



Per- and Poly-fluoroalkyl Substances (PFAS): Policy Analysis
Toxics Use Reduction Institute
DRAFT
October 2020

This document analyzes the implications of adding a substance category, *Per- and Poly-Fluoroalkyl Substances Not Otherwise Listed (PFAS NOL)*, to the TURA list of Toxic or Hazardous Substances (TURA List). The category would be defined as follows:

those PFAS that contain a perfluoroalkyl moiety with three or more carbons (e.g., $-C_3F_7-$, $n \geq 3$; or $CF_3-C_2F_4-$, $n \geq 2$) or a perfluoroalkylether moiety with two or more carbons (e.g., $-C_2F_5OC_2F_5-$ or $-C_2F_5OC_3F_7-$, n and $m \geq 1$), that are not otherwise listed.

With this addition, businesses in TURA covered sectors with 10 or more full time employee equivalents (FTEs) would be subject to TURA program requirements if they manufacture or process 25,000 lb/year, or otherwise use 10,000 lb/year, of chemicals in this category. These businesses would be required to file annual toxics use reports, pay annual toxics use fees, and develop a toxics use reduction plan every two years.

This policy analysis explains the definition of the proposed category, summarizes key scientific information, reviews existing information about how the chemicals in this category are used, discusses opportunities for toxics use reduction, summarizes relevant regulatory information, and discusses the implications of this policy measure for the TURA program. The TURA Science Advisory Board (SAB) has recommended adding this category to the list. **Based on a thorough review of this information, the Toxics Use Reduction Institute recommends that this category be added to the TURA list.**

This document represents the culmination of over three years of work by the Science Advisory Board and the TURA Program to study the science of per- and poly- fluoroalkyl substances. In its work to review the science of PFAS, the SAB took account of scientific resources collected by the TURA program, as well as information provided by industry and environmental stakeholders. While working with the Board to define a category of PFAS, the Toxics Use Reduction Institute provided information regarding the potential for regrettable substitutions within this large class of chemicals. TURA Program staff also worked with staff from other state agencies and considered the preventative role TURA can play in reducing impacts from this class of chemicals.

Overview

The per- and poly-fluoroalkyl substances (PFAS) constitute a large category of chemicals. PFAS chemicals have unique properties, such as water and stain resistance, making them useful in a variety of settings. They also share certain hazard characteristics, such as persistence and

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Per- and Poly-fluoroalkyl Substances (PFAS): Overview of Draft Policy Analysis

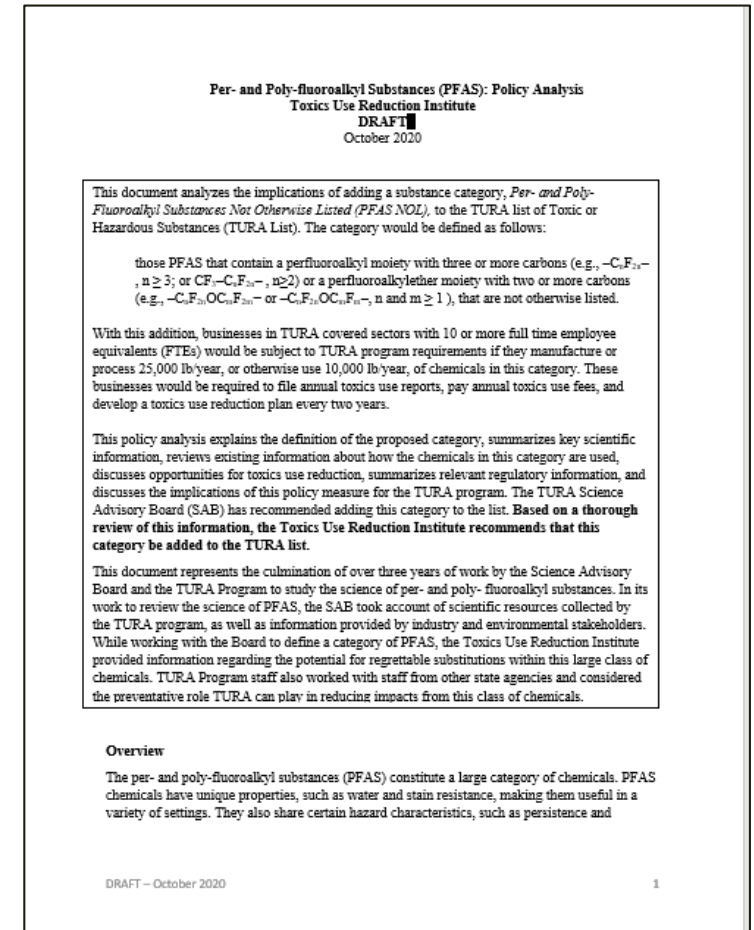
October 2020

Toxics Use Reduction Institute



Policy Analysis Overview

- Analyzes the implications of adding a substance category, Per- and Poly- Fluoroalkyl Substances, Not Otherwise Listed (PFAS NOL)
- With this addition, businesses in TURA covered sectors meeting relevant thresholds would be subject to TURA reporting, planning and fees
- Based on a thorough review of the Science Advisory Board's recommendation and policy implications, TURI recommends that the PFAS NOL category be added to the TURA List





PFAS Policy Analysis

Explains the definition of the proposed category

Summary of the Science

Use information

Opportunities for toxics use reduction

Regulatory context

Implications for the TURA program



Recommendation (pp. 1 & 2)

The TURA Science Advisory Board (SAB) has recommended adding the category *Per- and Poly- Fluoroalkyl Substances Not Otherwise Listed (PFAS NOL)*, to the TURA list of Toxic or Hazardous Substances (TURA List). The category would be defined as follows:

those PFAS that contain a perfluoroalkyl moiety with three or more carbons (e.g., $-\text{C}_n\text{F}_{2n}-$, $n \geq 3$; or $\text{CF}_3-\text{C}_n\text{F}_{2n}-$, $n \geq 2$) or a perfluoroalkylether moiety with two or more carbons (e.g., $-\text{C}_n\text{F}_{2n}\text{OC}_m\text{F}_{2m}-$ or $-\text{C}_n\text{F}_{2n}\text{OC}_m\text{F}_m-$, n and $m \geq 1$), that are not otherwise listed.

Based on a thorough review of the information summarized in this policy analysis, the Toxics Use Reduction Institute recommends that this category be added to the TURA list.



Approach to PFAS in MA (p. 3)



Drinking water

In 2020, MassDEP adopted an MCL of 20 parts per trillion (ppt) for six PFAS combined.

MassDEP is also offering free PFAS sampling to all public water supplies (PWS), and partnering with UMass Amherst to conduct sampling of private wells around the state.



Waste Sites

Some PFAS are considered to be "hazardous material" subject to the notification, assessment and cleanup requirements of the Massachusetts Waste Site Cleanup Program.

In 2019, MassDEP adopted a standard of 20 ppt for six PFAS combined for groundwater cleanup in areas where groundwater is a current or potential drinking water supply.



WWTP Sampling

MassDEP has begun a sampling program at wastewater treatment facilities to test for the presence of PFAS and to further locate upstream sources.



Assistance for affected communities



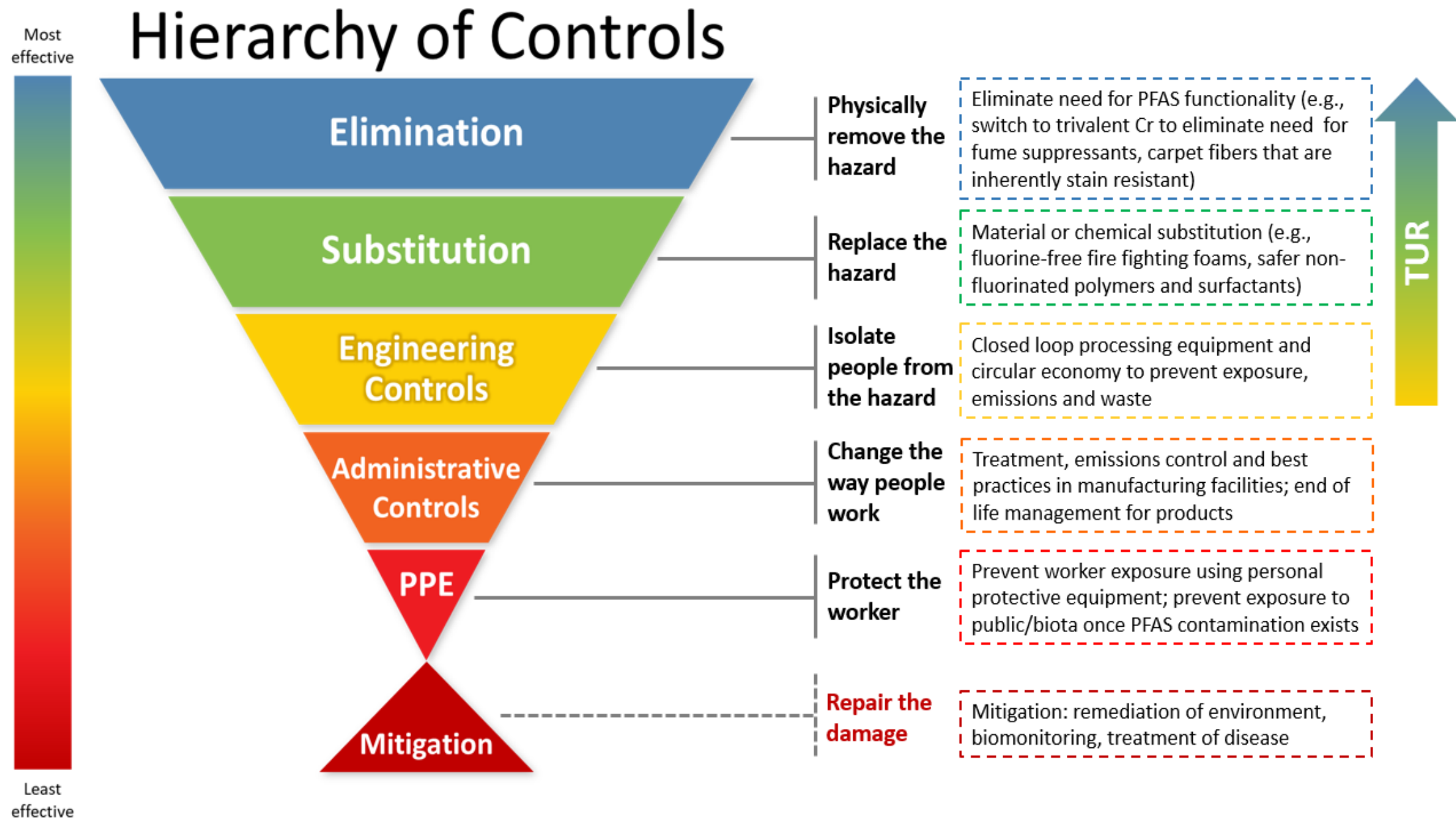
MassDEP and MA Department of Public Health (DPH) are working with impacted communities to help residents understand their exposure to PFAS and potential health effects.



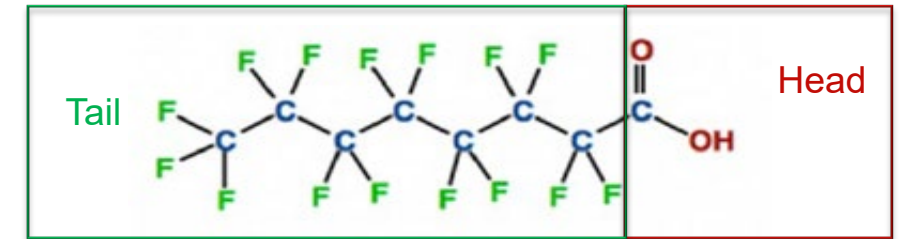
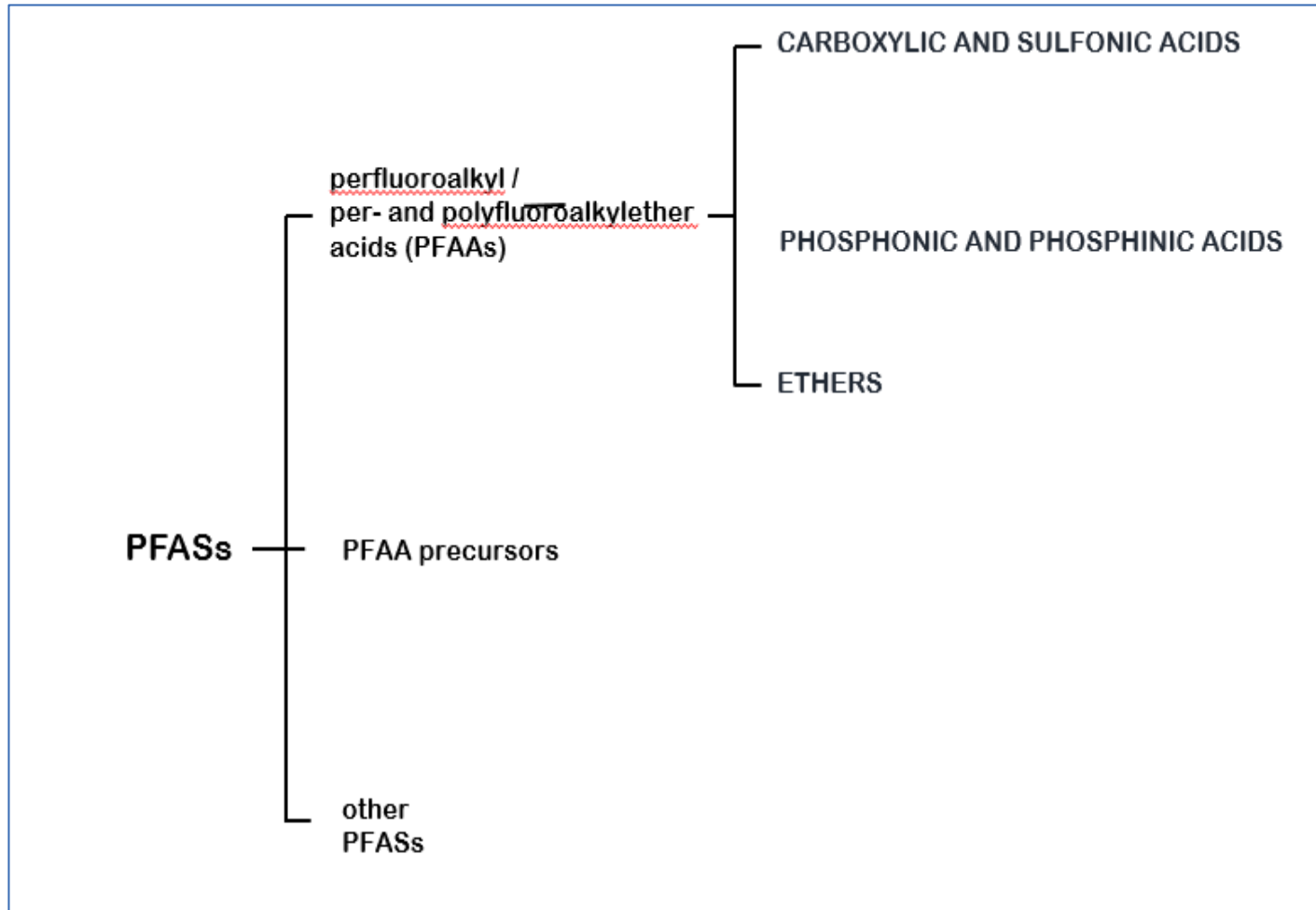
MA DPH is providing information to clinicians about medical care needs and answering questions from community members about their exposure and risk.



MassDEP has initiated a grant program to assist public water supplies as they address PFAS contamination.



Background on PFAS (p. 5)



PFOA - perfluorooctanoic acid

Also see Appendix A
for details/examples.



Summary of Scientific Information (p. 7)

To understand the characteristics of a range of PFAAs, the SAB examined eight substances of varying chain lengths: PFNA (C9); PFOS and PFOA (C8); PFHpA (C7); PFHxA and PFHxS (C6); and PFBA and PFBS (C4).

The SAB then reviewed two ethers (GenX and ADONA), and phosphonic and phosphinic acids (PFPA and PFPIAs) of varying chain lengths.

The SAB reviewed various health impacts as well as a number of degradation/transformation pathways, through which a PFAS precursor breaks down into one of the end degradation products.



Table 1: Chronic Health Effects (p. 10)

	PFNA	PFOA	PFOS	PFHpA	PFHxA	PFHxS	PFBA	PFBS	GenX	ADONA	PFPA/ PFPiA
Cancer		Kidney, testicular							X		
Immunotoxicity	X	Ulcerative colitis	X					X	X		
Thyroid		X			X	X	X	X		X	X
Endocrine (other than thyroid)					X	X	X	X			
Hematological		Cholesterol				X	X	X			
Liver/metabolic	X			X	X	X	X	X	X	X	X
Reproductive	X	PIH*							X	X	X
Developmental	X			X	X		X	X	X		
Neurodevelopmental						X					
Neurotoxicity	X				X	X		X			
Asthma						X		X			
Other	Mutagenicity				Kidney			Kidney	Kidney		Acute toxicity

Note: The SAB did not conduct a literature review for PFOS and PFOA due to the volume of information available through authoritative bodies and large scale epidemiological studies. Therefore, the endpoints shown for PFOA are not identical to those shown for the other chemicals, and are primarily the Board’s review of the C8 Health Study. For PFOS, the only endpoint noted is from the Board’s review of an NTP immunotoxicity study on PFOS and PFOA, although there is a significant body of evidence for many other chronic health effects.

* Pregnancy Induced Hypertension

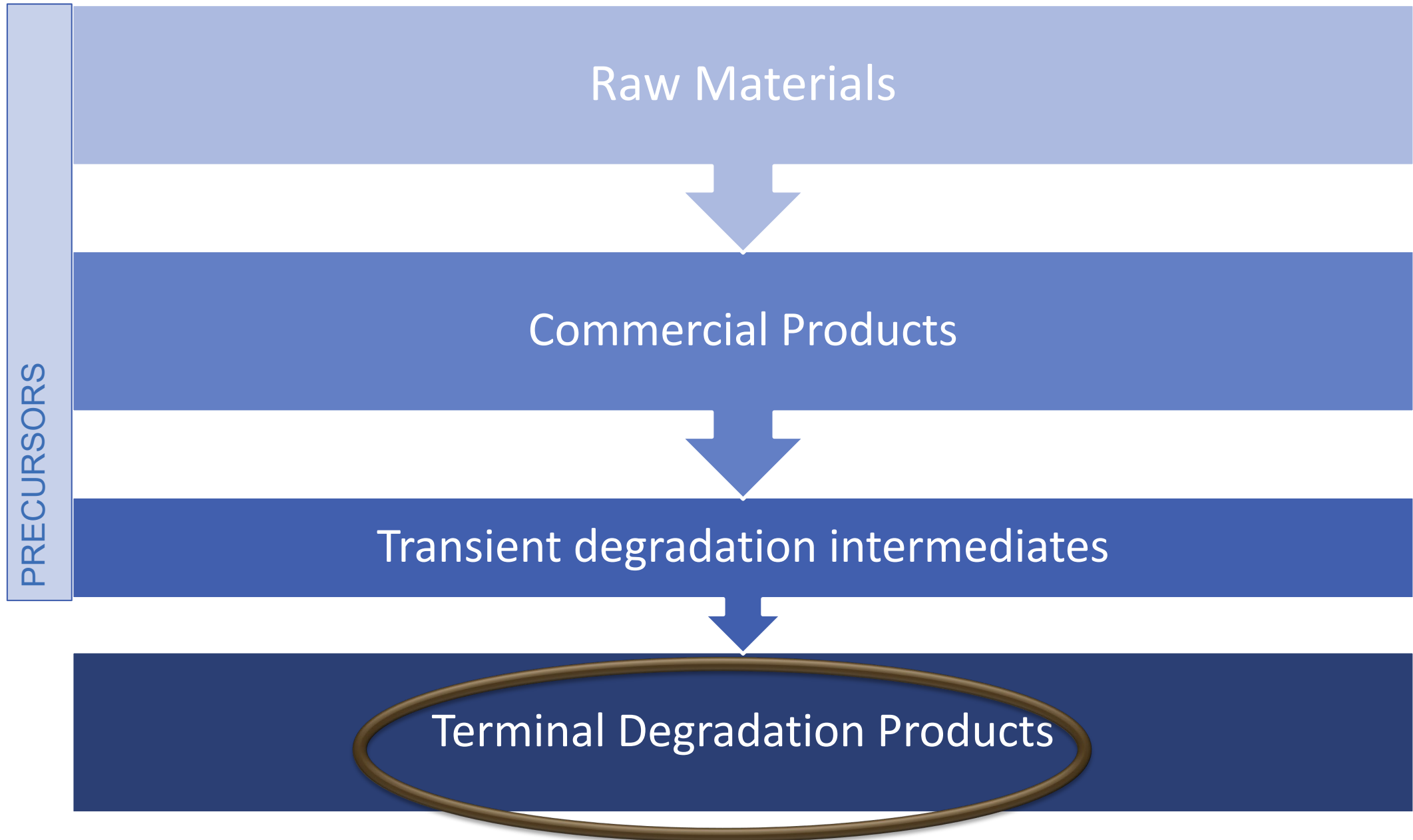
Table 2: Persistence, presence in the environment, & bioaccumulation (p. 10)

	PFNA	PFOA	PFOS	PFHpA	PFHxA	PFHxS	PFBA	PFBS	GenX	ADONA	PFPa/ PFPIA
Persistence	X	X	X	X	X	X	X	X	X	X	X
Bioaccumulation	X	X	X	X	X	X	X	X	X		X
Presence in the environment	X	X	X	X	X	X	X	X	X		
Presence in biota, including humans	X	X	X	X	X	X	X	X	X		X

- Notes:**
- Information on these chemical properties is drawn from peer reviewed studies and from US or EU and other government documents.
 - PFOS and its salts and perfluorooctanyl sulfonyl fluoride as well as PFOA, its salts, and PFOA-related compounds are designated as Persistent Organic Pollutants under the Stockholm Convention. For up to date information as of December 2019, see: <http://chm.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx>.
 - PFHxS, its salts and PFHxS-related compounds are under review for possible addition to the Stockholm Convention as well.
 - PFHxS and its salts are listed as vPvB, and PFNA and its salts, APFO, and PFOA are listed as PBT by the European Chemicals Agency (ECHA, Candidate List of Substances of Very High Concern for Authorization, <https://echa.europa.eu/candidate-list-table>).
 - For PFPAs and PFPIAs, evidence of bioaccumulation was primarily for longer chain substances and mixtures

Precursors

- In addition to reviewing the hazard information presented here, the SAB reviewed a number of degradation/transformation pathways.
- These are the pathways through which a PFAS **precursor** breaks down into one of the **end degradation** products.
- The SAB also reviewed the OECD spreadsheet and methodology for identifying PFAS precursors and looked at several representative precursors covering multiple breakdown pathways (See Appendix C for example pathways).
- **All the chemicals for which hazard information is presented here are end degradation products in addition to being used intentionally.**





SAB Recommendation

- Those PFAS that contain:
 - a perfluoroalkyl moiety with three or more carbons
 - (e.g., $-\text{C}_n\text{F}_{2n}-$, $n \geq 3$; or $\text{CF}_3-\text{C}_n\text{F}_{2n}-$, $n \geq 2$) or
 - a perfluoroalkylether moiety with two or more carbons
 - (e.g., $-\text{C}_n\text{F}_{2n}\text{OC}_m\text{F}_{2m}-$ or $-\text{C}_n\text{F}_{2n}\text{OC}_m\text{F}_m-$, n and $m \geq 1$), and
 - that are not otherwise listed, be added to the TURA list



Estimating use information (p. 10)

- Review Tier II : 5-10 potential filers
- SIC Specific search of business databases and websites to identify potential users: 20-40 estimated filers
- Program staff estimate a total of 25-50 users of PFAS in TURA covered sectors.
- This is a very rough estimate because of the lack of reliable information on use of PFAS.

Opportunities for TUR (p. 14)

- **Textile & fabric treatment**

- For visual/cosmetic applications, elimination may be most practical
- For protective applications (e.g. firefighters' protective clothing), need for research on safer alternatives
- Alternatives can include paraffins, silicones, dendrimers (hyper-branched polyurethane polymers), polyurethane, [siloxanes*], [urethanes*] (*under development & require alternatives assessment)
- Some companies have focused on specific product lines and specific PFAS. E.g., W.L. Gore has eliminated certain PFAS from over 50% of their “general outdoor product portfolio.”

Opportunities for TUR

- **Metal Finishing - Fume suppressants**
 - Hexavalent chromium plating and chromic acid anodizing operations
 - Reduce toxic vapors
 - Some products claim to be fluorine-free (may not be appropriate for all baths)
 - Safer alternatives to hexavalent chromium
 - Reducing use and emissions through improved process control, closed-loop processes, and improved O&M

Opportunities for TUR

- **Coatings: Food packaging & food contact paper**
 - Information on alternatives has been collected by Toxic-Free Future and Clean Production Action; Oregon; Washington
 - uncoated paper; paper with alternative coatings (petroleum or bio-based wax, kaolin clay, silicone and plastic (e.g., PET, PE, PVA, PLA); and non-paper materials, such as aluminum foil
- **Low-friction fluoropolymer coatings**
 - Medical devices
 - Siloxane-based coatings
 - Cookware
 - E.g. cast iron, enamel-coated cast iron, ceramic & stoneware, stainless steel, carbon steel



Opportunities for TUR

- **Fluoropolymer resins**
 - Used in manufacturing, e.g. insulation & jacketing of wire & cable
 - Variety of high-performance, non-fluorinated alternative resins
- **AFFF**
 - Primarily used by airports, military, & fire depts
 - Also some manufacturing facilities, though not likely to be subject to TURA requirements
 - Internationally, many airports have shifted to fluorine free foams (F3)
 - Many foam manufacturers now offer both options
 - Alternatives are cost competitive
 - MassDEP working with CT DEEP to test several F3 foams

Regulatory Context (p. 17)

- Due to emerging information on health and environmental impacts, and revelations about water supply contamination, a variety of regulatory processes are on-going.
- **International**
 - E.g. Certain PFAS addressed under Stockholm convention
 - E.g. EU: certain PFAS designated as SVHCs; others on Registry of Intentions for SVHC designation; restriction proposal for PFAS being prepared under REACH
 - Proposal being prepared by 5 member countries (Germany, Netherlands, Norway, Sweden & Denmark), & expected to enter into force in 2025
- **Federal**
- **States**



Regulatory Context

- **Federal**

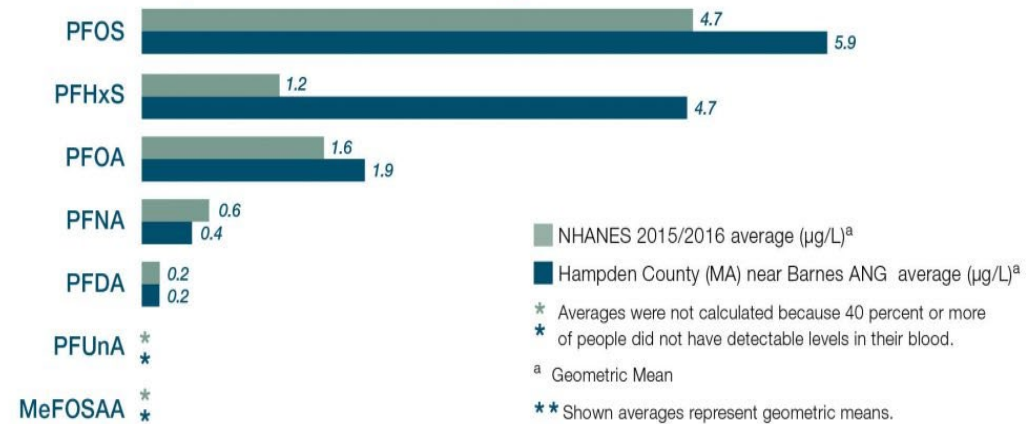
- TRI: NDAA provides for the addition of certain PFAS, effective January 1, 2020.
 - 100 lb reporting threshold
 - EPA has identified 172 PFAS meeting the NDAA criteria.
- TRI: EPA has issued an Advance Notice of Proposed Rulemaking (ANPRM) on possible listing of additional PFAS
 - Considering thresholds “that are lower than the usual statutory thresholds” due to persistence & bioaccumulation concerns

Regulatory Context

- Federal

- Significant New Use Rules (SNURs)
- Unregulated Contaminant Monitoring Rule 3 (UCMR 3)
 - Identified drinking water contamination in MA
- Health Advisory for PFOS and PFOA
- PFAS Action Plan (2019)
- Draft Toxicity Assessment for GenX and PFBS (2018)

PFAS Levels in Blood Compared to National Averages**



Source: ATSDR

- ATSDR toxicological profile (2018)
- ATSDR exposure assessments
 - Including Barnes Air Force Base in Westfield
- Dept of Defense – PFAS Task Force; stopped use of AFFF in training, testing & maintenance

Regulatory Context

- **State policies & approaches include:**
 - **monitor & study** PFAS;
 - **label or disclose** PFAS in products
 - **limit or ban** the use of PFAS;
 - **specify** that certain product types must be free of PFAS;
 - **regulate PFAS levels** in groundwater or drinking water.

Regulatory Context

- **States:** Examples are grouped by **type of activity** in the **text**, and grouped by **state** in **Appendix E**.

State	Actions
California	<ul style="list-style-type: none"> • Biomonitoring: PFASs are included in the state's biomonitoring program.¹²³ • Labelling and disclosure: In 2017, PFOS and PFOA were listed as known to the state to cause reproductive toxicity under Proposition 65. • California Safer Consumer Products Program: In 2018, the California Department of Toxic Substances Control proposed listing PFAS in carpets and rugs as a priority product under its Safer Consumer Products program,¹²⁴ and in November 2019, it proposed listing PFAS for use on converted textiles or leathers such as carpets, upholstery, clothing and shoes.¹²⁵
Connecticut	<ul style="list-style-type: none"> • Drinking water: The state's public health department developed a Drinking Water Action Level for drinking water in the state in which the sum of five PFAS chemicals (PFOA, PFOS, PFNA, PFHxS and PFHpA) should not exceed the limit of 70 ppt.¹²⁶
Massachusetts	<ul style="list-style-type: none"> • Drinking water: <ul style="list-style-type: none"> ○ In June 2018, MassDEP's Office of Research and Standards published recommendations that EPA's Health Advisories and Reference Doses for PFOS and PFOA also be applied to PFNA, PFHxS, and PFHpA, and that an additive toxicity approach be used. For PFBS, it recommended an interim approach of using the Minnesota standard.¹²⁷ ○ In December 2019, Massachusetts Department of Environmental Protection (MassDEP) issued a proposed regulation establishing a Total PFAS Contaminant Level (maximum contaminant level – MCL) of 20 ppt for the sum of the concentrations of six PFAS: PFOS, PFOA, PFHxS, PFNA, PFHpA, and perfluorodecanoic acid (PFDA). These regulations were promulgated in October 2020. • Groundwater cleanup standards: Massachusetts DEP proposed and adopted changes to its Waste Site Cleanup regulations to include new standards for PFAS. The groundwater cleanup standard for current or potential drinking water sources is set at 20 ppt for the six PFAS noted above. The standards became effective on December 27, 2019.¹²⁸ • Context for groundwater and drinking water standards: MassDEP noted that “since 2013, the sum of the concentrations of the six PFAS compounds above 20 ppt have been detected at over 20 PWSs [public water systems] in Massachusetts.”¹²⁹
Minnesota	<ul style="list-style-type: none"> • Environmentally Preferable Purchasing. State contract specifications require that compostable food ware products not contain PFAS.¹³⁰



Implications for the TURA Program (p. 25)

- Implications of category designation
- Compliance and reporting
- Thresholds
- TURA program services
- Fees and planning-related costs

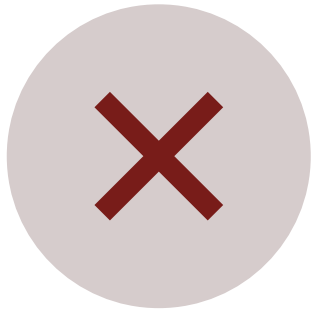


Implications of Category Designation

- Chemical categories are used in the TURA list in a number of cases.
- TURA's approach to categories has generally been based on the approach used under EPCRA.
- Most recent example: C1-C4 NOL.
- Defining a chemical category is appropriate in a number of circumstances & can provide several advantages compared with listing chemicals individually.



Implications of Category Designation



ADVERSE
SUBSTITUTIONS



INCOMPLETE LIST OF CAS
NUMBERS



SIMILAR HAZARDS
ACROSS A GROUP



CONFIDENTIAL BUSINESS
INFORMATION



Compliance and Reporting

- PFAS often not on SDS
- Facilities can request supplier disclosure
- Facilities can, but need not, conduct their own testing



Thresholds

TRI NDAA PFAS individually listed

- 100 lb threshold

PFAS NOL Category

- 10,000/25,000 lb threshold
- Unless HHS designation



TURA Program Services

- Information
- OTA services
- Industry Grants
- Research
- Continuing Education



Costs and Fees

- The total additional cost in fees to filers (and revenue to the program) could be \$27,500 to \$55,000 in per-chemical fees (25-50 filers for PFAS NOL).
- No new base fees are estimated at this time.



Thank you

Other slides

Implications of Category Designation

- Avoid **adverse substitutions**
- If there is an **incomplete set of CAS numbers**, a category defined through chemical structure is more informative
- **Similar hazards across a group**
- If manufacturers have claimed chemical identity as **CBI**, facilities reporting under TURA would not have to obtain and report specific chemical identity