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Dear Kara:

Thank you for considering our comments on Washington's PFAS Chemical Action Plan.

The Chemical Action Plan to address PFASs is a very important process to protect the health of Washington residents, fish, wildlife, and environment. As we have learned through surprising discoveries of contamination, these compounds are mobile and persistent in the environment, impacting not just their users but municipalities and individuals who are faced with contaminated water or fish. We also know that their use in food contact materials results in direct exposure to people, and use in carpets and textiles contaminates our indoor air and dust, again resulting in human exposure.

Ecology's goal in this plan should be to minimize all non-essential uses of PFASs, prioritizing for early action those that result in significant human or environmental exposure and/or have available safer alternatives. The Interim CAP should identify those early actions that can be taken in the near term.

To enable that prioritization, the CAP should clearly identify the uses that are resulting in releases to the environment and exposure of people and wildlife. While historical use information is important to include, it should emphasize current uses and their impacts. In many cases, chemical identity, fate and transport, and toxicity information are unavailable, but the CAP should provide available information and identify what is missing.

The Interim CAP should make the following recommendations:

- Ban the use of PFASs in food-contact materials on a short timeline.
- Establish interim restrictions on the release of PFAS-containing firefighting foams and identify safer alternatives.
- Set a timeline for phasing out other uses resulting in widespread exposure, such as textile treatments, in conjunction with alternatives assessment.
- Set protective drinking water standards with a mechanism for adding additional compounds as information becomes available.
- Develop the information needed to remediate existing contamination and identify contaminated sites: compounds used in products now and in the past along with their expected environmental behavior.

We provide details on these recommendations below:

Ban the use of PFASs in food-contact materials on a short timeline. The use of food packaging and other food-contact materials results in the transfer of PFASs to food and ultimately to human exposure. Since testing has shown that many restaurants and other users have already adopted alternatives, this is an unnecessary exposure that can be eliminated quickly.

There is strong scientific evidence that food-contact papers are treated with a mixture of PFASs, that the compounds migrate to food, and that many in-use products are PFAS-free. It has been estimated that 33% of the European production of PFAS is used for food packaging.[1] Paper coatings include fluoropolymers such as perfluoropolyethers, side-chain polymers, or non-polymeric surfactants.[1] [2]

Research in the United States and Europe has documented extensive migration of PFAS from food-contact materials into food.

- USEPA testing published in 2009 detected PFAAs in food contact papers at levels up to 4,640 ng/g for an individual compound, or up to 12,156 ng/g (12.2 ppm) total.[3]
- PFAS (specifically, S-diPAP) migration from microwave popcorn bags in the U.S. was measured at up to 3,900 ng/g food.[4] Fluorotelomer alcohols (FTOHs) have also been measured in the gas phase of popcorn bags after microwaving.[5]

The European Union Perfood project conducted extensive testing of food-contact materials and migration of PFASs into food items and food simulants. This project screened hundreds of paper samples for fluorine, and performed follow-up chemical-specific analysis. Their studies found 6:2, 8:2, and 10:2 FTOHs in all fluorine-positive samples, at levels up to 39,500 ng/g (40 ppm).[2] These precursor compounds transform into perfluoroalkyl carboxylates (PFCAs).[6] Researchers found the FTOHs migrate into food at all temperatures tested (5^{o}C to 220^{o} C), and found a "PFAS-factory" effect at baking temperatures: FTOHs are generated during heating. At the higher temperatures, the total amount of FTOHs that migrated into the food greatly exceeded the amount originally found in the packaging, indicating "a formation of FTOH from high molecular precursors at typical use conditions."[7]

Migration of FTOHs over time has not been extensively researched, but one study found that shorter-chain compounds migrate into food to a greater extent than longer-chain.[8] Butter was stored in PFAS-treated wrappers for 45 days at 5^{o}C, and the concentration of PFHxA increased nearly eight-fold over that time period.

In vivo and *in vitro* tests provide evidence that PFASs used in food contact materials have estrogenic activity. In an *in vitro* test of three PFAS-containing food-contact materials (technical mixtures) as well as several PFCAs and FTOHs, exposure to one food-contact material as well as to 6:2 FTOH increased estradiol levels.[9] Two food-contact materials and several FTOHs activated the estrogen receptor, with 6:2 FTOH eliciting the greatest response. In addition, all PFCAs tested led to greater PPAR-alpha and -gamma activity (except PFBA, which did not activate PPAR-gamma). The authors conclude that this evidence, taken together with in vivo tests that show similar effects, indicate estrogenic activity among tested PFAS and parent

substances used as food-contact materials. Other tests have found estrogenic activity of 6:2 FTOH in male medaka liver and in a yeast assay using medaka estrogen receptor.[10]

Establish interim restrictions on the release of PFAS-containing firefighting foams and identify safer alternatives.

The release of PFAS-containing firefighting foams, for training, firefighting, and equipment testing, has resulted in known contamination of drinking water supplies in several Washington communities. Since testing has been limited geographically and in terms of analytes, and the Department of Health has identified a number of high-risk communities that have yet to be tested, it is likely that contamination is more widespread than is currently known.

Fire-fighting foams currently in use include "legacy" formulations containing long-chain PFAS as well as newer formulations. It is likely that many fire stations currently use a mixture of legacy and newer products. By the nature of the use, PFASs in firefighting foam enter the environment in large quantities, and because of their persistence and mobility, have the ability to contaminate soil and drinking water.

In some cases, such as at civilian airports that meet a threshold for passenger traffic, fire stations are required to maintain a stock of firefighting foam that meets the military specification or "MIL-SPEC," which currently specifies only PFAS-containing foams. In many other settings, however, there are no regulations requiring the use of these foams, and the fire service can choose other foams that are effective in controlling oil fires.

The Department of Health is currently developing a testing project to further characterize the extent of contamination. We urge the department to include as extensive an analyte list as possible, to enable it to detect contamination from current-use products.

Beyond the testing project, we propose a three-part process to address the health threat from the use of PFAS-containing firefighting foam.

1. The CAP should recommend a ban on uncontained release of PFAS-containing foam in training and equipment testing. Uncontained releases are not necessary and contribute significantly to environmental contamination. Many members of the fire service have developed training regimens that do not involve training with foam. Releases during equipment maintenance and testing appear to be more difficult to avoid, but must be contained to prevent uncontrolled releases to the environment.

A study of wastewater treatment plants discharging to San Francisco Bay found elevated levels of PFASs in effluent from an airport industrial treatment plant: 560 ng/L PFOS, 390 ng/L 6:2 FtS, 570 ng/L PFPeA, and 500 ng/L PFHxA. The researchers also used the total oxidizable precursor assay, and found that 33 to 63% of the total PFAS concentration was attributable to precursors.[11] Follow-up research (to our knowledge as yet unpublished) traced regular increases in levels in effluent to periodic equipment testing/maintenance.

2. The CAP should establish a process for identifying and requiring the use of safer alternatives to PFAS-containing foam. Several manufacturers are currently producing PFAS-free Class B foams, and it is likely that a number of Washington state users have already adopted these foams. Ecology should conduct a full alternatives assessment to assess the hazard and performance of these PFAS-free foams so that users can transition to safer foams where there are no regulatory constraints on their use.

3. Our state agencies should use the results of the alternatives assessment to engage with the Department of Defense and the fire-fighting foam industry to adapt the military specification to, if possible, allow the use of PFAS-free foams. This would affect not only military uses but civilian airports regulated by the FAA.

Set a timeline for phasing out other uses resulting in widespread exposure.

While the state should prioritize fast action on food-contact materials and firefighting foam, there are significant other uses that result in widespread exposure to people and the environment. As the draft CAP details, in-home uses on textiles, including carpets, furniture, and apparel, constitute a major portion of PFAS uses. The interim CAP should include a timeline and plan for further characterizing these uses, conducting alternatives assessment, and transitioning to alternatives.

Set protective drinking water standards with a mechanism for adding additional compounds as information becomes available.

The Department of Health has already embarked on a process for establishing drinking water standards. We appreciate the department's willingness to quickly address this significant threat to Washington's drinking water, and ask the department to establish comprehensive standards that address not only legacy but current-use compounds. Contamination from products manufactured in the past is a serious issue that must be addressed, but the department should also assess which compounds in current-use products are creating a threat to drinking water. These compounds should be included in the standard, which should also have a mechanism for adding compounds as more information is developed.

Develop the information needed to remediate existing contamination and identify contaminated sites: compounds used in products now and in the past along with their expected environmental behavior.

Contamination of drinking water and other environmental media has already been documented in Washington State. Recent research, however, is finding scores of newly identified compounds at contaminated sites, and finding that large percentages of in-use products consist of unidentified compounds.[12, 13] Our government agencies charged with overseeing cleanup and preventing future contamination need to be equipped with information on the identify of PFASs used in products such as firefighting foam that are likely to be released into the

environment. They also need information on their mobility, persistence, and degradation and biotransformation pathways. The CAP should include a recommendation to require disclosure of this information to public agencies.

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