
		77	MOUSSOL®–FF 3/6 F-15 #7941	FF, AR
		78	MOUSSOL®–FF 3/6 F-5 #7942	FF, AR
		79	STHAMEX® 2% F6 Multi-purpose detergent foam	FF
		80	STHAMEX® K 1% F-15 #9143	FF
		81	STHAMEX® 3% F6 Multi-purpose detergent foam	FF
	WI, United States	82	RE-HEALING RF1, 1% FOAM CONCENTRATE	FF
		83	RE-HEALING RF1-AG, 1% FOAM CONCENTRATE	FF

Manufacturer	Location	No.	Product Name	Type
The Solberg Company (an Amerex Corporation company)		84	RE-HEALING RF1-S, 1% FOAM CONCENTRATE	FF
		85	RE-HEALING RF3, 3% FOAM CONCENTRATE	FF
		86	RE-HEALING RF3-LV, 3% LOW VISCOSITY FOAM CONCENTRATE	FF, LV
		87	RE-HEALING RF3x3% FREEZE PROTECTED ATC FOAM CONCENTRATE	FF, LT
		88	RE-HEALING RF3x6% ATC FOAM CONCENTRATE	FF
		89	RE-HEALING RF3x6% FREEZE PROTECTED ATC FOAM CONCENTRATE	FF, LT
		90	RE-HEALING RF6, 6% FOAM CONCENTRATE	FF
		91	RE-HEALING RF6, 6% FOAM CONCENTRATE	FF
The Solberg Company (Amerex Corporation)	WI, United States	92	RE-HEALING RF-MB FOAM CONCENTRATE	FF
Verde Environmental, Inc. (Micro Blaze)	TX, United States	93	Micro-Blaze Out	FF
vs FOCUM	Spain	94	Silvara 1 (1%)	FF, LV[e]
		95	Silvara APC 3x3	FF
		96	Silvara APC 3x6	FF
		97	Silvara ZFK (0.5%)	FF
		98	Silvara T3	FF
		99	Silvara APC 1	FF, AR
National Foam	PA, United States	100	Universal Green 3%-3%	FF, AR

[a] FF = Fluorine-free foam or firefighting wetting agent that is advertised to be free of fluorinated surfactants, and therefore free of fluorine.

[b] Hi-Ex = High-expansion foams that have an expansion ratio greater than or equal to 200. They are used when an enclosed space, such as a basement or hangar, must be quickly filled.

[c] LT = Low-temperature foams, sometimes labeled as “freeze free” or “freeze protected,” that are specifically formulated to be used at lower temperatures.

[d] AR = Alcohol-resistant foams that are used as a conventional AFFF on hydrocarbon fuels. They form an aqueous film on the surface of the hydrocarbon fuel. When used on polar solvents (or water miscible fuels), the polysaccharide polymer forms a tough membrane that separates the foam from the fuel and prevents the destruction of the foam blanket. Fifteen AR foams are especially effective for extinguishing and securing flammable hydrocarbon and polar solvent fires. High-risk facilities, such as refineries, pharmaceutical plants, and process areas, often require AR foams.

[e] LV = Low-viscosity foams that are formulated to be thinner than typical foams, thus flowing at a faster rate during application.

6.2 Fluorine-Free Training Foams

Firefighting foam manufacturers typically formulate one or more products specifically for training purposes. These foams do not typically meet performance specifications, as their use in training does not dictate the same level of performance. Similarly, manufacturers have formulated fluorine-free training foams for use at fire academies and other locations for training purposes. Table 3 contains fluorine-free training foams currently available on the market.

Table 3. Fluorine-Free Training Foams

Manufacturer	Country	No.	Product Name	Type
3F Company	United Kingdom	T1	T-FOAM SF 3	FF, T
		T2	T-FOAM SF 6	FF, T
Aberdeen Foam (Oil Technics Firefighting Products)	Scotland, United Kingdom	T3	Aberdeen Foam 1% Training Foam (synthetic)	FF, T
		T4	Aberdeen Foam 3% Training Foam (synthetic)	FF, T
Angus Fire	United Kingdom	T5	TF3/TF6 (3%/6% Training Foam Concentrate	FF, T
		T6	Trainol (3% Fluorine-free Training Foam Concentrate)	FF, T
Auxquimia (ICL Performance Products)(Phos-Chek Fire Retardant)	Spain	T7	Phos-Chek Training Foam 136	FF, T
		T8	Phos-Chek Training Foam EE-3	FF, T
Bio-ex	France	T9	BIO T3 (1-3%)	FF, T
Dafo Fomtec AB	Sweden	T10	Trainer E-lite	FF, T
Fire Services Plus	GA, United States	T11	FireAde Training	FF, T
Sthamer	Germany	T12	TRAINING FOAM-N 1% F-0 #9141	FF, T
The Solberg Company (Amerex Corporation)	WI, United States	T13	RE-HEALING TF, TRAINING FOAM CONCENTRATE	FF, T

6.3 Short-Chain (C6) Foams

Most manufacturers no longer offer long-chain (C8) firefighting foams, as the industry has voluntarily switched over to C6 foams. As a result, the universe of C6 products is vast. The project workgroup focused its efforts on identifying and collecting information on fluorine-free alternatives; the manufacturers in Table 4 are those that offer C6 foams. Please visit each manufacturer's accompanying link to learn about the C6 products they offer.

Table 4. Manufacturers of C6 foams

Manufacturer	Country	Link
3F Company	United Kingdom	http://www.3fff.co.uk/index.php/en/chemistry-3f-foams-extinguishers-specialities/smart-foams-industryprotection-3f-england-singapore-morocco-2
Aberdeen Foam (Oil Technics Firefighting Products)	United Kingdom	http://www.firefightingfoam.com/fire-fighting-foam/products-a-z/
Angus Fire (Angus International: Angus Fire, National Foam and Eau et Feu.)	United States / United Kingdom	http://angusfire.com/foam-concentrates/
Auxquimia (ICL Performance Products)	Spain	https://phoschek.com/brand/auxquimia-s-a/
BIOex	United Kingdom	http://www.bio-ex.com/products/types-of-risk/class-b-liquid-fires-hydrocarbons/product/biofilm-fluorosynthetic-afff-foam-concentrate-effective-on-hydrocarbon-fires-9
Buckeye Fire Company	NC, United States	http://www.buckeyefire.com/foam-equipment-concentrates/
Chemguard	WI, United States	http://www.chemguard.com/fire-suppression/catalog/foam-concentrates
Dr. Sthamer	Germany	https://sthamer.com/en/AFFF_foam_concentrate.php
Fire Safety Devices Pvt. Ltd.	India	http://fcfsd.com/fire-fighting-foams.html
FireAde	GA, United States	http://pro.fireade.com/products/fireade-climate-control/
Fomtec (Dafo Fomtec AB)	Sweden	https://www.fomtec.com/foam/category33.html
National Foam	PA, United States	http://nationalfoam.com/foam-concentrates/
Orchidee	Belgium	http://www.orchidee-fire.com/foams/
Solberg	WI, United States	http://www.solbergfoam.com/Foam-Concentrates/ARCTIC-Foam.aspx

7. Research Groups and Agencies Involved in Firefighting Foam Work

This section highlights the activities from the many organizations in the U.S. and abroad that are actively engaged in work in fluorine-free foams for Class B fires. It is recommended that readers follow up directly with the organizations listed as their work progresses and new information emerges. More information on the work of the research groups and agencies can be found in "Appendix E: Research Groups and Agencies Involved in AFFF Work."

7.1 Intergovernmental Organizations

1. The OECD/UNEP Global PFC Group released the updated "New Comprehensive Global Database of Per- and Polyfluoroalkyl Substances (PFAS)" and an accompanying methodology report in May 2018. The group's informational portal serves to facilitate the exchange of information on per- and poly-fluorinated chemicals, focusing specifically on PFAS, in order to support a global transition towards safer alternatives. The portal can be accessed at http://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/
2. The Interstate Technology and Regulatory Council (ITRC) has developed a series of fact sheets to summarize the latest science and emerging technologies for remediating PFAS-contaminated sites. The fact sheets are tailored to the needs of state regulatory program personnel who are tasked with making informed and timely decisions regarding PFAS-impacted sites. The content is also useful to consultants and parties responsible for the release of these contaminants, as well as community stakeholders. The fact sheets are available at https://pfas-1.itrcweb.org/fact-sheets/

7.2 Government

3. The U.S. DoD's Strategic Environmental Research and Development Program has active projects under its Environmental Research Programs: Per- and Polyfluoroalkyl Substances (PFASs) subsection. These projects focus on the research and development of fluorine-free AFFF for use by the U.S. military.
4. The U.S. Naval Research Laboratory (NRL) has current projects in fluorine-free foam development and remediation of PFAS-contaminated sites, though details of those projects are not available. A number of presentations and papers have been authored by NRL staff and focus on the performance of fluorine-free foams and the role of surfactants in AFFF.
5. The U.S. Environmental Protection Agency (EPA) has initiated the following:
   i. A request for application (RFA) titled "National Priorities: Per- and Polyfluoroalkyl Substances (PFAS)" closed in June 2018. The RFA solicited applications to generate new information for nationally assessing PFAS fate and transport, exposure, and toxicity.
   ii. On January 21, 2015, EPA proposed a Significant New Use Rule (SNUR) under the Toxic Substances Control Act. It required manufacturers, importers, and processers of PFOA and PFOA-related chemicals (including as part of articles) to notify EPA at least 90 days before starting or resuming new uses of these chemicals in any products. This notification would allow EPA the opportunity to evaluate the new use and, if necessary, take action to prohibit or limit the activity. This SNUR is not currently in effect.
   iii. EPA's New Chemicals Program reviews alternatives for PFOA and related chemicals before they enter the marketplace to identify whether the range of toxicity, fate, and bioaccumulation issues that have caused past concerns with perfluorinated substances may be present. This is done in order to ensure that the new chemicals may not present an unreasonable risk to health or the environment.

iv. Since 2000, EPA has worked to review substitutes to PFOA, PFOS, and long-chain PFAS. The focus is on whether the reviewed substances have similar properties to PFOA, PFOS, or long-chain PFAS, and to then try and determine if the reviewed compound raises any new concerns.

6. EPA has done a lot of work in characterizing and detecting PFAS, as well as characterizing fate and transport, researching ecological risk, exposure, toxicity research with animals, and research with computational modeling of PFAS.
7. The State of Washington was the first U.S. state to ban certain firefighting foams containing perfluorinated compounds. A new law, RCW 70.75A, prohibits (1) the use of PFAS containing Class B firefighting foam for training purposes as of July 1, 2018, and (2) the manufacture, sale, and distribution of PFAS containing Class B firefighting foam starting on July 1, 2020. Military, FAA-certified airports, petroleum refineries and terminals, and certain chemical plants are all exempt from this requirement.
8. Other U.S. states are actively involved in PFAS work to varying degrees. This list is not comprehensive. New Jersey found PFAS substances in surface water, sediment, and fish tissue in 2018. New York surveyed potential users of firefighting foam in the state to determine which facilities may be using PFOA/PFOS foams in order to target them for potential contamination and response. New York had a collection and disposal program for firefighting foam containing perfluorinated compounds. Vermont has identified a number of potential sources of PFAS water contamination. Michigan has established a PFAS response team to investigate sources and locations of PFAS contamination in the state, take actions to protect drinking water, and keep the public informed.
9. The Australian Government is currently investigating the use of PFAS contamination in and around military bases. An Expert Health Panel for PFAS was established to advise on the potential health impacts associated with PFAS exposure and to identify priority areas for further research in 2018. South Australia was the first Australian state to ban fluorinated foams in 2018.

7.3 Industry

10. The Petroleum Environmental Research Forum (PERF) is a non-profit organization created to provide a stimulus to and a forum for the collection, exchange, and analysis of research information relating to the development of technology for health, environment and safety, waste reduction, and system security in the petroleum industry. In May 2018, a project was contracted with an aim to capture the state of knowledge of the fate, transport, and effects of short-chain PFAS-based AFFFs and fluorine-free firefighting foams in order to identify limitations of and data gaps in the current studies or data sets. The project may use GreenScreen® assessments and may use the IC2 Alternatives Assessment methodology. The current plan is to include foam ingredient chemicals (as delivered) and their final degradates in the chemical hazard assessment.
11. The LASTFIRE ("LAST" stands for "Large Atmospheric Storage Tanks") Project was initiated to review the risks associated with large-diameter, open-top, floating-roof storage tanks. LASTFIRE has developed their own performance standard (see "Firefighting Foam and Water Additive Performance Specifications" [Section 4] of this report for more info) and holds regular foam industry summits.
12. The Dallas/Fort Worth Fire Training Research Center has presented results on the performance of fluorine-free foams and may be a good resource for performance testing. More information is available here: https://www.dfwairport.com/firetraining/#slide-1[21]

[21] LASTFIRE's 2018 International Fire Fighting Foam Summit and Fire Extinguishment Tests were held at Dallas/Fort Worth Airport.

7.4 Independent Organizations

13. Clean Production Action is collaborating closely with Toxic-Free Future and King County Local Hazardous Waste Management Program in the State of Washington to reduce exposure to PFAS in firefighting foam by identifying safer alternatives.

8. Firefighting Foam Research

The following section includes information to assist with identifying chemical alternatives for fluorinated compounds in firefighting foam and to characterize their impact on the environment and human health. Understanding the performance needs for suppressing Class B fires, beyond those included in the Core Performance Standards in "Firefighting Foam and Water Additive Performance Specifications" [Section 4] of this report, is also part of this task.

This research is performed to support a future alternatives assessment of firefighting water additives. *A Framework to Guide Selection of Chemical Alternatives*, a 2014 publication from the National Academies of Sciences, Engineering, and Medicine, was consulted to determine the point in the alternatives assessment process at which the research papers included here are most useful. Summaries of the research papers are included in "Appendix F: Firefighting Foam Research Detailed Summaries." A summary of key findings follows.

Key findings

1. **A number of fluorine-free surfactants have been developed**. These include patents issued for foams consisting of water and a high-molecular-weight acidic polymer (HMWAP), a siloxane-containing foam, and over 250 foams synthesized (these include carbohydrate siloxane surfactants, siloxane and carbosiloxane surfactants, silica-based foam, and a foam concentrate consisting of an acid group and/or a deprotonated acid group and an oliganosilane unit and/or oligosoloxane unit). The Swedish Chemicals Agency survey of foam manufacturers and their products with their ingredients may be helpful to further identify potential alternative surfactants.

2. **The amount of performance testing of fluorine-free foams is limited and the results of available tests show the performance of fluorine-free foams is not consistent across types**. In some cases, fluorine-free foams perform as well as fluorinated foams, and in other cases, fluorine-free foams do not.

    - Some performance tests show that fluorine-free foams perform as well as fluorinated foams.
        - Siloxane-based foam is tested against the German military performance standard and performs as well as fluorinated foams and better than fluorine-free foams on F-34 fuel fires.
        - Performance tests show that siloxane-based foams perform better on F-34 fuel fires than nonaqueous film-forming Class B foam.
        - In fire extinguishment and burnback tests of two fluorinated MIL-SPEC foams and one fluorine-free foam on four low-flash-point fuels, the fluorine-free foams perform more consistently than fluorinated foams and the fluorinated foams did not outperform the fluorine-free foams when film formation was not possible.
    - Some performance tests show that fluorine-free foams do not perform as well as fluorinated foams.
        - In a comparison of a fluorine-free foam (Solberg's RF6) to a fluorinated foam (Buckeye Fire Equipment's 3%), the RF6 forms larger bubbles and has a longer drainage time. This may contribute to fuel flux and ignition. RF6 had higher fuel flux across different fuels, and this may be due to RF6 not containing oleophobic surfactants, which are found in fluorinated foams and reject fuel as it transfers through the barriers.
        - In a different, independent test of Solberg's RF6 fluorine-free foam, it struggled to contain vapors well as it does not form a film. Two additional fluorine-free foams (composition confidential and not reported) had erratic performance and placed last in all tested

performance parameters, compared to a fluorinated foam and RF6. The paper noted that in actual practice, foams are reapplied frequently. Performance of both fluorinated and RF6 increased dramatically when reapplied. Therefore, it is suggested that in a practical scenario, rather than under the current testing parameters, RF6 would perform adequately.

3. **The ecotoxicity and impacts on human health of fluorine-free alternatives have not been well characterized or assessed**. Many fluorine-free firefighting water additives contain generic statements that they are preferable to fluorinated foams because they do not contain fluorine. Some of the fluorine-free firefighting wetting agents identified in Section 6 of this report have aquatic toxicity and human health information on the safety data sheet. Safety data sheets for about a quarter of the fluorine-free firefighting water additives could not be obtained. Furthermore, the safety data sheet contains aquatic toxicity information for the formulation and it is unknown how the surfactant itself contributes to human health and ecotoxicity effects. This is a significant gap and identifies a clear research need.

4. **Comprehensive papers exist that expand on performance needs for suppressing Class B fires beyond those included in the Core Performance Standards in this report.**

    - One paper, "The Future of Aqueous Film Forming Foam: Performance Parameters and Requirements," details the reasoning behind the MIL-SPEC performance requirements. Rich with information, this work is highly recommended reading for anyone seeking a deeper investigation into research in this field.
    - "What Properties Matter in Fire-Fighting Foams?" is a resource that provides a list of various properties, why standards have chosen to address them, the reason behind certain values, and the physical properties of concern with foams.

9. Conclusions, Research Needs, and Actions

From the review of firefighting foam performance standards, current and upcoming regulations, identification of fluorine-free foams, other researchers working in this area, and literature, the following conclusions, research needs, and actions have been identified:

1. **Three main information gaps need to be filled to characterize fluorine-free foams in order to promote them as safer alternatives to fluorinated foams:**
   a. **Performance data is uncertain and/or lacking.**
      Research need: Independent testing of fluorine-free foams to validate existing claims and test against others. The U.S. MIL-SPEC and IMO standards are the only performance specifications that require fluorinated surfactants. Performance testing of fluorine-free foams is needed to understand if the performance specifications can be met without the use of fluorinated surfactants. Some fluorine-free foams identified in this report indicate they meet performance specifications. There is some doubt in the firefighting foam industry that fluorine-free foams do in fact meet the standards. Independent performance testing to validate these claims would be beneficial. If foams cannot meet the specification, the testing process will identify exactly what parameter(s) is not being met. Performance testing fluorine-free foams is critical, as the FAA's Reauthorization Act of 2018 no longer requires major FAA airports to use fluorinated foams.
   b. **The makeup of foams is incomplete as many ingredients are protected as confidential business information. Many researchers and those in the firefighting foam industries have raised a concern about whether foams are truly fluorine-free or not.**
      Research need: Identify all fluorine-free foam ingredients and verify they are truly fluorine-free. Ingredients lists present on the safety data sheets of the fluorine-free foams identified in this study were reviewed. Many foams have incomplete lists, as ingredients are deemed confidential business information and excluded. Listing proprietary ingredients makes it impossible to characterize the fluorine-free alternatives to ensure promoted alternatives do not result in regrettable substitution, where one hazardous or toxic ingredient (in this case, fluorinated surfactants) is replaced with another ingredient possessing different hazard characteristics. There is some doubt within the firefighting foam industry that fluorine-free foams are truly free of fluorine. Analyzing a subset of foams would shed light on this concern and help to understand if the foams are completely free of fluorine or if they contain trace amounts.
      Research need: Achieve transparency of ingredients through credible third-party evaluation. Manufacturers may be amenable to an independent, third party evaluating confidential ingredients and formulations in order to report any hazard information without releasing proprietary ingredients and product formulations. This allows users to make informed decisions without releasing confidential business information.
   c. **The ecotoxicity and impacts on human health of most fluorine-free foams and their ingredients have not been characterized or assessed.**
      Research need: Characterize ecotoxicity and human-health impacts of fluorine-free foams, ingredients, and degradation products through third-party hazard and exposure evaluations. Most fluorine-free foams have generic statements that fluorine-free alternatives are preferable because they do not contain fluorine. Some of the fluorine-free foams identified in this report have aquatic toxicity and human-health information available on their safety data sheet. Safety data sheets could not be obtained for all products. Having complete ingredient lists or

formulations disclosed to a third party for analysis is critical to ensure the whole formulation is assessed. Again, characterizing alternative foams will help to eliminate regrettable substitutions.

2. **The use of performance standards across industries is not well understood and characterized.**
   Research need: Dig deeper into mapping performance specifications to applications. A cursory list of industries and situations to which each performance standard applies is included in this report. Reaching out to industry stakeholders, firefighters, and foam manufacturers to validate and expand this list would help to build an understanding of the performance needs for specific fire situations, which could then be used to determine the appropriate foam type for that need.

3. **It is unclear if gaps or discrepancies exist in the performance needs for extinguishing Class B fires and existing performance specifications.**
   Research need: Compare the performance needs and existing performance specifications. It is unclear if performance standards are too strict, not strict enough, or sufficient in all areas of fire suppression. Comparing the needs to standards, such as MIL-SPEC and UL 162, may identify gaps and discrepancies.

4. **Organizations are developing fluorine-free foams, characterizing them, and performing alternatives assessments. Washington is the first U.S. state to ban the sale of fluorinated foams.**
   Action: Monitor work by other organizations. The DoD's research to develop and characterize fluorine-free foams, PERF's alternatives assessment of fluorine-free foams, and CPA's work to develop a list of preferable PFAS-free foams are all notable and currently ongoing. The State of Washington is getting ready to implement their ban on the sale of fluorinated foams in 2020 and is currently working to assess alternatives. Their outcomes may be adopted by others and influence policy and product formulations. The landscape is rapidly changing and there may be other organizations in the near future doing similar work.

5. **There is no regulation preventing the use of fluorine-free foams by non-military users, including firefighting training centers, chemical manufacturers, oil refineries, and others.**
   Action: Assist training centers and other non-military users in switching to fluorine-free alternatives. Firefighting training centers do not have to follow the same performance standards as other users and typically use foams that are not certified to a performance standard. There is no regulatory roadblock for training centers to use fluorine-free foams.

Appendix A: Additional Performance Standards

APSAD R12. France. APSAD R12 is concerned with automatic high-expansion foam extinguishing installations. The rule stipulates the design, construction, commissioning, periodical checking, and maintenance requirements of fixed, automatic, high-expansion foam extinguishing systems installed in buildings in the industrial, commercial, agricultural, or tertiary sectors. English version of the standard is not available. Only one mention of this standard was found during the project, so it has very limited application. Learn more: http://www.cyrus-industrie.com/non-classe-en/apsad-r12-4447

CAN/ULC-S564 Standard for Categories 1 and 2 Foam Liquid Concentrates. Canadian standard: https://www.scc.ca/en/standardsdb/standards/23093

CAP168 Licensing of Aerodromes. UK standard: https://www.folkestone-hythe.gov.uk/webapp/lydd-airport/CORE%20DOCS/CD16/CD16.1.pdf

Class A: Ceren Certificate. Forest fire standard: http://www.valabre-ceren.org/

Draves Test AATCC 17-2005. Efficiency of ordinary commercial wetting agents. Learn more: https://members.aatcc.org/store/tm17/484/

FM 5130 Foam Extinguishing Systems. Complex standard covering foams in their entirety from suppression system to concentrate. Referenced once throughout project duration. Learn more: https://www.fmapprovals.com/approval-standards

GB15308-94: General specification for Foam Extinguishing Agents. Standards Administration of China. Referenced once throughout project duration. See standard: https://standards.globalspec.com/std/143880/sac-gb-15308-94

GESIP. Based in France with a French website, this standard was developed by an oil and chemical industry safety research group that shares feedback, and provides training and information. It has been difficult to glean information; appears they certify companies to standards with respect to the oil industry. It is similar to LASTFIRE. Learn more: http://gesip.com/

IMO MSC.1/Circ 1312. Provides some standard information with respect to foams utilized by boats. It seems that, if this standard is met, then the foam is acceptable for ship use, though it does not include other standards associated with suppression systems. Learn more: http://www.imo.org/blast/blastDataHelper.asp?data_id=25955&filename=1312.pdf.

IMO MSC/Circ.670: Guidelines for the Performance and Testing Criteria and Surveys of High-Expansion Foam Concentrates for Fixed Fire Extinguishing Systems. While it is unclear if this is an outdated version of the IMO MSC.1/Circ 1312 or just very similar to it, it is not necessary to consider it individually. Learn more: http://imo.udhb.gov.tr/dosyam/EKLER/MSC-Circ.670.pdf

LASTFIRE. Standard focused on fires with respect to hydrocarbon fuels. Developed by petrochemical companies and designed with constraints less focused on emergency (life-threatening) situations. Learn more: http://www.lastfire.co.uk/

Lloyd's Register. Independent organization that certifies to ISO standards. Learn more: https://www.lr.org/en/

Marine: Veritas/BV. Independent organization that certifies products/companies to ISO/IMO standards. It appears certification by this company means that the vessel is following all standards necessary for the use of foam on a ship. Learn more: https://www.bureauveritas.com/marine-and-offshore

MED Wheelmark. Independent organization that certifies European Union maritime vessels. Learn more: http://www.ecosafene.com/EN/firetesting/marine/262.html

NFPA 1145 Guide for the Use of Class A Foam in Firefighting. This guide assists fire departments and wildland fire agencies in the safe and effective use of Class A foams for manual structural firefighting and protection. Foam application is outside the scope of this project. Learn more: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1145

NFPA 1150 Standard on Foam Chemicals for Fires in Class A Fuels. This standard defines the acceptance requirements and test methods for fire-fighting foam chemicals that are used to control, suppress, or prevent fires in Class A fuels. May be a fluorine-free standard. Learn more: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1150

NFPA 18 Standard on Wetting Agents. Provides requirements for the performance and use of wetting agents as related to fire control and extinguishment. It is intended for the guidance of the fire services, authorities having jurisdiction (AHJs), and others concerned with judging the acceptability and use of any wetting agent offered for such a purpose. It could be applied to film-forming foams, but it may not be ideal since it is very broad in scope. Learn more: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=18

NFPA 298 Standard for Foam Chemicals for Wildland Fire Control. Specifies requirements and test procedures for foam chemicals used in wildland firefighting. The standard is most likely concerned with Class A fires, so fluorosurfactants would not be as vital to its assessment. It may be a fluorine-free standard. Learn more: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=298

UK 42-42. UK Military spec firefighting foam that was replaced by EN 1568.

U.S. Department of Agriculture Forest Service Specification 5100-307a Specification for Fire Suppressant Foam for Wildland Firefighting (Class A Foam). This standard outlines requirements for foams utilized for Class A fires. It contains biodegradability requirements, which means that foams meeting this standard are not likely to contain fluorosurfactants. It may inadvertently be a fluorine-free standard. Learn more: https://www.fs.fed.us/rm/fire/wfcs/documents/307a.pdf

USC/CNC; USL/CNL. Unable to find information on these standards. The foam manufacturer FireAde lists them on their website: http://pro.fireade.com/products/fireade/

Appendix B: Core Performance Standards Details

This section includes a summary of each core performance standards along with key text and table excerpts from the standards.

B.1 Australian Government DEF (AUST) 5706

Guidelines for testing fixed Aqueous Film Forming Foam (AFFF) suppression systems

Australia military standard. Criteria similar to ISO. Updated in 2018. Accessible here: http://www.defence.gov.au/EstateManagement/Governance/Policy/EngineeringMaintenance/FireProtection/Guidelines/GuidelinesForTestingFixedAqueousFilmFormingFoam(AFFF)SuppressionSystems.pdf

These guidelines are for testing fixed Aqueous Film Forming Foam (AFFF) monitor, overhead deluge, and pop-up sprinkler fire suppression systems in Australian Defense hangars. They include general guidance in relation to testing, commissioning tests, and requirements for storage, collection, treatment, and disposal of AFFF and AFFF wastewater.

The National Fire Protection Association (NFPA) 11—Standard for Low-, Medium-, and High-Expansion Foam is the internationally and locally acknowledged relevant standard. These guidelines endorse and supplement the general testing provisions included in NFPA 11. In the event of conflict between the requirements of NFPA 11 and the guidelines set out in DEF (AUST) 5706, the latter prevails.

B.2 European Standard EN 1568, Parts 1–4

A general-use standard developed by the European Union to replace the individual standards that each country had possessed. Updated in 2018. Available for purchase here: https://www.en-standard.eu/

- Not a pass or fail standard: Concentrates are given performance grades (in other words, Grades 1-4 for extinguishing performance and Grades A-D for burnback resistance). **Grade 1A is the highest achievable grade**.
- EN 1568-approved products are not conformance monitored after accreditation.
- **Part 1** applies to medium-expansion foam for use on water-immiscible liquids.
- **Part 2** applies to high-expansion foam for use on water-immiscible liquids.
- **Part 3** applies to low-expansion foam for use on water-immiscible liquids.
- Requires a 4.52 m^2 heptane fire with a pre-burn of 60 s to be extinguished at an application rate of 2.52 L/min/m^2 using foam with potable and sea water.
- **Part 4** applies to low-expansion foam for use on water-miscible liquids.
- Requires a 1.72 m^2 acetone fire with a preburn of 120 s to be extinguished at an application rate of 6.6 L/min/m^2 using foam with potable and sea water.

EN 1568-1	
Sediment Before/After Ageing	0.25%/1%
Viscosity:	
Newtonian	>200 mm^2/s
Psuedo Plastic	120 mPa*s
pH	6.0-9.5
Extinction Time	>120 s
1% Burnback	<30 s

EN 1568-2	
Sediment Before/After Ageing	0.25%/1%
Viscosity:	
Newtonian	>200 mm^2/s
Psuedo Plastic	120 mPa*s
pH	6.0-9.5
Extinction Time	>150 s

EN 1568-3					
Extinguishing Performance Class	**Burnback Resistance Level**	**Gentle Application Test**		**Forceful Application Test**	
		Extinction Time Not More Than	**25% Burnback Time Not Less Than** (min)	**Extinction Time Not More Than**	**25% Burnback Time Not Less Than** (min)
I+	A			1.5	10
	B		15	1.5	
	C		10	1.5	
	D		5	1.5	
I	A			3	10
	B		15	3	
	C		10	3	
	D		5	3	
II	A			4	10
	B		15	4	
	C		10	4	
	D		5	4	
III	B	5	15		
	C	5	10		
	D	5	5		

EN 1568-4			
Extinguishing Performance Class	**25% Burnback Resistance Level**	**Extinction Time Not More Than** (min)	**25% Burnback Time Not Less Than** (min)
I	A	3	15
	B	3	10
	C	3	5
II	A	5	15
	B	5	10
	C	5	5

B.3 ICAO: The International Civil Aviation Organization Airport Services Manual

The standard that the aviation industry developed with a focus on rapid extinguishment. It is primarily used in airports and was developed to minimize potential danger to those on flights. It provides recommendations and classifications A-C for firefighting foams as well as other best practices for airports. It is internationally applied, though the Federal Aviation Administration (FAA) is U.S. centric. It was last updated in 2014. Available here: https://www.docdroid.net/13f3i/icao-airport-services-manual-part-1-rescue-and-fire-fighting.pdf.

- International Civil Aviation Organization (ICAO)-approved products are not conformance monitored after accreditation.
- ICAO Level A requires a 2.8 m^2 fire to be extinguished at an application rate of 4.1 L/min/m^2.
- ICAO Level B requires a 4.5 m^2 fire to be extinguished at an application rate of 2.5 L/min/m^2.
- ICAO Level C requires a 7.32 m^2 fire to be extinguished at an application rate of 1.75 L/min/m^2.
- All levels require a heptane fire with a 60 s preburn and use of potable water.
- Chapter 8 (p. 43) of the manual is of the most interest as it discusses firefighting foams, detailing procedures for storage, transport, application, standard testing, testing conditions, etc.
- **It does not explicitly mention the need for foams to be fluorinated.**
- It includes best practices for airports with respect to firefighting and general safety.
- The following quote outlines the manual's specific requirements for foam-concentrate performance:

  For each performance level, a foam concentrate is acceptable

  a) if the time to extinguish the fire from the overall surface of the tray is equal or less than 60 s, and b) the re-ignition of 25% of the tray surface is equal to or longer than five minutes. (Note for testing authorities: At the 60 s time, minute flames (flickers) visible between the foam blanket and the inner edge of the tray are acceptable.)

  a) if they [flickers] don't spread in a cumulative length exceeding 25% of the circumference of the inner edge of the tray, and b) they [flickers] are totally extinguished during the second minute of foam application.

ICAO Performance Specifications			
Fire Tests	Performance Level A	Performance Level B	Performance Level C
Nozzle (Air Aspirated)			
Branch Pipe	"Uni 86" Foam Nozzle	"Uni 86" Foam Nozzle	"Uni 86" Foam Nozzle
Nozzle Pressure	700 kPa	700 kPa	700 kPa
Application Rate	4.1 L/min/m2	2.5 L/min/m2	1.56 L/min/m2
Nozzle Discharge Rate	11.4 L/min	11.4 L/min	11.4 L/min
Fire Size	2.8 m2 circular	4.5 m2 circular	7.32 m2 circular
Fuel (on Water Substrate)	Kerosene	Kerosene	Kerosene
Preburn Time	60 s	60 s	60 s
Fire Performance			
Extinguishing Time	< 60 s	< 60 s	< 60 s
Total Application Time	120 s	120 s	120 s
25% Reignition Time	> 5 min	> 5 min	> 5 min

B.4 IMO: International Maritime Organization

Guidelines for the Performance and Testing Criteria and Surveys of Foam Concentrates for Fixed Fire-Extinguishing Systems

Follows similar criteria to ISO and largely focuses on how to perform the tests. Updated in 2009.

The IMO standards are focused on merchant ships and are required by many maritime administrations and classification bodies for foam concentrates to be used on board ships in international waters. They arose as part of the implementation of the Safety of Life at Sea (SOLAS) Convention.[22] There are 174 member states that follow IMO.

- **Explicitly calls out aqueous film-forming concentrate as having fluorinated surfactants**
- **IMO MSC Circ.670** sets out the testing protocols and acceptance criteria for the testing of high-expansion foam concentrates. Find further information here: http://imo.udhb.gov.tr/dosyam/EKLER/MSC-Circ.670.pdf
- The standards are now required by many maritime administrations and classification bodies for foam concentrates to be used on board ships in international waters and have arisen as part of the implementation of the SOLAS Convention.

IMO Specifications	
Sedimentation	$\leq$ 0.25% by volume
Kinematic Viscosity	Max: 200 mm^2/s
pH	6 < pH < 9.5 at 20 ^oC
Spreading Coeffcient	> 0 N/m
Expansion Ratio Parameters:	
Flow Rate	11.4 L/in
Nozzle Pressure	6.3 $\pm$ 0.3 bar
Extinction Time	$\leq$ 5 min
Burnback Time	> 15 min for 25% of the surface
Mass Density	ASTM D 1298-85 (reference)

[22] Read the International Convention for the Safety of Life at Sea (SOLAS), 1974 here: http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx

B.5 ISO-7203

Fire Extinguishing Media: Foam Concentrates

International focus. Updated in 2011.

The International Standards organization developed a general use standard with respect to foam performance. These were not developed with a singular specific purpose and the multitude of classes provide variety in how well the foam will perform so that buyers will know exactly what they are getting. Below are the ISO's specifications in detail.

ISO 7203-1 Specification for low-expansion foam concentrates for top application to water-immiscible liquids (Full document: http://iso-iran.ir/standards/iso/ISO_7203_1_2011_,_Fire_Extinguishing.pdf)

ISO Max Extinction Times and Min Burnback Times (min)					
Extinguishing Performance Class	Burnback Resistance Level	Gentle Application Test		Forceful Application Test	
		Extinction Time Not More Than	25% Burnback Time Not Less Than (min)	Extinction Time Not More Than	25% Burnback Time Not Less Than (min)
I	A	Not applicable		3	10
	B		15	3	Not applicable
	C		10	3	
	D		5	3	
II	A	Not applicable		4	10
	B		15	4	Not applicable
	C		10	4	
	D		5	4	
III	B		15	Not applicable	
	C		10		
	D		5		

ISO 7203-2 Specification for medium- and high-expansion foam concentrates for top application to water-immiscible liquids (Full document: http://iso-iran.ir/standards/iso/ISO_7203_2_2011_,_Fire_Extinguishing.pdf)

Types of Expansion Foam	**Medium Expansion Foam**	**High Expansion Foam**
Extinction Time (s)	Not more than 120	Not more than 150
1% burnback Time (s)	Not less than 30	Not applicable

ISO 7203-3 Specification for low-expansion foam concentrates for top application to water-miscible liquids (Full document: (Full document: http://iso-iran.ir/standards/iso/ISO_7203_3_2011_,_Fire_Extinguishing.pdf)

Extinguishing Performance Class	**Burnback Resistance Level**	**Extinction Time Not More Than (min)**	**25% Burnback Time Not Less Than (min)**
I	A	3	15
	B	3	10
	C	3	5
II	A	5	15
	B	5	10
	C	5	5

B.6 LASTFIRE Hydrocarbon Storage Tanks

Updated in 2015. Accessible here: http://www.lastfire.org.uk/uploads/LFTestSpecRevD-APR2015.pdf

The LASTFIRE standard emerged when a consortium of oil industry leaders came together to provide accurate information on firefighting foams. ("LAST" is an acronym for Large Atmospheric Storage Tank.) More of a "best practices" guide than a set of standards, it ranks foams from 0–100. It is focused on atmospheric tank fires and, as a result, is more concerned with how foams will behave and degrade over a long period of time than with rapid extinguishment.

- The project was initiated due to the oil and petrochemical industries' recognition that the fire hazards associated with large-diameter, open-top, floating-roof tanks were insufficiently understood to be able to develop fully justified site-specific fire-response and risk-reduction policies.
- Part of this project was to develop a foam-testing protocol in order to assess a foam's capability to achieve the special performance characteristics relevant to large storage tank firefighting.
- The LASTFIRE test was rapidly established as a standard for this severe application and has been included as a requirement in foam concentrate procurement specifications by major international oil companies.
- Applications are focused on putting out fires in open-top fuel tanks
- Ratings are based on a scale of 100% effectiveness (p. 13)
  - Fire control: 5%
  - Extinguishment capability: 65%
  - Post-extinguishment vapor suppression: 15% (2 trials of 7.5% each)
  - Burnback resistance: 15%
  - These values were based on polls of experienced operators and what they felt was important in the foams.
- 100–80% is considered "Good Fire Performance."
- 79.5–50% is considered "Acceptable Fire Performance."
- 49.5–25% is considered "Reduced Fire Performance."
- 24.5–0% is considered "Poor Fire Performance" (p. 21).

LASTFIRE Criteria	Minutes from ignition	Score	Remarks
Fire Control	0-5	5	
	>5-8	2	
	8-10	0	
	>10	FAIL	Overall Fail
	Maximum score	***5***	***5% of total***
Extinguishment	0-6	65	
	>6-10	55	
	>10-12	45	
	>12-20	25	
	20-30	15	
	>30	FAIL	Overall Fail
	Maximum score	***65***	***65% of total***
Vapor Suppression	**Test One**		
		7.5	*No reignition*
		5	*Minor edge ignition only*
		2.5	*Full circumference ignition or single ghosting over surface*
		0	*Full flash and prolonged ghosting over surface*

LASTFIRE Criteria	Minutes from ignition	Score	Remarks
	Maximum score	***7.5***	***7.5% of total***
	Test two - scoring as test one		
		7.5	*No reignition*
		5	*Minor edge ignition only*
		2.5	*Full circumference ignition or single ghosting over surface*
		0	*Full flash and prolonged ghosting over surface*
		OVERALL FAIL	*Significant prolonged flaming 25-50%, flames>pan*
	Maximum score	***7.5***	***7.5% of total***
Burnback Resistance		15	*<25%, minor flaming*
		10	*<25% flash/<65% circ.*
		5	*Flash 25-50%/<65% circ.*
		0	*Full flash/continued ghosting 25-50%*
		OVERALL FAIL	*Full flash/sustained flaming or ghosting >50%/exposed fuel >10%, iceberging*
	Maximum score	***15***	***15% of total***
	Total	**100**	

Below are extracts from LASTFIRE regarding specific topics.

Fire control:

Marks are awarded for the foam's ability to achieve 90% control up to a maximum of eight min from ignition (in other words, 5 min [of] foam application). Foams controlling the fire in 8–10 min (5–7 minutes of foam application) are given no marks in this section. Those foams that fail to control the fire once foam application has ceased even after 30 minutes from ignition are deemed to have "failed" the requirements of the LASTFIRE test and given a resultant zero overall score.

Extinguishment:

Recognising that extinguishment of the fire is the ultimate aim of foam application and, generally speaking, the sooner it is achieved the better, scoring shall be based on a "sliding scale" with full marks given for extinguishment during the first three minutes of foam application (up to 6 min from ignition). If extinguishment is not achieved within the full 30 min test, then the foam is classified as "FAIL" and given an overall zero score.

Vapor suppression:

Vapor suppression performance shall be assessed in the LASTFIRE test by passing a lighted torch around the full circumference and centre of the foam blanket. This shall be done twice during the test and each test [will be] given a maximum possible 7.5% of the total test marks. The extent of reignition shall be evaluated and scores given for each "torch test" based on the following observations:

- Seven-and-a-half marks for no reignition
- Five marks for < 65% of the circumference of the pan reignition which then extinguish and are not taller than the pan height.
- Two-and-a-half marks for > 65% of the circumference of the pan reignition or minor "ghosting" occurs which is short lived and extinguished rapidly.

- Zero marks for full flashover if flames subside rapidly or > 65% of the circumference ignites with flames greater than the pan height that persist, or ghosting is persistent but not greater than the height of the pan.
- "OVERALL FAIL" shall be deemed if significant, prolonged flaming over a large proportion of the surface (25–50 %) is observed, with flames greater than the test pan height. "OVERALL FAIL" shall be given, even if flaming subsides, and subsequent seal or burn back tests can be conducted.

Burnback resistance:

Different foams are able to resist "burnback" to varying degrees. Upon removal of the burnback pot (and in some cases before removal) foams can exhibit minor or extended reignition of the foam blanket. In some cases, the fuel surface will be exposed as subsequent foam "layers" are burnt and deteriorate. . . . Marks shall be awarded for burnback resistance as follows:

- Fifteen marks for < 25% of reignition at any point during test, no full surface flash, minor flickers no greater than the height of the pan are allowed, <65% of circumference flash with flames no greater than the height of the pan, and no visible fuel is observed.
- Ten marks for < 25% of reignition with a full flash permitted if it subsides slowly and <25% continues to burn, < 65% of circumference burns and flames are less than the pan height, and no exposed fuel is observed.
- Five marks for < 25% of reignition with a full flash permitted if it subsides slowly and <25% continues to burn, < 65% of the circumference burns but the flames are greater than the pan height, and no exposed fuel is observed.
- Zero marks for 25–50% of the fuel flaming at the end of test, ghosting or flaming is persistent over 25–50% of the test bed, fuel exposure is evident as long as it is < 10% of pan area.
- OVERALL FAIL shall be deemed if > 50% of the surface area is caught in a full flash or is burning at the end of the test, prolonged surface flames greater than the height of the pan are observed, > 10% fuel exposure is observed, or significant foam deterioration occurs (iceberging).

B.7 NFPA 11 Standard for Low-, Medium-, and High-Expansion Foam

U.S. standard focused on firefighting systems. Updated in 2016. Available for purchase here: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=11.

This standard was developed with tank fires as the primary concern and is mostly concerned with foam transit time across a hot fuel surface. It covers the design, installation, operation, testing, and maintenance of low-, medium-, and high-expansion foam systems for fire protection. Criteria apply to fixed, semi-fixed, or portable systems for interior and exterior hazards.

B.8 UL 162 Standard for Foam Equipment and Liquid Concentrates

Internationally recognized standard developed and maintained by Underwriters Laboratories Inc. Updated in 2018. Available for purchase here https://standardscatalog.ul.com/standards/en/standard_162.

This is a comprehensive and persistent standard that shows the compatibility of foams and provides firefighting performance specifications. Its requirements cover foam-producing equipment and liquid concentrates employed for the production and discharge of foam that has an expansion ratio of 20:1 or less and is used for fire extinguishment. This standard evaluates specific combinations of foam concentrates and foam equipment together, since performance for a given concentrate may vary depending on equipment-specific factors.

- It is a pass/fail test.
- UL 162 requires a 50 ft^2 heptane fire with a preburn of 60 s to be extinguished at an application rate of 1.63 L/m^2 using a freeze-protected foam with potable and sea water.
- UL-listed products are monitored with samples that are sent to UL every three months for conformance testing. This guarantees the foam being supplied is the same formulation as was originally tested; no other test standard requires this monitoring.

Products that meet the current standard can be found by searching UL category code "GFGV" on the UL Certifications Directory (Access here: http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html). Each company listing includes the foam products it carries and the equipment that the foams are certified to work with.

B.9 U.S. Federal Aviation Administration (FAA)

The Federal Aviation Administration (FAA) outlines in Title 14, Code of Federal Regulations (CFR) [Part 139] that, in order to issue airport-operating certificates, an airport must

- serve scheduled and unscheduled air-carrier aircraft with more than 30 seats, or
- serve scheduled air-carrier operations in aircraft with more than nine seats but fewer than 31 seats.

Below are resources related to Part 139.

- A list of airports certified under Part 139 can be accessed here: https://www.faa.gov/airports/airport_safety/part139_cert/media/part139-cert-status-table.xls
- Operators of Part 139 airports must provide aircraft rescue and firefighting (ARFF) services during air carrier operations that require a Part 139 certificate. The guidance and resources below address ARFF training, ARFF vehicles, and other aviation fire and rescue requirements.
- General website summarizing ARFF standards: https://www.faa.gov/airports/airport_safety/aircraft_rescue_fire_fighting/
- In Chapter 6 of a 2004 advisory circular outlining performance requirements for Aircraft Fire Extinguishing Agents, the following specifications are outlined:

  > AFFF agents must meet the requirements of Mil-F-24385F. It is important to note that if one vendor's foam is mixed with another vendor's foam in the reservicing process, there must be compatibility between foams to prevent gelling of the concentrate.[23]

- The statement below is from a National Part 139 CertAlert [No. 16-05] issued by the FAA in 2016, titled "Update on Mil-Spec Aqueous Film Forming Foam (AFFF)."[24]

  > 3. Actions.
  >
  > a. Airport operators must ensure any AFFF purchased after July 1, 2006, meets MilSpec standards.
  >
  > i. AFFF meets Mil-Spec standards if the AFFF appears on the DoD QPD web site.
  >
  > ii. If the AFFF is NOT on the QPD, the AFFF is NOT authorized for use at Part139 airports.
  >
  > b. However, if a Part 139 airport operator:
  >
  > i. Purchased the previous AFFF standard of UL 162 prior to July 1, 2006, the airport operator can continue to use the current inventory until depleted or the AFFF reaches the manufacturers' expiration date; or
  >
  > ii. Purchased AFFF listed on the QPD after July 1, 2006, but that AFFF is no longer listed on the current QPD, the airport operator can continue to use the current inventory until depleted or the AFFF reaches the manufacturers' expiration date.

- Further regulatory information can be found in Title 14, CFR [Part 139.137], titled "Aircraft Rescue and Firefighting: Equipment and Agents." It contains specifications for vehicles and extinguishing agents and can be found here: https://www.faa.gov/airports/airport_safety/part139_cert/

[23] Access the advisory circular here: https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_150_5210-6D.pdf
[24] See the advisory alert here: https://www.faa.gov/airports/airport_safety/certalerts/media/part-139-cert-alert-16-05-Mil-Spec-AFFF-website-update.pdf

B.10 US Military Specification (MIL-SPEC)

MIL-PRF-23485F(SH) w/Amendment 2, 7 Sept 2017

Focused on rapid extinguishment. Developed with the prevention of weapons discharge aboard Navy ships as the primary focus. Approved for use by all departments and agencies of the U.S. Department of Defense (DoD). Only standard that includes maximum PFOA and PFOS content. Available here http://quicksearch.dla.mil/qsDocDetails.aspx?ident_number=17270

The following segments from the standard outlines the requirements it specifies:

> 3. REQUIREMENTS 3.2 Materials. Concentrates shall consist of fluorocarbon surfactants plus other compounds as required to conform to the requirements specified hereinafter. The material shall have no adverse effect on the health of personnel when used for its intended purpose.
>
> Total fluorine content of the AFFF shall be determined and shall not deviate more than 15 % of the value determined and reported at time of qualification report.
>
> 4.7.8 PFOA and PFOS content. The tests for PFOA and PFOS content shall be conducted by a laboratory that is accredited by the DoD Environmental Laboratory Accreditation Program (ELAP) and tests in compliance with the "Per- and Polyfluoroalkyl Substances (PFAS) Using Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS) with Isotope Dilution or Internal Standard Quantification in Matrices Other Than Drinking Water" table of DoD QSM Version 5.1. (A list of ELAP accredited laboratories can be found online at http://www.denix.osd.mil/edqw/accreditation/accreditedlabs. Under the "Method" drop-down list, select "PFAS by LCMSMS Compliant with QSM 5.1 Table B-15.") Test results shall be recorded from the lowest dilution possible while still meeting all of the requirements in the DoD QSM table. This may require results to be recorded from two different dilutions; one for PFOA and one for PFOS.
>
> 6.6 PFOA and PFOS content. The DoD's goal is to acquire and use a non-fluorinated AFFF formulation or equivalent firefighting agent to meet the performance requirements for DoD critical firefighting needs. The DoD is funding research to this end, but a viable solution may not be found for several years. In the short term, the DoD intends to acquire and use AFFF with the lowest demonstrable concentrations of two particular PFAS; specifically PFOS and PFOA. The DoD intends to be open and transparent with Congress, the Environmental Protection Agency (EPA), state regulators, and the public at large regarding DoD efforts to address these matters. AFFF manufacturers and vendors are encouraged to determine the levels of PFOS, PFOA, and other PFAS in their products and work to drive these levels toward zero while still meeting all other military specification requirements.

MIL-SPEC Table 1: Chemical and Physical Requirements for Concentrates or Solutions		
Requirement	Values	
	Type 3	Type 6
Minimum Refractive Index	1.3630	1.3580
Viscosity (Centistokes)		
Maximum at 5 °C	20	10
Minimum at °C	2	2
pH	7.0-8.5	7.0-8.5
Minimum Spreading Coefficient	3	3
Foamability:		
Minimum Foam Expansion	5.0	5.0
Minimum Drainage Time, 25 %	2.5	2.5
Corrosion Rate:		

General		
Cold-Rolled Steel, Maximum milli in/yr	1.5	1.5
Copper-Nickel, Maximum milli in/yr	1.0	1.0
Nickel-Copper, Maximum milli in/yr	1.0	1.0
Bronze, Maximum mg	100	100
Localized, Corrosion Resistant Steel	No Pits	No Pits
Perfluorooctanoic Acid (PFOA) Content, Maximum ppb	800	800
Perfluorooctane Sulfonate (PFOS) Content, Maximum ppb	800	800

MIL-SPEC Table 2: Fire Performance			
	AFFF Solutions, percent		
	1.5% of Type 3 3% of Type 6	3% of Type 3 6% of Type 6	15% of Type 3 30% of Type 6
	(Fresh and Sea)	(Fresh and Sea)	(Sea)
28 ft^2 fire:			
Maximum Foam Time to Extinguish	45	30	55
Minimum Burnback Time	300	360	200
50 ft^2 fire:			
Maximum Foam Time to Extinguish		50 (sea only)	
Minimum Burnback Time		360	
Minimum 40 s Summation		320	

MIL-SPEC Qualified Products

There are currently eight MIL-SPEC-qualified products, each available at 3% and 6% concentration. All qualified products contain short-chain (C6) fluorosurfactants. The list of qualified products is available online at http://qpldocs.dla.mil/. Related information is summarized below.

MIL-SPEC Qualified Products	Environmental info, per the manufacturer	Manufacturer
AER-O-WATER 3EM-C6 AFFF AER-O-WATER 6EM-C6 AFFF	C6 Fluorosurfactants National Foam Concentrates do not contain PFOS.	NATIONAL FOAM, INC. 350 E UNION ST WEST CHESTER, PA 193823450 www.NationalFoam.com
TRIDOL-C6 M3 AFFF TRIDOL-C6 M6 AFFF	Angus Fire foam concentrates do not contain PFOS. The C6 surfactants balance high performance and low environmental impact, and are biodegradable.	
ANSULITE AFC-3MS 3% AFFF ANSULITE AFC-6MS 6% AFFF	C6 fluorochemicals manufactured using a telomer-based process that does not produce PFOS. These C-6 materials do not breakdown to yield PFOA compounds.	TYCO FIRE PRODUCTS LP TYCO FIRE PROTECTION PRODUCTS 1 STANTON ST MARINETTE, WI 541432542

MIL-SPEC Qualified Products	Environmental info, per the manufacturer	Manufacturer
CHEMGUARD C306-MS 3% AFFF CHEMGUARD C606-MS 6% AFFF	C6 fluorochemicals are manufactured using a telomer-based process that does not produce PFOS. These C6 materials do not breakdown to yield PFOA compounds. Meets the goals of the UPEPA 2010/15 PFOA Stewardship Program.	
ARCTIC 3% MIL-SPEC AFFF ARCTIC 6% MIL-SPEC AFFF	C6 fluorosurfactants comply with the U.S. EPA 2010/2015 PFOA Product Stewardship Program. Arctic Foam concentrates do not contain PFOS.	AMEREX CORPORATION SOLBERG COMPANY, THE 1520 BROOKFIELD AVE GREEN BAY, WI 543138808 http://www.solbergfoam.com
FIREADE MILSPEC 3 FIREADE MILSPEC 6	Made from 98% organic compounds and zero hazardous chemicals. Encompasses water-based and food-grade ingredients. They are biodegradable and contain no ingredients reportable under the Superfund Amendments and Reauthorization Act (SARA) Title III, Section 313 of 40 CFR-372 or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).	FIRE SERVICE PLUS, INC 180 ETOWAH TRACE FAYETTEVILLE, GA 302145902 http://www.fireade.com
FOMTEC AFFF 3%M "SWE" FOMTEC AFFF 3%M "USA"	Products are biodegradable, formulated with the latest fluorine technology and uses only “All-C6 fluorinated” compounds.	DAFO FOMTEC AB VINDKRAFTSVAGEN 8 STOCKHOLM, 13570 http://www.fomtec.com
PHOS-CHEK 3% AFFF MS PHOS-CHEK 6% MILSPEC AFFF	Made with a mixture of water, hydrocarbon surfactants, solvents, and C6 fluorosurfactants.	ICL PERFORMANCE PRODUCTS LP WILDFIRE CONTROL DIVISION 10667 JERSEY BLVD RANCHO CUCAMONGA, CA 917305110 www.phoschek.com

Appendix C: Core Performance Standards Requirements Comparison

This section contains summary tables of the core requirements of performance standards in order to facilitate easy comparison.

Table C1 contains performance parameters defined in a majority of the standards.

Table C2 contains additional performance parameters that are covered in some, but not all, of the standards.

Table C1. Summary of core performance standards requirements

Standard	Fire Size	Preburn Time	Application Time	Time to Extinguish(s)	25% Reignition Time(s)[a]
DEF (AUST) 5706	4.5 m^2	60	120	50	300
EN 1568-1	1.73 m^2	60	120	120	30 (1% burnback)
EN 1568-2	1.73 m^2	60	120	150	
EN 1568-3 I A	4.52 m^2	60	180	180 (F)	600 (F)
EN 1568-3 I B	4.52 m^2	60	180(F)/300(G)	180 (F)	900 (G)
EN 1568-3 I C	4.52 m^2	60	180(F)/300(G)	180 (F)	600 (G)
EN 1568-3 I D	4.52 m^2	60	180(F)/300(G)	180 (F)	300 (G)
EN 1568-3 I+A	4.52 m^2	60	180	90 (F)	600 (F)
EN 1568-3 I+B	4.52 m^2	60	180(F)/300(G)	90 (F)	900 (G)
EN 1568-3 I+C	4.52 m^2	60	180(F)/300(G)	90 (F)	600 (G)
EN 1568-3 I+D	4.52 m^2	60	180(F)/300(G)	90 (F)	300 (G)
EN 1568-3 II A	4.52 m^2	60	180	240 (F)	600 (F)
EN 1568-3 II B	4.52 m^2	60	180(F)/300(G)	240 (F)	900 (G)
EN 1568-3 II C	4.52 m^2	60	180(F)/300(G)	240 (F)	600 (G)
EN 1568-3 II D	4.52 m^2	60	180(F)/300(G)	240 (F)	300 (G)
EN 1568-3 III B	4.52 m^2	60	300	300 (G)	900 (G)
EN 1568-3 III C	4.52 m^2	60	300	300 (G)	600 (G)
EN 1568-3 III D	4.52 m^2	60	300	300 (G)	300 (G)
EN 1568-4 I A	1.73 m^2	60	180	180	900
EN 1568-4 I B	1.73 m^2	120	180	180	600
EN 1568-4 I C	1.73 m^2	120	180	180	300
EN 1568-4 II A	1.73 m^2	120	300	300	900
EN 1568-4 II B	1.73 m^2	120	300	300	600
EN 1568-4 II C	1.73 m^2	120	300	300	300
ICAO A	2.82 m^2	60	120	60	300
ICAO B	4.5 m^2	60	120	60	300
ICAO C	7.32 m^2	60	120	60	300
IMO	4.5 m^2	60	300	300	900
ISO High Expansion	1.73 m^2	60	120	150	
ISO I A	4.52 m^2	60	180(F)/300(G)	180 (F)	600 (F)
ISO I B	4.52 m^2	60	180(F)/300(G)	180 (F)	900 (G)

Standard	Fire Size	Preburn Time	Application Time	Time to Extinguish(s)	25% Reignition Time(s)[a]
ISO I C	4.52 m^2	60	180(F)/300(G)	180 (F)	600 (G)
ISO I D	4.52 m^2	60	180(F)/300(G)	180 (F)	300 (G)
ISO II A	4.52 m^2	60	180(F)/300(G)	240 (F)	600 (F)
ISO II B	4.52 m^2	60	180(F)/300(G)	240 (F)	900 (G)
ISO II C	4.52 m^2	60	180(F)/300(G)	240 (F)	600 (G)
ISO II D	4.52 m^2	60	180(F)/300(G)	240 (F)	300 (G)
ISO III B	4.52 m^2	60	180(F)/300(G)		900 (G)
ISO III D	4.52 m^2	60	180(F)/300(G)		300 (G)
ISO IIIC	4.52 m^2	60	180(F)/300(G)		600 (G)
ISO Medium Expansion	1.73 m^2	60	120	120	30 (1% burnback)
MIL-SPEC 1.5% Type 3 MIL-SPEC 3% Type 6[b]	28 ft^2	10	90	45	300
MIL-SPEC 15% Type 3 MIL-SPEC 30% Type 6 [b]	28 ft^2	10	90	55	200
MIL-SPEC 3% Type 3 MIL-SPEC 6% Type 6 (SEA) [b]	28 ft^2	10	90	30/50 (SEA)	360/360 (SEA)
NFPA 11	NFPA is a very different style of test. Instead of foam being applied via nozzle, foam is instead applied to the fuel surface and the foam is expected to travel across the fuel. NFPA is focused on transit time of the foam, making it more ideal for tank fires but largely unavailable for reporting here.				

*Notes:

[a] (F) is the forceful application of foam, or direct application to liquid fuel and (G) is the gentle application of foam, or application via backboard or other surface.

[b] MIL-SPEC foams must pass all three iterations. To clarify, Type 3 foams must pass tests at 1.5%, 3%, and 15% concentrations and Type 6 foams must pass tests at 3%, 6%, and 30%.

Table C2. Additional core performance standards requirements

	Minimum Refractive Index	Surface Tension, mN/m	Viscosity, Centistokes (maximum/ minimum)	pH	Sedimentation Potential (maximum)	Minimum Spreading Coefficient	Minimum Foam Expansion Ratio	Minimum Drainage Time, 25%, min	Maximum PFOA Content,	Maximum PFOS Content, ppb	LC_{50} Toxicity mg/L (minimum)	COD, mg/L	BOD/COD
DEF (AUST) 5706[a]		0.5 of acceptance testing value	10% of approved manufacturer value	6.5-9									
EN 1568		Within .95x and 1.05x of sampled foam concentrate	200/120 mPa*s (Pseudo Plastic)	6-9.5	0.25% before aging 1% aged			20% of fresh water value					
ICAO			200	6-8.5	0.50%		6-10 film-forming & fluorine-free 8-12 protein based foam	>3 film forming >5 protein based foam					
IMO			200	6-9.5	0.25%	Must be Positive							
ISO		70	200/120 mPa*s (Pseudo Plastic)	6-8.5	0.25% before aging 1% aged	Must be Positive	+ - 20% or + - 1 of manufacturer stated value	+ - 20% of the manufacturer stated time					
MIL-SPEC Type 3[b]	1.363		20/2	7-8.5		3	5	2.5	800	800	500	1000K	0.65
MIL-SPEC Type 6[b]	1.358		2-Oct	7-8.5		3	5	2.5	800	800	1000	500K	0.65

[a] DEF (AUST) 5706 requires corrosion information in the form of mass change. [b] MilSpec also requires corrosion information.

Appendix D: Research Groups & Agencies involved in AFFF Work

This section summarizes the activities from the many organizations in the United States and abroad that are actively engaged in fluorine-free AFFF work. It is recommended that readers follow up directly with the organizations listed as their work progresses and new information emerges.

Table of contents

D.1 Intergovernmental Organizations

OECD/UNEP Global PFC Group

URL: http://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/

The OECD/UNEP Global PFC Group was established in 2012 and brings together experts from OECD-member and non-member countries in academia, governments, industry, and within the NGO sectir, as well as representatives from other international organizations.

It was created in response to the International Conference on Chemicals Management (Resolution II/5) (See details of conferences here: https://old.saicm.org/index.php?option=com_content&view=article&id=218:iccm2-outcomes-and-follow-up&catid=89:iccm-2), calling upon intergovernmental organizations, governments and other stakeholders to:

> …consider the development, facilitation and promotion in an open, transparent and inclusive manner of national and international stewardship programmes and regulatory approaches to reduce emissions and the content of relevant perfluorinated chemicals of concern in products and to work toward global elimination, where appropriate and technically feasible.

The Group's online portal serves to facilitate the exchange of information on per- and polyfluorinated chemicals, focusing specifically on PFAS. It provides information on the following areas:

1. What are PFAS? (URL: http://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/aboutpfass/)
2. Risk reduction approaches (URL: http://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/riskreduction/)
3. Alternatives (URL: http://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/alternatives/)
4. Production and emissions (URL: http://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/countryinformation/)
5. Information from countries (URL: http://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/countryinformation/)

Information provided in the portal comes principally from the work done within the context of the Group.

The OECD released their updated New Comprehensive Global Database of Per- and Polyfluoroalkyl Substances (PFAS) and accompanying methodology report in May 2018. http://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/

Interstate Technology Regulatory Council (ITRC)

PFAS Fact Sheets

URL: https://pfas-1.itrcweb.org/fact-sheets/

Fact sheets summarize the latest science and emerging technologies for PFAS and are tailored to the needs of state regulatory program personnel who are tasked with making informed and timely decisions regarding PFAS-impacted sites. Content is also useful to consultants and parties responsible for the release of these contaminants, as well as community stakeholders.

An Introductory document (URL: https://pfas-1.itrcweb.org/wp-content/uploads/2017/11/pfas_fact_sheet_introductory__11_13_17.pdf) has been prepared that briefly describes the contents of each of the fact sheets.

- Naming Conventions and Physical and Chemical Properties (URL: https://pfas-1.itrcweb.org/wp-content/uploads/2018/03/pfas_fact_sheet_naming_conventions__3_16_18.pdf) (updated Mar. 16, 2018)
- Regulations, Guidance, and Advisories (URL: https://pfas-1.itrcweb.org/wp-content/uploads/2018/01/pfas_fact_sheet_regulations__1_4_18.pdf) (updated Jan. 4, 2018)
    - Section 4 Tables Excel file (URL: https://pfas-1.itrcweb.org/tables/ITRCPFASFactSheetSect4TablesNovember17.xlsx) (published Nov. 2017)

    - Table 4-1 presents the available PFAS water values established by the U.S. EPA, each pertinent state, or country (Australia, Canada, and Western European countries)
    - Table 4-2 presents the available PFAS soil values established by the U.S. EPA, each pertinent state, or country (Australia, Canada, and Western European countries)
    - Section 5 Tables Excel file (URL: https://pfas-1.itrcweb.org/tables/ITRCPFASFactSheetSect5TablesNovember17.xlsx) (published Nov. 2017)
    - Table 5-1 summarizes the differences in the PFOA values for drinking water in the United States.
    - Table 5-2 summarizes the differences in the PFOS values for drinking water in the United States.
- History and Use (URL: https://pfas-1.itrcweb.org/wp-content/uploads/2017/11/pfas_fact_sheet_history_and_use__11_13_17.pdf) (published Nov. 13, 2017)
- Environmental Fate and Transport (URL: https://pfas-1.itrcweb.org/wp-content/uploads/2018/03/pfas_fact_sheet_fate_and_transport__3_16_18.pdf) (published Mar. 16, 2018)
    - Table 3-1 Log Koc values for select PFAS Excel file (published Apr. 2018)
- Site Characterization Considerations, Sampling Precautions, and Laboratory Analytical Methods (URL: https://pfas-1.itrcweb.org/wp-content/uploads/2018/03/pfas_fact_sheet_site_characterization_3_15_18.pdf) (published Mar. 15, 2018)
- Remediation Technologies and Methods (URL: https://pfas-1.itrcweb.org/wp-content/uploads/2018/03/pfas_fact_sheet_remediation_3_15_18.pdf) (published Mar. 15, 2018)
    - Remediation Comparison Tables (published Apr. 2018), Table 1 – Solids Comparison & Table 2 – Liquids Comparison
- Aqueous Film-Forming Foam (expected soon)

D.2 Government

US Department of Defense

Environmental Research Programs on PFAS by the Strategic Environmental Research and Development Program (SERDP)

URL: https://www.serdp-estcp.org/Featured-Initiatives/Per-and-Polyfluoroalkyl-Substances-PFASs

Project objectives are identified in annual statements of need. The AFFF formulation projects are in the "Weapons Systems and Platforms" program area (See: https://serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/(list)/1/). Some projects contain additional information and are organized by "Active Projects" and "Completed Projects" on the program-area web page. No recent AFFF projects were identified among the "Completed Projects" group (accessed May 2018). Projects related to AFFF under the "Active Projects" group are detailed below by start year.

Contact:
Robin A. Nissan, Ph.D.
Program Manager for Weapons Systems and Platforms Strategic Environmental Research and Development Program (SERDP)
4800 Mark Center Drive, Suite 17D08
Alexandria, VA 22350-3605
Phone: 571-372-6399 E-Mail: Robin.A.Nissan.civ@mail.mil

"Fluorine-Free Aqueous Film-Forming Foam"
FY 2017 Statement of Need Projects

URL: https://www.serdp-estcp.org/Program-Areas/Environmental-Restoration/Contaminated-Groundwater/Contaminated-Groundwater-SONs/Film-Forming-Foam-PFAS-WP

The projects listed below were selected to address the objectives of this Statement of Need.

"WP-2737 Novel Fluorine-Free Replacement for Aqueous Film Forming Foam"
The objective of this project is to demonstrate proof-of-concept for the development of the next generation of fluorine-free firefighting foam formulations as a replacement for existing AFFF. The novel foam systems produced in this research are derived from polysaccharide copolymers and nanoparticles (based on chitosan) that are sustainable, non-toxic, water-soluble (or water-dispersible) and will be applied using existing military firefighting equipment. These foam systems will meet or exceed both environmental regulations and firefighting performance defined in military specification (MIL-SPEC) MIL-F-24385F "Military Specification: Fire Extinguishing Agent, Aqueous Film Forming Foam (AFFF) Liquid Concentrate, For Fresh and Seawater" (1994).

Principal Investigator: Dr. Joseph Tsang, NAVAIR, Phone: 760-939-0256, joseph.tsang@navy.mil

Status (April 2018): This project started in January 2017 and reportedly is complete. No report is available at this time (personal communication, Robin Nissan, SERDP). Additional project description is available here: https://www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-2737

"WP-2738 Fluorine-Free Aqueous Film Forming Foam"
The environmental issue to be addressed in this project is the use of fluorosurfactants and fluoropolymers in AFFF for fire suppression. All foams that meet the requirements of MIL-F 24385 must contain fluorocarbons. Older formulations contain C8; newer products have shorter C6 fluorocarbon chains. C6 fluorocarbons are persistent in the environment, but their toxicology to humans and aquatic species is considered more benign than C8. A fire-fighting foam that genuinely biodegrades in the natural environment would eliminate any future concerns.

The objective of this project is to use scientific methods to increase understanding of the physical and chemical processes that underlie fire-fighting foams and how the components of a foam formulation can deliver the properties required for good fire performance while minimizing environmental burdens. Statistical methods will be employed to develop a fluorine-free surfactant formulation that meets the performance requirements defined in MIL-F 24385.

A life-cycle assessment (LCA) will compare the environmental impact of each foam type and identify routes to improving environmental performance.

Principal Investigator: John Payne, National Foam, john.payne@aisafetygroup.com

Status (April 2018): This project began January 2017 and is expected to continue through 2019. A detailed project plan was provided by the principal investigator (PI) and is available among the IC2 project documents. The project LCA is nearly complete, and the PI provided a poster summary. Formulation work should be complete in mid-to-late 2019. Quick results are expected through the use of existing commercial surfactants rather than new, synthesized formulations. A project summary can be found here: https://www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-2738

"WP-2739 Fluorine-free Foams with Oleophobic Surfactants and Additives for Effective Pool Fire Suppression"
The objective of this project is to develop a fluorine-free, firefighting surfactant formulation that meets the performance requirements of MIL-F-24385F and is an environmentally friendly, drop-in replacement for the current environmentally hazardous AFFF.

This project will build on U.S. Naval Research Laboratory (NRL) experience and on the toxicology and analytical capabilities of Oregon State University in a dual-track approach to identify and develop fluorine-free surfactants with both fire suppression effectiveness and low environmental impact. The investigators will choose oxyhydrocarbon and siloxane surfactants from commercial sources where available or synthesize at laboratory scale. Investigators employ a tiered-approach, wherein the number of candidate surfactants taken forward will be reduced at each tier based on the results from modeling, measurements of fire suppression efficiency, and environmental acceptability. They will choose and modify surfactant

structures to balance oleophobicity and amphiphilicity to improve suppression of fuel transport through foam and foam stability. They will use QSAR, molecular and continuum dynamics models to select, eliminate, and modify surfactant structures based on acute toxicity and fuel transport through a single lamella (bubble's liquid wall). They will perform prescreening measurements of surfactant solution properties and lamella dynamics to down-select promising surfactants. They will evaluate surfactants by quantifying long-term toxicity, biodegradability, and the fire-suppression effectiveness of the foams at laboratory scale. Finally, investigators will perform the 28-ft^2-pool-fire-suppression test and the aquatic toxicity test according to MIL-F- 24385F and the appropriate ASTM, EPA, OECD methods on the down-selected foam formulations.

Principal Investigator: Ramagopal Ananth, U.S. Naval Research Lab, Phone: 202-767-3197, ramagopal.ananth@nrl.navy.mil

Status (April 2018): The project started in January 2017 and is expected to continue through 2019. The PI provided a number of presentations and documents related to NRL work in the AFFF area (available in the IC2 project files). A project summary can be found here: https://www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-2739

"Innovative Approaches to Fluorine-Free Aqueous Film Forming Foam"
FY 2018 Statement of Need Projects

The objective of this limited-scope Statement of Need is to develop a fluorine-free surfactant formulation for use in AFFF fire-suppression operations.

URL: https://serdp-estcp.org/content/download/45625/425507/file/WPSON-18-L1%20Fluorine-Free%20AFFF.pdf

Several AFFF projects were identified from the SERDP website with start dates in 2018:

"WP18-1638 Fluorine-free Aqueous Film Forming Foams Based on Functional Siloxanes"
AFFF containing PFOA and PFOS have been traditionally used by the DoD in fuel-fire suppression operations. These chemicals have strong chemical bonds and are considered as persistent, bio-accumulative and toxic (PBT) substances. PFOS/PFOS chemicals have been detected around the world in the food chain, drinking water, animals, and human blood. Therefore, EPA is regulating the chemical industry for the complete elimination of PFOA and PFOS chemicals along with certain C6 substances (containing six fluorinated carbons) by 2015. Therefore, the DoD is seeking non-toxic alternatives—preferably fluorine-free compounds—to replace PFOA/PFOS in firefighting foam formulations. In this project, specifically functionalized siloxane-based surfactants will be synthesized, and their physical and fire suppression abilities will be evaluated. The tests will include the evaluation of 28-ft^2-fire performance, spreading coefficient, aquatic toxicity, chemical oxygen demand (COD), and bio-persistency.

Principal Investigator: Kris Rangan, Materials Modification, Inc., Phone: 703-560-1371

Status (May 2018): The project started in March 2018. No attempt was made to contact the PI.
A project summary can be found here: https://www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP18-1638

"WP18-1519 Surfactants with Organosilicate Nanostructures for Use as Fire-Fighting Foams (F3)"
The objective of this research project is to explore an innovative approach in using polyhedral oligomeric silsesquioxanes (POSS) as drop-in replacements of perfluoroalkyl surfactants found in current AFFF concentrates used in fire-fighting by the DoD. The new POSS surfactants produced in this research will contain only the elements carbon, silicon, hydrogen, and oxygen. Foams containing the new surfactants will extinguish small-scale, unleaded-gasoline pool fires in 45 seconds or less, as dictated by MIL-F-24385F. In addition, the POSS surfactants will have low, acute toxicity to fish and be biodegradable according to measurements of chemical oxygen demand and biological oxygen demand of microorganisms. Commercially available alkylated POSS compounds will be chemically modified with hydrophilic polyethylene glycol (PEG) units. A range of PEG lengths will be used in the selective modification to

determine the proper size range imparting surfactant properties to the PEGylated POSS. By this approach, the organosilicate cage of the POSS surfactants will be targeted to reside at the air-water boundary layer of the bubble lamella in foams. The new POSS surfactants will be characterized by standard analytical techniques (nuclear magnetic resonance [NMR], gas chromatography mass spectrometry [GCMS]). Key physical properties of the POSS surfactants will be measured such as density, surface and interfacial tensions, foam expansion rate, and spreadability. The POSS surfactants will be formulated into AFFF concentrates similar to commercial varieties used by the DoD. The thickness of POSS surfactant film, alone or in concentrate form, supported by hydrocarbon solvent will be measured. Small-fire extinguishing experiments will be conducted to compare the differences (time to extinguish and burnback) between the POSS-based AFFF and the current technology. The small-scale experiments will be a stepping stone to the large MIL-SPEC test (MIL-F-24385F). A preliminary toxicity screening of the POSS surfactants by the Microtox assay and acute toxicity to fish will be made by fee-for-service laboratories.

Principal Investigator: Dr. Matthew Davis, NAWCWD China Lake, Phone: 760-939-0196, matthew.davis@navy.mil

Status (May 2018): The project started in March 2018. No attempt was made to contact the PI.
A project summary can be found here: https://www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP18-1519

"WP18-1592 Stability of Fluorine-Free Foams with Siloxane Surfactants for Improved Pool Fire Suppression"

The research team plans to synthesize siloxane surfactants with a systematic structural variation of the head group and quantify the effects on foam degradation, fire extinction, and environmental impact by quantitative structure-property relationships. This knowledge will be used to achieve full coverage of burning pool surface with a siloxane foam. The researchers have been conducting research to identify and develop fluorine-free surfactants having both high fire-suppression effectiveness and low environmental impact. The evaluation of several commercial fluorine-free siloxane surfactants in the last several months has shown that foams made from several of these surfactants exhibit more rapid degradation relative to AFFF containing fluorocarbon surfactants. The rapid degradation prevents these siloxane-based fluorine-free foams from completely covering the liquid fuel surface; full coverage is necessary but not sufficient to extinguish the fire because the foam layer must also block the diffusion of fuel vapors through the foam. Quantifying the effects of systematic and fundamental variations in surfactant structure on foam stability is essential to achieve foam's full coverage of the fuel pool's surface.

This research will synthesize fluorine-free, siloxane-based surfactants by attaching different head groups (cationic, anionic, non-ionic, zwitterionic) to a fixed tail group because the solubility of surfactant in fuel (versus water phase) and stability of the lamellae (bubble walls) within the foam are affected by the charge or polarity of the surfactant's head group. Researchers will also attach different tail groups (straight chain siloxane, trisiloxane with methyl pendant groups, and a trisiloxane with phenyl pendant groups) to the most promising head group to vary the packing density and stiffness of the tail at the lamella surface. They will quantify the effect of both head group and tail group substitution on foam stability. They will also synthesize a straight-chain siloxane with a sulfonate head group and compare its performance with a hydrocarbon analogue (e.g., sodium dodecyl sulfonate); they will test the basic hypothesis that siloxane-based surfactant tails are more effective than hydrocarbon tails for suppressing fuel transport and thus more effective at fire suppression. The research team will use Quantitative Structure Activity Relationships (QSAR) and EPA models to assess the environmental impact of the promising siloxane-based, fluorine-free surfactants.

Principal Investigator: Ramagopal Ananth, U.S. Naval Research Lab, Phone: 202-767-3197, ramagopal.ananth@nrl.navy.mil

Status (April 2018): The project started in March 2018. The PI provided a number of presentations and documents related to Naval Research Laboratory work in the AFFF area (available in the IC2 project files).
A project summary can be found here: https://www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/WP18-1592.

US Naval Research Laboratory (NRL)

NRL is the home of work in the Navy on AFFF, but there may be other work at other branches of the military. NRL has ongoing funding to improve/develop AFFF. In addition to a standing budget, they can apply for and win SERDP funding for environmental projects. They have current projects in fluorine-free foam development and in remediation of PFAS-contaminated sites.

The Navy is not willing to sacrifice performance of foams. They feel that many lives were lost before the introduction of PFAS foams that would have otherwise been saved. They are strongly committed to the existing firefighting infrastructure on ships. Huge costs would be involved in changing the equipment to meet a different set of foam properties. NRL is always willing to evaluate and test the performance of alternatives. Any foam can apply to join the Qualified Products List; suppliers need to pay the costs of the testing work at NRL.

The Navy has considered whether there should be a change in specifications. For example, it might make sense to have a different standard for ships from what is used for land-based applications.

Presentations and Papers

"Molecular Dynamics Simulations of the Fluorinated and Fluorine-free Surfactant Monolayers at Air-Water and Heptane-Water Interfaces" [presentation], 255th ACS National Meeting, New Orleans, LA (March 18-22, 2018), Xiaohong Zhuang, ASEE Postdoctoral Associate and Katherine Hinnant and Ramagopal Ananth, Chemistry Division, U.S. NRL

"Evaluating Foam Degradation and Fuel Transport Rates Through Novel Surfactant Firefighting Foams for the Purpose of AFFF Perfluorocarbon Replacement," Spring Technical Meeting, Eastern States Section of the Combustion Institute, State College, PA (March 4-7, 2018), Xiao Zhuang, ASEE Postdoctoral Associate and Katherine Hinnant, Art Snow, Spencer Giles, and Ramagopal Ananth, Chemistry Division, U.S. NRL

URL: https://blogs.gwu.edu/houston/2018/02/12/evaluating-foam-degradation-and-fuel-transport-rates-through-novel-surfactant-firefighting-foams-for-the-purpose-of-afff-perfluorocarbon-replacement/

"Liquid-Pool Fire Extinction Characteristics of Aqueous Foams Generated from Fluorine-free Surfactants" [presentation], Spring Technical Meeting, Eastern States Section of the Combustion Institute, State College, PA (March 4-7, 2018), Dr. R. Ananth, S. Giles, K. Hinnant, X. Zhuang, A. Snow, J. Fleming, J. Farley, Chemistry Division, U.S. NRL

"Comparison of Firefighting Performance Between Commercial AFFF and Analytically Defined Reference AFFF Formulations" [paper], Katherine Hinnant, Art Snow, John Farley, Spencer Giles, Ramagopal Ananth, U.S. NRL, Washington, DC

"Comparing Firefighting Performance Between Commercial and Analytically Defined AFFF" [presentation and paper], SupDet 2017, College Park, MD (September 14, 2017), Katherine Hinnant, Art Snow, John Farley, Spencer Giles, and Ramagopal Ananth, Chemistry Division, U.S. NRL

URL: https://www.nfpa.org/-/media/Files/News-and-Research/Resources/Research-Foundation/Symposia/2017-SUPDET/SUPDET17-Hinnant-et-al.ashx?la=en&hash=DDE76AC1EC354C8107497344F7DB5309837B5D18

"Development of an Analytical AFFF Formulation" [presentation], 10th US National Combustion Meeting, College Park, MD, April 24, 2017; Katherine Hinnant, Art Snow, John Farley, Spencer Giles and Ramagopal Ananth, Chemistry Division, US Naval Research Laboratory

URL: https://blogs.gwu.edu/houston/2017/04/24/development-of-an-analytical-afff-formulation-for-the-evaluation-of-alternative-surfactants/

"Mechanisms of Fire Suppression with Aqueous Foams and the Role of Surfactants" [presentation], 10th US National Combustion Meeting, College Park, MD, April 24, 2017; Ramagopal Ananth and Katherine Hinnant, Chemistry Division, US Naval Research Laboratory

U.S. Environmental Protection Agency (EPA)

"National Priorities: Per- and Polyfluoroalkyl Substances (PFAS)" Request for Application (RFA)

URL: https://www.epa.gov/research-grants/national-priorities-and-polyfluoroalkyl-substances

Open Date: May 4–June 18, 2018

National Priorities: Per-and polyfluoroalkyl substances

Background: The U.S. EPA released an RFA, "National Priorities: Per- and Polyfluoroalkyl Substances (PFAS)." EPA sought applications that generate new information for nationally assessing PFAS fate and transport, exposure, and toxicity. Per- and polyfluoroalkyl substances (PFASs) are manmade chemicals designed to resist heat, water, and oil. Used in a variety of consumer products and industrial applications, PFASs are moderately-to-highly water soluble, persistent, bioaccumulative, and toxic.

This RFA will inform new strategies that protect public health and the environment from PFAS exposure and adverse outcomes. The EPA anticipates funding approximately two awards under this RFA for a total of $1,984,400. The total project period requested in an application submitted for this RFA may not exceed three years.

For information on eligibility and project specifications, go to https://www.epa.gov/research-grants/national-priorities-and-polyfluoroalkyl-substances

"National Priorities: Per-and Polyfluoroalkyl Substances" is part of EPA's Safe and Sustainable Water Resources (SSWR) Research Program.

"Research on Per- and Polyfluoroalkyl Substances (PFAS)"

URL: https://www.epa.gov/chemical-research/research-and-polyfluoroalkyl-substances-pfas

Provides brief insight into the efforts being supported by EPA, as well as indicating some of the findings and what role they might play. A summary is below.

- Characterizing and detecting Per and Polyfluoroalkyl substances:
  - EPA developed a Stewardship Program to voluntarily stop producing commercial products that could lead to the generation of PFOA. This was requested after discovery that PFOA was toxic to the environment and poses health risks to both aquatic life and humans.
- Characterizing fate and transport of Per and Polyfluoroalkyl substances:
  - EPA has supported research focused on the degradation of fluorotelomer-based polymers (FTP) into PFOA and PFAS. This research suggests that FTP do break down over time, which was not widely known or supported before the publication. This was largely done through mass spectroscopy method development. The analysis methods can then also be applied so that soil, sludge, plants, animal tissue, and water can be tested for contamination. Initial analysis suggests that using sewage sludge and applying it to agricultural land may be a large contributor to human contamination with PFAS.
- Research on ecological risk from Per and Polyfluoroalkyl substances:
  - The link between PFAS and fish health is largely unclear due to the varied nature of the substances. EPA continues to support research into PFAS impact on fish populations so that policies relating to fish consumption might be developed.
- Exposure from Per and Polyfluoroalkyl substances:
  - EPA works to develop methods to detect PFAS, determine breakdown of PFAS, determine levels of PFAS in a product, and evaluate impact of PFAS on fish populations. Methods already exist to minimize PFAS discharge via wastewater treatment, so the current focus of research is to determine whether biosolids with PFAS can be spread on fields.
- Per- and Polyfluoroalkyl toxicity research with animal models:

- In the 1980s and 1990s, liver toxicity and tumor development were seen in animals exposed to PFAS as well as stillbirth in pregnant rodents that had been exposed. Biomonitoring also reported elevated levels of PFAS in the general population and in waterways, including those in the Arctic. After additional research, EPA determined that a high level of PFOS exposure would likely cause pulmonary failure in rats/mice while moderate levels would cause retardation in growth and development. PFOA did not produce similar results, but the data was difficult to interpret due to differences between male and female rats and humans. These findings will be used by EPA to generate guidelines, support policies, and support rule-making decisions.

- Using computational modeling for Per- and Polyfluoroalkyl substances research:
  - Computational models are used by EPA to predict what biological effects commonly detected compounds might have to attempt to characterize them. Pharmacokinetic studies are focused on chemical fate within a body. These studies help to show how a chemical will travel, be modified by, and be removed by the body. Comparisons between species can be drawn and overall effects predicted. Overall, these studies have indicated that persistence in the body is proportional to chain length, meaning shorter chains, like PFBA, may be acceptable replacements.

"Risk Management for Per- and Polyfluoroalkyl Substances (PFASs) Under TSCA"

URL: https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-and-polyfluoroalkyl-substances-pfass

EPA has taken a range of regulatory actions to address PFAS substances in manufacturing and consumer products, as noted below. In addition, EPA worked with eight major leading companies in the PFAS industry to develop and implement a global stewardship program with the goal of eliminating these chemicals from emissions and products by 2015.

- Learn more about EPA's 2010/2015 PFOA Stewardship Program: https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-and-polyfluoroalkyl-substances-pfass#tab-3
- Read background information on PFAS: https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-and-polyfluoroalkyl-substances-pfass#tab-2
- Current actions
  - On January 21, 2015, EPA proposed a significant new use rule (SNUR) under the Toxic Substances Control Act to require manufacturers, importers, and processors of PFOA and PFOA-related chemicals (including as part of articles) to notify EPA at least 90 days before starting or resuming new uses of these chemicals in any products. This notification would allow EPA the opportunity to evaluate the new use and, if necessary, take action to prohibit or limit the activity. (See SNUR here: https://www.regulations.gov/document?D=EPA-HQ-OPPT-2013-0225-0001)
  - EPA's New Chemicals Program reviews alternatives for PFOA and related chemicals before they enter the marketplace. Its purpose is to identify whether any new chemicals contain the range of toxicity, fate, and bioaccumulation issues that have been associated with perfluorinated substances in order to avoid any unreasonable risk to health or the environment. (See program documentation here: https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/new-chemicals-program-review-alternatives-pfoa-and)
- Previous actions
  - On September 30, 2013, EPA issued a rule requiring companies to report all new uses of certain PFOA-related chemicals as part of carpets, a category of potentially harmful chemicals once used on carpets to impart soil, water, and stain resistance. Companies must now report to EPA their intent to manufacture or import these chemical substances use as part of carpets or to treat carpets. This also includes any importation of carpets already containing these chemical substances. (See SNUR: https://www.regulations.gov/#%21documentDetail;D=EPA-HQ-OPPT-2012-0268-0034)
  - On October 9, 2007, EPA finalized a SNUR on 183 PFAS chemicals believed to no longer be manufactured, imported, or used in the United States. Read more information on the 2007 SNUR for 183 chemicals here: https://www.gpo.gov/fdsys/pkg/FR-2007-10-09/pdf/E7-19828.pdf
  - On March 11, 2002, EPA published a SNUR to require notification to EPA before any future manufacture or import of 13 PFAS chemicals specifically included in the voluntary phase-out of

PFOS by 3M that took place between 2000 and 2002. This SNUR allowed the continuation of a few specifically limited, highly technical uses of these chemicals for which no alternatives were available, and which were characterized by very low volume, low exposure, and low releases. Any other uses of these chemicals would require prior notice to and review by EPA. Read more information on the 2002 SNUR for 13 chemicals: https://www.gpo.gov/fdsys/pkg/FR-2002-03-11/pdf/02-5746.pdf

- On December 9, 2002, EPA published a SNUR to require notification to the agency before any future manufacture or import of 75 PFAS chemicals specifically included in the voluntary phase out of PFOS by 3M that took place between 2000 and 2002. This SNUR allowed the continuation of a few specifically limited, highly technical uses of these chemicals for which no alternatives were available, and which were characterized by very low volume, low exposure, and low releases. Any other uses of these chemicals would require prior notice to and review by EPA. Read more information on the 2002 SNUR for 75 chemicals: https://www.gpo.gov/fdsys/pkg/FR-2002-12-09/pdf/02-31011.pdf

"Fact Sheet: 2010/2015 PFOA Stewardship Program"

URL: https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/fact-sheet-20102015-pfoa-stewardship-program

In 2006, eight companies committed to attempt to achieve 95% reduction in per- and polyfluoroalkyl substance and any precursor substance emissions by 2010. Additionally, they would attempt to eliminate these chemicals from emissions and products entirely by 2015. Participating companies submitted baseline data, reported annual progress, and agreed to work with the EPA cooperatively. All public documents, including final reports, can be found in EPA Docket EPA-HW-OPPT-2006-0621. All participating companies met the goals of the program. This was achieved by most companies stopping the manufacture and importation of long-chain PFAS. The PFOA Stewardship Program was developed because of concerns with the impact of PFOA and long-chain PFAS on human health and the environment. These concerns developed due to the chemical's persistence, presence in the environment, long half-life in people, and developmental effects in lab animals. The participating companies were Arkema, Asahi, BASP Corporation, Clariant, Daikin, 3M/Dyneon, DuPont, and Solvey Solexis. All of them provided commitments on March 1, 2006, and are global companies. The baseline for comparison purposes was emission- and product-content data from the year 2000. Largely, PFOS and PFOA are no longer manufactured in or imported into the United States, though stocks may exist and still be in use.

"Significant New Use Rules: Long-Chain Perfluoroalkyl Carboxylate and Perfluoroalkyl Sulfonate Chemical Substances"

URL: https://www.regulations.gov/document?D=EPA-HQ-OPPT-2013-0225-0001

The following is an extract from the SNUR titled "Long-Chain Perfluoroalkyl Carboxylate and Perfluoroalkyl Sulfonate Chemical Substances."

> Under the Toxic Substances Control Act (TSCA), EPA is proposing to amend a significant new use rule (SNUR) for long-chain perfluoroalkyl carboxylate (LCPFAC) chemical substances by designating as a significant new use manufacturing (including importing) or processing of an identified subset of LCPFAC chemical substances for any use that will not be ongoing after December 31, 2015, and all other LCPFAC chemicals substances for which there are currently no ongoing uses. For this SNUR, EPA is also proposing to make inapplicable the exemption for persons who import LCPFAC chemical substances as part of articles. In addition, EPA is also proposing to amend a SNUR for perfluoroalkyl sulfonate (PFAS) chemical substances that would make inapplicable the exemption for persons who import PFAS chemical substances as part of carpets. Persons subject to these SNURs would be required to notify EPA at least 90 days before commencing such manufacture or processing. The required notifications would provide EPA with the opportunity to evaluate the intended use and, if necessary, an opportunity to protect against potential unreasonable risks from that activity before it occurs….

1. EPA would receive notice of any person's intent to manufacture or process LCPFAC chemical substances, PFOA or its salts, or PFAS chemical substances for the described significant new use before that activity begins.
2. EPA would have an opportunity to review and evaluate data submitted in a SNUN before the notice submitter begins manufacturing or processing these chemical substances for the described significant new use.
3. EPA would be able to regulate prospective manufacturers or processors of these chemical substances before the described significant new use of the chemical substance occurs, provided that regulation is warranted pursuant to TSCA sections 5(e), 5(f), 6, or 7.

This is the most recent version of the SNUR, but there are older versions that indicate that EPA has been concerned with PFAS use and the resulting chemicals for several years. In brief, notices on imports or business concerning selected compounds must be submitted to EPA so that it can place restrictions on the activity, if necessary. Large business notices are expected to cost no more than $8,589 per notice and, for small businesses, the notices are expected to cost no more than $6,189. EPA developed the SNUR due to concerns with how LCPFAC and PFAS may affect human health and the environment. With the Stewardship Program and the halting of importation via carpets, EPA expects that the presence of PFAS will decline over time. The previous SNURs were implemented in 2007 and 2002, while this latest version is from 2013.

"New Chemicals Program Review of Alternatives for PFOA and Related Chemicals"

URL: https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/new-chemicals-program-review-alternatives-pfoa-and

Since 2000, EPA is working to review substitutes to PFOA, PFOS, and long-chain PFAS. The agency focuses on whether the reviewed substances have similar properties to PFOA, PFOS, or long-chain PFAS, and try to determine if the reviewed compound raises any new concerns. These concerns could be related to either health or the environment. Testing of short-chain fluorotelomers includes degradation potential to determine bioaccumulation potential, toxicity, and overall fate compared to PFOA. While previously exempt, polymers containing CF3 or longer chain length fluorinated compounds under the Polymer Exemption Rule can no longer be considered to "not present an unreasonable risk to human health or the environment."

"Final Report: Fluorine-Free Hybrid Surfactants for Fire-Fighting Foams"

URL: https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.highlight/abstract/5089/report/F

The following is an extract from the EPA report titled "Final Report: Flourine-Free Hybrid Surfactacts for Fire-Fighting Foams."

> **Description:** Aqueous film-forming foams (AFFFs) are among the most popular fire-fighting foams used against fuel and oil fires because of their effectiveness and their ease of application. Unfortunately, recent studies have shown that one key ingredient of AFFFs, the fluorosurfactant perfluorooctyl sulfonate (PFOS), is toxic to aquatic life and is a persistent chemical that accumulates in the blood of humans and other animals. Thus, the production of PFOS was stopped in May 2000. Among the phased-out products are 44 fire-fighting foams and foam components. The fire-fighting industry currently is stocked with materials that have been phased out and that, sooner or later, need to be replaced. New fluorosurfactants have been introduced into the market since 2000, and used to formulate aqueous fire-fighting foam concentrates. The toxicity of the new fluorosurfactants and their persistence in the environment are not well established and still are under investigation. Their presence in the future market is unsure. Therefore, the fire-fighting industry has an urgent need for new, environmentally friendly foaming agents and foam stabilizers to replace fluorosurfactants in aqueous fire-fighting foams.

The State of Washington

The State of Washington's Departments of Ecology and Health are working together to develop a chemical action plan that identifies sources and recommends actions to reduce the use, release, and exposure to PFAS in

Washington. The Interim Chemical Action Plan for Per- and Polyfluorinated Alkyl Substances (April 2018) can be found here https://fortress.wa.gov/ecy/publications/summarypages/1804005.html

Washington will be the first U.S. state to ban certain firefighting foams containing perfluorinated compounds beginning in 2018. RCW 70.75A (See here http://app.leg.wa.gov/RCW/default.aspx?cite=70.75A&full=true) was passed in early 2018.

Local Hazardous Waste Management Program in King County, Washington

The Local Hazardous Waste Management Program in King County, Washington, is collaborating closely with Clean Production Action and Toxic-Free Future to reduce exposure to PFAS in firefighting foam by identifying safer alternatives as part of their Safer Alternatives Strategy. King County is also working on reducing exposures to PFAS from food-contact paper and other sources to protect human health and the environment.

New Jersey

"Investigation of Levels of Perfluorinated Compounds in New Jersey Fish, Surface Water, and Sediment"

A report by the New Jersey Department of Environmental Protection, Division of Science, Research, and Environmental Health, SR15-010 (June 18, 2018)

URL:
https://www.nj.gov/dep/dsr/publications/Investigation%20of%20Levels%20of%20Perfluorinated%20Compounds%20in%20New%20Jersey%20Fish,%20Surface%20Water,%20and%20Sediment.pdf

The Division of Science, Research, and Environmental Health (DSREH) within the New Jersey Department of Environmental Protection performed an initial assessment of 13 PFAS, all of which are perfluorinated compounds (PFC), at 11 waterways across the state. Fourteen surface-water and sediment samples and 94 fish-tissue samples were collected at sites along these waterways. The sites were selected based on their proximity to potential sources of PFAS and their likelihood of being used for recreational and fishing purposes.

New York

"Per- and Polyfluorinated Substances (PFAS)"

A web page published by New York State's Department of Environmental Conservation (DEC) on its website.

URL: https://www.dec.ny.gov/chemical/108831.html

Statewide PFAS Survey

DEC surveyed select businesses, fire departments, fire-training centers, bulk-storage facilities, airports, and Department of Defense (DoD) facilities from June to September 2016. The responses to the survey have helped to determine if these entities have used or stored PFOA/PFOS. The results have provided essential information to DEC and to the Water Quality Rapid Response Team so that they can further investigate additional areas for potential contamination. The results of this survey will be updated periodically as additional responses are received.

State Firefighting Foam Collection Efforts

Through funding prioritized by Governor Andrew Cuomo in the Environmental Protection Fund, DEC has worked with the Division of Homeland Security and Emergency Services to launch a collection program for the removal and appropriate disposal of firefighting foam containing perfluorinated compounds. Through the $600,000 investment, DEC is working with municipal fire and emergency response departments across the state to dispose of the

contaminated foam. As of the end of 2017, more than 20,000 gallons of contaminated foam have been collected and properly disposed; the collection is ongoing.

Vermont

"Perfluoroalkyl Substances (PFAS) Contamination Status Report" (July 2018)

URL:
http://dec.vermont.gov/sites/dec/files/documents/PFAS%20Sampling%20Report%207.10.18%20FINAL.pdf

In February 2016, Vermont's Department of Environmental Conservation (DEC) discovered a contamination problem in Bennington of perfluoroalkyl substances (PFAS) from a former Teflon-coating factory located in North Bennington. Since that first discovery, the DEC has investigated numerous sources of PFAS using a strategic sampling strategy that is updated and adapted based on the latest scientific research. This report provides an overview of the findings of this work and provides a look into additional work needed in the future.

Michigan

"PFAS Response, Taking Action to Protect the Public's Water"

Michigan PFAS Action Response Team (MPART)

URL: https://www.michigan.gov/pfasresponse/

In 2017, the Michigan PFAS Action Response Team (MPART) pulled together agencies representing health, environment, and other branches of state government to investigate the sources and location of PFAS contamination in the state, take actions to protect drinking water, and keep the public informed. The state is working

1) to better understand how PFAS may affect people's health;

2) to identify locations where PFAS may be present as a contaminant by testing drinking water from all community water supplies and a selection of groundwater, lakes and streams, soil, sediment, wastewater, and PFAS foam that can accumulate at lakes and rivers;

3) to provide a map of confirmed detections of PFOA and PFOS in groundwater;

4) to test deer and fish for PFAS and issue "do not eat" advisories as appropriate;

5) and to work with the fire service community to identify the amount of PFAS foam in use, it's training and emergency storage protocols, and other best-practice procedures in order to develop statewide solutions to dispose of the foam properly and prevent further contamination.

Australia

"Inquiry into the management of per- and polyfluoroalkyl substances (PFAS) contamination in and around Defence bases"

A report from the Joint Standing Committee on Foreign Affairs, Defence and Trade, the Parliament of Australia

URL: https://www.aph.gov.au/Parliamentary_Business/Committees/Joint/Foreign_Affairs_Defence_and_Trade/InquiryintoPFAS

On 30 May 2018, the Joint Standing Committee on Foreign Affairs, Defence and Trade adopted an inquiry referred by the Australian Senate, asking the committee to inquire into and report on the management of per- and polyfluoroalkyl substances (PFAS) contamination in and around Australian Defence bases.

The following is an extract from the report:

> Terms of Reference
> The Committee shall inquire into the Commonwealth Government's management of per- and polyfluoroalkyl substances (PFAS) contamination in and around Defence bases, with particular reference to:
> a) the extent of contamination in and around Defence bases, including water, soil, other natural assets and built structures;
> b) the response of, and coordination between, agencies of the Commonwealth Government, including, but not limited to, the Department of Prime Minister and Cabinet, the Department of Health, the Department of the Environment and Energy, the Department of Defence and the Australian Defence Force;
> c) communication and coordination with state and territory governments, local councils, affected local communities and businesses, and other interested stakeholders;
> d) the adequacy of health advice and testing of current and former defence and civilian personnel and members of the public exposed in and around Defence bases identified as potentially affected by contamination;
> e) the adequacy of Commonwealth and state and territory government environmental and human health standards and legislation, and any other relevant legislation;
> f) remediation works at the bases; and
> g) what consideration has been given to understanding and addressing any financial impact to affected businesses and individuals.

Australian Government PFAS Website

URL: https://www.pfas.gov.au/

This website provides easy access to information on per- and polyfluoroalkyl substances (PFAS) and PFAS contamination for a wide range of interested audiences. It provides links to PFAS information pages on Commonwealth and State/Territory government agency websites, as well as links to relevant international sites. PFAS-specific guidance materials can also be accessed on this site. Follow the links to search for PFAS information by audience, location, or topic.

"Expert Health Panel for PFAS Report" (April 2018)

URL: http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-pfas-expert-panel.htm

The Australian Government established the Expert Health Panel for PFAS to advise on the potential health impacts associated with PFAS exposure and to identify priority areas for further research.

New Zealand

URL: http://www.mfe.govt.nz/land/pfas-and-poly-fluoroalkyl-substances/pfospfoa-nz

According to New Zealand's Ministry for the Environment, no importation, manufacture, or use of PFOS compounds is permitted, with the only exception being when it is for laboratory use. Furthermore,

The New Zealand Defence Force has been advised by its suppliers that since 2002 they have not supplied to NZDF any foam products containing PFOS or PFOA above trace levels.

Fire and Emergency NZ (FENZ) has had the bulk of its Class B foam stocks chemically analysed, and has confirmed that none of these products contain any PFOS or PFOA.

FENZ is taking a precautionary approach and instructing its personnel not to use the small amount of type of Class B foams that has not been tested as at this stage they can't be completely assured that they don't contain PFOS or PFOA.

D.3 Industry

PERF (Petroleum Environmental Research Forum)

URL: http://perf.org/projects/

Project 2016-05

Below is an extract from the project documentation:

> A mixture of Per- and Poly-fluorinated Alkylated Substances (PFAS) are found in aqueous film-forming foams (AFFF) used for firefighting. Some of the long-chain PFAS and some of their degradation products are highly persistent in the environment, bioaccumulative in wildlife and humans, and have been linked to environmental and human health impacts. The nature of oil and gas operations necessitates the use of AFFFs to combat liquid hydrocarbon fires and use of AFFFs in drills and incidents may result in input of PFAS into the environment. The costs and feasibility of long-chain AFFF stockpile replacement are unclear and must be balanced with the risk reduction realized from switching to short-chain AFFFs or fluorine-free foam. While scientific studies support that short-chain PFAS AFFFs are less bioaccumulative and toxic, a recent compilation of these data is needed to address uncertainty in how much short-chain PFAS AFFFs or fluorine-free foam reduces H&E risks.
>
> This project aims to capture the state of knowledge of the fate, transport, and effects of short-chain PFAS-based AFFFs and fluorine-free firefighting foams and identify limitations of and data gaps in the current studies or data sets. This project will help to address uncertainties regarding human health and environmental hazards associated with long-chain PFAS foam alternatives, inform future research opportunities, support advocacy for effective fire response tools, and inform risk-based decision-making on foam replacement and management.

Project status (April 2018): A contract for this work was put out for bid in May 2018. The project manager reported that the contract includes an alternatives assessment for fluorine-containing and fluorine-free foams. The project may use GreenScreen® assessments and may use the IC2 Alternatives Assessment methodology. However, the final comparisons will likely be based on risk assessment calculations. The current plan is to include foam ingredient chemicals (as delivered) and their final degradates in the chemical hazard assessment.

LASTFIRE Project, United Kingdom

URL: http://www.lastfire.co.uk/default.aspx?ReturnUrl=%2f

On behalf of a consortium of 16 oil companies, a project was initiated in the late 1990s to review the risks associated with large diameter (greater than 40 m) open-top, floating-roof storage tanks. The project was known as the LASTFIRE Project ("LAST" meaning "Large Atmospheric Storage Tanks"). The project was initiated due to the oil and petrochemical industries recognition that the fire hazards associated with large-diameter, open-top, floating-roof tanks were insufficiently understood to be able to develop fully justified site specific fire response and risk reduction policies

Research Paper: "Foam Concentrate Usage and Options" (October 2016)

URL: http://www.lastfire.co.uk/uploads/Foam%20Position%20Paper%20Issue%202%20Oct%202016%20s.pdf

LASTFIRE Foam Summit: 17-18 October 2017 (Budapest, Hungary)

The LASTFIRE Foam Summit follows the "Cradle-to-Grave" approach used in the recently published LASTFIRE Foam Assurance Guidance and Questionnaire. It included speakers from around the world. Presentations are available here: http://www.lastfire.org.uk/refmatpapers.aspx

Firefighting Foam Summit and Fire Extinguishing Tests: October 2018 (Dallas/Fort Worth Airport, TX)

An international event organized by LASTFIRE, Arcadis, and DFW Airport to review the current situation related to selection, use, and management of firefighting foam.

Dallas/Fort Worth Fire Training Research Center

URL: https://www.dfwairport.com/firetraining/#slide-1

This center has presented results on the performance of fluorine-free foams. They may be a good source of information on performance testing and may have experience with fluorine-free foam performance.

D.4 Independent Organizations

Clean Production Action

Firefighting Foam – Identify, prioritize, and assess alternatives with GreenScreen Certified™

The following is from the Clean Production Action website (https://www.cleanproduction.org/):

> Clean Production Action is collaborating closely with Toxic-Free Future and King County Local Hazardous Waste Management Program to reduce exposure to PFAS in firefighting foam in Washington State. Our focus is to educate and align stakeholders on the need to ensure PFAS-free products are also safer and not regrettable substitutes, to create market pressures for manufacturers of PFAS-free products to use hazard assessment to evaluate ingredients, and to create a list of preferred PFAS-free products using GreenScreen Certified™. For more information, contact Clean Production Action at greenscreen@cleanproduction.org.

Toxic-Free Future, State of Washington

URL: https://toxicfreefuture.org/science/chemicals-of-concern/perfluorinated-chemicals-pfcs/

Toxic-Free Future works to eliminate PFAS in AFFF and food packaging in the State of Washington.

Contact: Erika Schreder | Science Director, eschreder@toxicfreefuture.org, 206-632-1545 x 119 Toxicfreefuture.org

Green Science Policy Institute

The Green Science Policy Institute hosts monthly PFAS conference calls. Below are relevant publications.

- "PFAS in Drinking Water: The Need for a Coordinated Strategy" (URL: http://greensciencepolicy.org/pfas-statement/)
- "Consumers' Guide to Highly Fluorinated Chemicals" (URL: http://greensciencepolicy.org/highly-fluorinated-chemicals/)

Appendix F: Detailed Summaries of Firefighting-Foam Research

The National Academies of Sciences publication *A Framework to Guide Selection of Chemical Alternatives* and the IC2's *Alternatives Assessment Guide* were consulted to determine the point in the alternatives assessment process at which the research papers collected below are most useful. A summary of each paper is included. Papers are listed alphabetically by title within the applicable framework step, the title and location where the work took place and/or the authors' affiliations is included, and a link to the paper is provided.

1. Identify Chemical of Concern

"Identification of Novel Fluorochemicals in AFFF Used by the U.S. Military,"

URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3390017/

Fast-atom-bombardment mass spectrometry (FAB-MS) and high-resolution quadrupole-time-of-flight mass spectrometry (QTOF-MS) were combined to elucidate chemical formulas for the fluorochemicals in AFFF mixtures used by the U.S. military. Structures were assigned along with patent-based information. Sample collection and analysis were focused on AFFF that have been designated as certified for U.S. military use. Ten different fluorochemical classes were identified in the seven military-certified AFFF formulations, and include anionic, cationic, and zwitterionic surfactants with perfluoroalkyl chain lengths ranging from 4 to 12. The environmental implications are discussed and research needs are identified.

2. Scoping and Problem Formulation

"Preliminary Assessment Aqueous Film-Forming Foam Use Portland International Airport Portland," Oregon

URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3390017/

Study performed to determine the history of AFFF at an airport and other high-use areas. Provides detailed insight into operations and history at the airport; this may be helpful with identifying stakeholders and understanding performance requirements

"Queensland Firefighting Foam Survey—Results Summary," Australia

URL: https://environment.des.qld.gov.au/assets/documents/pollution/management/incidents/firefighting-foam-survey-summary.pdf

Recent survey of foam uses in the Australian state of Queensland. Type of foam and industry groups are identified. Useful for identifying industry groups for outreach and potential stakeholders.

- Industries most likely to use and store foam are bulk fuel and chemical storage.

"Use and Potential Impacts of AFFF Containing PFAS at Airports," U.S. Transportation Research Board

URL: https://www.nap.edu/read/24800/chapter/6

- Metal-plating operations utilize fluorinated compounds and are considered essential. It is possible they contribute to contamination of areas.
- Recommended for future research: Alternatives to AFFF containing PFAS, disposal methods, replacing AFFF in existing systems, environmental standards for AFFF, evaluation of existing separation/treatment facilities for processing wastewater impacted by PFASs, understanding how firefighting can be optimized, broadly applicable analytical methods, environmental and human-health risks associated with short-chain PFAS in AFFF, feasible cost-effective remediation techniques and/or approaches.

3. Identify Potential Alternatives

"Fire Testing a New Fluorine-Free AFFF Based on a Novel Class of Environmentally Sound High-Performance Siloxane Surfactants," Germany

URL: http://iafss.org/publications/fss/11/1261/view/fss_11-1261.pdf

A new family of carbohydrate siloxane surfactants was synthesized and successfully tested for film-forming capabilities.

- May be possible to produce a fluorine-free AFFF for the military—relevant fuels are based on siloxane surfactants.

- A comparison of commercial firefighting foam agents with the experimental siloxane surfactant blend and blind tests proves that the water film significantly promotes the extinguishing performance in terms of extinction times and burnback process. It is particularly noticeable that the extinguishing performance of the experimental siloxane blend is only surpassed by the fluorine-containing AFFF, although its composition is net yet optimized. Conversely, the fluorine-free Class B foams clearly perform worse. For the future, the drainage of the siloxane-containing foam should be adjusted to the behavior of the fluorinated foam to optimize the burnback characteristics of the foam.

"Fire Testing of Experimental Siloxane-Based AFFF: Results From New Experiments," Germany

URL: https://www.nfpa.org/-/media/Files/News-and-Research/Resources/Research-Foundation/Symposia/2015-SUPDET/2015-papers/SUPDET2015HetzerAbstract.ashx?la=en

More than 250 siloxane and carbosilane surfactants were synthesized and tested as possible film-formers for fluorine-free foams. The surfactant T-C3-Malt was chosen for a fire test because of its film-forming ability and foaming behavior. Five foam solutions were mixed and four application rates of each foam were tested.

- The series of fire tests shows that the rising of the siloxane surfactant concentration strongly reduces the fire-extinguishing times on F-34 fuel. In comparison with commercially available fluorine-free Class B foams and fluorinated foams, according to the German Armed Forces technical specification TL 4210-0112, the experimental siloxane-based aqueous film-forming foams clearly surpass the fluorine-free Class B foams and reach nearly the extinguishing performance of the fluorinated foams in small-scale fire tests.
- Conducted experiments show the ability of siloxane surfactants to act as an alternative film-forming compound for fluorine-free high-performance firefighting foams for pool fires.

"Fluorine-Free Firefighting Agents and Methods," U.S. Patent Application US2005000119, issued 2006

URL: https://patents.google.com/patent/US20050001197A1/en?q=~patent%2fUS9687686B2&page=1

A foam concentrate comprising water and a high-molecular-weight acidic polymer (HMWAP), and a coordinating salt.

"Fluorine-Free Firefighting Agents and Methods," U.S. Patent Application US20050001197A1, issued 2006

URL: https://patents.google.com/patent/US20050001197A1/en

Kirtland Clark (original assignee: Chemguard, current assignee: Tyco Fire and Security GmbH)

The concentrate is formed from water, a high-molecular-weight acidic polymer (HMWAP), and a salt.

"Silica Foams for Fire Prevention and Fire Fighting," Russia

URL: https://pubs.acs.org/doi/abs/10.1021/acsami.5b08653

Detailed description of the physicochemical processes of silica-foam formation at the molecular level and functional comparison with current fire-extinguishing and firefighting agents.

- As a result of fire-extinguishing tests, it is shown that the extinguishing efficiency exhibited by silica-based sol–gel foams is almost 50 times higher than that for ordinary water, and 15 times better than that for state-of-the-art, firefighting-agent aqueous film-forming foam. The biodegradation index determined by the time of the induction period was only 3 d, while, even for conventional foaming agents, this index is several times higher.

"Silicon-Containing Organic Acid Derivatives as Environmentally Friendly AFFF Extinguishing Agent," U.S. Patent Application US20170259099A1, pending 2015

URL: https://patents.google.com/patent/DE102014112851A1/en

A firefighting foam concentrate with a first surfactant that comprises an acid group and/or a deprotonated acid group and an oligosilane unit and/or oligosiloxane unit.

"Siloxane-Containing Fire Extinguishing Foam," U.S. Patent 9,687,686, issued June 27, 2017, for fluorine-free foam

URL: https://patents.google.com/patent/US9687686B2/en

Professor Dirk Blunk at the University of Cologne (Germany) has multiple patents on alternatives. It is a carbohydrate-containing siloxane surfactant.

"Survey of Fire-Fighting Foam," Swedish Chemicals Agency (KEMI)

URL: https://www.kemi.se/global/pm/2015/pm-5-15-survey-of-fire-fighting-foam.pdf

Summary of foam use in Sweden. Authors reached out to manufacturers for information on their products. List of foams and their ingredients are provided as an appendix.

"The Phase-out of Perfluorooctane Sulfonate (PFOS) and the Global Future of Aqueous Film-Forming Foam," India

URL: http://pubs.sciepub.com/ces/2/1/3/

High-level discussion of the history of fluorinated foams with a brief interlude about where the industry is headed with telomere-based foams.

- Foams are now telomere-based, which has displaced electrochemical fluorination as the primary synthesis method. Telomer surfactants are generated via telomerisation. Telomers are typically shorter in chain length (< C6) and are perfluorinated as opposed to polyfluorinated.

4. Assess Human Health Hazards

"Environmental Management of Firefighting Foam Policy - Explanatory Notes (Revision 2)," Australia

URL: https://www.qld.gov.au/__data/assets/pdf_file/0034/68776/firefighting-foam-policy-notes.pdf

Comprehensive study on the distinctions between different types and aspects of fluorinated foams. Focus on impacts of firefighting foams, including ecotoxicity, and human-health concerns, treatment and disposal of foams, and use issues.

"What Properties Matter in Fire-Fighting Foams?" Australia and the United States

URL: https://www.solbergfoam.com/getattachment/3fe1d44d-3b44-4714-89f4-4af37e381b5b/WP-WHAT-PROPERTIES-MATTER-IN-FIRE-FIGHTING-FOAMS.aspx

Describes important properties in firefighting foams, identifies a number of standards that firefighting foams must follow. Provides a comprehensive list of each foam's various properties, why standards have chosen to address them, the reason behind certain values, and the most concerning physical properties of foams. Additional explanations provide insight into why certain values and properties were chosen. Properties of bubbles are explored and their effect on foams discussed.

- Concerns were raised that all PFAS decompose to perfluorooctanesulphonic acid (PFOSH), which binds to blood and buildup in the gallbladder and liver. This may be due to the body mistaking these compounds for bile acids. No adverse effects have been reported.
- PFOA, specifically ammonium salt, was concluded by EPA to be weakly carcinogenic.

5. Assess Ecotoxicity

"Discovery of 40 Classes of Per- and Polyfluoroalkyl Substances in Historical Aqueous Film-Forming Foams (AFFFs) and AFFF-Impacted Groundwater," United States

URL: https://pubs.acs.org/doi/abs/10.1021/acs.est.6b05843?src=recsys

An in-depth analysis on fluorinated compounds found in contaminated groundwater sites using mass spectroscopy as the primary characterization method.

"Discovery and Implications of C_2 and C_3 Perfluoroalkyl Sulfonates in Aqueous Film-Forming Foams and Groundwater," United States

URL: https://pubs.acs.org/doi/abs/10.1021/acs.estlett.5b00049

Evidence showed that the short chain compounds in 3M's foams have persisted in the environment for about 15 years. Paper recommends PFEtS and PFPrS be included among the PFASs monitored in groundwater potentially impacted by AFFFs and other PFASs sources.

"Environmental Management of Firefighting Foam Policy - Explanatory Notes (Revision 2)," Australia

URL: https://www.qld.gov.au/__data/assets/pdf_file/0034/68776/firefighting-foam-policy-notes.pdf

Comprehensive study on the distinctions between different types and aspects of fluorinated foams. Focuses on impacts of firefighting foams, including ecotoxicity and human-health concerns, treatment and disposal of foams, and use issues.

"Historical Usage of Aqueous Film-Forming Foam: A Case Study of the Widespread Distribution of Perfluoroalkyl Acids From a Military Airport to Groundwater, Lakes, Soils, and Fish," Sweden
URL: https://www.sciencedirect.com/science/article/pii/S0045653514010650?via%3Dihub

Transport of fluorinated compounds from extinguishing sites through concrete to groundwater and fish.

"Foam Concentrate Usage and Options," LASTFIRE Group
URL: http://www.lastfire.co.uk/uploads/Foam%20Position%20Paper%20Issue%202%20Oct%202016%20s.pdf

Practicality and performance of fluorine-free foams as compared to fluorinated counterparts, including anecdotal evidence of performance with fluorine-free foams.

- List of environmental data that should be included when assessing a foam: dissolved oxygen, BOD (biological oxygen demand), persistence in the environment, bioaccumulation, toxicity, COD (chemical oxygen demand), and aquatic toxicity.

"Perfluorinated Surfactants and the Environmental Implications of Their Use in Fire-Fighting Foams," United States
URL: https://pubs.acs.org/doi/abs/10.1021/es991359u

Technical overview of the potential impact of AFFF on the environment. Published in 2000, so while it provides some good points, it may be outdated.

"Perfluoroalkyl Substances in a Firefighting Training Ground, Distribution, and Potential Future Release," Australia
URL: https://www.sciencedirect.com/science/article/pii/S0304389415001958?via%3Dihub

Analysis of long- and short-chain fluorinated compounds traveling through and retaining in concrete washpads in Australia. Shorter chain compounds move more easily through the concrete and were found throughout the vertical column. Long-chain compounds were found exclusively at the surface layer. This may imply that shorter chain compounds are more mobile and can impact groundwater more readily.

"The Search for Alternative Aqueous Film-Forming Foams (AFFF) With a Low Environmental Impact: Physiological and Transcriptomic Effects of Two Forafac® Fluorosurfactants in Turbot," *Aquatic Toxicology* (August 2011)
URL: https://www.sciencedirect.com/science/article/pii/S0166445X1100110X?via%3Dihub

An in-depth study of two specific foams and their toxicity to fish. One foam consists of C6 and C8 fluorochemicals and the other consists of C6, C8, C10, and C12 fluorochemicals.

"Use and Potential Impacts of AFFF Containing PFAS at Airports," U.S. Transportation Research Board
URL: https://www.nap.edu/read/24800/chapter/6

Comprehensive look at foam use in airports. Survey of 167 airports across the US & Canada focused on life cycle of foams and legacy impacts.

- Two-thirds of the responding North American airports indicated that AFFF discharged during testing is disposed of onto the ground. The remaining third of respondents discharge AFFF into an engineered containment system. For the one-third of respondents who used engineered containment systems, the type of system most widely used was a small or non-permanent vessel, and the next most widely used system was testing in a designated area such as a containment basin or training pit.

6. Life-Cycle Thinking

"Use and Potential Impacts of AFFF-Containing PFAS at Airports," U.S. Transportation Research Board
URL: https://www.nap.edu/read/24800/chapter/6

Comprehensive look at foam use in airports. Survey of 167 airports across the United States and Canada that is focused on the life cycle of foams and legacy impacts.

7. Performance Assessment

"The Extinguishing Performance of Experimental Siloxane-Based AFFF," Germany
URL:
https://www.researchgate.net/profile/Ralf_Hetzer/publication/305033141_The_Extinguishing_Performance_of_Experimental_Siloxane-Based_AFFF/links/577f7ad108ae9485a43983ca/The-Extinguishing-Performance-of-Experimental-Siloxane-Based-AFFF

Siloxane-based foam is tested against the German military performance standard, and performs as well as fluorinated foams and better than fluorine-free foams on F-34 fires.

- Fluorine-free siloxane based foam can be achieved for military relevant fuels on the base of siloxane surfactant SLB.
- The siloxane-based foams exhibit an extinguishing performance similar to fluorinated foam according to TL 4210-0112 (German military specification) and significantly outperform the fluorine-free foams on fires of the NATO standard fuel F-34.
- Additional laboratory and application tests demonstrate that the experimental siloxane-based foam concentrate is surprisingly near to a commercially viable foam concentrate. Furthermore, it already matches the requirements of the German military technical specification in many aspects.

"Extinguishment and Burnback Tests of Fluorinated and Fluorine-Free Firefighting Foams With and Without Film Formation," U.S. National Fire Protection Association (NFPA)

The fire extinguishment and burnback performance of three foams (two fluorinated MIL-SPEC qualified foams and one fluorine-free foam) were tested on four low-flash-point fuels with different surface tensions. This paper is often cited in articles referring to the limitations of fluorine-free foams.

- AFFFs did not perform any better than fluorine-free foam when film formation was not possible.
- Fluorine-free foams behave more consistently than AFFF.

"The Future of Aqueous Film-Forming Foam (AFFF): Performance Parameters and Requirements," U.S. Navy Technology Center for Safety and Survivability
URL: https://www.nist.gov/sites/default/files/documents/el/fire_research/R0201327.pdf

Provides insight into the reasoning behind MIL-F-24385F. Specifically, it explains how AFFF operates and it establishes the role of fluorinated carbons in AFFF. It also describes the challenges of MIL-SPEC, outlines the surface tension requirements of MIL-SPEC, and summarizes the issues many have raised concerning MIL-SPEC's use of equilibrium surface tension values.

"Influence of Fuel on Foam Degradation for Fluorinated and Fluorine-Free Foams," U.S. Naval Research Laboratory
URL: https://www.sciencedirect.com/science/article/pii/S0927775717302169

Theoretical discussion on how foam is influenced by various parameters like heat and bubble size.

- Mixed surfactants are better at slowing degradation than individual surfactants.
  - Smaller chain hydrocarbons also contribute to faster degradation.
  - Heat can also contribute due to increased evaporation and expansion of gas inside of bubbles causing ruptures and liquid drainage.
- Foam lifetime decreases as temperature of the fuel increases. Severe enough to change the scale of degradation from hours at room temperature to minutes at elevated (50 °C) temperatures. This is due to increased fuel vapors at the interface.
  - At 50 ° C, RF6 degrades in three minutes. Buckey degrades in 35 minutes.

"LASTFIRE Large Atmospheric Storage Tank Fires, Foam Concentrate Usage, and Options," LASTFIRE Group
URL: http://www.lastfire.co.uk/uploads/Foam%20Position%20Paper%20Issue%202%20Oct%202016%20s.pdf

Practicality and performance of fluorine-free foams as compared to fluorinated counterparts, including anecdotal evidence of performance with fluorine-free foams.

- Performance testing shows that C6 products have not performed as well as C8. One manufacturer reported that changing to a C6 formulation will result in reduced performance or higher cost, and concludes no "C6-based or FF formulations have been able to achieve the same levels of extinguishing performance demonstrated by previously proven high-quality concentrates for tank-fire application."

"Measuring Fuel Transport Through Fluorocarbon and Fluorine-Free Firefighting Foams," U.S. Naval Research Laboratory
URL: https://www.sciencedirect.com/science/article/pii/S0379711217301352?via%3Dihub

Focuses on the major factors affecting fuel transfer in firefighting foams. Provides good insight into characteristics of interest when it comes to suppressing fuel transfer and, therefore, potential flash fires.

- Fluorine-free RF6 (Solberg) forms larger bubbles than Buckeye 3% (Buckeye Fire Equipment) and has a longer drainage time. May contribute to fuel flux and ignition.
- Fluorinated foams had lower fuel fluxes consistently across several different fuels as compared to RF6.
  - Fluorosurfactants are likely the cause, as they contain highly oleophobic aspects that attempt to reject the fuel as it attempts to transfer through the barriers, which slows down flux. RF6 does not contain oleophobic surfactants and therefore has less discouraging power.
- Experiments with iso-octane indicate that the foam layer may be more important than the aqueous film to fuel flux. This is likely due to the many bubbles present in the foam and how difficult it would be for fuel to transfer through so many mediums and surfaces.

"Preliminary Assessment: Aqueous Film-Forming Foam Use Portland International Airport," Portland, Oregon
URL: https://www.deq.state.or.us/Webdocs/Controls/Output/PdfHandler.ashx?p=4079b1d7-f8b6-4343-b701-e739287b8357.pdf&s=Preliminary%20Assessment%20Aqueous%20Film-Forming%20Foam%20Use%20PDX%2020170803.pdf

Summarizes the history of AFFF at an airport and other high-use areas. Provides detailed insight into operations and history at the airport. It may be a helpful resource for identifying stakeholders and building an understanding of performance requirements.

"Sealability Properties of Fluorine-Free Fire-Fighting Foams," *Fire Technology* (September 2008)
URL: https://link.springer.com/article/10.1007/s10694-007-0030-8

Comparison of three synthetic foams without fluorine and AFFF-vapor sealability performance utilizing Australian Defense Force Specification (DEF(AUST)) 5706. Provides strong insight into concerns with vapor suppression and briefly discusses tests with respect to actual practices. Useful for discussing vapor suppression in foams and their purpose to firefighting foams.

- In performance testing, Fluorine-free RF6 (Solberg) struggled to contain vapors well as it does not form a film. AFFF consistently outperformed all other foams in all areas. RF6 consistently came in second in all areas. Formulations A and B (both fluorine free) were erratic and always came in third/fourth in all areas.
  - Actual practices in firefighting have foam reapplied frequently and the performance of both the AFFF and RF6 increased dramatically when following these guidelines. It is suggested that in a practical scenario, RF6 would perform adequately.

"Siloxane-Based AFFF: Testing of Experimental Foam Concentrates," Bundeswehr Research Institute for Protective Technologies and NBC-Protection (WIS), Germany
URL: https://www.nfpa.org/-/media/Files/News-and-Research/Resources/Research-Foundation/Symposia/2016-SUPDET/2016-Papers/SUPDET2016Hetzer.ashx?la=en

- Performance and toxicological parameters of a siloxane-based foam (consisting of 180 g/kg Glucopon 215 CS UP, 150 g/kg siloxane surfactant 1, 500 g/kg 2-[2-Butoxyethoxy] ethanol and 170 g/kg solvent) compared to fluorinated foam.
- Performance and toxicological parameters of a siloxane-based foam (consisting of 180 g/kg Glucopon 215 CS UP, 150 g/kg siloxane surfactant 1, 500 g/kg 2-(2-Butoxyethoxy)ethanol) show:
  - An extinguishing performance that significantly surpasses the commercial fluorine-free foams and nearly meets the performance of the fluorinated foams in the fire suppression tests with the NATO standard fuel F-34.
  - The viscosity and density of the 1% siloxane-based foam concentrate are acceptable in a temperature range between -15 °C and 60 °C
  - The toxicological behavior of the siloxane-based experimental foam concentrate is acceptable.
  - Siloxane-based fluorine-free foams are easily manufactured and perform significantly better on F-34 than the non-aqueous film form class-B-foam without persistent ingredients.

"What Properties Matter in Fire-Fighting Foams?" National Research Institute of Fire and Disaster

URL: https://www.solbergfoam.com/getattachment/3fe1d44d-3b44-4714-89f4-4af37e381b5b/WP-WHAT-PROPERTIES-MATTER-IN-FIRE-FIGHTING-FOAMS.aspx

Describes important properties in firefighting foams. Identifies a number of standards firefighting foams must follow. Also provides a list that outlines the properties of foams, why specific standards were chosen, the reasoning behind certain values, and the physical properties of foams that cause the most concern. Additional explanations provide further insight into why certain values and properties are included when creating standards. Properties of bubbles are explored and their effect on foams discussed.

- Fluorosurfactants are useful because they exhibit hydrophilic heads and hydrophobic tails. This is a unique property that makes forming a film possible.

<END>

From: Ellen Rice
To: PFAS Taskforce
Subject: PFAS Draft Report must be stronger
Date: Thursday, December 05, 2019 2:05:38 PM

PFAS Taskforce Maine

RE: PFAS Draft Report must be stronger

Dear PFAS Taskforce Maine,

The draft report by the PFAS Task Force does not go far enough. I'm writing to call on the Taskforce to make this report stronger with four key changes.

First, we need a 1 ppt maximum contaminant level (MCL) for total PFAS. This is the only standard that could be truly health protective for Mainers exposed to these toxic chemicals.

Second, we must immediately stop the spreading of sludge-sourced compost. It's recently been discovered that this compost spread across farms and gardens in Maine is contaminated with PFAS, and we need to stop this ongoing contamination immediately.

Third, we must make clear that polluters must be held responsible for this contamination so the costs of cleanup and healthcare do not fall on our state or our neighbors.

Finally, I'm calling on you to extend the public comment period in this process to allow greater participation from people who are directly impacted by this contamination. This public comment period has been too short, especially with the holidays, to allow for meaningful participation.

Thank you for considering these comments.

Sincerely,
Ellen Rice
27 Hovey Lane
Brunswick, ME 04011
(413) 548-9629

November 19, 2019

Dr. Meredith Tipton
Chair, Maine PFAS Task Force
17 State House Station,
Augusta, ME 04333-0017

RE: Maine PFAS Task Force's Draft PFAS Report Outline

Dear Chairwoman Tipton:

FluoroCouncil appreciates this opportunity to provide comments on the Maine PFAS Task Force's Draft PFAS Report Outline. FluoroCouncil is a global organization representing the world's leading manufacturers of products based on per-and polyfluoroalkyl substances (PFAS), including fluoropolymers, fluoroelastomers, and fluorotelomer-based products.[1] FluoroCouncil has a fundamental commitment to product stewardship and rigorous, science-based regulation, and, as part of its mission, addresses science and public policy issues related to PFAS.

We understand the important issues currently facing Maine regarding detections of certain PFAS at levels of concern at different locations in the state. Further, we appreciate the significant efforts the Task Force has put into compiling the Draft PFAS Report Outline, which can serve as a critical tool in identifying potential actions to address these PFAS contamination issues. It is crucial that Maine takes a science- and risk-based approach grounded in a thorough understanding of the broad family of PFAS in order to develop a set of recommendations that will address these issues in an appropriate and effective manner.

FluoroCouncil is supportive of many of the recommendations outlined in the Draft PFAS Report Outline, which are enumerated below. However, as currently drafted, certain recommendations appear to inappropriately conflate the extremely broad and diverse group of chemicals referred to as "PFAS," which includes products and substances that do not present a significant risk to human health or the environment and are not relevant to the issues in Maine. We are encouraged by the thoughtfulness put into developing the Draft PFAS Report Outline and recommend that the Task Force refine the Report's focus to a more narrow and appropriate scope.

Below is a summary of our comments, and attached are slides previously presented by FluoroCouncil to the PFAS Task Force.

[1] FluoroCouncil's member companies are AGC Inc., Daikin Industries, Ltd., Solvay Specialty Polymers, The Chemours Company LLC, Archroma Management LLC (associate), Dynax (associate), and Tyco Fire Products LP (associate).

A. PFAS cannot be addressed as a broad class.

PFAS is a term that describes a wide variety of groups of chemical substances and polymers with very diverse properties. PFAS is too general to be useful for communication purposes and is insufficient to describe a regulatory class. Because there is so much variation among the alleged 4,700+ chemicals in the PFAS category,[2] no scientifically sound rationale exists for treating them all the same as a matter of public policy.

PFAS vary significantly in their hazard profiles. For instance, not all PFAS and related products are persistent, bioaccumulative, and/or toxic, particularly at concentrations typically present in the environment. While some PFAS remain in the environment for years, other PFAS are short-lived and convert to other substances in a matter of hours or days. Not all PFAS persist in biological tissues. Certain PFAS compounds, including short-chains, are readily eliminated from the human body and do not bioaccumulate.[3] Kinetics studies in animals further demonstrate that the persistence of PFAS compounds generally decreases with decreasing chain length.[4]

PFAS also do not share a common toxicity profile. For example, toxicity testing on some PFAS substances shows carcinogenic potential while similar testing on other substances does not show any evidence of carcinogenicity.[5] In addition, even when toxicity testing of PFAS substances may show some similarity of effects, the point of departure dose[6] associated with those effects can vary by orders of magnitude from substance to substance.[7]

Furthermore, PFAS chemicals that occur as mixtures may not share the same target organ, mode of action for toxicity, or dose-response relationship, across concentration ranges.[8] Sound science dictates that when multiple chemicals have differing toxicity characteristics, they cannot be

---

[2] *See* OECD, Summary Report on Updating the OECD 2007 List of Per- and Polyfluoroalkyl Substances (PFASs), www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV-JM-MONO(2018)7&doclanguage=en.

[3] Chengelis C.P., J.B. Kirkpatrick, N.R. Myers, M. Shinohara, P.L. Stetson, and D.W. Sved. 2009a. Comparison of the toxicokinetic behaviour of perfluorohexanoic acid (PFHxA) and nonafluorobutane-1-sulfonic acid (PFBS) in cynomolgus monkeys and rats. Reprod Toxicol, 27(3-4):342-351. Gannon S.A., T. Johnson, D.L. Nabb, T.L. Serex, R.C. Buck, S.E. Loveless. 2011. Absorption, distribution, metabolism, and excretion of [1-14C]-perfluorohexanoate ([14C]-PFHx) in rats and mice. Toxicology, 283: 55–62. Iwai H. 2011. Toxicokinetics of ammonium perfluorohexanoate. Drug and Chem. Toxicol. 34: 341–346.

[4] Chang S-C, K. Das, D. Ehresman, M.E. Ellefson, G.S. Gorman, J.A. Hart, P.E. Noker, Y-M Tan, P.H. Lieder, C. Lau, G.W. Olsen, and J.L. Butenhoff. 2008. Comparative pharmacokinetics of perfluorobutyrate in rats, mice, monkeys, and humans and relevance to human exposure via drinking water. Tox. Sci. 104: 40-53. Kudo, N., E. Suzuki-Nakajima, A. Mitsumoto, and Y. Kawashima. 2006. Responses of the liver to perfluorinated fatty acids with different carbon chain length in male and female mice: In relation to induction of hepatomegaly, peroxisomal beta-oxidation and microsomal 1-acylglycerophosphocholine acyltransferase. Biol. Pharm. Bull. 29:1952–57. Ohmori, K., N. Kudo, K. Katayama, and Y. Kawashima. 2003. Comparison of the toxicokinetics between perfluorocarboxylic acids with different carbon chain length. Toxicology 184:135–40.

[5] Klaunig, J.E., M. Sinohara, H. Iwai, C. Chengelis, J. Kirkpatrick, Z. Wang, and R. Bruner. 2015. Evaluation of the chronic toxicity and carcinogenicity of perfluorohexanoic acid (PFHxA) in Sprague-Dawley rats. Tox. Pathology 43:209-220.

[6] The term "point of departure" (POD) is used here to refer to a dose that corresponds with a specified response level, such as a 5% or 10% change in incidence of liver hypertrophy in rats, compared with a control group. The POD is used to calculate a toxicity reference value for purposes of deriving a risk-based drinking water action level.

[7] ATSDR. 2015. Draft toxicological profile for perfluoroalkyls. Agency for Toxic Substances and Disease Registry. U.S. Department of Health and Human Services Public Health Service, August.

[8] An *in vitro* study conducted by researchers at the USEPA Office of Research and Development (Wolf et al. 2013; Toxicology 316:43-54. 10.1016/j.tox.2013.12.002) found that binary pairs of PFAS exhibited inconsistency in concentration- and response-addition across dose ranges.

grouped together for risk assessment purposes.[9] Given the wide variations in toxicities and other hazard characteristics exhibited by different PFAS chemicals, it is scientifically inappropriate to group all PFAS together for purposes of risk assessment, or to assume that exposures to mixtures of PFAS result in concentration additivity.

The broad family of PFAS includes some substances that have been developed and are actually used in commercial applications; however, a large number have not been developed and many of the PFAS compounds cited in the OECD report are not items in commerce.[10] Additionally, it is important to understand that those PFAS with commercial uses are not used interchangeably. Different PFAS impart different properties, and those in the marketplace have been designed for specific uses, making it essential for public policy to be based on the risks associated with exposure to individual substances in particular uses. For example, fluoropolymers are not used to make grease-resistant food wrappers, and fluorotelomers are not used to make plastic parts. Consequently, the life-cycle impact of any particular compound within the PFAS category can differ by orders of magnitude.

As a result of this significant diversity within the family of PFAS, it is inappropriate to address PFAS as a broad class. Rather, regulatory and policy measures should be substance-specific.

B. Specific Comments on the Draft PFAS Report Outline.

1. PFAS in products

The Task Force was charged with identifying PFAS exposures in Maine, as well as resulting risks to human health and the environment, which is fitting, as any consideration of product deselection should be based on whether a material is of concern and at what level it presents a concern. Consequently, blanket bans and some of the Draft PFAS Report Outline's overly broad suggestions regarding reduction and/or elimination of PFAS-containing products are not only scientifically unsubstantiated, as PFAS can vary greatly as described above, but also may restrict access to many different products that provide unique and often critical benefits enabled by PFAS.

Multiple industries depend on high-performance PFAS, including aerospace, alternative energy (e.g., solar), automotive, building and construction, chemicals and pharmaceuticals, electronics, healthcare, oil and gas, outdoor apparel and equipment, and semiconductors, just to name a few. PFAS are used in a wide array of products and play a vital role in everything from designing automobiles with lower emissions and improved safety, reliability and fuel-efficiency to manufacturing semiconductors, solar panels and high performance electronics.

---

[9] As OECD notes, equating the risks of various chemicals for which there are known differences in toxicity is not "scientifically warranted." *See* http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=env/jm/mono(2014)4&doclanguage=en at 18. Similarly, if analysis of one chemical using information about another does not create "an accurate and credible assessment of the hazards for the substance in question," then it is inappropriate to read-across between the substances. http://www.ecetoc.org/wp-content/uploads/2014/08/ECETOC-TR-116-Category-approaches-Read-across-QSAR.pdf at 44.

[10] According to USEPA, approximately 600 PFAS compounds have been active in US commerce since 2006. *See, EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan* (February 2019) at 12 (www.epa.gov/sites/production/files/2019-02/documents/pfas_action_plan_021319_508compliant_1.pdf)

For instance, fluoropolymers, one type of PFAS, can be found in everyday items such as implantable medical devices, cell phones, and automobiles (including electric vehicles). Notably, fluoropolymers do not pose a significant risk to human health or the environment due to their stability and lack of bioavailability, among other properties. Therefore, any restriction on fluoropolymers' use in products would not provide any additional health protections to human health or the environment, but may instead unnecessarily restrict Maine's citizens from accessing critical, and often life-saving, technologies.

For instance, the Draft PFAS Report Outline recommends requesting that the federal government "reduce and eliminate the use of PFAS chemistry for non-essential applications" and require reporting of PFAS-containing consumer product manufacturers. As stated, both of these overly broad recommendations are scientifically unsubstantiated and undermine the regulatory framework, which is intended to utilize risk-based decision-making, taking into account both hazard and exposure. Alternatively, the Task Force's recommendation to "[m]odify the list of Chemicals of High Concern under the Toxic Chemicals in Children's Products … law to include all PFAS that meet statutory criteria" is a preferred approach, as it utilizes an existing regulatory framework and risk-criteria to determine whether certain PFAS chemistries meet specified criteria of concern, instead of broadly restricting or otherwise impacting their use in products.

Furthermore, the Draft PFAS Report Outline suggests listing the "PFAS family of compounds" as priority chemicals in food packaging under the state's newly amended law. The U.S. Food and Drug Administration (FDA) has regulatory oversight over these applications and is responsible for carrying out robust reviews of chemicals exposure from both food contact materials and from food itself, as food safety is of national concern. A significant body of data exists for the PFAS chemistries currently used in food contact applications permitted by FDA for use in the U.S. Maine should defer to the regulatory process to work as designed, with FDA using science to determine whether PFAS substances used in a food contact application are safe for their intended use.

While FluoroCouncil is generally supportive of the Task Force's recommendation regarding fluorinated class B firefighting foams (AFFF), we believe that any take-back program should be limited to long-chain based foams. AFFF remains the most effective tool for fighting high hazard flammable liquid fires, and we believe that the use of current AFFF formulations should remain available as a tool for firefighters to efficiently and effectively protect life and property.

FluoroCouncil is supportive of utilizing best management practices to minimize unnecessary exposures to the environment. Generally speaking, PFAS-containing products should only be used when necessary and users should only use what is needed; residual liquids should be reused/recycled, if possible, and waste and emissions should be minimized; and proper disposal practices should be employed. These best management practices apply to the handling and use of all PFAS applications, from fluorinated class B firefighting foams[11] to fluorinated repellant treatments utilized in the apparel industry. Implementing additional management practices, as opposed to blanket bans or restrictions on PFAS-containing products, are the most appropriate

[11] Legislation has passed in several states this year that codifies these best practices by heavily restricting or banning fluorinated foam use in non-emergency situations while allowing firefighters to have access to life and property-saving tools for appropriate emergency situations (e.g. VA, GA, NM) and is pending in others (e.g. OH, WI).

way for the Task Force to accomplish its goal of minimizing exposure and releases, while also preserving the use of critical technologies.

2. *Testing*

FluoroCouncil is supportive of Maine's plan to conduct prioritized testing to detect PFAS in different media. We encourage the Task Force to use EPA-validated laboratory methods for analysis of public drinking water, and consequently support the recommendation for additional laboratory methods to be developed at the federal level. Furthermore, we encourage the state to focus its efforts on PFAS analytes of greatest concern to ensure the most efficient use of resources. We also believe that the prioritized approach for determining which systems to test first is appropriate and efficient, and such an approach should be utilized for all of the state's testing and monitoring projects. For all analytical testing, we recommend that all analysis be conducted with appropriate QA/QC controls by appropriately trained analytical technicians, from sample collection through processing. These recommendations will help ensure that any testing provides meaningful information on the detection and quantification of specific PFAS analytes.

3. *Enforceable standards/guidelines and other regulatory programs*

FluoroCouncil appreciates the Task Force's recommendations regarding the promulgation of enforceable standards and guidelines for PFAS levels in different media (e.g., water, air, soil, products). FluoroCouncil also supports the recommendations that several of these standards be established at the federal level (e.g. Maximum Contaminant Level, adulterated food screening levels), but recommend that such standards focus on PFAS analytes of greatest concern. If the State decides to move forward with setting such standards on its own, FluoroCouncil recommends that the appropriate regulatory processes are utilized, providing for sufficient notice and comment from interested stakeholders, and that all standards and guidelines should be based on sound science and enforceable with applicable validated analytical methods.

Additionally, we are supportive of the caveats (e.g., "specified PFAS compounds," "a suite of PFAS compounds") qualifying the recommendation of adding certain PFAS chemistries to the state's Toxics Use Reduction Program and Toxics Release Inventory. As stated before, not all PFAS chemistries share the same properties; therefore, PFAS as a blanket class should not be considered for addition to any regulatory program, no matter if just for reporting purposes or otherwise.

4. *Public outreach and education*

Any public outreach and education regarding PFAS should be clear, specific, and descriptive, especially when discussing potential risks associated with exposure to drinking water or other media (including products) that contain PFAS. As discussed above, PFAS is a broad group of classes of chemistries with greatly varying uses and properties. Therefore, exposure to different PFAS chemistries may present different risks, depending on the PFAS chemistries present and the amount at which they are present. Maine's public messaging should have a strong focus on risk communication and not inappropriately make unsubstantiated blanket statements regarding PFAS chemistries that may unnecessarily concern the State's residents.

* * * * *

FluoroCouncil understands and appreciates Maine's need to address the PFAS-related contamination issues in the state. Accordingly, it is critical that the approach taken to address those issues be focused on specific PFAS chemicals of concern found at levels of concern in the state. FluoroCouncil welcomes the opportunity to work with the task force to refine the Draft PFAS Report Outline to ensure it results in a targeted set of recommendations supported by a scientifically sound foundation. Please do not hesitate to contact me at 202-249-6708 or renee_lani@americanchemistry.com with any questions or clarifications.

Sincerely,

Renée M. Lani
On behalf of FluoroCouncil

Attachments:

- FluoroCouncil PFAS Overview Presentation (September 25)

From: George Seel
To: PFAS Taskforce
Subject: Draft Report Comments - Managing PFAS in Maine
Date: Tuesday, December 03, 2019 4:47:57 PM

Dr. Tipton and Members of the PFAS Task Force,

Thank you for providing the public an opportunity to review and provide feedback on your December 2019 draft report, Managing PFAS in Maine. Overall the PFAS Task Force and your supporting staff from DEP, DACF, DHHS and Emergency Management have obviously done a significant amount of work in a short amount of time. To those of you who are volunteering your time, my thanks. Given the evolving nature of our knowledge about PFAS, their sources, the human health threats, protective exposure levels and exposure routes, I suspect this report is only the first word on this issue in Maine.

Until my retirement in 2015, I was the Director of Technical Services in DEP's Bureau of Remediation and Waste Management and dealt with the remediation of petroleum and hazardous substance sites for most of my 35-year career. My comments are however limited and general in nature, focusing on whether the scope of your investigations to date and this report are sufficient since I do not have any detailed technical expertise regarding PFAS contamination (during my tenure, DEP's remediation efforts were limited to former DOD sites).

In my opinion there are two obvious omissions in the scope of your report and assessment of possible human exposure routes –the threat to private drinking water wells from subsurface wastewater disposal systems, and the land spreading of septage sludge produced by these systems on lands used for crop production. The report acknowledges the presence of PFAS in residential waste water and septage, but does not address the subject any further, either in recommendations to close existing data gaps with future environmental and drinking water sampling initiatives upon which to base management recommendations, or an explanation based on existing data to support a conclusion that PFAS discharged to the environment via subsurface waste water disposal systems and septage disposal do not pose a human exposure risk.

Risk of PFAS contamination of private drinking water supply wells from subsurface wastewater disposal systems.

The report does not address the concentrations of PFAS in residential or commercial waste water discharged via leach fields or engineered systems that discharge human waste water effluent to soil and ground water in residential neighborhoods, usually in close proximity to private wells, and the risk posed to those drinking water supplies. The underlying premise of the siting criteria and design of these systems, even new systems, that any exposure/health risk is from bacteria and nutrients, rather than mobile and persistent compounds like PFASs. As the report notes, most Mainers (51%) get their drinking water from private wells. These wells have been documented by prior studies and MDEP contamination field investigations to be vulnerable to contamination from a variety of sources at unhealthy or nuisance concentrations (e.g. petroleum storage facilities, the former gasoline additive MTBE, home heating oil, commercial and residential subsurface waste water disposal systems, sand/salt piles, etc.). For example in the course of numerous DEP oil contamination investigations, basic background analyses of private well water has found indications of contamination by septic systems (e.g. fecal coliform bacteria, nitrates, caffeine, Ibuprofen) in coastal communities or other sites with shallow to bedrock soils (Harpswell, Phippsburg, Friendship, Penobscot, Deer Isle, Jonesport, Cherryfield, N. Berwick, Industry to name those I recall).

To eliminate residential subsurface wastewater disposal systems as possible PFAS contamination threat to private drinking water systems there are at least several approaches to close this data gap. One approach would be to conduct a sampling study of septage and effluent from randomly selected residential and commercial wastewater disposal systems for PFAS concentrations, similar to that done in the 1990s when DEP and the Environmental Health unit in DHHS collaborated in the random sampling of 1,000 private wells across Maine for MTBE (another ubiquitous, mobile and persistent contaminant). This type of approach could give insight in how widespread PFAS contamination is statewide and in what concentrations. Or another option worth consideration is to focus a sampling

study on the most vulnerable private wells, like those in coastal peninsula communities. If no problem is found there, it may be safe for now to infer this exposure route may not be a significant one statewide.

Septage Land spreading Sites and the Production of Food Crops and Livestock Feed.

Under Chapter 420 of the DEP's regulations, septage land spreading sites are licensed. Land spread septage comes primarily from the septic and holding tanks of residential and commercial subsurface wastewater disposal systems, and in some cases industrial systems. Section 6 of these rules allow for the use of land spreading sites for food crops, grazing, and livestock feed crops after 38 months, 30 days, and again 30 days, respectively, from the last date of septage application. To what extent crops have been produced on septage land spreading sites is not addressed in the report. The focus of these rules is the risk from bacteria, nutrients and heavy metals to surface water, ground water and the human food chain. Are the above timeframes adequate for persistent, so-called "forever" chemicals, like PFAS with their different mobility, chemical and toxicological characteristics? No sampling has been done or is proposed of the soil or crops from these waste facilities in the draft report's recommendations to evaluate if a risk to the human food chain exists as a result of this State regulated waste management practice. I would suggest the report address this potential human exposure route consistent with the approach the Maine DEP has taken with land spreading of treatment plant sludge on crop lands, possibly starting with a sampling program or study of soils and vegetation on existing septage land spreading sites.

Again, thank you for the opportunity to review and comment on your draft report. I believe it represents a good start toward better understanding the human and environmental risks from PFAS in Maine, and ultimately managing those risks.

Sincerely,

George Seel, Belgrade, Maine

Date: December 4, 2019
To: PFAS Task Force
From: Representative Henry L Ingwersen, House District 10 - Arundel, Dayton, Lyman, (part)
Re: PFAS Task Force Draft Report Comments

First, let me say I applaud the hard work the PFAS Task Force has been undertaking these many months to address the serious and seemingly pervasive problem of PFAS contamination in Maine. This draft report is a great first step in trying to deal with this issue. I would like to recommend the following improvements to this report:

1. Most importantly, both public and private actions are needed to ensure that uncontrolled PFAS pollution sites are cleaned up and that compensation is paid. It does no good at all for us to discover PFAS pollution and have no recourse in place for landowners and private citizens who are facing loss of income or danger to their health. Current Maine law is inconsistent and unfair, allowing State government to initiate an action against a responsible party within 6 years of the discovery of PFAS pollution, but requiring private citizens to initiate an action within 6 years of the occurance of PFAS contamination. Therefore, the **PFAS Task Force should recommend that the Legislature change the statute of limitations for private actions to 6 years from discovery of PFAS pollution.**
2. Testing of all Maine land where sludge was historically spread with a clear plan and timetable: the DEP has compiled a list of almost 500 sites, mostly farmland, where sludge was spread over the last 40 years. Data is clearly needed on whether or not these sites are contaminated. **The PFAS Task Force should recommend that DEP develop a plan and timetable for testing all sludge spreading sites in Maine to find any as-yet undiscovered contamination.**
3. **The TASK Force should recommend testing of farm products and private wells on any farmland found to have PFAS contamination of the soils detected above a screening level set for beneficial use of residuals.**
4. **The Task Force should recommend that the Dept. of Health and Human Services require all community water systems in Maine to test their drinking water for for all measurable PFAS and make this data publicly available.**
5. **The Task Force should recommend that if any PFAS are detected in tested community drinking water supplies, the DEP shall investigate potential sources of the contamination and test any nearby private wells for potential PFAS contamination.**
6. **The Task Force should recommend that the Maine CDC adopt Maine-specific health risk levels for all PFAS compounds with sufficient data, based on the best available science. The risk values should inform a proposed adoption of a Maine drinking water standard for all total PFAS.**
7. Similar to action taken by Washington State, the Maine **PFAS Task Force should recommend legislation to phase out non-required uses of fluorinated**

Aqueous Film-Forming Foam (AFFF) with manufacturer take-back responsibility.

8. Similar to New Hampshire and other states, **the Task Force should recommend that that the Maine Attorney General take legal action to seek cost recovery from PFAS manufacturers.**

Thank you for taking my comments and suggestions into consideration.

Representative Henry L. Ingwersen

Comments on the Maine PFAS Task Force Draft Final Report
Submitted by Sharon Treat, Senior Attorney, Institute for Agriculture and Trade Policy (IATP)
December 6, 2019

Thank you for the opportunity to comment on "Managing PFAS in Maine," the draft Final Report from the Maine PFAS Task Force. These comments are submitted on behalf of the Institute for Agriculture and Trade Policy (IATP), a 501(c)(3) nonprofit headquartered in Minneapolis, Minnesota with offices in Hallowell, Maine and other locations.[1] As an organization that works closely with farmers and seeks to promote local, sustainable and environmentally beneficial agriculture, IATP is particularly interested in how PFAS contamination is affecting food, farms and farmers. Since the PFAS Task Force first convened in May, we have closely followed its meetings and reviewed the data and findings of the state agencies investigating the extent of PFAS contamination in Maine. We have also reviewed reports and recommendations of PFAS commissions in other states facing similar problems.

The Task Force report provides a good starting point for identifying future action to address PFAS in Maine. We have been impressed with the serious effort undertaken by Maine agencies - including the Department of Environmental Protection (DEP), Drinking Water Program and Center for Disease Control and Prevention (Maine CDC) in the Department of Health and Human Services, Department of Agriculture, Conservation and Forestry (DACF), and the Department of Defense, Veterans and Emergency Management - to identify PFAS sources and to comprehensively map PFAS contamination. This effort is commendable, given the lack of dedicated funding and the need to shift resources and staff from other priorities. While there remain significant holes in this data mapping - particularly with respect to historic field spreading of sewage, composted biosolids and paper mill sludge, as well as both historic and current septage disposal sites - the agencies' work so far provides important baseline information that can guide future agency investigations and state policy choices.

We are also pleased that the section of the report focused specifically on agriculture is relatively comprehensive. It properly recognizes the need to: (1) expand data collection and assessment, including future testing of milk and other agricultural products; (2) review historic records; (3) continue scientific study of plant and animal uptake; (4) establish PFAS standards for food; and (5) secure additional funding to assist farmers who face financial hardship from lost production caused by PFAS contamination.

[1] IATP also has offices in Washington, D.C. and Berlin, Germany (IATP Europe). For over 30 years, IATP has provided research, analysis and advocacy on a wide range of agriculture-related issues including farm to school; climate; agroecology; soil health and water quality and access; farmworker health and economic security; and trade and market policies. For more information, see www.iatp.org.

The agricultural recommendations could be improved by the addition of timelines for proposed action, greater specificity, and cross-cutting measures that we discuss in more detail below. These improvements include establishing a State Maximum Contaminant Level (MCL) that is protective of health including that of vulnerable populations; expanding testing of water and agricultural products to identify PFAS compounds in addition to PFOS and PFOA; measuring and reporting on PFAS contamination below the current 50 ppt screening level; prohibiting all land spreading of sewage sludge and other residuals including composted biosolids; and detailing funding requests and strategies.

In general, while there is useful information and some identifiable recommendations in the Task Force report, it lacks clarity and has significant gaps. A number of its recommendations fall short of the effective steps we would expect Maine's government to commit to in order to meet the guiding principles and the seven goals of "greatest importance" the Task Force itself enumerated on page one of its report.[2] These limitations include:

- **The report is not a comprehensive blueprint for action.** The report lacks specificity and timelines, failing to propose even general timelines such as identifying short-term and longer-term initiatives and actions, an approach taken by the Connecticut Interagency PFAS Task Force (which calls its report an "Action Plan").[3] In many areas, the report is curiously passive and doesn't clearly make any recommendation. In one example, it refrains from specifically supporting a requirement that community water systems and wastewater treatment facilities be tested (p.8). This puts public health at risk. One of the most alarming pieces of information reported to the Task Force was that several schools and day cares simply refused to allow drinking water testing, even though the State was paying the cost. Since some of the systems serving children that *were* tested showed PFAS contamination, this refusal is serious and ought to be addressed promptly with legislation or regulations if needed.

  Similarly, while DEP has done a good job identifying 500 properties, mostly farmland, where sludge was spread over the past 40 years, the report lacks a strong recommendation that the State develop and implement testing and investigation of these historical sludge-spreading sites on an expedited basis. This is despite the fact that the Task Force was established in large part because of the discovery of elevated PFAS levels on farmland spread with sludge and the consequent contamination of hay, milk and cows. Likewise, while the report includes a recommendation that additional testing of milk and other agricultural products should be conducted, there is no timeline attached or sense of

[2] These goals are: (1) Identifying and reducing sources of PFAS; (2) Protecting safe drinking water; (3) Protecting our food supply; (4) Responsible waste disposal and management; (5) Improving public education about PFAS; (6) Demanding federal action; and (7) Funding for state agencies to investigate, respond to and reduce exposure of Maine citizens to PFAS.

[3] Connecticut's PFAS Action Plan (November 1, 2019), https://portal.ct.gov/-/media/Office-of-the-Governor/News/20191101-CT-Interagency-PFAS-Task-Force-Action-Plan.pdf?la=en

urgency. Food and farm concerns may extend well beyond potential dairy contamination; in Australia, PFAS contamination has been found in fruit, cattle and sheep.[4]

- **Inexplicably, the report fails to recommend that the State adopt its own health-based drinking water standard for PFAS (Maximum Contaminant Level or MCL).** The passivity of the Task Force on the question of establishing a state health standard flies in the face of repeated assertions by agency staff and several Task Force members themselves that the lack of an enforceable drinking water standard is limiting their legal authority and hindering their efforts to collect data, require testing and cleanup, bring legal actions, and establish food safety standards, among other activities. The non-decision on setting an MCL makes Maine an outlier in the region, with Connecticut, Massachusetts, New Hampshire, and Vermont all moving to adopt enforceable health-based drinking water standards.[5] Other states that have established or are in the process of establishing MCLs for PFAS include Michigan,[6] Minnesota, New Jersey, New York[7] and Washington.[8]

  Instead, the Task Force defers to the federal government to set an MCL - an action that is highly unlikely to occur any time soon or to sufficiently protect public health. The Environmental Protection Agency (EPA) has been dragging its feet on PFAS standards and cleanup for years. Despite a recent flurry of media releases from EPA touting its PFAS plan, including this week's announcement the agency is taking steps to establish a drinking water standard, even under the best of circumstances its proposal is likely years from going into effect.[9] And we are not facing the best of circumstances. EPA's early-stage proposal is now sitting in the Office of Management and Budget awaiting approval before it can proceed. This is the same bottleneck agency that is holding up $10 million in funds appropriated by Congress in 2018 for the U.S. Center for Disease Control and Prevention to study PFAS and

---

[4] "Katherine mango farmer seeks compensation from Defence AM" By Nancy Notzon, 9 Oct 2017, https://www.abc.net.au/news/2017-10-10/pfas-contamination-katherine-mango-farmer-seeks-compensation/9032150; "Toxic chemical PFAS found in livestock no cause for alarm, Victoria's chief vet says," By Robert French, 25 Jun 2018, https://www.abc.net.au/news/2018-06-24/pfas-in-livestock-no-cause-for-alarm-victoria-chief-vet-says/990432

[5] Connecticut's PFAS Action Plan recommends legislation in order to establish a state standard, Plan at 3; Massachusetts https://www.mass.gov/lists/development-of-a-pfas-drinking-water-standard-mclNew Hampshire has proposed strict state PFAS drinking water standards, https://www.des.nh.gov/media/pr/2019/20190628-pfas-standards.htm; Vermont law requires drinking water standards for PFAS and the state is moving ahead with recommending strict standards, https://dec.vermont.gov/water/drinking-water/water-quality-monitoring/pfasCheck on which states have proposed or adopted standards.

[6] Michigan Department of Great Lakes, Environment and Energy, Media Release, "Michigan moves forward on drinking water standards for PFAS," Oct. 11, 2019, https://www.michigan.gov/egle/0,9429,7-135--509830--,00.html

[7] ECOS, New York Proposes Strict PFAS Standards, July 26, 2019, https://www.ecos.org/news-and-updates/new-york-proposes-strict-pfas-standards/

[8] Washington State Department of Health, https://www.doh.wa.gov/CommunityandEnvironment/Contaminants/PFAS

[9] EPA's December 4, 2019 media release makes clear the agency is in the early stages of a lengthy (years-long) process to establish drinking water standards for PFOA and PFOS only, https://www.epa.gov/newsreleases/epa-moves-forward-key-drinking-water-priority-under-pfas-action-plan. The process is outlined on this website, referenced in the media release: Drinking Water Contaminant Candidate List (CCL) and Regulatory Determination, https://www.epa.gov/ccl."

health.[10] These actions are part of a pattern across federal agencies right now. The Food and Drug Administration tried to keep secret its own studies showing PFAS contamination of food including milk, meat, and produce.[11] The U.S. Department of Agriculture (USDA), which the report also looks to for action on PFAS, is in the process of effectively dismantling many of its research activities and other programs.[12] In any event, even if an EPA standard were imminent, the agency proposes to stick with its outdated and insufficiently protective 70 ppt guidance, and to set limits for only two of the hundreds of PFAS chemicals.[13] We discuss the deficiencies of EPA's guidance in more detail below.

- **The report's data and conclusions are flawed throughout by state agencies' reliance on the insufficiently protective EPA health advisory of 70 ppt for PFOA and PFOS.** Virtually every conclusion of the report - whether the level of PFAS detected in milk is of concern; what constitutes an "adulterated" food product; whether drinking water provided to children in schools is safe; whether plant uptake of PFAS from contaminated soils poses a health threat; whether fish contaminated with PFAS should be eaten – relies on the 70 ppt baseline. This approach has led to some data simply not being reported (for example, the levels of PFAS detected in milk) and the issuance of reassuring statements by agency staff during Task Force meetings that the public shouldn't be concerned about potential exposure to, for example, PFAS-contaminated commercial compost used by home gardeners, or drinking water that is contaminated by PFAS but meets the EPA guidance. Indeed, the section of the report on the Maine Drinking Water Program minimizes any concerns based on the fact that only one community system tested so far exceeded the 70 ppt level combined for PFOS and PFOA, when in fact other systems tested positive for these compounds at levels above where other states are setting their MCLs (Report p.7-9). These data need to be included in the report.

  The EPA guidance is outdated and insufficiently protective of public health. Comprehensive health research conducted over several years by the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), part of the federal CDC, led that agency to recommend in its draft Toxicological Profile for Perfluoroalkyls that in order to protect health, MCLs should be set about 10 times lower than the EPA guidance.[14] The ATSDR has been described by State Toxicologist Dr. Andrew Smith, a Task Force member, as "the federal authoritative agency" on PFAS and health.[15] Paradoxically the Task Force report relies on ASTDR's authoritative

---

[10] "White House, CDC feuding over study of toxic chemicals in drinking water," Kyle Bagenstose, USA TODAY Network, November 30, 2019, https://www.usatoday.com/story/news/nation/2019/11/29/white-house-cdc-feuding-over-study-pfas-drinking-water/4330529002/

[11] "Leaked FDA study finds milk, meat, produce contaminated with 'forever chemicals'", by REBECCA BEITSCH, The Hill, June 3, 2019, https://thehill.com/policy/energy-environment/446696-leaked-fda-study-finds-food-contaminated-by-cancer-causing

[12] The state of the USDA: A quiet dismantling, https://www.iatp.org/blog/201902/state-usda-quiet-dismantling

[13] USEPA Draft Interim Recommendations to Address Groundwater Contaminated with Perfluorooctanic Acid and Perfluorooctane Acid (June 10, 2019), https://www.epa.gov/sites/production/files/2019-04/documents/draft_interim_recommendations_for_addressing_groundwater_contaminated_with_pfoa_and_pfos_public_comment_draft_4-24-19.508post.pdf

[14] Toxicological Profile for Perfluoroalkyls, Draft for Public Comment, June 2018, https://www.atsdr.cdc.gov/toxprofiles/tp200.pdf at 19-20

[15] Comments of Dr. Smith at the November 26, 2019 Task Force meeting.

2018 study to describe the significant health effects of PFAS exposure while ignoring the ASTDR's conclusion, based on that research, on what constitutes a safe level of PFAS exposure (Report p.3-5).

Most states that have established or are in the process of establishing their own MCLs have rejected the EPA guidance as insufficiently protective and are setting significantly stricter standards. They have also sought to address additional PFAS compounds beyond the already phased out (in the U.S.) PFOA and PFOS. For example, Vermont plans to test for 18 PFAS compounds in the environment, and drinking water programs must ensure levels of five PFAS contaminants — PFOA, PFOS, PFHxS, PFHpA and PFNA — are below a combined 20 ppt.[16] New Hampshire "using the most recent and best science available" has finalized drinking water standards that are intended to be protective for the most sensitive populations over a lifetime of exposure. The New Hampshire MCLs are: PFOA, 12 ppt; PFOS, 15 ppt; PFHxS, 18 ppt; and PFNA, 11 ppt.[17] Other states adopting standards well below 70 ppt for several PFAS compounds include Massachusetts, Minnesota, Michigan, New Jersey and New York.[18] In contrast, Maine's Task Force report is based on state agency data for soils, fish, water and milk that generally tested only for PFOS and PFOA, even though upwards of 25 chemicals in the class can be identified by current testing methods, including by the laboratory conducting analysis of milk for DACF.[19] The Maine Task Force recommendation for future testing of drinking water, soils, biosolids and food doesn't clearly rectify this data gap, specifying only "PFAS".

- **The report doesn't protect drinking water.** In addition to the failure to recommend a State MCL and the reliance on the insufficiently protective 70 ppt guidance, the report needs more detail on how it will ensure that drinking water for all Mainers is free from PFAS contamination. In particular, the Task Force needs to come up with a plan to address potential PFAS contamination of drinking water for the 51% of Maine residents who rely on wells and other sources of water that are not provided through public water systems. Most of these sources are not being tested as part of the investigation by the state Drinking Water Program, since it currently has jurisdiction only over public water systems – unlike some other states. Many private wells are located in more rural areas, perhaps in close proximity to historic sludge spreading sites and both closed and open landfills, so it seems likely that contamination may be found if testing is done (DEP has found some private wells near landfills that have been tested to be contaminated).

---

[16] The law can be accessed here: https://legislature.vermont.gov/bill/status/2020/S.49. For news coverage see, State to begin widespread PFAS sampling this summer, https://vtdigger.org/2019/06/23/state-begin-widespread-pfas-sampling/

[17] NHDES Proposes New PFAS Drinking Water Standards, Final Rulemaking Proposal for PFOA, PFOS, PFHxS and PFNA, https://www.des.nh.gov/media/pr/2019/20190628-pfas-standards.htm

[18] See chart showing selected states' PFAS standards or proposals in HEALTH-BASED DRINKING WATER VALUE RECOMMENDATIONS FOR PFAS IN MICHIGAN, SCIENCE ADVISORY WORKGROUP, at p.6, https://www.michigan.gov/documents/pfasresponse/Michigan_Science_Advisory_Workgroup_Health_Based_Drinking_Water_Values_for_PFAS_in_Michigan_Presentation_659261_7.pdf. After conducting this review, Michigan issued final rules in October setting some of the strictest limits in the nation: PFNA, 6 ng/L (ppt); PFOA, 8 ng/L (ppt); PFHxA, 400,000 ng/L (ppt); PFOS, 16 ng/L (ppt); PFHxS, 51 ng/L (ppt); PFBS, 420 ng/L (ppt); GenX, 370 ng/L (ppt)

[19] http://www.vista-analytical.com/documents/Vista-PFAS-rev3.pdf

The report also must ensure that all community water systems are tested, in particular any systems serving children. With 17 of 36 public water systems having "declined to participate" in the latest sampling effort (even though paid for by the State), it is impossible to know whether drinking water is safe (Report at p.8). If the State lacks legal authority to mandate this testing – which we find hard to believe, and encourage a thorough legal review by the Attorney General to be sure – then enacting legislation to clarify the law should be a priority.

- **The report fails to clearly outline a plan that protects water, soils and food from PFAS in sludge, biosolids and other waste residuals.** The report recommends protecting the food supply through "restrictions on the agronomic utilization and land application of PFAS-containing residuals" (Report at p.12). What restrictions? The report doesn't say. The report recommends continued testing of residuals prior to spreading and suggests granting authority to the Board of Environmental Protection to lower the screening level for PFAS, but makes no recommendations about what the screening level should be (or what criteria should be used to set that level). As we discussed above, without establishing a State MCL, which the report fails to recommend, it is unclear how enforceable this approach is.

  Further, the Task Force appears to be endorsing a continuation of the state's current policy, which allows spreading of sludge that exceeds DEP's 50 ppt PFAS screening level on agricultural land so long as the soils aren't already contaminated. This practice will simply continue and even expand PFAS contamination to soils, water and food. This policy might have been acceptable as a short term stop-gap measure to limit immediate harm while the Task Force was meeting to develop its long term plan. Now that DEP has 30,000 data points at 244 locations showing contamination near multiple closed landfills, in drinking water, at historic spreading sites, in fish, and in most tested biosolids, the Task Force has enough information to adopt a long term policy that will actually work. To continue a policy that simply spreads around the pollution is irresponsible and inconsistent with the goals of the Task Force and sound environmental and agricultural policy.

  A better approach is to responsibly phase out land spreading and agricultural use of sludge, biosolids and residuals. Given the ubiquity of PFAS - including in consumer products, fire suppressants, furniture, paper and textile manufacturing and end products, car and floor waxes, and food packaging – the chemicals will continue to contaminate wastewater and sewage sludge for years to come. As health and food uptake data is collected and analyzed, scientists' recommendations for safe levels of PFAS exposure are changing – downward. These chemicals last virtually forever and move up the food chain, and are easily transported into water. In the case of Stoneridge farm, the contaminated sludge may have been applied many years ago, and now that farm is out of business, possibly forever. Out of upwards of 5,000 PFAS compounds, only two – PFOA and PFOS – are no longer in U.S. production due to health concerns. Nonetheless, PFOA and PFOS continue to show up in water and biosolids in Maine and across the country. Products made elsewhere, including China, still contain these toxic chemicals. EPA recently approved 40 new PFAS chemicals for production and use, even though they share characteristics with the discontinued

compounds.[20] If we want to keep our food and water safe, and avoid dangerous levels of contamination in the future, we need to phase out agricultural use altogether.

IATP recognizes that this is no easy lift. Alternative disposal options that are safe and don't simply transfer PFAS from one media to another are limited and expensive. EPA's current incineration standards for biosolids are insufficiently protective and would not result in the complete destruction of PFAS; there are also environmental justice concerns with the siting of these hazardous waste incinerators in areas that disproportionately affect poor and minority populations.[21] Phasing out agricultural use of sludge, septage, biosolids and residuals will impose additional costs on farmers who have used these wastes as cheap fertilizer; on wastewater treatment plants and their customers, who have relied on farms as a cheap way to dispose of these wastes; and on businesses that make money by composting these wastes for sale as fertilizer. Nonetheless, the time is now to plan for an orderly transition away from agricultural use and, as we discuss in the section below, to develop a plan to finance this transition. In planning for the transition away from biosolids as fertilizer, the State should develop a process to engage farmers and other stakeholders.

During Task Force deliberations, it was frequently pointed out by Maine CDC and DEP staff that PFAS are only one class of pollutants threatening Maine's environment, drinking water and food supply, and that the recent focus on PFAS is taking resources away from addressing other high-risk contaminants. We think that the focus on PFAS is justified, given their ubiquity, mobility, toxicity, and persistence. That said, removing biosolids from agricultural uses would be an important step in addressing not only PFAS but also a wide range of contaminants *in addition to PFAS* that threaten the quality and safety of water and food grown on farmland using biosolids as fertilizer.

A recent report by the EPA Inspector General (IG) reviewing that agency's biosolids program identified 352 pollutants in biosolids that are currently unregulated at the federal level, including pharmaceuticals, steroids and flame retardants. The IG's analysis determined that the 352 pollutants include 61 designated as acutely hazardous, hazardous or priority pollutants in other programs. Yet EPA consistently monitors biosolids for only nine regulated pollutants, all heavy metals. The IG report further determined that EPA's capacity to manage pollutants in biosolids is extremely weak, and that current federal "laws, regulations, guidance, policies or activities, were incomplete or had weaknesses and may not fully protect human health and the environment." The IG report found that "EPA has chosen to reduce staff and resources in the biosolids program over time" and currently has only 2 staff associated with the program. Not only has the agency failed to evaluate the risks of land spreading of biosolids, but what information it does have has not been made public. The IG report found that "EPA's website, public documents and biosolids labels do not explain the full spectrum of pollutants in biosolids and the uncertainty regarding their

[20] "EPA ALLOWED COMPANIES TO MAKE 40 NEW PFAS CHEMICALS DESPITE SERIOUS RISKS," by Sharon Lerner, The Intercept, September 19, 2019: https://theintercept.com/2019/09/19/epa-new-pfas-chemicals/

[21] See, e.g., Sierra Club comments on hazards with incineration of PFAS containing biosolids submitted to the Maine PFAS Task Force, https://www.ourhealthyfuture.org/sites/default/files/pdfs/sc-maine-sept-2019-biosolids-incineration.pdf

safety. In addition, the EPA has not conducted regular biosolids training, and its inspection goals are different than what the agency recommends for authorized states." [22]

These facts, and the State's own findings, strongly support phasing out sludge, biosolids and other residuals from agricultural use as soon as possible.

- **The report doesn't include sufficient information about costs and funding strategies, nor does it clearly call for increased state funding to address PFAS.** While acknowledging that the recommendations of the Task Force "will cost many millions of dollars in the coming years," the report recommends only that "funding from appropriate State of Maine accounts should be utilized, to the extent it is available" (Report at p.14). Limiting funding to existing resources and borrowing "from Peter to pay Paul" is no way to comprehensively prevent future PFAS contamination and to clean up already contaminated land and water.

  We have discussed above the passive approach the Task Force is taking in the matter of setting a state MCL, which is inconsistent with Maine's historic proactive environmental policies and with the policies being pursued by neighboring states. Is this failure to adopt a more protective strategy the consequence of a desire to avoid asking the Governor and Legislature for the funding that would be needed to carry it out? The failure to request funding certainly raises this question. The Task Force needs to bite the bullet and identify all of the costs and agency staff time already devoted to PFAS investigations and remediation, and recommend that the General Fund include new monies to continue these efforts with adequate staffing and to fully carry out the report's recommendations. It is up to the Governor and Legislature to set final funding amounts for competing priorities, not the Task Force, which should advocate for what is needed to address PFAS.

  We support the Task Force recommendation for a bond initiative for water sampling, remediation and treatment which would complement increased General Fund monies for state agency staff. The bond should also include funding for the agricultural supports recommended by DAFC. In addition, the Task Force or the DAFC should explore the potential for USDA funding to test farms and farm products, without delaying Maine's own research. The Connecticut PFAS Task Force recommended working with their university system and the cooperative extension service on agronomic research. The report should include a similar recommendation for the University of Maine, and for reaching out to other states to share resources and research priorities regionally.

  Going after responsible parties including PFAS manufacturers and industrial facilities that created PFAS-contaminated wastes is the most equitable and direct way of securing funding that doesn't rely on taxpayer dollars. Maine should pursue these cases as other states have done. The report rightly calls for the Attorney General to pursue litigation to hold responsible parties accountable and to help fund testing and cleanup. This recommendation

[22] Report: EPA Unable to Assess the Impact of Hundreds of Unregulated Pollutants in Land-Applied Biosolids on Human Health and the Environment, Report #19-P-0002, November 15, 2018, https://www.epa.gov/office-inspector-general/report-epa-unable-assess-impact-hundreds-unregulated-pollutants-land, at p. 12.

should include investigating legal strategies for negligent as well as "knowing" actions (Report at p.15).

We also support the request from private litigants at the November meeting that the Task Force recommend clarifying Maine's Statute of Limitations in civil cases to ensure that the Discovery Rule is applied. Fred Stone as well as other farmers and households who may find out in the coming months or years - after DEP investigates the 500 historic sludge spreading sites throughout the state - that their agricultural land or drinking water is contaminated, should have recourse in the courts. The Discovery Rule properly starts the clock ticking for filing legal actions from the date those affected should have known there was a problem, not the date the PFAS was first introduced into the soil or water. This could well have been sometime decades in the past when PFAS contamination of biosolids was unknown; at a time when the U.S. EPA and Maine DEP encouraged farmers to use this inexpensive fertilizer; and while manufacturers actively hid information about the toxic qualities of these chemicals.

The report should also recommend legislation to establish a fee on current manufacturers of PFAS chemicals and products that contain PFAS.[23] Given the thousands of products made with PFAS, this strategy could raise substantial funds even with a very small fee. The product manufacturer fee has the added benefit of using market signals to encourage those manufacturers to switch to more benign products and processes, addressing the Task Force goal of "turning off the tap" and reducing sources of PFAS contamination. While Maine could choose to outright ban some PFAS-containing products, with as many as 5,000 variants of this class of chemicals, such bans are only part of a strategy to get PFAS out of the waste stream.

SUMMARY OF RECOMMENDATIONS:

- **Establish timetables for recommended actions.** These should include timetables for: (1) Investigation of historic sites of sludge and residuals land spreading; (2) Investigation of current and historic septage disposal sites; (3) DACF working with DEP and CDC to identify additional farms and agricultural products for testing based on proximity to sources and other factors indicating elevated risk; (3) Completing the testing of community water systems and wastewater treatment plants; (4) Completing the collection of information on firefighting foam (AFFF) storage and use locations; (5) Agronomic research on plant and animal uptake of PFAS.
- **Test for all PFAS.** The full panoply of PFAS compounds that can be tested for, should be. State agencies shouldn't limit testing to PFAS and PFOA but should include the full list of 25 compounds that current testing methods can identify and measure.
- **Measure and report on any PFAS contamination including below the current 50 ppt screening level**.

[23] At least one member of Congress has submitted legislation to do just that. See, Rep. Harley Rouda Press Release, "Rep. Harley Rouda Leads Bill to Fight Toxic Chemical Epidemic," May 8, 2019, https://rouda.house.gov/media/press-releases/rep-harley-rouda-leads-bill-fight-toxic-chemical-epidemic

- **Set a legally enforceable State MCL that will fully protect public health, including vulnerable populations and those relying on fish in subsistence diets.** The Task Force should direct the Legislature to enact legislation (if needed) and the Board of Environmental Protection to immediately initiate a process to establish a State MCL for the class of PFAS compounds, based on the evidence-based ATSDR standard and research supporting limits adopted in New Hampshire, Michigan and other states.
- **As soon as possible, start phasing out agricultural use of sewage sludge, biosolids and other residuals including composted biosolids.** This transition should be accompanied with resources to aid, and opportunities for input, from those hurt during this transition.
- **Expand agricultural research**. DACF and CDC should follow up its dairy studies with a plan to identify the research needed to determine if other Maine food and agricultural products are contaminated. If USDA's promised beef data is not forthcoming in the near future, or if the information provided is limited in scope, Maine CDC should reach out to the University of Maine and work with agencies in other states to ensure that this research is completed.
- **Require all community water systems to be tested for PFAS contamination.** School and other public water systems should not be allowed to jeopardize public health and opt out of testing.
- **Request increased General Fund monies and detail additional funding strategies.** These include clarifying the Statute of Limitations for civil suits, expanding the proposed bond issue to cover agricultural costs, and putting a fee on PFAS products to assure ongoing funding and pollution prevention.

Conclusion. IATP appreciates the hard work of the many state agencies and their staff, and of Task Force members, who have put in untold hours over much of this year to collect data, clean up contamination, and develop strategies for protecting the public from exposure to PFAS. The Task Force report is a good start, but doesn't fully respond to ever-expanding data and research on PFAS both in Maine and nationally. It lacks a sense of urgency and a commitment to use all available tools to once and for all stop future PFAS pollution, clean up existing contamination, and assure to the extent possible that Maine's water, fish, agricultural products and environment are safe and healthy. IATP appreciates the opportunity to provide these comments in the hopes that the final recommendations of the Task Force will provide a blueprint for action on PFAS.

Respectfully submitted,

Sharon Anglin Treat
Senior Attorney
Institute for Agriculture and Trade Policy

Maine office:
2 Beech Street, Suite D
Hallowell, ME 04347
207-242-8558
streat@iatp.org

Comments for the Public Record

The Draft Report
Managing PFAS In Maine
Report of the PFAS Maine Task Force
December 2019

Submitted by;
Jacquelyn C. Elliott
148 West Road
Waterboro, ME 04087
(207) 247-0103
j.c.elliott@roadrunner.com

Maine Department of Environmental Protection's (DEP) mission: *Legislative mandate directs DEP to prevent, abate and control the pollution of the air, water and land. The charge is to preserve, improve and prevent diminution of the natural environment of the State.*

The Draft Report on per- and polyfluoroalkyl substances (PFAS) is a good first step but continued serious work and action is now required.

All Maine citizens are stakeholders in the issue of PFAS pollution of our air, waters, lands, and bodies. We have the right to clean air, safe water and an environment free of threat from known sources of toxic contamination. Our decision makers and regulators are obligated to act on the evidence before them to legislate, authorize and enact specific, clear, and enforceable policy and regulations that will protect and ensure that citizens of Maine, their air, waters and environs are protected from further contamination by dangerous PFAS chemicals and like hazards.

Maine citizens have already been conclusively harmed by PFAS contamination of their soil and water with loss of livestock, farmland and livelihood. Many lingering deleterious effects are unknown. There must be decisive and prompt action taken by those entrusted with the public health and environmental wellbeing of Maine citizens. Those actions must be structured to prevent, mitigate and provide reparation for those currently known to be adversely affected by these harmful chemicals.

For our legislators, regulators and rule makers to do less is irresponsible and in effect immoral. Our air, lands and waters must not be toxified through unsafe practices. Our food supply must not become unsafe because of production and regulatory failures. As Maine citizens we particularly have the right to a safe water supply whether it is sourced privately, municipally, or commercially.

The fact that PFAS and like chemicals are dangerous to human health and the health of our environment is no longer debatable. The data has established exposure to these toxic products is injurious and lingering. It is past time to act decisively. Our public health,

environment and economy are at risk and the current standards for regulation and restitution are untenable.

I will commence my comments with the subject of sludge waste as this is likely a considerable contributor to the PFAS hazard facing the state. It is indefensible that sludge (an unsafe waste product of sewage treatment and unwanted industrial waste euphemistically renamed by polluters as biosolids} has been and continues to be foisted on farmers and other landowners for spreading as fertilizer. This practice is widespread in Maine. We are finding the outcomes from this practice dangerous and undeniable. In fact the federal Clean Water Act defines sludge as a pollutant. Sludge contains pathogens such as viruses and bacteria; heavy metals like lead, mercury and arsenic; and potent carcinogens such as dioxin. Research shows there are no safe levels of exposure to such toxins as lead, mercury and dioxin and they build up in our environment and bodies. They are particularly harmful to our unborn and developing children. In 1999 Maine took the wrongheaded action and relaxed standards for heavy metals in sludge.

Industry and market pressure relaxed federal standards to allow sludge to be classified as fertilizer. The record is replete with decades of data documenting harm to humans, livestock and the environment resulting from spreading this toxic product on our lands. Producers of these hazardous products currently escape liability and the cost is passed onto citizens with damage to their health; their air, lands and waters; and their livelihoods. Land spreading sludge and allowing it to be utilized in compost production is insidious as it directly contaminates our food supply. And now the menace compounds as we discover that PFAS are included in the threat.

Maine has long ignored the evidence of the risks presented with land spreading of sludge. In response to citizens' concerns in 2001 Toxics Action Center did a study and produced a report on the practice and impacts of land spreading sludge in the state. Legislators and regulators have disregarded the findings and prescription for action provided by citizens and experts in this report. It is nearly two decades since the initial alarm was sounded. Defaulting to inadequate federal regulation and inaction is unacceptable. To citizens, this inaction has the feel of malfeasance and criminal negligence. Maine must be proactive in instituting protections for its citizens. (Please see: *Toxic Sludge In Our Communities: Threatening Our Public Health and Our Farmlands,* Toxic Action Center, 2001. https://toxicsaction.org/wp-content/uploads/toxic-sludge-in-our-communities.pdf).

The work of the Task Force must continue to fulfill the mandate per the executive order that established it.

Specific Recommendations:

1. The time for public comment must be extended. Going forward public participation must be included in an open process of developing legislation, policy and regulation. Specific stakeholders from the public must be identified and included in the work of the Task Force and process going forward.

2. The Task Force must institute a proactive assessment of the existing contamination from PFAS with specific actions identified that will protect public health and the environment. These actions must be quantifiable and include a timetable for testing all sludge spreading sites. This assessment must include soil and agricultural products for levels of contamination.
3. The Task Force must engage the Maine Center for Disease Control (CDC) to adopt health risk levels for all PFAS identified with sufficient best available science based data. These risk values should form the basis for Maine to adopt a drinking water standard for total PFAS to include as well all other applicable standards for public health and the environment.
4. DEP must utilize its existing authority under Title 38, to include Chapter 16-D (Products) and Chapter 3 (Water) and require reporting of all PFAS uses focusing on source reduction of these toxins into sewage systems and our rivers. These actions would assist to protect wildlife and water quality. The Task Force must engage with DEP to adopt water quality standards that prevent PFAS contamination. Funding for education and assistance for testing private water sources to identify PFAS contamination should be included. The Legislature should be urged to fund PFAS contamination response through the state budget with the emphasis on preventing PFAS contamination. It should strongly recommend that the Attorney General take appropriate legal action to seek remedy from manufacturers of PFAS. The Legislature should be pressed to extend the statute of limitations to six years of discovery of PFAS pollution for private citizens' actions.
5. The Task Force should charge the DEP to eliminate the land spreading of sludge and sludge amended compost especially those products which exceed current screening levels. Minimally, development and deployment of a quantifiable treatment process must be introduced with the goal of establishing safer regulations. Included in these efforts must be legislation that phases out non-required use of Fluorinated Firefighting Foam and includes a provision for manufacturer take-back responsibility.

Respectfully submitted into the record by,

Jacquelyn C. Elliott
148 West Road
Waterboro, ME 04087
(207) 247-0103
j.c.elliott@roadrunner.com

From:	mailagent@thesoftedge.com on behalf of Karen Turner
To:	PFAS Taskforce
Subject:	Strengthen the Draft Report of the Maine Governor"s PFAS Task Force
Date:	Tuesday, November 26, 2019 4:21:56 PM

Dear PFAS Task Force Members:

The draft report of the Governor's PFAS Task Force provides a solid foundation but it must be strengthened to protect public health and the environment. I would like to see the following improvements added to the report:

1. Investigate Historical Sludge-Spreading Sites and test Agricultural Products for PFAS Contamination: The Task Force should explicitly recommend that DEP develop an investigation plan and timetable for testing all sludge spreading sites to find any yet-undiscovered high-level PFAS contamination. Both the soil and the agricultural products from these farms should be assessed without further delay.

2. Establish Health-Based Risk Values to Inform Maine PFAS Standards: The Task Force should recommend that Maine Center for Disease Control and Prevention (CDC) adopt Maine-specific health risk levels for all PFAS compounds with sufficient data, based on the best available science. Those risk values should inform the proposed adoption of a Maine drinking water standard for total PFAS, as well as other relevant environmental public health standards.

3. Strengthen Safety Protections for Residential Drinking Water Wells: The Task Force should recommend funding for educational outreach and financial assistance to expand testing and treatment of residential well water to reduce exposure to PFAS.

Thank you for all your work.

Sincerely,

Karen Turner
4 Eagle Rock Lane
Kennebunk, ME 04043

December 5, 2019

Dr. Meredith Tipton, Chair
PFAS Task Force

VIA EMAIL

Re: Comments for the PFAS Task Force's Final Report

Dr. Tipton

Thank you for the opportunity of providing the following input. You, the Task Force members and State staff have worked diligently of this topic for several months. Many opinions have been expressed and discussed. I compliment you on keeping the dialog professional and productive. Along that line, we all want a productive outcome to this initiative; giving the Governor a solid set of recommendations for her consideration and action.

The Governor's Order establishing the Task Force is clear. In simple terms, the Task Force's mission is to identify, address and chart a course toward mitigating the risks of PFAS to the people of Maine and to Maine's environment.

The following comments are being provided in the order presented in the current draft of the report:

1. Identifying and Reducing Sources of PFAS

A very important and achievable task for the State is to search out, identify and evaluate all existing PFAS "hot spots". After having personally dealt with local and regional PFAS issues for the past three-plus years, the writer is of the firm belief that Maine has many such sites, in great part due to the lack of knowledge about the environmental implications of PFAS by the involved parties at that time. Also, with our increased awareness and knowledge, it is unlikely that many additional sites will be added to the list. This leaves us with the unavoidable conclusion that the vast majority of Maine's PFAS contamination issues relate to past practices. As such, it is incumbent on us to do our best to identify its extent. When considering the random discovery of one (now out of business) dairy farm in Arundel having over 800,000 PPT of PFAS in its soil nearly 30 years after PFAS-laden residuals were spread (as was the case with hundreds of Maine farms), this point cannot be taken lightly. ***Due to its importance, this task must be clearly stated as a stand-alone item and given a high and urgent priority.***

Related to the topic of existing PFAS sites is the historic use of AFFF (fire fighting foam). The Task Force's AFFF Committee should be commended for their efforts in attempting to determine the extent of AFFF use and inventory. It is now obvious that the

State must have full access to all past uses, including in particular past fire training exercise locations. In all likelihood, those locations will have the highest levels of PFAS contamination. ***Legislation should be proposed to give the State the authority to acquire all such information.***

2. Providing Safe Drinking Water

The writer supports a customer notification level below 70 PPT, with the condition that the Drinking Water Program or its assigns first develop the notification verbiage and related educational information for the public to properly interpret the notification and have a better understanding of PFAS risks and exposure pathways. Recent scientific studies are indicating statistically measurable health risks related to at PFAS in drinking water at levels below 70 PPT. As a drinking water professional, the writer feels that we should err on the side of caution, while not creating unnecessary fear and distrust. As such, well thought out proactive (and not reactive) actions are paramount. It would be prudent to have all community water systems and all schools and daycare facilities regulated as non-community non-transient (NCNT) water systems test for PFAS at least once, and periodically thereafter depending upon the initial results and upon the discovery of potential local contamination risks. ***Funding assistance for this initial round of testing should be provided***, as many of the NCNT supplies would struggle with the $300 to $500 cost (including refrigerated shipping) for such a test.

The topic of private wells must be (and thankfully is) addressed in the report. With approximately 50% of Maine's population being served by private wells and with this segment of the population not being directly represented on the Task Force, this area of concern deserves special consideration. Understandably, administering a program for such a diverse and widespread population group can be problematic. In spite if that concern, the writer recommends that ***funding assistance be provided for the testing of all private wells that are likely to be impacted*** as further described in this section of the Report.

3. Protecting our Food Supply

Food has been determined to be a significant PFAS exposure pathway. The Report's recommendations relating to Federal actions are sound. With respect to food produced in Maine, the extensive investigations specified in item 1 above are needed. In addition, there is still much work to be done in determining the actual uptake of different PFAS in different crops. Meanwhile, ***the testing of crops grown on known PFAS-contaminated farm fields should be mandated and funded by the State***.

4. Responsible Waste Management

It is the writer's opinion that the highest concentration of PFAS from the spreading of residuals on Maine's farms and other sites is from industrial, rather than domestic

wastewater residuals. That said, it is obvious that the general public is flushing small amounts of PFAS down the drain, ending up in septic tanks and in wastewater treatment facilities. Obviously the first priority is to "turn off the PFAS faucet", which is a multi-faceted initiative, including public education and the promulgation of Federal and State laws and regulations. Meanwhile, Maine should use the data from the investigation stated in Item 1 above to determine if domestic wastewater residuals (as compared to industrial residuals) has impacted Maine's drinking water and agriculture. This may result in the setting of more reasonable PFAS screening levels in wastewater residuals that are based upon actual field data.

5. Public Education

This is a critically important and urgent initiative. Work should begin on this item immediately, in light of the attention that will likely be brought to the topic when the movie *Dark Waters* is widely seen over the next few weeks. On an ongoing basis, the challenge is to provide timely, informative and credible information to the public, in a fast-paced electronic world, fraught with misinformation and fear.

6. Demand for Federal Action

Under Item A) Source Reduction - ***the request that the USEPA ad PFAS to the hazardous Substance list should be clarified to exempt water and wastewater treatment facilities***, as proposed in testimony provided to the USEPA by several national water and wastewater organizations, which can be found online.

7. Funding for State Actions

As discussed in the November 26, 2019 Task Force meeting, the writer recommends a more specific list of funding recommendations, including need for additional staff and financial resources for the regulatory agencies. As currently drafted, it is felt that the Governor is getting little direction from the Task Force in this area.

It has been and will continue to be my pleasure to contribute to the health and prosperity of our Great State of Maine. Thank you for the opportunity to serve.

Sincerely,

Norm Labbe, PE

From: Lani Graham
To: PFAS Taskforce
Subject: Final Comments
Date: Thursday, December 05, 2019 7:42:57 AM

Hello,

First I want to certainly echo the comment made at the end of the meeting that the draft was a wonderful effort and everyone who was involved deserves a lot of credit. I particularly appreciate that the average reader may get something out of the clearly stated objectives at the beginning.

One general thought is that we have not responded directly to some of the letters written to us. Two of the more recent ones (one from the American Chemistry Council and one from the Yarmouth Water District) raised the same concern—namely that it would not be appropriate to notify customers if PFASs were found at a lower level than 70ppt and there was mention of such an action being "arbitrary" and "without scientific justification". I did not hear anyone on our Task Force agree with this position, and from what we already know about PFAS, it seems clear that once our Federal government actually sets an Maximum Contaminant Level (MCL), it considerably lower than 70 PPT for PFOS and PFOA combined and it will include other PFAS compounds as well

But because I imagine others may have a similar concern, **I think it is important that Dr. Smith be clear about his scientific justification for the 10ppt choice. I believe he did a good job in the body of the report on that, but it might help to be a little more clear about why 10ppt. It was mentioned that the levels for other states be included, and I agree. Also I think it would help the average person to understand that, unfortunately, there are other substances in drinking water that also have potential health effects—arsenic, lead, other chemicals, as Dr. Smith has repeatedly pointed out. For that reason, I think it would help to have the discussion of the level chosen included with a general discussion of the challenges of keeping drinking water safe.** Based on the way contaminants are currently reported, it seems likely that any "finding" of PFAS will indeed result in a "notification". The challenge will be determining what to do about the "notification". A reasonable solution could be to set the standard for remediation for public water supplies at 10ppt, since it has been repeatedly pointed out that few such will be found. But those that are found serve large and vulnerable populations. At the least a case can be made for reporting any detected PFAS, similar to many other chemical contaminants that are reported upon on all mandated annual water quality reports.

I have taken to heart what the Chair said about making this "our report". While I fully appreciate the fact that the audience for this report is the Governor, I believe enough in the Governor to believe she would be disappointed if we did not provide our best advice. Ultimately it will be her job and that of the Legislature to decide how much of a priority this pubic health problem will be for Maine as set against the many other public health needs.

It might be useful to explain that the timetable for the implementation of many of these recommendations will be dependent on available resources as determined by funding priorities set at the state and federal level.

As you know I advocated for a **Financial Section** in the narrative part of the report. The purpose of this would be to explain the current financial burdens imposed by PFAS along with some glimpse into the future costs—for government agencies and for private citizens. I think the Task Force as a whole supported this idea as it is clearly necessary for the Governor, the Legislature and Maine people to understand the burden this contamination is creating. **This section might be divided into two parts—a part that focuses on the burdens placed on government agencies and a part that focuses on the potential financial impacts for individual Maine people.** And in touching on the latter, it would not be out of place to mention what this whole issue turns on, namely, that there are likely to be some adverse health effects which will be expensive in and of themselves to say nothing about the terrible impact on certain Mainers of those specific adverse effects. We all know that a health problem prevented is far less expensive and painful than one which is treated. **At present, current financial estimates of the cost of adverse health effects related to PFAS indicate that such costs will dwarf those of clean-up.** While this cannot be quantified for Maine at present, it does not hurt to mention that the issue is out there. In one of my previous emails I sent a reference for health information, **The Cost of Inaction** by the Nordic Council of Ministers, 2019. I can forward the report again if needed.

Here are some of the costs, more easily quantified, that might be mentioned and I am sure there are others.

- Resources that have been and are being used by state agencies (I had asked for this once before and got a pretty good estimate)
- Costs for A) testing and for B) remediation of contaminated community and non-community, non-transient water supplies
- Costs for A) testing and for B) remediation of private wells
- Costs for soil testing as currently being conducted and as recommended
- Costs for sludge testing on an on-going basis as being recommended
- Costs related to AFFF (replacement of the product)
- Costs that must be assumed by waste treatment facilities when farmland spreading of waste products is not possible and these residuals must be disposed of in a different way.

It is, as the Commissioner has often said, not possible to satisfy everyone. If some of what I am advocating here cannot be included in the bulk of the report, I hope it will be included in any “minority” considerations.

Possibly the financial section is a place to make clear that many of the recommended actions will be completely dependent on obtaining resources, with those determined to be high priority getting just that, a high priority.

But, for what is included in the full report, I think it is very important to be as clear as possible about what action steps are recommended and how those relate to the “principles”, which are really more “goals”. I understand that my suggested format may not survive (people do like their own cooking best), but I do hope it will get a good look and that some of the ways the

action steps are stated might resonate with those who spoke for more clarity as well as more prioritization. The same recommendations and information could certainly be organized around the Governor's Order, while still leaving the principles at the front. But if the present format (without the bullets) is maintained, I also recommend the moving of some action items from one goal to another in certain cases for clarity. For example, an action item about legislation for authority over PFAS was moved from "waste management" (#5) to "Determining contamination" (#3) because AFFF is a problem and there may be other examples of contamination not directly tied to waste management.

#1. **Providing Safe Drinking Water**

- Support legislation to require all community water systems to test for PFAS and to notify their customers of results and to recommend remediation for levels above 10ppt. This level is subject to change as new scientific information becomes available. This is a high priority.
- Support legislation to require all non-community, non-transient water systems to test for PFAS and to notify their customers of results and to recommend remediation for levels found above 10ppt. This level is subject to change as new scientific information becomes available. This testing should be phased in with priority placed on those systems within X number of feet of known PFAS contamination or that serve vulnerable populations, such as schools and day care centers. Resources must be sought to support this recommendation.
- Resources must be sought to support testing and remediation of private wells near known or suspected PFAS contamination areas.
- Support legislation to require all bottled water sold in Maine to be tested for PFAS.

#2. **Protecting Our Food Supply**

- Restrict agronomic utilization and land application of PFAS-containing residuals according to specific guidelines based on scientific assessment of the risks related to on-going contamination, pending a scientific determination of the best way to dispose of PFAS-containing residuals. This is a high priority and is already in progress.
- Investigate all potential sites of PFAS contamination with a high priority placed on those sites that may be associated with food production.
- Begin PFAS testing of produce grown on PFAS contaminated sites, including corn and hay, used in the dairy industry, and expand testing to include produce sold for human consumption.
- Continue testing of retail milk supply for PFAS contamination
- Continue testing of fish tissue from fish caught near known sites of PFAS contamination and issue additional health warnings if PFAS contamination exceeds the level already required by mercury contamination
- Continue testing of shellfish caught near known sites of PFAS contamination.

#3. **Determining the Extent of Current PFASs Contamination in Maine and Acting to Address that contamination as Needed**

- Set up a plan for investigating all known sites of previous sludge spreading, industrial release of PFAS, or release of AFFF in training exercises, based on available historical information, prioritizing the testing of those sites thought to be at highest risk of

contamination and posing a potential risk to human health. This is a high priority action.
- Support legislation to require that fire departments report to the Department of Environmental Protection (DEP) all known sites where training exercises using AFFF took place.
- Support legislation to amend Maine's Uncontrolled sites law to include pollutants and contaminants, which would give the state authority to require the removal and treatment of PFAS when there is a danger to the public's health. This is a high priority.
- Establish clean up standards for soil and groundwater

#4. **Identify and Reduce Sources of PFAS Contamination**

- DEP use its existing authority to require reporting of PFAS discharges into sewage systems and rivers
- Support legislation that would require manufacturers to report the intentional use of all PFAS in manufacturing and consumer products and use safer alternatives when available. This is a medium priority
- Support legislation that would require fire departments to report current stocks of AFFF to the DEP and any discharge of that product. This is a high priority.
- State of Maine procurement guidelines should discourage the purchase of PFAS-containing products.
- Stop accepting PFAS contaminated waste materials from other states

#5. **Assuring Responsible Waste Management and Disposal of PFAS**

- Require regular testing of residuals for PFAS prior to land spreading or commercial use in Maine. This is a high priority.
- Support legislation that would authorize the Board of Environmental Protection to update DEP's screening levels for individual PFAS and other constituents through routine technical rulemaing so those levels can be kept up to date. This is high priority.
- Continue efforts to investigate the availability of treatment and disposal technologies that minimize the potential for PFAS contamination and can safely destroy PFAS.
- Promote the development of infrastructure needed to manage PFAS-contaminated wastes safely and in a cost-effective manner.

#6. **Assuring Public Education**

- Develop appropriate informational materials to inform the general public abut PFAS--how to reduce use of PFAS tainted materials, how well water may be testing and the significance of PFAS contaminated drinking water. These materials to be widely available on web pages, training events and fairs.
- Develop specific appropriate targeted educational materials for those who are in occupations at a higher risk of exposure.

#7. **Seeking Urgent Federal Action**
a) Establish the Significance of PFAS and Reduce Sources to the lowest possible levels

- The United States Environmental Protection Agency (U.S.EPA) must add PFAS to the

hazardous substance list under the (CERLA) authority. This is a high priority
- Congress should require manufacturers to reduce and eliminate the use of the PFAS family in non-essential applications with high potential for human exposure, such as dental tape or gymnasium floor wax.
- Congress should require manufacturers (domestic and foreign) of consumer products to report **all** use of PFAS compounds in products sold in the United States
- The Federal Aviation Administration and Department of Defense should identify effective forms that do not contain PFAS and should eliminate requirements for firefighting foams to contain PFAS

b) Protection of workers

- The Occupational Safety and Health Administration (OSHA) and the National Institute of Occupational Health and Safety (NIOSH) must establish exposure limits for **all** workers exposed to PFAS

c) Protecting Drinking Water

- The U.S.EPA should establish a maximum contaminant level for PFAS in drinking water, which should also apply to bottled water. This is a high prority

d) Protecting the Food Supply

- To minimize dietary exposure, the U.S.EPA should establish PFAS adulteration levels for all foods. This is a high priority

e) Waste Management

- The Agency for Toxic Substances and Disease Registry (ATSDR) should finalize toxicity values for PFAS found in environmental samples
- Based on the work of ATSDR noted above, the U.S. EPA should update regional screening values to include the additional screening level guidelines
- The U.S. EPA should certify additional laboratory methods tom measure PFAS in various media (groundwater, wastewater, socks, other solids and ambient air)

f) Financial Support (see financial section)

- The U.S. Department of Agriculture should establish additional sources of funding support for farmers impacted by PFAS contamination, similar to the Farm Service Agency's Dairy Indemnity Payment Program
- Congress should allocate funds for state action to address drinking water contamination, firefighting products needs, food safety, and education of the public in the form of grants.

#8 State Funding for action and Legal Support for Damage Claims (see financial section)

- Introduce and support a bond initiative to raise money for the costs of PFAS sampling, remediation and drinking water treatment. This is high priority
- Allocate resources from appropriate state of Maine accounts to specifically address the needed work on the recommendations included in this report.
- Assure adequate staffing to conduct the recommended action steps.
- Ask the Attorney General to investigate legal actions being taken in other states to

recover from responsible parties the costs related to the adverse health and environmental impacts of PFAS contamination with a view to determining if such action might be taken by Maine.

- Support legislation to change the statute of limitations for private actions to recover damages for PFAS contamination to six years from the discovery of the contamination.

From:	Dale F. Doughty
To:	PFAS Taskforce
Cc:	Mark Adams; Crichton Peter (pcrichton@auburnmaine.gov); Denis D'Auteuil; Jeffrey D. Preble; Lamie Norm (nslamie@hotmail.com); Sid Hazelton (shazelton@awsd.org)
Subject:	Comments on Managing PFAS in Maine
Date:	Friday, December 06, 2019 4:25:10 PM
Attachments:	image003.png

The Lewiston-Auburn Water Pollution Control Authority (LAWPCA) is the third largest waste water treatment plant in Maine. We were created by an act of the Maine Legislature in 1967 to provide wastewater treatment services to the Cities of Lewiston and Auburn and we began operations in 1974. On average, we treat 9 million gallons of effluent per day and in wet weather up to 32 million gallons per day. We are somewhat unique in that in 2013 we transitioned to anaerobic digestion of our wastewater solids; reducing the volume of our solids by over 50% and CO_2 (a greenhouse gas) by 80%. We do generate methane (another greenhouse gas), but we burn this in our electrical power plant. We have worked closely with local farmers, supplying them with free fertilizer through the beneficial reuse of our biosolids since 1987. We currently produce 120 tons biosolids per week. If all of this material were landfilled at current rates this could cost Lewiston and Auburn resident an additional $200,000 to 500,000 per year. LAWPCA is committed to cost effective community service, innovation and environmental stewardship. It is in the spirit of these values that we offer the following comments on the Draft Final Report of the Governors PFAS Taskforce, entitled Managing PFAS in Maine.

We applaud the Task Force's timely work on this complicated issue. We recognize that because of its rapid development, ever-changing base of knowledge, and lack of clear federal guidelines, each jurisdiction is struggling to address developing public concerns in a prudent and safe manner.

We have a few take-aways from the body of the report as it relates to our work:

- US production of these PFOS/PFOA compounds began to be phased out in the early 2000's. Imports continue to contain PFOS and PFOA compounds. This is a prime area for national action.
- The US Centers for Disease Control reported an 80% reduction in PFOS/PFOA compounds in blood serum in NHANES participants since 1999. PFOS/PFOA remain in the body for years so this reduction may lag behind reductions in exposure. Therefore, some additional average reduction in blood serum will likely be realized into the future based on past changes.
- Ingestion of food and consumption of contaminated drinking water appear to the dominant pathways for human exposure to PFAS compounds.
- The heath affects in humans are not well understood or documented and animals have exhibited multiple heath affects in high doses. This makes modeling and setting of realistic regulatory limits challenging.
- Only a limited number of public and private wells sampled to date have tested positive for PFAS compounds. Only two public water supplies have taken action due to the detection of PFAS compounds at or approaching advisory levels and private wells impacted all seem to be associated with discrete and unique sources, from past practices.
- With the exception of one dairy farm, with a unique and specific history of industrial sludge application, all milk tested in Maine has been below the detection limits for PFOA and PFOS. This includes those farms using feed from fields spread with a long history of biosolid applications.
- Continuing to manage and eliminate the introduction of PFAS compounds into our environment is key. It seems clear that the reduction in US production has significantly reduced exposure. Continuing to reduce the potential for exposure through regulating products containing these compounds should be our first and best line of defense.

Comments on the Waste Management Recommendations:

1. *"The State of Maine must take actions to prevent PFAS from entering Maine's environment, food supply, and drinking water. The Task Force supports legislation to amend Maine's Uncontrolled Sites law to include pollutants and contaminants, which would give the State authority to require the removal and treatment of PFAS when they are a danger to public health."*

   Maine and LAWPCA has a long and successful program of land application of biosolids for agricultural purposes. Adding PFAS compounds to the Uncontrolled Sites law will have a chilling effect on farmers desire to use these products as soil enhancements. Although we are not opposed to this addition, some clarity with what "danger to public health" means will be needed. This is especially true with the absence of clear heath affect data.

2. *"The Task Force recommends that DEP require regular testing of residuals for PFAS prior to land spreading or commercial distribution in Maine. The Task Force also recommends expanding existing requirements to include septage that is agronomically utilized or land applied. The Task Force supports legislation that would authorize the Board of Environmental Protection to update DEP's screening levels for individual PFAS and other constituents through routine technical rulemaking so those levels can be kept up to date.*
   The Task Force also recommends the State continue efforts to sample for PFAS in prioritized locations, analyze sampling results for patterns, and refine models of PFAS fate and transport."
   We support this recommendation, but again some further definition is needed. We support that Maine DEP work with regional industry leaders and associations such as the Maine Water and Environment Association and North East Biosolids and Residuals Association to develop a plan to perform an updated fate and transport model. This should be based on developing science and Maine's experience with biosolids application and food product testing. We further support Maine Water and Environment Association's recommendations to the PFAS Task Force of September 23, 2019.

3. *"Maine DEP should investigate the availability of treatment and disposal technologies that minimize the potential for environmental PFAS contamination. Preference should be given to technologies with the demonstrated capacity to safely destroy PFAS. Additionally, the State of Maine should promote the development of infrastructure, on the scale necessary to meet the needs of the State, to manage PFAS contaminated wastes safely and in a cost-effective manner"*
   This is a key recommendation. Currently Maine does not have the infrastructure to manage the disposal of this waste stream if beneficial use is limited. Balancing the statement "manage PFAS contaminated wastes safely and in a cost-effective manner" will be challenging and should be the leading line in this recommendation. Any additional or modified infrastructure proposed should be evaluated though a cost: benefit screening protocol.

In closing the LAWPCA Board thanks you for you work. Members of our Board attended several of your meetings and followed your materials, so we understand the complexity of this issue. Please accept our recommendations and if we can support you or the State Agencies furthering you work please contact me (207) 513-3003 ext3400 or ddoughty@lewistonmaine.gov. We will follow this e-mail with a document via US Mail.

Respectfully,
Dale. F. Doughty, C.G.
Public Works Director
Lewiston, Maine

From: Marjorie Monteleon
To: PFAS Taskforce
Subject: PFAS Draft Report must be stronger
Date: Thursday, December 05, 2019 8:48:22 PM

PFAS Taskforce Maine

RE: PFAS Draft Report must be stronger

Dear PFAS Taskforce Maine,

The draft report by the PFAS Task Force does not go far enough. I'm writing to call on the Taskforce to make this report stronger with four key changes.

First, we need a 1 ppt maximum contaminant level (MCL) for total PFAS. This is the only standard that could be truly health protective for Mainers exposed to these toxic chemicals.

Second, we must immediately stop the spreading of sludge-sourced compost. It's recently been discovered that this compost spread across farms and gardens in Maine is contaminated with PFAS, and we need to stop this ongoing contamination immediately.

Third, we must make clear that polluters must be held responsible for this contamination so the costs of cleanup and healthcare do not fall on our state or our neighbors.

Finally, I'm calling on you to extend the public comment period in this process to allow greater participation from people who are directly impacted by this contamination. This public comment period has been too short, especially with the holidays, to allow for meaningful participation.

Thank you for considering these comments.

Sincerely,
Marjorie Monteleon
P O Box 1302
85 Herrick Road
Southwest Harbor, ME 04679
(207) 244-5577

Managing PFAS in Maine

Final Report from the Maine PFAS Task Force
December 2019

Commented [SFE1]: We would recommend changing the picture as it only speaks to one source of PFAS.

Table of Contents

PFAS Task Force Members

Dr. Meredith Tipton
Chair

Amanda Beal, Commissioner
Department of Agriculture, Conservation and Forestry

Michael Belliveau
Environmental Health Strategy Center

Andre Brousseau
Certified Wastewater Treatment Plant Operator

Major General Doug Farnham
D*epartment of Defense, Veterans and Emergency Management*

Dr. Lani Graham
Maine Public Health Association

Charles Kraske
Pulp and Paper Industry

Norm Labbe
Public Drinking Water Professionals

Jeanne Lambrew, Commissioner
Department of Health and Human Services

Jeff McBurnie
Biosolids Management Professionals

Jerry Reid, Commissioner
Department of Environmental Protection

DRAFT

Guiding Principles

Governor Janet Mills created the Maine PFAS Task Force in March 2019 to review the extent of PFAS contamination in Maine and provide recommendations about how we can protect Maine residents from exposure.

The Maine PFAS Task Force reviewed information from a variety of sources, including results of sampling by State of Maine agencies and various health studies, and solicited input from stakeholders and other members of the public.

The varied viewpoints of Task Force members strengthened discussions about priorities for State action. These diverse perspectives helped us deliver more comprehensive recommendations that center around a shared set of priorities.

Summary of Recommendations

To be most protective of Maine citizens, now and in the future, we believe the following are of greatest importance:

1. **Identifying and reducing sources of PFAS;**
2. **Providing safe drinking water;**
3. **Protecting our food supply;**
4. **Responsible waste disposal and management;**
5. **Improving public education about PFAS;**
6. **Demanding federal action; and**
7. **Funding for state agencies to investigate, respond to and reduce exposure of Maine citizens to PFAS.**

Commented [SFE2]: These recommendations do not line up with the duties the Task Force was supposed to accomplish and should reflect them.

PFAS is a health concern for Maine citizens and requires our attention. Nearly everyone is exposed to these chemicals from numerous sources. Our recommendations reflect a commitment to determine where PFAS contaminants exist in Maine and put in place strategic responses to protect people from exposure. The following report details recommendations the Task Force has identified as action items State of Maine agencies should implement.

DRAFT

PFAS Background

What is PFAS?

"PFAS" (per- and poly-fluoroalkyl substances) are a large group of manmade fluorinated chemicals. There are over 4,000 compounds that have been identified as PFAS to-date.

The two most commonly used PFAS were PFOA (perfluorooctanoic acid) and PFOS (perfluorooctane sulfonate). These two compounds were used in households across the country in the non-stick, grease resistant convenience items of the 20th century. PFOA and PFOS are still required components in a class of firefighting foam (Class B Aqueous Film Forming Foam (AFFF)) used to quickly extinguish petroleum-based fires. Some of the highest levels of PFOA and PFOS in Maine have been found at current or former military bases where Class B AFFF had been repeatedly discharged.

Chemical manufacturers in the U.S. phased out production of PFOA and PFOS in the early 2000's, but they were replaced with a wide variety of other PFAS. PFOA and PFOS are also still present in imported products, and many other PFAS break down in the environment into the more stable PFOA and PFOS compounds.

A wide variety of PFAS, many still unidentified as manufacturers claim their formulations to be proprietary information, are now used in consumer products that are stain, oil, heat, and water resistant, such as clothing, furniture fabric, food packaging, carpets, cookware, outdoor recreational items, and electronics. Because these chemicals are used so widely in consumer products, they are also present in our wastewater in septic tanks and at treatment plants.

The scientific understanding of how PFAS impacts people and the environment is still developing, and for thousands of PFAS compounds much remains unknown. Laboratories can still only accurately analyze for a small subset of PFAS.

State governments typically rely on the federal government to certify analytical methods for environmental contaminants. At this time, the U.S. EPA has only formally certified one method for analysis of 18 PFAS in drinking water (Method 537.1, Document #EPA/600/R-18/352 (2018)), although other methods for groundwater, wastewater and soils have been accepted by the U.S. EPA and Department of Defense for remediation site cleanup decisions. Other states have wide-ranging levels of industrial activity and methods for managing wastes, which have resulted in varying levels of PFAS contaminants within their borders. These differences among states are reflected in the variety of standards and screening levels for PFAS that other states have established in the absence of federal action to respond to their own unique circumstances.

Commented [SFE3]: Should be replaced with synthetic

Commented [SFE4]: We recommend removing this comment as it is only talking about one area and not the other PFAS sources.

Human exposure to PFAS continues to be widespread because this chemistry is used in hundreds of products for a variety of applications. Manufacturers do not report their uses of PFAS so it is difficult to limit exposures. International studies have been supported by Maine-specific sampling to indicate that PFAS are present in our environment, and that the highest concentrations of PFAS exist in environmental media such as soil and groundwater in areas where materials containing PFAS were disposed. In 2019, Maine is similar to other states trying to manage a shifting landscape while keeping pace with changes in our knowledge of this emerging contaminant and protecting human health with limited resources and authority.

Health Concerns

Commented [SFE5]: We recommend it be changed to Human Exposure Concerns

Scientists are still learning about the possible health effects from exposure to PFAS chemicals. Four specific PFAS chemicals - PFOA, PFOS, PFHxS and PFNA - have been studied more extensively than other PFAS. According to the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), studies of people who have higher PFOA or PFOS levels in their blood have shown that these chemicals may:[1]

- increase cholesterol levels;
- decrease how well the body responds to vaccines;
- increase the risk of thyroid disease;
- increase the risk of high blood pressure or pre-eclampsia in pregnant women;
- lower infant birth weights; however, the decrease in birth weight is small and may not affect the infant's health;
- increase risk of kidney cancer or testicular cancer.

Studies with laboratory animals exposed to high doses of one or more of these PFAS have shown changes in liver, thyroid, pancreatic function, and hormone levels, and increases in testicular, liver and pancreatic tumors.

Nearly everyone is exposed to PFAS chemicals. By measuring PFAS in blood serum it is possible to estimate the amount of PFAS that have entered people's bodies. Because some PFAS persist in our bodies for years, the levels in our blood serum at any time reflects exposure to these chemicals over the preceding several years. U.S. Centers for Disease Control (CDC) scientists have measured at least 12 PFAS in the blood serum of participants who have taken part in the National Health and Nutrition Examination Survey (NHANES) since 1999.[2] Four PFAS (PFOS, PFOA, PFHxS and PFNA) have been found in the

[1] https://www.atsdr.cdc.gov/pfas/PFAS-health-effects.html
[2] National Report on Human Exposure to Environmental Chemicals – US CDC: https://www.cdc.gov/exposurereport/index.html

blood serum of nearly all the people tested, indicating widespread exposure to these PFAS in the U.S. population. Notably, since 1999 the measured levels of PFOS and PFOA in the blood serum of NHANES participants have decreased by about 80 percent. The exposure pathway or pathways responsible for this decline remains unclear, though the timing does coincide with the declining use of these chemicals in the U.S.

For most people, diet is thought to be the primary source of exposure to PFAS.[1] The major types of dietary exposure for PFAS include either ingesting food contaminated with PFAS and eating food packaged in materials containing PFAS. Hand-to-mouth transfer from dust in households containing products treated with PFAS-containing stain protectants, such as carpets, is thought to be an important exposure pathway for infants and toddlers. Dermal exposure from water is thought to be a minor exposure pathway, and therefore bathing is not considered of concern.

For individuals drinking water with even relatively low level PFAS contamination (e.g., as low as 20 ppt), water consumption is likely their dominant exposure pathway.[2] Much of the early attention to PFAS nationally has been in response to contaminated drinking water supplies. Both community drinking water supplies, and residential wells have been contaminated through past use of AFFF ~~at military bases~~, as well as releases at chemical manufacturing facilities. Sizable population exposures to contaminated water have been reported in Colorado, Michigan, Minnesota, New York, New Hampshire, Pennsylvania, and Vermont.

More recent testing has shown drinking water may be contaminated by many different sources, such as landfills, residuals and septage spreading sites, air emissions from manufacturing facilities, and the discharge of AFFF for firefighting.

In 2016, the U.S. Environmental Protection Agency (EPA) issued a final Lifetime Health Advisory (LHA) informing state health agencies with regulatory authority over public water systems that, due to its adverse health effects, members of the public should not drink water where PFOA and PFOS individually or combined are measured above 70 parts per trillion (ppt). EPA Health Advisories are intended as informational resources for administrators of public water systems and agencies responsible for their oversight. Health Advisories are not regulations and do not represent legally enforceable standards. (EPA HA, 2016)

Commented [SFE6]: We recommend moving this to PFAS in Maine section and removing military bases as its not just at military bases.

Commented [SFE7]: In our research we didn't see a reference to this on the EPA site. However, we did find EPA's health advisories are non-enforceable and non-regulatory and provide technical information to states agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination."

Source: https://www.epa.gov/sites/production/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf

[1] Egeghy & Lorber. Journal of Exposure Science and Environmental Epidemiology (2011) 21, 150–168

[2] Need to check calculations on this, but latest NHANES blood serum levels and pharmacokinetic modeling suggests a typical daily intake for PFOS of around 28 ng/day. A typical adult person consumes a bit less than a liter per day of tap water. So at water levels above 20 ng/L, water is clearly the dominant exposure pathway.

Since the release of the 2016 PFOA/PFOS health advisory, the ATSDR and several states have reviewed the toxicity information available for PFOA, PFOS (and some agencies have also reviewed information on PFHxS and PFNA) and proposed or developed their own toxicity values. Despite looking at the same toxicity information as EPA, nearly all of these agencies have adopted toxicity values as much as 10-fold lower (including ATSDR's – another federal agency - proposed values), with differences largely a consequence of divergent views on which animal studies and which toxic effects to rely on, as well as divergent views on the appropriate application of uncertainty factors.

Absent a federal drinking water standard (called a Maximum Contaminant Level or MCL), some states confronting significant community water contamination problems have proposed or adopted their own drinking water standards. These state specific standards are lower than EPA's Health Advisory, a consequence of both the aforementioned lower toxicity values but also differences in the modeling of exposure. EPA's Health Advisory is based on water consumption by a lactating woman, to be consistent with a toxicity value based on developmental toxicity resulting from in utero exposure. Some states have instead modeled water consumption by the formula-fed infant, conservatively assuming the infant has similar sensitivity to PFAS as the developing fetus. Recently a few states have modeled transgenerational exposure to PFAS in water that considers both exposure in utero from water consumption during pregnancy followed by exposure to the infant from breast feeding. While most states continue to rely on EPA's Health Advisory for making risk management decisions on water contamination (including Maine), a national consensus regarding appropriate guidelines for PFAS in water has not been achieved. Moreover, toxicity data is lacking for most PFAS.

Across the country, as well as here in Maine, PFOA, PFOS, and other PFAS are also being detected in soils, sediment, surface water, air, biosolids, septage, compost, fish, and some foods. With these discoveries, new exposure pathways become apparent, such as soil-to-groundwater and soil-to-plant. Yet models and data for some of these exposure pathways are limited, posing challenges for developing guidelines for these media. It is also becoming apparent that trace levels of PFAS can be found in soils and freshwater fish in locations with no known release of PFAS, indicating a possible role for atmospheric transport and deposition.[3]

[3] Reference VT background soil study.

DRAFT

PFAS in Maine

PFAS was first discovered in groundwater in Maine at former military installations. Those sites were already known to contain other contaminants and surrounding areas are served by public water supplies. The potential for more widespread PFAS impacts in Maine was not realized until PFAS was discovered in the Kennebunk, Kennebunkport, Wells Water District supply well, which led to the discovery of PFAS in a nearby dairy farm well, milk, hay and soil. This one incident raised a series of questions about the soil-to-groundwater pathway, agronomic exposure pathways, and whether this was an isolated or more common occurrence. Since that time, many State of Maine agencies have become involved in efforts to investigate, respond to, and reduce exposure of Maine citizens to PFAS.

Maine DEP, the Maine Department of Agriculture, Conservation and Forestry (DACF), and the Maine Drinking Water Program, in cooperation with the Maine Center for Disease Control (Maine CDC) continue to investigate sites and materials for possible PFAS compounds, including:

- Public water supplies near potential sources of PFAS
- Groundwater, surface water, and private water supplies around Maine DEP cleanup sites, landfills, sludge land application sites, and Superfund sites
- Retail milk supply
- Vegetation (corn and hay) associated with agricultural feed for the dairy industry
- Sludge and other residuals
- Fish tissue

Commented [SFE8]: Systems instead of supplies

Commented [SFE9]: Systems instead of supplies

Commented [SFE10]: Biosolids instead of sludge

Maine Department of Environmental Protection

As of October 2019, the Maine DEP has more than 30,000 records for PFAS at 244 locations across the State. The DEP follows a step-out approach to site investigation – if contaminants are found above screening levels at a sampling point, DEP evaluates environmental pathways for those contaminants and conducts testing at nearby locations where impacts may also be predicted. For example, DEP may investigate contamination along a bedrock fracture where groundwater is predicted to travel to drinking water wells. DEP's Remedial Action Guidelines, developed in collaboration with Maine CDC, recommend treatment or replacement of drinking water supplies where PFOA and PFOS exceed 70 ppt, or where all PFAS exceed 400 ppt. As a result of this approach, carbon filtration drinking water treatment systems for PFAS have been installed on several private supplies near closed, unlined municipal landfills.

Maine DEP, DACF, and Maine CDC are continuing efforts to refine modeling assumptions to ensure that decisions are made based on the best available science. Work is on-going or underway to:

- Assess historic records to determine extent of sludge spreading activities on farmland and determine appropriate next steps;
- Sample corn stalks growing on farm fields with extensive land spreading history that will be harvested for silage feedstock;
- Further evaluate the extent to which PFAS compounds transfer from soil to silage corn to animals and ultimately into the food chain;
- Communicate with other states and agencies to evaluate toxicological data that is the foundation of our modeling work.

All data is publicly available through Maine DEP's website in several formats, including:

- An interactive mapping tool that includes a visual map, the ability to search for sites, and all supporting data in a downloadable format
- For sludge land application sites, a table that includes information for all licensed sites as well as all available records of land application
- A copy of all PFAS test results for all site types included in Maine DEP's database

Recognizing the financial burden PFAS has placed on some of Maine's wastewater treatment facilities, in 2019 Maine DEP:

- Offered emergency dewatering grants to certain facilities that did not have a way to dispose of low-solids content wastewater sludge that cannot be land applied due to high PFAS levels
- Offered planning grants to assist these same facilities in planning for future wastewater sludge disposal.

Maine Drinking Water Program

Just over half (51 %) of Maine citizens obtain their drinking water from private wells, which are not subject to federal or state regulation or testing requirements. The remaining 49% of Maine's population is served water by Community Water Systems, which are regulated under the federal Safe Drinking Water Act administered through Maine CDC's Drinking Water Program. Maine has approximately 378 regulated Community Water Systems (water systems that serve people in their homes on a year-round basis). Community Water Systems must test for approximately 87 manmade and natural contaminants on a regular basis and take necessary steps to reduce detected contaminant levels to below

Commented [SFE11]: Biosolids instead of sludge

Commented [SFE12]: Biosolids instead of sludge

Commented [SFE13]: Biosolids instead of sludge

Commented [SFE14]: Biosolids instead of sludge

Commented [SFE15]: should have some charts as attachments to show this.

Commented [SFE16]: Synthetic instead of manmade

drinking water standards established by EPA, known as Maximum Contaminant Levels (MCLs). Maine also has 375 Non-Transient Non-Community systems (these include schools and businesses); 1,151 Transient systems (these include restaurants and campgrounds); and 54 regulated bottled water sources. These systems are also subject to regulation, albeit less rigorous than the requirements for Community Water Systems.

Public water supplies are not required to monitor for or treat PFAS in drinking water. However, several public water supplies have been sampled for PFAS in Maine through an EPA-coordinated sampling program from 2013-2015 and two sampling rounds coordinated by the Maine CDC Drinking Water Program in 2017 and 2019. These programs were part of a data gathering effort to help evaluate the presence of PFAS in Maine's public water systems to inform future decisions on possible regulation of these chemicals as drinking water contaminants. The combined sampling efforts have resulted in analysis of drinking water samples for PFAS concentration in a total of 53 public water systems in Maine, mostly Community Water Systems. These systems represent more than 65% of the population served by Community Water Systems.

Maine CDC has advised public water systems testing for PFAS to use EPA's Health Advisory to guide decisions on whether to install filtration to reduce PFAS levels. The current Health Advisory for drinking water is a combined concentration of 70 ppt for two PFAS compounds, perfluorooctanoic acid (PFOA) and perfluoro octane sulfonate (PFOS). To date, only one public water supply was found to have combined PFOA and PFOS above the health advisory of 70 ppt. This is a small community system in Houlton, Maine (Houlton Mobile Home Park) serving approximately 140 people. This system is currently providing bottled water to their customers while considering installation of a treatment system and/or replacement of the water source. In addition, one public water supply in southern Maine (Kennebunk, Kennebunkport & Wells Water District) serving a population of approximately 34,250 elected to install a treatment system for PFAS in one of their well sources, although PFAS levels in the well did not exceed 70 ppt.

Based on PFAS sampling in Maine's public water systems to-date, PFAS does not appear to be present in most public drinking water. Where detected, PFAS levels tend to be ~~very~~ low (i.e., ~~well~~ below EPA's Health Advisory), with a couple of exceptions as noted above. Considering that all the systems included in the State-coordinated sampling programs were selected due to their proximity to potential sources of PFAS contamination, these results indicate that Maine does not have widespread PFAS contamination of public drinking water. However, since PFAS is present in many consumer products, waste streams and industrial processes, a thorough assessment of potential risk to consumers served by Community Water Systems would need to include sampling of all 378 systems.

Commented [SFE17]: Systems instead of supplies

Commented [SFE18]: Systems instead of supplies

Commented [SFE19]: Should add table of Maine data results

Commented [SFE20]: Should remove "very" as a statement it sounds better to say PFAS levels tend to be low.

Commented [SFE21]: Should remove "well" as it sounds better with just below EPA's Health Advisory

In Maine's most recent PFAS sampling round conducted in 2019, seventeen (17) of the thirty-six (36) public water systems included in the program declined to participate, in several cases stating that they wished to wait until testing was required rather than participating in the voluntary sampling program. Based on this result, it may be necessary to create a requirement for Community Water Systems to sample for PFAS to assess potential risks to all of Maine's citizens that receive their water from Community Water Systems. This would require action by the State Legislature to enact new laws requiring Community Water Systems to test for PFAS at specified intervals in addition to their regular monitoring requirements under the Safe Drinking Water Act. The Maine CDC recommends that public water systems continue to use EPA's Health Advisory to guide decision making on treatment and public notification when PFAS is detected until EPA's Health Advisory may be superseded by new MCLs established at the federal level.

Maine Department of Agriculture, Conservation and Forestry

DACF is responsible for ensuring the safety of Maine's food supply while providing support to farmers and food producers through a host of programs and resources. To date, DACF has concentrated its efforts on investigating potential contamination of PFAS in retail milk; however, it anticipates this scope to expand upon further data collection and assessment, additional scientific study, and the establishment of recognized PFAS standards for food.

In late 2016, PFAS chemicals were found to be present at levels up to 1420 ppt in the milk of a Maine dairy farm that had historically applied biosolids and papermill residuals to its fields. These results exceeded the Action Threshold of 210 ppt for milk that was developed by the Maine Center for Disease Control & Prevention to determine when milk is considered adulterated.

To determine the safety of Maine's current overall milk supply, DACF completed a state-wide retail milk survey in June 2019. The survey focused on Maine-produced, fluid pasteurized milk that was: 1) bottled in-state; or 2) was bottled out of state but sold in Maine. Twenty-six samples were taken throughout the state to ensure broad geographic representation. All results were below the laboratory reporting level of 50 ppt.

At the same time DACF tested milk from three commercial dairy farms, two with an extensive history of biosolid and/or paper mill residual applications and whose soil samples exceeded DEP's screening levels for PFOA and/or PFOS. The third farm was near the farm that had tested high for PFOS in 2016. The results from all three farms were also below the lab's reporting level of 50 ppt.

Future testing of milk and other agricultural products will occur based on additional factors, including the careful review of historic records, assessment of emerging science (including improved testing methods), and with the establishment of PFAS thresholds for other foods. DACF is in the process of assessing historical records of where licensed residuals may have been applied on Maine farmland. These records must be vetted to fully understand past spreading activities (residual type(s), location(s), amount(s), and date(s)), the crops or livestock produced, soil characteristics, and other relevant data to assess potential risk and next steps.

DACF will work closely with any farmer whose products may be found to be adulterated by PFAS, with the goal of identifying mitigation strategies that could allow them to continue farming and producing safe agricultural products. DACF, in collaboration with DEP and DHHS, is prepared to help identify on-farm sources of PFAS contamination, design elimination strategies, and conduct ongoing testing and monitoring. It will further advocate for additional sources of funding to assist farmers who face financial hardship from lost production caused by PFAS contamination.

Maine Emergency Management Agency

The Maine Emergency Management Agency implements the Toxics Release Inventory (TRI) reports for the State. At the current time PFAS is not a TRI chemical but recommendations to the US EPA have been sent on behalf of Maine to include PFAS on the chemical list.

The AFFF working group was formed to establish a comprehensive inventory of Class B AFFF firefighting foam throughout Maine and to make recommendations to the Governors PFAS Task Force regarding the future use of Class B AFFF. The AFFF workgroup included the State Fire Marshal and representation from Maine DEP, MEMA, Maine Fire Chief's Association, Maine Professional Firefighters Association, Maine Department of Labor, Maine Fire Service Institute, Bangor International Jetport, Portland International Jetport, Sappi Fine Paper, Maine State Police, Irving Oil, Citgo Oil, Global Partners LP, Gulf Oil, State Emergency Response Commission, and the Maine Air National Guard. A formal letter of request from the State Fire Marshall along with a survey was developed and sent to all Maine fire departments and industry partners to collect Class B AFFF information on behalf of the Task Force. Additionally, working group members developed and emailed a Class B AFFF infographic to all fire service organizations and industry partners in the state. Out of 305 fire departments in the State only 60 responses were received and out of 20 industry partners only 8 were received. Response to these surveys has been

Commented [SFE22]: Should be replaced with Professional Firefighters Association of Maine

disappointing, even after multiple requests. We are unaware of any mechanism that obligates response to these surveys. Maine DEP, MEMA and the State Fire Marshal's office will continue to encourage organizations to respond to these surveys and manage survey data for future use to ensure accurate information is available once an appropriate takeback and replacement program is established.

The AFFF workgroup submitted their recommendations to the Maine PFAS Task Force at their October 29, 2019 meeting. Those recommendations are included in Appendix D.

Commented [SFE23]: Should be Appendix C

Recommendations

1. **Identifying and reducing sources of PFAS;**
2. **Providing safe drinking water;**
3. **Protecting our food supply;**
4. **Responsible waste management;**
5. **Improving public education about PFAS;**
6. **Demanding federal action; and**
7. **Funding for state agencies to investigate, respond to and reduce exposure of Maine citizens to PFAS.**

Commented [SFE24]: These should reflect the duties assigned by the Governor for the task force to complete and have actionable items that address data gaps.

1. Identifying and Reducing Sources of PFAS

The Task Force recommends that the State of Maine require manufacturers to report the intentional use of all PFAS in manufacturing processes and in consumer products, and to require the use of safer alternatives when they are available. Legislation would be necessary to require this.

The Task Force supports the recommendations of the Firefighting Foam workgroup, included in Appendix D. This includes reporting discharges of Class B AFFF to the DEP and establishing a Class B AFFF take back and replacement program.

Commented [SFE25]: Should be Appendix C

Commented [SFE26]: Add: once a suitable replacement is found.

The Task Force recommends that State of Maine procurement guidelines should discourage the purchase of PFAS-containing products.

2. Providing Safe Drinking Water

The Task Force recommends that all public water systems should be required to test for PFAS and to notify their customers if PFAS are detected. This is similar to the approach taken by the State of California.

Commented [SFE27]: We recommend adding a level here to show what it should be.

Commented [SFE28]: We would recommend striking this from the paragraph as it calls out one State and not others that may have done similar things.

Task Force members disagreed about the level at which customers should be notified; Maine DWP recommended 10 ppt while some other members recommended notification at any level of detection. Maine has not, to-date, taken this approach with any other contaminants. For all other drinking water contaminants, Maine public water systems are only required to provide notice if concentrations exceed a maximum contaminant level

Commented [SFE29]: Where did this come from, is it an EPA standard? Should list what it is quoting. It should also state what wells you are talking about, private and or public.

(MCL). Legislation would be required to establish a testing and notification requirement for PFAS.

The Task Force also recommends that private drinking water should be tested for PFAS in areas where groundwater is likely to have been impacted by PFAS at unsafe levels, such as: 1) manufacturing locations that utilized PFAS chemistry; 2) unlined landfills; 3) areas where Class B AFFF has been discharged or stored; and 4) residuals land spreading sites. Some members recommended that the State should require PFAS testing of private wells at the time of real estate transfers.

3. Protecting our Food Supply

Foods may contain PFAS in unsafe quantities due to contact with PFAS-containing materials (such as packaging or processing equipment), due to vegetative uptake into produce, due to livestock consumption of PFAS-containing feed, or due to other environmental exposures. Regulation of contaminants in food is controlled almost exclusively by the U.S. Food and Drug Administration. (See Recommendation #6 for further discussion of federal actions.)

The Task Force recommends that the State protect foods produced in Maine from PFAS adulteration through restrictions on PFAS uses, restrictions on the agronomic utilization and land application of PFAS-containing residuals, and through the investigation and remediation of PFAS contamination.

4. Responsible Waste Management

The State of Maine must take actions to prevent PFAS from entering Maine's environment, food supply, and drinking water. The Task Force supports legislation to amend Maine's Uncontrolled Sites law to include pollutants and contaminants, which would give the State authority to require the removal and treatment of PFAS when they are a danger to public health.

The Task Force recommends that DEP require regular testing of residuals for PFAS prior to land spreading or commercial distribution in Maine. The Task Force also recommends expanding existing requirements to include septage that is agronomically utilized or land applied. The Task Force supports legislation that would authorize the Board of Environmental Protection to update DEP's screening levels for individual PFAS and other constituents through routine technical rulemaking so those levels can be kept up to date.

The Task Force also recommends the State continue efforts to sample for PFAS in prioritized locations, analyze sampling results for patterns, and refine models of PFAS fate and transport.

Maine DEP should investigate the availability of treatment and disposal technologies that minimize the potential for environmental PFAS contamination. Preference should be given to technologies with the demonstrated capacity to safely destroy PFAS. Additionally, the State of Maine should promote the development of infrastructure, on the scale necessary to meet the needs of the State, to manage PFAS-contaminated wastes safely and in a cost-effective manner.

5. Public Education

Maine citizens, physicians, government officials and other professionals must have access to information regarding PFAS to guide their own decision making. The Task Force recommends that the State develop educational materials at the appropriate literacy level for their intended audience, to be provided through a variety of forums such as webpages, training events, and fairs. Those audiences should include healthcare providers, farmers, drinking water and wastewater utility customers, fire fighters and students.

Commented [SFE30]: We recommend also adding in education and referring to social media as that is what is used mostly to get information.

6. Demand for Federal Action

The Maine PFAS Task Force demands that federal government agencies take prompt action to reduce harmful exposures of citizens to PFAS due to the widespread nature of PFAS uses and potential exposures. These actions should include:

a) Source reduction

The federal government should require manufacturers to reduce and eliminate the use of PFAS chemistry in non-essential applications, with particular focus on those uses with the highest potential for human exposure. Manufacturers (domestic and foreign) of consumer products should be required to report their use of PFAS compounds in products sold in the United States.

The Federal Aviation Administration and the Department of Defense should identify effective foams that do not contain PFAS and should eliminate requirements for firefighting foams to contain PFAS.

Commented [SFE31]: We recommend wording this differently or taking it out as most of the DOD and FAA sites are already trying to do this.

OSHA and NIOSH should adopt exposure limits for workers exposed to PFAS. These limits should also apply to firefighters and other emergency personnel supporting emergency response activities.

The U.S. EPA should add PFAS to the hazardous substance list under CERCLA authority.

b) Drinking Water

The U.S. EPA should establish a Maximum Contaminant Level for PFAS in drinking water, which should also apply to bottled water.

c) Food supply

The U.S. FDA should establish PFAS adulteration levels for foods in order to minimize dietary exposures to all PFAS.

Commented [SFE32]: We recommend adding in foods and food packaging

The U.S. Department of Agriculture should establish additional sources of funding support for farmers impacted by PFAS contamination, similar to the Farm Service Agency's Dairy Indemnity Payment Program.

d) Waste Management

ATSDR should finalize toxicity values for PFAS commonly found in environmental samples. The U.S. EPA should then update Regional Screening Levels to include additional screening level guidelines. The U.S. EPA should also certify additional laboratory methods to measure PFAS in various media (groundwater, wastewater, soils and other solids, ambient air).

7. Funding for State Actions

The State of Maine is expending significant funds to investigate and control PFAS exposures for Maine citizens, and substantial additional funding will be needed to continue this work. Municipalities, drinking water and wastewater utility districts, farmers, businesses, property owners and other Maine citizens are also bearing direct and indirect costs from PFAS contamination.

State funding

The Task Force recommends that funding from appropriate State of Maine accounts should be utilized, to the extent it is available, to fund sampling and treatment of drinking water supplies, and to fund the investigation of PFAS contamination that threatens Maine's citizens. State of Maine agencies must also be adequately staffed to

conduct the work necessary to implement any and all of the Task Force's recommendations, which will cost many millions of dollars in the coming years.

Bond Initiative

The Task Force recommends that the State of Maine introduce a bond initiative to raise money for the State's costs for PFAS sampling, remediation, and drinking water treatment.

Damage Claims

Many municipalities and states across the country are engaged in litigation against companies that manufactured PFOA and PFOS products, including claims for financial compensation. The Task Force recommends that the State of Maine fully consider available legal avenues to apply the costs of PFAS contamination in Maine to appropriate responsible parties who knowingly supplied products that are harmful to human health and the environment.

Conclusion

These recommendations reflect a commitment to determine where contamination exists in Maine and to put in place strategic responses to protect people from exposure. Through our deliberations and review of data, we concluded that PFAS is a health concern for Maine citizens and requires our attention. We believe that these recommendations exemplify the sincerity of our work and the seriousness of this contamination issue.

Commented [SFE33]: We recommend removing "many" and just leaving it as millions of dollars since we don't have a guaranteed figure.

Commented [SFE34]: We recommend getting some language from the AG as they are already taking care of some of this now.

Commented [SFE35]: We recommend saying it's a health advisory instead of concern. Studies are still being done on this so we should also be looking at those.

Maine Forest Products Council

The voice of Maine's forest economy

December 5, 2019

PFAS Task Force
c/o Maine DEP
17 State House Station, 28 Tyson Drive
Augusta, Maine 04330

RE: Comments on the draft PFAS Task Force Report

Dear PFAS Task Force members;

Please find attached comments submitted by PFAS Task Force member Dr. Charles Kraske. Dr. Kraske has been serving on the Governor's task force as a representative of the pulp and paper sector. The MFPC Pulp & Paper Environmental Committee represents the mills operating in Maine, and all have worked with Dr. Kraske in reviewing and preparing these comments.

We appreciate all of the work done by the committee and the opportunity to add our collective comments and perspectives to the final draft document.

Sincerely,

Patrick J. Strauch
Executive Director

Charles Kraske, Ph.D.
Senior Environmental Engineer
Verso Corporation, Androscoggin Mill

COMMENTS ON MAINE PFAS TASK FORCE DRAFT RECOMMENDATIONS

These comments were prepared in consultation with the Maine Forest Products Council (MFPC) for submission to the Maine PFAS Task Force created by Governor Mills' Executive Order. These comments were developed after review of the Task Force's draft recommendations.[1]

Our view: A Measured, Scientifically Sound Response to PFAS Contamination is Needed -- and Required -- If It Is to Support Rational Decision Making and Regulation.

Members of the MFPC use certain FDA-approved PFAS in applications in some paper making. MFPC supports several recent and planned action on PFAS. Those include adopting MCLs for drinking water, testing residuals that are land spread that may have exposures that lead to potential health impacts, development of appropriate analytical methods that are commercially available, analytical testing of environmental and drinking water where there are reasons to test, and support for additional PFAS toxicological testing. The highest priority should be to identify and address current exposures that meet or exceed adopted threshold levels.

However, MFPC has concerns for a number of the recommendations that do not reflect the science and fundamental principles of our regulatory and legal framework.

At the outset, MPFC points out that it is the only trade organization and industry represented on the task force. Many of the recommendations of the task force come from those who do not have manufacturing or commercial experience, nor experience with other industries or commercial users. The task force must recognize and acknowledge that its recommendations are unable to reflect that important broad and deep experience, which will be necessary for informed decision making by legislators and regulators. *We urge the task force to incorporate a recommendation to encourage early involvement and advance drafts to the public so that all stakeholders may provide information and comment*. The Maine Department of Environmental Protection's (DEP's) recent advance draft of its proposal to identify PFAS as a "hazardous matter" under its Chapter 800 regulations and the state's hazardous matter law was a good example of that practice. That strategy resulted in the Department obtaining valuable insight on how the DEP's objectives might be achieved, and ultimately changing the course of the DEP's decision making.

I. Fundamental Principles for PFAS Regulation, given the State of PFAS Science Exposure and Risk

1. Decisions must be based on science, not on fear or ease of implementation, and stakeholders should work collaboratively. Legislators, regulators, the public, wastewater and waste management industries, drinking water utilities, and commercial users of PFAS Stakeholders should work collaboratively to decide how to manage PFAS holistically, with science, facts, and all relevant information driving each

[1] These comments cover both (1) the Draft Summary of Recommendations, with recommendations numbered 1-31, dated on or about Nov. 4, 2019, and (2) the Draft Final Report "Managing PFAS in Maine," released by Kerri Malinowski, DEP dated on or about Nov. 19, 2019.

decision. The public doesn't like the idea of being exposed to chemicals that they don't understand, and that has led to fear and even outrage. But fear and outrage cannot be the basis for decision making. Neither is the discredited "Precautionary Principle."[2] Finally, although it is easy to define the category of "all PFAS," we must not confuse that ease with a *basis* to regulate "all PFAS."

2. Science does not yet support regulation of all PFAS as a group. Science is still evolving to understand the fate, exposure, and toxicity of PFAS in various environmental media. To regulate to protect risks requires that those risks be identified with adequate confidence to support rational decision making and regulation that has a rational basis. PFOA, PFOS, and PFBS arguably meet that threshold. But except for a limited number of PFAS chemicals there is not enough information on risks to support regulation with a rational basis. No credible scientific risk assessment body has concluded that all PFAS are similar. As recently as November 25, 2019 in discussing proposed regulation of PFAS under Emergency Planning and Community Right-to-Know Act rules, U.S. EPA has described the state of the science, and is collecting and reviewing data to determine if exposures to similar PFAS result in similar effects, but has been unable to identify categories for regulation, with the possible exception of PFOS and its salts.[3] Currently, the NTP Responsive Evaluation and Assessment of Chemical Toxicity, or REACT, Program is broadening our understanding of PFAS by studying over a hundred compounds that fall into different subclasses based on similarities in chemical properties. Others have suggested groups for priority testing and development of analytical methods based on screening information,[4] but those are not a basis for regulation; only for development of scientific data that may support regulation once groups or subgroups are identified. It may be scientists are able to identify subclasses but no such classes have been identified yet.

3. Risk-based thresholds must be developed for chemicals before risks can identified, communicated to the public, or regulated. These thresholds must be developed based on toxicological data and risk assessment tools. PFOA, PFOS, and PFBS arguably meet that threshold. Additional data and risk assessments are being developed monthly. See, e.g., the EPA Notice dated November 8, 2019 Federal

---

[2] The precautionary principle applies when there is uncertainty, but there is always uncertainty and the principle begs the question of what is an adequate level of certainty/uncertainty for what action (and action is usually presented as a binary choice, when there are typically multiple choices). In fact, environmental regulatory decisions and risk levels incorporate safety factors to account for uncertainty, with additional safety factors to account for additional degrees of uncertainty. Cass Sunstein, who was Administrator of the White House Office of Information and Regulatory Affairs in the Obama administration from 2009 to 2012, has issued more damning criticisms of the Precautionary Principle. *Sunstein, Cass (2005). "The Precautionary Principle as a Basis for Decision Making" (PDF). The Economists' Voice. 2(2):8 (2). doi:10.2202/1553-3832.1079.*

[3] EPA Advance Notice of Proposed Rulemaking, Addition of Certain PFAS; Community Right-to-Know Toxic Chemical Release Reporting, 40 CFR Part 372, signed November 25, 2019, to be published in the Federal Register in December 2019, at pp. 9-10.

[4] Environ Health Perspect. 2019 Jan;127(1):14501. doi: 10.1289/EHP4555. A Chemical Category-Based Prioritization Approach for Selecting 75 Per- and Polyfluoroalkyl Substances (PFAS) for Tiered Toxicity and Toxicokinetic Testing. Patlewicz G, Richard AM, Williams AJ, Grulke CM, Sams R, Lambert J, Noyes PD, DeVito MJ, Hines RN, Strynar M, Guiseppi-Elie A, Thomas RS.

Register at 60393 publicly noticing the Availability of the Systematic Review Protocol for the PFDA, PFNA, PFHxA, PFHxS and PFBA IRIS Assessments; CDC/ATSDR announced on September 23 that they established cooperative agreements with seven partners to study the human health effects of exposures to per- and polyfluoroalkyl substances (PFAS) through drinking water at 11 locations across the nation; and many hundreds of other toxicity assessments are currently underway.

4. Analytical Methods capable of measuring to those risk-based thresholds are required before setting limits or regulation. Before an enforceable regulations with limits can be adopted, there must be appropriate analytical methods to allow regulators to make decisions on impacts, to allow the public to determine whether water or other media is safe or a threat, and to allow those who are regulated to determine how to comply. Testing is only appropriate where there are reliable analytical methods for the environmental media or waste to be sampled and where results can be measured against scientifically-based health or environmental standards. The analytical methods needed to study and accurately monitor these chemicals at such trace concentrations are still in development, except for a limited number of methods in drinking water and perhaps soils.

5. Recommendations that the state cannot afford are not helpful or realistic; nor are recommendations that can't be implemented. Maine is a small state with limited resources, and the Maine DEP, the Maine CDC, and the Maine Drinking Water Program do not have the resources to support many of the PFAS recommendations and requests of the public or the Task Force. Leveraging and relying on national expertise in toxicology and analytical methods is an absolutely necessity. It is unrealistic to imagine that Maine DEP and DHHS will have or develop the capabilities to do the jobs of the U.S. Food and Drug Administration scientists and regulators better, especially with a fraction of the funding and experience. Any limited funds that might be made available from the Maine Legislature should focus on high priority state-level tasks that will manage and regulate PFAS holistically, starting with existing PFAS legal mandates (unless those are legislatively reordered).

6. Prioritize identifying and addressing unreasonable exposures. The tasks to be undertaken, and all PFAS policy or regulation, should focus on the most effective steps needed to reduce human exposure that present unreasonable risks based on accepted approaches to risk assessment, and implement them within the broad context of protecting human health. This requires differentiating high concentration sites from background concentrations and taking action to mitigate concentrations at sites where humans the environment are at material risk.

7. Developing science will require changes in regulation over time. Fortunately, there is no reason to take an all-or-nothing, now-or-never, approach to PFAS regulation. Because scientific data and analytical methods for PFAS are developing rapidly, there is no justifiable need to attempt to accomplish all possible regulatory goals immediately, or to give up examining PFAS simply because the real world is complicated and changing. The other reason not to regulate all PFAS compounds now is that such policy will prevent or delay focusing on those PFAS of highest concern with real exposures, because resources will be spread and squandered, rather than focused and effective. Prioritizing decision-making and regulation based on available data is not only defensible and rational, but developing science requires regular reconsideration and adjustment of regulations and strategies as PFAS toxicology data and studies become available and as analytical methods are developed.

8. Maine paper companies want to continue to use and innovate with short-chain PFAS compounds that do not pose risks and that are FDA approved. Put bluntly, if Maine bans or discourages use of all PFAS, it will put Maine paper companies at a competitive disadvantage as compared to companies that do not face such regulation, and will be doing so without a scientific or rational basis. Banning or discouraging all PFAS use also runs a risk of driving use of less studied compounds with potential risks that may be greater. Finally, broad bans do not consider "essentiality" of *any* of the compounds in the class. Furthermore, Maine's paper companies rely on the EPA and FDA chemical approval process for all food contact materials. Indeed, industry must respect and rely on FDA (and EPA, in some cases) for approval of *any* chemical used in food contact materials. The paper industry (and others) must work within that context, regardless of whether the chemicals used are PFAS or some alternative chemical used to achieve paper properties that are necessary in food packaging-related products.

9. Several important aspects of Task Force recommendations for federal government agency action are well-founded and supported by MFPC. However, those federal recommendations differ markedly from the task force recommendations for Maine regulation, and the related recommendations for Maine are not well-founded.

One example of federal recommendation: ATSDR should finalize toxicity values for PFAS *commonly found* in environmental samples (emphasis added*)*. The U.S. EPA should then update Regional Screening Levels to include additional screening level guidelines. The U.S. EPA should also certify additional laboratory methods to measure PFAS in various media (groundwater, wastewater, soils and other solids, ambient air).

By contrast, the task force recommendation for Maine calls for multiple regulatory or other actions against all PFAS, without regard to whether toxicity values available or analytical methods for measuring PFAS in various media. We believe that a more targeted approach should be taken, using appropriate analytical methods, for PFAS compounds with known toxicological impacts, in the areas of primary risk.

II. General Comments on the Task Force Recommendations and Priorities

There are numerous recommendations – many of which are given to the three Maine agencies who are already struggling to keep up with current demands, including those related to PFAS. There are no designated priorities among the recommendations, and no guidance to these agencies as to how PFAS issues should be prioritized among its current priorities. These recommendations must be prioritized in conjunction with other critical, known environmental issues, such that limited state resources are targeted on the most pressing of needs. State funding and resources should then be directed to those recommendations that are most important or which steps should logically be implemented first.

Overall, we think that the highest priority should be to identify and address current exposures that meet or exceed adopted threshold levels.

III. Specific Comments corresponding to Specific Task Force Recommendations

The following specific comments include references to recommendations in both (1) the Draft Summary of Recommendations, with recommendations numbered 1-31, dated on or about Nov. 4, 2019 and (2) the Draft Final Report "Managing PFAS in Maine," released by Kerri Malinowski, DEP dated on or about Nov. 19, 2019. The recommendation numbering below reflects the numbering of the Nov. 19th draft.

Recommendation 1. Identifying and Reducing sources of PFAS. A new law requiring manufacturers to report on intentional use of all PFAS and in consumer products is not well based, regardless of the ultimate intent. There is no scientific basis for regulating all PFAS as a class under the Toxics Use Reduction Program, the Toxics Release Inventory, or food packaging law, since there are significant differences in toxicity, fate, and persistence. Some of the more detailed recommendations ("all PFAS that meet the statutory criteria") and ("the regulated PFAS under Chapter 420") appear to recognize that regulation must be limited to PFAS of concern, rather than all PFAS.

Discouraging purchase of all PFAS containing products without regard to alternatives or the essentiality or need for the product simply does not consider all relevant factors. The concept of "safer alternatives" is an attractive, simple phrase which masks a number of basic issues that we believe regulators are ill-equipped to address in finite timeframes, often because there are no criteria for decision making and because manufacturing chemistry, product development, and product efficacy and testing are not expertise government regulators possess across the range of potential products affected.

MFPC has serious doubts about the possibility and usefulness of enacting new legislative provisions to require reporting under the Maine Toxics Use Reduction Act. Although it is hard to comment on proposals without specific legislative language, the hurdles of adopting a rational scheme include:

- The fact that the rule would have to focus on specific PFAS, and a law or rule couldn't and shouldn't cover all PFAS
- Many PFAS are proprietary, and it is often impossible to obtain verification of which PFAS may be in a mixture, and even whether PFAS are included, thus preventing effective reporting
- Forcing a reduction in PFAS that don't pose identifiable risks doesn't advance protection of health or the environment.

We strongly oppose adding all PFAS under Maine Toxic Chemical Release Reports (37-B M.R.S. § 799), which is the reporting requirement under the federal Emergency Planning and Community Right to Know Act. First, there is no "Maine" report – it is a federal law that requires such reports, that provides a detailed regulation on when reporting is required, supplemented by multiple guidance documents, and that supplies a detailed federal form that must be completed. The Maine law also requires that same federal reporting – in one sentence – simply by referencing the federal law and rules. All reporting is now electronic to the federal government, with a copy to the state and local entities. There is no authority for any Maine agency to change reporting, modify the forms, or to set up electronic forms. Second, the questions of class regulation and ability to identify PFAS for possible reporting noted above are practical and real problems for changing Maine Toxic Chemical Release Reporting.

Third, under Toxic Chemical Release Reporting, the following additional decision-making challenges arise:

- What PFAS should be included, and why?
- What volume thresholds for use should apply to trigger reporting?
- If those include PFOA and PFOS, how could reporting address background levels? EPA provides detailed guidance on calculating possible releases from uses. No such guidance would exist for PFAS; how would reporting companies make rational descriptions of releases?
- How could releases be confirmed or levels determined if there are no validated analytical methods?
- If there aren't specific risk levels adopted by government levels for judging risks, how can the public make sense of any reported releases?

On November 25, 2019, EPA signed an advance notice of proposed rulemaking (ANPRM), soliciting information from the public as EPA considers proposing a future rule on adding certain PFAS to the list of toxic chemicals subject to reporting under § 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) and § 6607 of the Pollution Prevention Act. EPA raised the above listed issues and many others that remain to be decided based on toxicity reviews, ability to adopt meaningful classes or subclasses, and application of the legal requirements of EPCRA. We question whether DEP or MEMA has the experience or expertise to make federal EPCRA policy decisions. We note that Maine waited until EPCRA rules were adopted and implemented before it adopted the parallel Maine law, and then simply incorporated the existing federal reporting requirement into Maine laws. We think the same approach is appropriate here for PFAS.

Recommendation 2. Providing Safe Drinking Water. Consistent with above principles, testing for PFAS can proceed only when there is a valid scientific basis for toxicity, when thresholds or limits of concern can be established, and after there are appropriate analytical methods to allow detection. Requiring notification of any level of any PFAS serves no useful purpose if there are not standards by which to judge the risks of exposure to those standards. Notification is useful to warn or avoid risks of concern, but neither individuals nor the public can make sense of PFAS levels without a hazard reference. Testing for specific PFAS compounds that are of concern in wells or drinking water if those sources may contain PFAS based on location-specific relevant information is a reasonable approach, and one that we understand was followed in the recent voluntary state-funded testing .

Recommendation 3. Protecting our Food Supply. We are mindful that the just-adopted L.D. 1433, the Food Packaging Law amendments, already provides regulatory authority for addressing PFAS in food packaging. MFPC questions whether any further recommendation should be included on that topic, since the DEP is already tasked with (and has already begun) developing a strategy under that law.

We noted a detailed recommendation from the November 4th, 2019 Draft Summary Recommendations, calling on the legislature to set a Maine-specific health risk value for PFAS Standards and treatment decisions across the state. It is unclear how the legislature could set a Maine-specific health risk value. First, the legislature is not well suited to examine toxicological studies, develop exposure scenarios and identify risk based values, even if all data were available. Second, Mainers are no more or less susceptible to PFAS risks than citizens in any other state, and may in fact be far less exposed as a state-wide population that most other states. As a result, we do not understand how a risk level could be

"Maine-specific." We believe that the U.S.EPA and in conjunction with the federal Centers for Disease Control have the expertise and resources to take the lead on this activity, with the Maine CDC acting upon guidance from those agencies. Finally, as noted below, the duties of the Task Force as set forth in the Governor's Executive Order do not include making recommendations for additional legislation.

Recommendation 4. Responsible Waste Management. Adding the term "pollutants and contaminants" to the Uncontrolled Hazardous Substances Sites law would dramatically expand the scope of this law, which now already includes all federal Hazardous Substances, all Maine Hazardous Matter, and all Maine Hazardous Waste. This would make Maine's law broader than CERCLA[5] and most all similar laws in other states, and is even much broader than "all PFAS" which is also overbroad. For example, dirt is a pollutant under the waste discharge laws, and so is temperature. Besides increasing the DEP's burdens in looking at new sites, DEP could arguably reopen every site that is already been remedied, imposing additional costs on PRPs, which include towns, school districts, the state national guard, and the state itself (as a PRP generating waste). If the proposal is to add specific PFAS substances to the cleanup program established under this law based on adequate toxicity data, then that is more typically a regulatory determination, and not a determination the legislature has expertise or experience in making. If any PFAS is to be added to law, then DEP will have to be ready with reliable analytical methods and reasonable cleanup standards to judge whether cleanup is necessary and to what extent in which media. The recommendation as formulated is at worst overly broad, and at best it is unclear to the point that it couldn't be effectively implemented. Again, the Executive Order does not include any directive to the Task Force to recommend legislation.

We note the provision on requiring fire departments to report any discharge of Class B AFFF. We believe DEP must focus on those Class B AFFF foams that pose risks. As a general matter, MFPC supports reporting of hazardous substances released to the environment in quantities that pose risks, and does not support reporting of "any discharges."

Recommendation 5. Improving Public Education about PFAS. MFPC supports public education, but that education will have to be completely transparent and science-based. Public education on the extent of PFAS or PFAS contamination -- without giving the public (1) information on the significance of the risks and (2) a comparison with other risks (both "involuntary" and "voluntary") -- invites additional public confusion, environmental illiteracy, and unnecessary concern. Of course, without a scientific basis, there can be no useful description of or education on PFAS risks. Therefore, because there is no accepted basis for class regulation, useful public education cannot simply refer to PFAS. We have great concerns that supplying only general information will be misleading, raise concerns that are unfounded, or leave the public justifiably confused and frustrated.

Finally, in public comment period at the November 26, 2019 PFAS Task Force Meeting, a public commenter sought Task Force support for a legislative proposal that might affect the ability to bring potential PFAS legal claims in court. We note that the Governor's Executive Order identified eight broad

[5] CERCLA includes "pollutants and contaminants" in the authorities of the United States to spend its own funds. 42 U.S.C. § 9604(a) and (b). The United States does not have authority to compel cleanup of (or recover cleanup costs for) "pollutants and contaminants" by potentially responsible parties, reserving that authority for hazardous substances. 42 U.S.C. § 9607(a).

duties of the Task Force, but none of those duties included recommending legislation. The Task Force has labored for months, but the issue of promoting private legal claims for PFAS was not raised by any Task Force member nor in any of the draft recommendations. While we acknowledge that this proposal did not come from the Task Force, we believe such topics are well beyond the scope of the Task Force's authority and beyond members' expertise, and we do not believe that favoring potential litigants on one side of future lawsuits is an appropriate subject for Task Force recommendations in any event. Therefore, we do not believe a recommendation on this topic can be or should be included.

MAINE RURAL WATER ASSOCIATION

PO Box 263 • 254 Alexander Reed Rd
Richmond, ME 04357
Phone: 207-737-4092 • Fax: 207-737-7150
E-Mail: mrwa@mainerwa.org
Website: www.mainerwa.org

December 6, 2019

Dr. Meredith Tipton, Chair
PFAS Task Force
VIA EMAIL

Re: Comments on PFAS Task Force Draft Final Report

Dr. Tipton:

The Maine Rural Water Association and our members are dedicated to the public health of the residents of Maine and recognize the impact that PFAS has on their wellbeing. We sincerely thank Governor Mills for recognizing the importance of this issue, and dedicating state resources to learn more about the causes, effects, and possible solutions to the issue of PFAS. The members of the Task Force should also be praised for their diligent work on this issue. Our comments are below on the draft of the Final Report from the Maine PFAS Task Force.

Identifying and Reducing Sources of PFAS:

Requiring manufacturers to report PFAS use without setting an acceptable limit is not an effective way to reduce the amount of PFAS the public is exposed to. This may serve as a reasonable stop-gap measure to learn who the major PFAS contributors are in the industrial sector but will not ultimately decrease the level of products that contain PFAS released in the environment.

As the Task Force acknowledges, a significant source of PFAS released into groundwater supplies is due to Class B AFFF and industrial residuals. Reporting future discharges and instituting a take back program is a positive step in limiting the exposure of AFFF in the future and MRWA supports those efforts. There is, however, a large amount of foam that has previously been deployed and the State should compile a comprehensive list of historic AFFF discharge sites to better investigate the safety of the drinking water in the surrounding areas. Previous large industrial discharges should be documented for the same reason. These issues are not mentioned in the draft of the Final Report but are ones we feel should be included as these discharge sites meet the threshold of "prioritized locations" and are critical to understanding the dispersion of PFAS in our state.

Providing Safe Drinking Water:

As noted in the report, there is no regulated contaminant that currently has a notification level set at "any level of detection." We agree that PFAS should be regulated by the Maine Drinking Water Program but argue the requirements should not be initially set stricter than those of all other contaminants. The notification limit should be set after a scientific review process that adequately determines a reasonable limit and is defensible to all parties involved. Until that process takes place, we do not support mandatory public reporting for PFAS below the federal advisory threshold.

Protecting our Food Supply:

The Maine Rural Water Association agrees that federal action is needed on the topic of PFAS. Regulation of food, packaging, and processing equipment are critical to reducing PFAS and those guidelines must come from the federal government. We do not agree that restrictions

on residuals are appropriate as the current research by the DEP and CDC indicate soil to plant uptake linkage is not as strong as initially believed. Restrictions in this area could cause immediate changes for wastewater utilities and significantly raise costs for ratepayers. We do not support restrictions until stronger evidence is found regarding agronomic uses of residuals.

Responsible Waste Management:

The requirement to test residuals implies that there is an acceptable limit, which must be defined in regulation. We believe that because PFAS is ubiquitous and affects so many different sectors of society, any rulemaking considerations reach far beyond that of routine technical. Regular testing must also be defined. With funds provided by the state, testing will become easier but increasing regularity of these tests without corresponding funding will place a substantial strain on wastewater districts.

Public Education:

We support the goals laid out in this section. A coordinated approach should be developed by the relevant agencies and stake holders to ensure that the state is moving forward in a single direction. As new data is uncovered the same entities should work to present a unified message. As these messages are generated a great deal of thought should be paid to the potential domino effect they can cause. We must guarantee that the public is properly educated on the issue of PFAS without creating unneeded panic or confusion. Failure to do so will result in both and could lead to public distrust in the science and/or process. It is crucial that this effort is executed in language intended for the general public. A thoughtful public discussion around PFAS will come from an informed citizenry.

Demand for Federal Action:

MRWA supports the recommendation that PFAS be addressed at the federal level. Source reduction and eventual elimination will be the most effective way to decrease the amount of PFAS in the environment. Establishing limits for PFAS in drinking water, food supply, and waste management are also critical so affected entities have a singular target to hit. Regulations should not be finalized before harmful levels are determined through a rigorous peer reviewed process. A rush to rulemaking without adequate evidence may cause unnecessary actions and create undue financial burdens on municipal and private partners.

The need for federal guidelines is also highlighted by the current quilt-like standards that are being established on a state by state basis. All people should feel confident that their government is keeping them safe, regardless of the state in which they reside. Interstate commerce regulations may also be brought into the discussion as entities attempt to move residuals containing PFAS across state lines with differing regulations.

Funding for State Actions:

MRWA agrees that significant funding is needed to combat the problem of PFAS in our state and supports the idea that all avenues should be explored to secure the necessary funding. Water and wastewater utilities are critical partners in the treating and disposing of materials that contain PFAS and they are not able to quickly undertake additional processes that will be required should stricter regulations be put into place without substantial financial assistance. The vast majority of water and wastewater districts are municipal or quasi-municipal entities, and as such the financial burden of any new regulation is shouldered by the general public.

Additional Comments:

The Maine Rural Water Association is honored to represent water and wastewater utilities across our state. Our members prioritize public health above all else and will comply with regulations from the state and federal governments regarding PFAS. With that said, many of our members are small utilities with limited budgets and are not prepared to make large capital expenditures on short notice. The lack of a fiscal note attached to this report is concerning. We encourage the state to evaluate the level of funds needed to undertake any recommendations made within this report. We strongly believe that state funding should be available to community and non-community non-transient water supplies that will be required to test and treat for PFAS.

The concern over PFAS as a threat to public health continues to grow. Until we can reduce the amount of PFAS entering our state, water and wastewater utilities recognize that they stand on the front line in preserving public health. They will continue to work with regulators to find the best solutions available to them. However, treatment will not be the ultimate solution to this problem. PFAS chemicals surround us, and we must focus on reducing the amount created. Research has shown this is a worthwhile approach. Blood serum tests of PFOA and PFOS have shown roughly an 80% reduction since the manufacture of these specific chemicals was banned in the United State in the mid-2000's. With PFAS a ubiquitous contaminant we must look to eliminate the source instead of cleaning up the mess.

As water and wastewater providers, protecting public health is our primary mission. We accomplish this through a set of laws and regulations that define what is protective of human health and what is not. These clear boundaries not only help us meet our responsibilities, but also helps the public understand how their health is protected. We look to the Task Force to develop recommendations for setting these boundaries, for without them, the water and wastewater industry is left awash in uncertainty.

Respectfully submitted,

Bradley Sawyer
Maine Rural Water Association
Director of Government Affairs

MAINE RURAL WATER ASSOCIATION

PO BOX 263 • 254 ALEXANDER REED RD
RICHMOND, ME 04357
PHONE: 207-737-4092 • FAX: 207-737-7150
E-MAIL: MRWA@MAINERWA.ORG
WEBSITE: WWW.MAINERWA.ORG

November 15, 2019

Dr. Meredith Tipton, Chair
PFAS Task Force
VIA EMAIL

RE: Comments on PFAS Task Force Draft Recommendations

Dear Dr. Tipton,

The Maine Rural Water Association and our members of over 400 water and wastewater providers, greatly appreciate your leadership and the effort the Task Force has committed to this very important issue. While we realize comments on the Draft Recommendations were solicited exclusively from Task Force members during the last meeting of Oct 29th, our membership has voiced concerns that the Task Force should be aware of. We offer the following comments and recommendations from a regulated community targeted in the Draft Recommendations dated November 4, 2019.

Comments on Sampling and Analysis

Recommendation 1:

We agree with continuing the current DWP-sponsored PFAS testing program for select Community and Non-transient non-community drinking water sources; the results of which were shared at the Task Force meeting on October 29th. There are obvious data gaps that should be filled before expending further funds.
Any long-term or permanent testing requirements beyond that program should be limited to Community Water Systems and certain Non-transient non-community water systems such as schools and daycare facilities. We do not believe that PFAS testing of Transient water systems is a wise allocation of limited resources because these water systems do not present the exposure scenario that would warrant targeted monitoring. To that end, we agree with the prioritized approach found in Recommendation 2, however monitoring exemptions should be made for non-detections or detections below a defined threshold. Without such a sunset provision, valuable funds would be needlessly expended.

Recommendations 2, 3, 4, 5:

The improper interchangeable use of the terms "biosolids" and "residuals" in the document is confusing. Chapter 400 of the DEP's rules defines the term "residuals" to mean "solid wastes generated from municipal, commercial or industrial facilities that may be suitable for agronomic utilization. These materials may include: food, fiber, vegetable and fish processing wastes; dredge materials; ***sludges; dewatered septage***; and ash from wood or

sludge fired boilers" (emphasis added). Throughout all of the listed recommendations, the term "biosolids and residuals" is used. Since biosolids are defined by Department rules as a *subset* of residuals, the phrase is redundant, and misleading as it unfairly singles out wastewater sludges and dewatered septage. We support the use of the term "residuals" and suggest striking all references to "biosolids".

Recommendations 3, 19, 20:

Testing of residuals, especially compost and municipal sewage sludge for PFAS is unnecessary without a defined regulatory limit. It is ubiquitous in the environment and in the food stream, and in human bodies. That it is present in municipal sewage is a given. The requirement to test residuals implies that there is an acceptable limit, which must be defined in regulation. We believe that because PFAS is ubiquitous and effects so many different sectors of society, any rulemaking considerations reach far beyond that of routine technical. We do not support Recommendation 20.

Recommendation 18:

Listing of PFAS in food packaging does not remove it from the waste stream. Without prohibiting manufacture or use, end-of-pipe industries, such as wastewater treatment and composters, are unfairly penalized. We suggest strengthening this language.

Recommendation 21:

We support adopting a health risk value to inform PFAS standards and treatment decisions. However, we ask for more specificity on what this standard may be. The varying regulatory health advisory and action levels currently in play across the country creates confusion for the regulated community and the public alike. Given the range of state-specific standards across the country, we support utilizing the current Federal Health Advisory of 70 ppt until a federal Maximum Contaminant Level is established that is science-based and peer reviewed.

Recommendation 22

We reject mandatory public reporting for any levels of PFAS, particularly those levels below the federal health advisory level until the human health risks are fully understood. We support defining a sensible and defensible risk-based reporting threshold.

General Comment on Regulatory and Statutory Changes:

As water and wastewater providers protecting public health is our primary mission. We accomplish this through a set of laws and regulations that define what is protective of human health and what is not. These clear boundaries not only help us meet our responsibilities, but also helps the public understand how their health is protected. We look to the Task Force to develop recommendations for setting these boundaries, for without them, the water and wastewater industry is left awash in uncertainty.

General Comment on Public Education:

There are no specific recommendations for the content of public education, only outlets for information. In practical terms, if testing and public notification is required, a coherent unified message should be coordinated between agencies. Managers are confronted with contradictory and confusing information, which only adds to public confusion and outcry.
We hope that the comments and observations assist you and the Task Force in your deliberations.

Respectfully,

Alex Wong, Director of Capacity Development
Cc: Kerri Malinowski, DEP
Norm Labbe
Jeff McBurnie
Andre Brousseau

From:	NANCY CONWAY
To:	PFAS Taskforce
Subject:	Managing PFAS in Maine
Date:	Friday, December 06, 2019 4:35:00 PM

I believe the water at the Nestle Bottling Plant site in Hollis should be included in the testing for the following reasons:

Waste water from the plant is being sprayed over the area.

Previously, the area was farmland and potato fields where sludge and many unknown substances/chemicals were also spread. Also, the old town dump is the vicinity.

Because of this, I am concerned that the water could be at risk.

Respectfully,

Nancy Conway
Hollis resident

Comments of PFAS Task Force Summary of Recommendations

Norm Labbe

November 14, 2019

Thank you for the opportunity of providing input on November 4, 2019 draft of recommendations.

The following four items are being provided as context:

1. In general, it is the writer's opinion that the Task Force's mission is to identify, address and chart a course toward mitigating the risks of PFAS to the people of Maine and to Maine's environment.
2. Of the 31 action items listed, several are overlapping and/or interdependent. As such, prioritizing the top 10 of the 31 items (without first combining some) will fail to capture some of the important action items that have already been conceptually agreed to by the members of the Task Force.
3. It is anticipated that the action items are brief, general statements that will be substantially amplified in the Task Force report.
4. Being the Public Drinking Water Professionals representative on the Task Force, these comments are focused primarily on items related to drinking water. That being said, with respect to total human exposure to PFAS, there are other significant areas of consideration related to this topic, including but not necessarily limited to agronomics and residuals handling, which may need as much or more attention than that of drinking water.

In identifying the risk from the standpoint of drinking water, **Items 1 and 2** are of paramount importance. It will be enlightening to see the draft report's details relating to these items, as much work is still needed to identify all existing PFAS "hot spots" from available (and currently unavailable) records. When considering the random discovery of one farm having over 800,000 PPT of PFAS in its soil 30 years after certain residuals were spread (and the outfall of that discovery), this point cannot be understated.

As written, **Items 21 and 22** are unclear. It is assumed that the report's amplification will address the following in detail:

1. Will it be recommended to require PFAS testing for all Community Public Water Systems and certain Non-transient, Non-Community Public Water Systems, such as schools?
2. Will the notification level be based upon detection (which is continually changing) or upon a "more reasonably based" figure?
3. How will the notification be made? Immediately? In an annual Consumer Confidence Report?

4. Will some additional “action level” (e.g. mandatory public hearing or an MCL (i.e., mandatory treatment) be proposed?

Public education must also be a top priority. **Items 25 through 31** are a start, but don’t directly address the underlying issue as written. The challenge is to provide timely, informative and believable information to the public, in a fast-paced electronic world, fraught with misinformation and fear. Drinking water suppliers are very concerned as to what they will be telling their customers if they detect a relatively small amount (e.g.: less than 10 PPT) of PFAS in their water. Will Maine’s regulations be based upon science, politics or fear? How are New Hampshire’s and Vermont’s actions toward PFAS going to affect Maine’s decision making and the overall dialog?

Although unrelated to drinking water, **Item 9** may be a low priority in Maine, for the following reasons: Airborne PFAS is ubiquitous. Absent a manufacturing facility in Maine (or on its border) that produces, uses or processes significant amounts of PFAS, this initiative may not be the best use of limited resources. With respect to airborne PFAS exposure in Maine, new stain resistant carpeting in an enclosed home during the winter months is probably of greater concern.

In summary, it is the opinion of the writer that we need to:

1. Identify existing PFAS exposure pathways (including determination of the locations and approximate quantities of existing contaminated material)
2. Minimize the production of and use of PFAS-containing products (minimize what comes in to Maine from now on),
3. Minimize human exposure from 1 and 2 above
4. Strive to scientifically determine at what levels and from what exposure pathways PFAS poses a measurable human health risk (from food, water, air, dust, etc.),
5. Educate the public and
6. Determine the order in which items 1 through 4 above should (or must) be undertaken (e.g., public education may be #1).

Portland Water District
FROM SEBAGO LAKE TO CASCO BAY

December 5, 2019

PFAS Task Force
c/o Maine DEP
17 State House Station, 28 Tyson Drive
Augusta, Maine 04330

Sent Via Email - pfastaskforce@maine.gov

Dear Chairperson Tipton:

The challenges and concerns related to PFAS in Maine, New England, and the U.S. are significant and I would like to commend the members of the Task Force for their careful deliberation and review of this issue over the past months. This has been a significant undertaking, which has set the tone for Maine's response in the coming years.

There are many details in the Draft Report of the Maine PFAS Task Force and those details will be considered through future debate and policy actions. Recognizing this, I would like to share two over-reaching concerns related to biosolids management in Maine.

Ch. 418 screening levels – The Department of Environmental Protection (Department) has relied on screening levels for PFOS, PFOA, and PFBS in the evaluation of the suitability for biosolids for land application and for the distribution of composted biosolids. The modelling performed to derive the current screening levels was subsequently reviewed by an independent consultant, Stone Environmental, and the results were shared with the Department.

This review suggested the use of a model that more closely approximated actual biosolids land application practices along with the use of specific model parameters (i.e. ground water depth, soil adhesion, etc.) may be more appropriate. The use of the Stone Environmental model, with very conservative inputs, suggested screening levels that are protective of groundwater that could be several times higher than the current levels used by the Department.

We request that the Department sponsor an evaluation of the current screening levels through a modelling approach that more closely simulates actual biosolds utilization. This model should be fully peer reviewed and used to determine future screening levels.

225 DOUGLASS STREET P.O. BOX 3553 PORTLAND, MAINE 04104-3553
PHONE: 207.774.5961 FAX: 207.761.8307 WEB: WWW.PWD.ORG

Perform a comprehensive study of biosolids management options - The Department's sudden action to restrict the land application of biosolids and the distribution of composted biosolids created a significant shock to the already fragile biosolids management infrastructure. Beneficial use of biosolids, which was utilized to manage the majority of biosolids generated in Maine, provides for the utilization of this nutrient rich product. This important recycling of nutrients also provides a very cost-effective alternative managing the material generated each day by the 161-wastewater treatment plants working across Maine to protect public health and our treasured environment.

The Department's actions, coupled with the growing uncertainty surrounding possible future biosolids management restrictions have significantly disrupted the market and costs have increased. The expectation is that costs will soon begin to dramatically rise; how high is anyone's guess.

There is not enough landfill capacity to reliably manage the daily volume of biosolids generated in Maine. Additionally, incineration of biosolids has been suggested. However, there are no incinerators equipped to manage biosolids and permitting and constructing incinerators will take a decade and strain utility budgets.

When making statewide policy decisions regarding biosolids management (and restrictions on biosolids management), we believe the feasibility and costs of the conceptual solutions must be understood. To understand this, the Department should complete an inventory of the biosoloids (and probably septage) to be managed, the existing infrastructure capacity to manage these volumes, and the infrastructure investment required to reliably meet these needs well into the future.

We request that Department commission a study to determine the feasibility and costs of long-range infrastructure needs and related policy recommendations to manage biosolids.

Thank you for your hard work and we look forward to meaningful engagement in this issue in the future. Please feel free to reach me at (207) 774-5961 or at sfirmin@pwd.org.

Sincerely,

/s/ Scott M. Firmin, P.E.

Director of Wastewater Services

From: mailagent@thesoftedge.com on behalf of richardlkillmer@gmail.com
To: PFAS Taskforce
Subject: Strengthen the Draft Report of the Maine Governor"s PFAS Task Force
Date: Tuesday, November 26, 2019 4:36:43 PM

Dear PFAS Task Force Members:

The draft report of the Governor's PFAS Task Force provides a solid foundation but it must be strengthened to protect public health and the environment. I would like to see the following improvements added to the report:

1. Investigate Historical Sludge-Spreading Sites and test Agricultural Products for PFAS Contamination: The Task Force should explicitly recommend that DEP develop an investigation plan and timetable for testing all sludge spreading sites to find any yet-undiscovered high-level PFAS contamination. Both the soil and the agricultural products from these farms should be assessed without further delay.

2. Establish Health-Based Risk Values to Inform Maine PFAS Standards: The Task Force should recommend that Maine Center for Disease Control and Prevention (CDC) adopt Maine-specific health risk levels for all PFAS compounds with sufficient data, based on the best available science. Those risk values should inform the proposed adoption of a Maine drinking water standard for total PFAS, as well as other relevant environmental public health standards.

3. Strengthen Safety Protections for Residential Drinking Water Wells: The Task Force should recommend funding for educational outreach and financial assistance to expand testing and treatment of residential well water to reduce exposure to PFAS.

Thank you for all your work.

Sincerely,

Richard Killmer
PO Box 370
Yarmouth, ME 04096-0370

From:	mailagent@thesoftedge.com on behalf of Sally Wylie
To:	PFAS Taskforce
Subject:	Strengthen the Draft Report of the Maine Governor"s PFAS Task Force
Date:	Tuesday, November 26, 2019 4:12:43 PM

Dear PFAS Task Force Members:

The draft report of the Governor's PFAS Task Force provides a solid foundation but it must be strengthened to protect public health and the environment. I would like to see the following improvements added to the report:

1. Investigate Historical Sludge-Spreading Sites and test Agricultural Products for PFAS Contamination: The Task Force should explicitly recommend that DEP develop an investigation plan and timetable for testing all sludge spreading sites to find any yet-undiscovered high-level PFAS contamination. Both the soil and the agricultural products from these farms should be assessed without further delay.

2. Establish Health-Based Risk Values to Inform Maine PFAS Standards: The Task Force should recommend that Maine Center for Disease Control and Prevention (CDC) adopt Maine-specific health risk levels for all PFAS compounds with sufficient data, based on the best available science. Those risk values should inform the proposed adoption of a Maine drinking water standard for total PFAS, as well as other relevant environmental public health standards.

3. Strengthen Safety Protections for Residential Drinking Water Wells: The Task Force should recommend funding for educational outreach and financial assistance to expand testing and treatment of residential well water to reduce exposure to PFAS.

Thank you for all your work.

Sincerely,

Sally Wylie
26 Masonic St.
Rockland, ME 04841

From:	Save Forest Lake
To:	PFAS Taskforce
Subject:	Public Comment: Maine PFAS Task Force
Date:	Sunday, December 01, 2019 10:21:39 AM

Dear Maine PFAS Task Force:

First off, thank you for your efforts to examine the impact PFAS contaminants have on the lives of your citizens. I'm certain many other states, including my own, NH, will be following your lead and taking steps to protect us from present and future threats to our health as we all learn more about these forever chemicals. Do No Harm should be the mantra of all companies and public entities and I hope that will apply to your recommendations relative to your efforts. We know that many of these contaminants reach the public via the water that we consume and much of these contaminants eminate from landfill waste in the form of leachate. I am not certain how your state handles its landfill leachate, but NH currently allows for it to be shipped to WWTPs, where there is currently no means to treat for the removal of PFAS, and it is ultimately release with the effluent back into the waterways, where further harm is surely to be caused. I hope and implore you to see that this practice is stopped, as the effluent and the sludge aka biosolid application to land methods of leachate disposal only cause harm ultimately. I would recommend that PFAS usage by manufacturers be regulated, so as to ensure tracking and monitoring of these harmful chemicals, and that manufacturers and landfill operators work together to find ways to better protect the public from landfill leachate and the PFAS present in such waste. Again, thank you for your efforts, I do hope NH and surrounding states will take note and follow your lead.

Do No Harm.

Thank you!

Jon Swan
(603) 991-2078
Founder, Save Forest Lake
Please Help Us To Save Forest Lake!
http://www.SaveForestLake.com

*Look for us on Facebook and Twitter!

Dump Casella!

Do not allow this proposed development to scar the beautiful landscape of the North Country for generations to come

Have an odor to report relative to the NCES Landfill in Bethlehem? Be sure to send an email to ReportOdor@yahoo.com for mapping and reporting purposes!

From: Alice Elliott
To: PFAS Taskforce
Subject: Task Force Reccommendations
Date: Thursday, December 05, 2019 11:19:36 AM

Sierra Club Maine thanks the Task Force for its work on the PFOS Recommendations draft. We urge the task force to adopt the suggestions set forth by the Environmental Health Strategy Center, below.

1. Investigate Historical Sludge-Spreading Sites with a Clear Plan and Timetable.
2. Test Agricultural Products for PFAS Contamination.
3. Establish Health-Based Risk Values to Inform Maine PFAS Standards.
4. Strengthen Safety Protections for Residential Drinking Water Wells.
5. Turn off the Tap through Optimal Use of Existing Source Reduction Authority.
6. Phase Out the Use of Fluorinated Firefighting Foam.
7. Adopt Ambient Water Quality Criteria and Effluent Limits for PFAS.
8. Phase Out Spreading of PFAS-Contaminated Sludge and Compost.
9. Increase State Funding to Find, Assess and Prevent PFAS Pollution.
10. Make the Polluters Pay - Recover Costs from PFAS Manufacturers.
11. Extend the Statute of Limitations for Private Actions to Six Years from Date of Discovery

Thank you for considering these changes.

Alice

"The world is big and I want to have a good look at it before it gets dark." – John Muir

~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Alice D. Elliott, Director
Sierra Club Maine
565 Congress Street, Suite 206B
Portland, ME 04101
207.761.5616
~~~~~~~~~~~~~~~~~~~~~~~~~~~~

142 High Street, Suite 624
Portland, ME 04101

December 4th, 2019

Dear PFAS Task Force Members,

The draft report by the PFAS Task Force on managing PFAS in Maine is too little, too late. Toxics Action Center requests that the Task Force call for a 1ppt MCL for total PFAS, call for immediately stopping the spreading of sludge, hold polluters financially accountable, and actively encourage public participation on PFAS issues including extending the public comment period.

At Toxics Action Center, we believe that everyone has the right to breathe clean air, drink clean water, and live in a healthy community with a government that operates responsively and democratically. We envision a toxic-free world where we phase out harmful chemicals from manufacturing, and where we do everything possible to clean up the toxic legacies of past mistakes. We provide side-by-side community organizing training to people facing environmental hazards in their neighborhoods. For over thirty years, our role has been to help first-time community activists create and execute strategies for cleaning up and preventing pollution -- and nowhere has that been more important over the past few years than in communities affected by PFAS.

We believe this draft report is not strong enough. We urge you to strengthen your report by incorporating recommendations to:

1. **Establish a 1ppt Maximum Contaminant Level (MCL) for all PFAS.** The more we learn about this family of chemicals, the more toxic we learn it is. Extremely small amounts have significant health impacts. We need a health-based standard that is protective for infants, children, and the most vulnerable populations.While industries have moved away from PFOA and PFOS, they are being replaced with shorter chain chemicals which are also toxic. We must avoid regrettable substitutions and regulate PFAS as a class. We're calling on Maine to lead the way in taking meaningful action with a 1ppt MCL for all PFAS.

2. **Immediately Halt the Spreading of Sludge and Sludge Sourced Compost.** To protect our health, we must regulate existing contamination and stop new exposures. The state is currently allowing toxic sludge and sludge-sourced compost containing PFAS exceeding screening levels to be spread on farmland and sold to the public. We must stop contaminating our farms, our gardens, and our communities.

3. **Make Polluters Pay.** Polluters must be held financially accountable for contamination. Neither Mainers nor the state should pay for the legacy of these pollutants on our bodies and on the land. We recommend Maine's Attorney General take legal action against chemical companies that manufacture PFAS.

4. **Encourage Public Participation.** Toxics Action Center has a long history of working with community groups in Maine fighting pollution issues in their communities. We submitted comments with Conservation Law Foundation for a treatment technique for PFAS chemicals. While we have established ourselves as meaningful and engaged stakeholders on this critical issue, we were denied the petition, and were not alerted or invited to the PFAS Stakeholder Task Force. The comment period for this Report is very short and over a Federal holiday. Other stakeholders and concerned residents were not made aware, invited, or encouraged to participate in this process. The public comment period of this Report must be extended, and moving forward, impacted community members and the public must be centered in conversations about PFAS regulation.

Sincerely,

Dana Colihan
Maine Community Organizer

From:	Bruce Osgood
To:	Keith Pooler; PFAS Taskforce
Cc:	tammy@belfastwater.org; Colby Horne; Eileen Dubinett; Henry Chalmers; "Stephen Hall"
Subject:	RE: Testing of Municipal water supplies and reporting for PFAS. in Maine
Date:	Monday, December 09, 2019 4:04:07 PM

Could I suggest the following:

On behalf of the Belfast Water District Trustees and myself, we offer the following comment;
We feel it is important to do everything possible to ensure safe drinking water for our customers.
We support the adoption of the Federal EPA standard of 70PPT which is consistent with the standards that are now in place for all other drinking water tests in the State of Maine.
Thank you for your consideration in this matter;

From: Keith Pooler [mailto:keith@belfastwater.org]
Sent: Monday, December 9, 2019 3:22 PM
To: pfastaskforce@maine.gov
Cc: tammy@belfastwater.org; Bruce Osgood <bosgood@waldocountyymca.org>; Colby Horne <colby@colburnshoe.com>; Eileen Dubinett <dubinett@bluestreakme.com>; Henry Chalmers <hchalmers@roadrunner.com>; 'Stephen Hall' <hallsj63@hotmail.com>
Subject: Testing of Municipal water supplies and reporting for PFAS. in Maine

Dear Sirs,

On behalf of the Belfast Water District Trustees and myself, we offer the following comment for your consideration.

While it is always important to do everything possible to insure Safe drinking water to our customers at all times, we don't feel it is necessary to test beyond or report results that are lower than the Federal EPA standard of 70PPT.

Doing so would be inconsistent with the standards that are in place now for all other drinking water tests in the State of Maine, as well.

Thank you for your consideration in this matter;

Keith Pooler,
Superintendent,
Belfast Water District

From: Bob MacKinnon
To: PFAS Taskforce
Cc: Eric Gagnon; info@drumlinllc.com
Subject: PFAS Draft Report, Comments by Yarmouth Water District pfastaskforce@maine.gov
Date: Monday, November 18, 2019 4:13:26 PM

Dear Task Force,

Thank you for your work on this important issue, as one of my fellow water district colleagues stated we are all in this together. I have reviewed the draft report outline and would offer the following comments and suggestions for your consideration on the sections as noted below:

Sampling and Analysis

1). The cost estimate for statewide testing ($115,500 to 231,000) seems to be quite a low number for the amount of systems not yet tested. Our system has four active production wells and three reserve wells, so I would estimate the lab fees for those samples to be in excess of $ 1,500 alone.

Statutory Authority

21). Agree with using the current US EPA Health Advisory as a threshold to require installation of treatment. The requirement for public notification should not be set arbitrarily at the 10 ppt for any compound without scientific justification in my opinion. As written, this suggests to the public that contaminants at that level present a health risk, which may or may not be true. It would be better to either use the total 70 ppt as the threshold for notification or require notification of any results.

I would suggest the following addition under statutory authority:

Consider emergency legislation that would prohibit the transfer of PFAS contaminated materials that may result in a discharge to the environment. According to the November 7, 2019 Portland Press Herald, a wastewater treatment plant here in Maine accepted more than 250,000 gallons of landfill leachate contaminated with PFAS compounds. This article stated that the waste was ultimately legally discharged to the Kennebec River. As we all know, these materials and wastes eventually all need to go somewhere, however these places should be secure, licensed landfill facilities. Documentation, testing and monitoring of such transfers should be required.

Thank you,

Bob MacKinnon

Superintendent, Yarmouth Water District