STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION AND FORESTRY
BOARD OF PESTICIDES CONTROL
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Memorandum

To: Board of Pesticides Control
From: Pamela J Bryer, Ph.D. | Pesticides Toxicologist
Subject: Feasible definition of PFAS in pesticide products
Date: October 8, 2021

Background

LD 264 directs the Maine Board of Pesticides Control to implement affidavits as part of the pesticide product registration process. These affidavits are to affirm to the state that none of the pesticide products being registered contain per- and polyfluoroalkyl substances (PFAS). In order for registrants to attest via these affidavits the BPC must define PFAS.

The term PFAS has several different meanings based on both the chemical structural definition and how the jargon has been used. At its most restrictive PFAS indicates five chemicals that were commonly used for a variety of consumer goods whose health effects were the first to raise alarm about PFAS. In all early regulations on this class of chemicals, the term PFAS referred to those five chemicals. The reality, however, is that there are thousands of structures, more or less related to one another, that can be classified at PFAS. The unifying characteristic of PFAS chemicals is fluorine atoms bonded to carbon atoms, typically many fluorines to each carbon in long carbon chains. On EPA's CompTox Dashboard many PFAS lists can be found, the largest of these lists contains 9,252 different chemicals.

The goal of chemicals regulation is to protect human and environmental health. Typically, decisions on a chemical's use in the marketplace follows a risk assessment to estimate the potential of harm. The depth of risk assessment differs by how the chemical will be used. Medicine and pesticides, because of their close relationship to humans, are scrutinized to a much deeper degree than other industrial chemicals

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that may only be used in small quantities in manufacturing processes. The science is still developing on what should be considered a PFAS of concern. Approximately 20 pesticide active ingredients registered in Maine, turn up on the list of 9,252 chemicals and as such we do know those particular active ingredients have passed the risk assessment stage and are not likely to cause undue harm to humans or the environment. There is even one pesticide inert ingredient that qualifies for use in organic agriculture due to its historical use and lack of toxicity. Currently, on the EPA CompTox Dashboard there is a list of 75 compounds that have been flagged, by the National Toxicology Program, as candidates for expedited toxicological screening due to the potential for harm based on chemical structure. This list of 75 includes the five historically referenced PFAS.

The PFAS of concern share some structural commonalities, however, structural identification, and therefore structural definitions, are not the best indicators of risk. Each compound needs to be evaluated independently and assessed based on its unique properties. The PFAS that are most concerning five years from now will be different from the PFAS of concern twenty years from now. Our understanding of risk due to PFAS will be evolving over time. The list of PFAS used on the BPC affidavits should be revisited repeatedly over time to ensure the registration review process remains current with the best available science.

Proposed PFAS to be included on the registration affidavits

The BPC is reliant on other agencies at the state and federal level in determining the potential risk posed by PFAS chemicals. These largely industrial chemicals are outside of the purview and authority of the BPC. Attached to this memo are the 75 PFAS EPA has identified as potential candidates for expedited toxicological screening. Adopting these compounds for use on the required affidavits makes sense because the best available science currently points to these chemicals as having the greatest potential for risk. Ensuring that none of these 75 PFAS are present in pesticides and spray adjuvants is currently the closest BPC can be to estimating potential for harm in a sound and not arbitrarily capricious manner. It is expected that this list will change in the future and the BPC should be ready to be responsive to future work by partner agencies.

Referenced website:
https://comptox.epa.gov/dashboard/chemical_lists

EPA's Prioritized PFAS List

CAS Number	Chemical Name
1691-99-2	N-Ethyl-N-(2-hydroxyethyl) perfluorooctanesulfonamide
678-39-7	8:2 Fluorotelomer alcohol
375-73-5	Perfluorobutanesulfonic acid
307-24-4	Perfluorohexanoic acid
375-95-1	Perfluorononanoic acid
1763-23-1	Perfluorooctanesulfonic acid
335-67-1	Perfluorooctanoic acid
4151-50-2	N-Ethylperfluorooctanesulfonamide
2795-39-3	Potassium perfluorooctanesulfonate
29420-49-3	Potassium perfluorobutanesulfonate
3825-26-1	Ammonium perfluorooctanoate
3871-99-6	Potassium perfluorohexanesulfonate
754-91-6	Perfluorooctanesulfonamide
163702-08-7	Perfluoroisobutyl methyl ether
647-42-7	6:2 Fluorotelomer alcohol
333-36-8	Flurothyl
28523-86-6	Sevoflurane
2144-53-8	6:2 Fluorotelomer methacrylate
19430-93-4	3,3,4,4,5,5,6,6,6-Nonafluorohexene
1652-63-7	Perfluorooctanesulfonamido ammonium iodide
335-99-9	1H,1H,7H-Dodecafluoro-1-heptanol
355-80-6	1H,1H,5H-Perfluoropentanol
356-24-1	Heptafluorobutyryl methyl ester
375-01-9	1H,1H-Heptafluorobutanol
375-22-4	Perfluorobutanoic acid
376-90-9	Hexafluoroamylene glycol
662-50-0	Heptafluorobutyramide
1623-05-8	Perfluoro(propyl vinyl ether)
2043-47-2	4:2 Fluorotelomer alcohol
31506-32-8	N-Methylperfluorooctanesulfonamide
163702-05-4	Ethyl perfluorobutyl ether
406-58-6	1,1,1,3,3-Pentafluorobutane
56860-81-2	Difluoromethyl 1H,1H-perfluoropropyl ether
1763-28-6	3,3-Bis(trifluoromethyl)-2-propenoic acid
375-02-0	Perfluorobutyraldehyde
678-78-4	Perfluoroglutaryl difluoride
1694-30-0	3H-Perfluoro-4-hydroxy-3-penten-2-one

CAS Number	Chemical Name
374-41-4	Methyl perfluoroethyl ketone
355-66-8	Octafluoroadipamide
424-18-0	Methyl perfluorohexanoate
2648-47-7	5H-Perfluoropentanal
355-81-7	Perfluoropentanamide
15242-17-8	Allyl perfluoroisopropyl ether
55621-21-1	Perfluoro-3,6-dioxaoctane-1,8-dioic acid
423-65-4	11:1 Fluorotelomer alcohol
330562-41-9	Perfluoro-3,6,9-trioxatridecanoic acid
3792-02-7	4:4 Fluorotelomer alcohol
355-27-1	1H,1H-Perfluoropentylamine
74427-22-8	2,2-Difluoroethyl triflate
679-02-7	3-(Perfluoropropyl)propanol
355-95-3	1-Propenylperfluoropropane
77953-71-0	3H-Perfluoro-2,2,4,4-tetrahydroxypentane
239795-57-4	2-Vinylperfluorobutane
813-03-6	5H-Octafluoropentanoyl fluoride
1767-94-8	6H-Perfluorohex-1-ene
243139-64-2	3-(Perfluoroisopropyl)-2-propenoic acid
129301-42-4	1H,1H,8H,8H-Perfluoro-3,6-dioxaoctane-1,8-diol
883498-76-8	Bis(1H,1H-perfluoropropyl)amine
151772-58-6	Perfluoro-3,6-dioxaheptanoic acid
31253-34-6	2-Aminohexafluoropropan-2-ol
125070-38-4	3-(Perfluoro-2-butyl)propane-1,2-diol
58244-27-2	tris(Trifluoroethoxy)methane
13485-61-5	Nonafluoropentanamide
132424-36-3	Methyl 2H,2H,3H,3H-perfluoroheptanoate
329710-76-1	2-(Trifluoromethoxy)ethyl trifluoromethanesulfonate
1619-92-7	2-Amino-2H-perfluoropropane
863090-89-5	Perfluoro(4-methoxybutanoic) acid
375-72-4	Perfluorobutanesulfonyl fluoride
356-42-3	Pentafluoropropanoic anhydride
914637-49-3	2H,2H,3H,3H-Perfluorooctanoic acid
374-40-3	1-Pentafluoroethylethanol
13252-13-6	Perfluoro-2-methyl-3-oxahexanoic acid
757124-72-4	4:2 Fluorotelomer sulfonic acid
679-12-9	4H-Perfluorobutanoic acid

Reference:

Patlewicz, Grace, Ann M. Richard, Antony J. Williams, Christopher M. Grulke, Reeder Sams, Jason Lambert, Pamela D. Noyes, Michael J. DeVito, Ronald N. Hines, Mark Strynar, Annette Guiseppi-Elie, and Russell S. Thomas. 2019. A Chemical Category-Based Prioritization Approach for Selecting 75 Per- and Polyfluoroalkyl Substances (PFAS) for Tiered Toxicity and Toxicokinetic Testing. Environmental Health Perspectives Jan 2019. Vol. 127, No. 1
https://doi.org/10.1289/EHP4555

Below is the referenced paper's abstract reprinted:

Abstract

Summary: Per- and polyfluoroalkyl substances (PFASs) are a group of fluorinated substances of interest to researchers, regulators, and the public due to their widespread presence in the environment. A few PFASs have comparatively extensive amounts of human epidemiological, exposure, and experimental animal toxicity data (e.g., perfluorooctanoic acid), whereas little toxicity and exposure information exists for much of the broader set of PFASs. Given that traditional approaches to generate toxicity information are resource intensive, new approach methods, including *in vitro* high-throughput toxicity (HTT) testing, are being employed to inform PFAS hazard characterization and further (*in vivo*) testing. The U.S. Environmental Protection Agency (EPA) and the National Toxicology Program (NTP) are collaborating to develop a risk-based approach for conducting PFAS toxicity testing to facilitate PFAS human health assessments. This article describes the construction of a PFAS screening library and the process by which a targeted subset of 75 PFASs were selected. Multiple factors were considered, including interest to the U.S. EPA, compounds within targeted categories, structural diversity, exposure considerations, procurability and testability, and availability of existing toxicity data. Generating targeted HTT data for PFASs represents a new frontier for informing priority setting.