

MA TURA PFAS Category and Avoiding Regrettable Substitutes

Liz Harriman – MA Toxics Use Reduction Institute NEWMOA Science of PFAS Conference April 5, 2022



Overview

- Chemical classes for prevention
- Massachusetts TURA Certain PFAS NOL category
- Avoiding regrettable substitutes

Massachusetts Toxics Use Reduction Act (TURA)

Helps Massachusetts companies and communities *reduce the use of toxic chemicals* while **promoting competitive advantage** of Massachusetts businesses

Chemical use reporting

Biennial toxics use reduction planning

Annual fee



TURA Program





Massachusetts Department of Environmental Protection (MassDEP): Planner certification, filings, enforcement, data analysis

Massachusetts Office of Technical Assistance and Technology (OTA): Business Assistance, On-site, confidential technical assistance



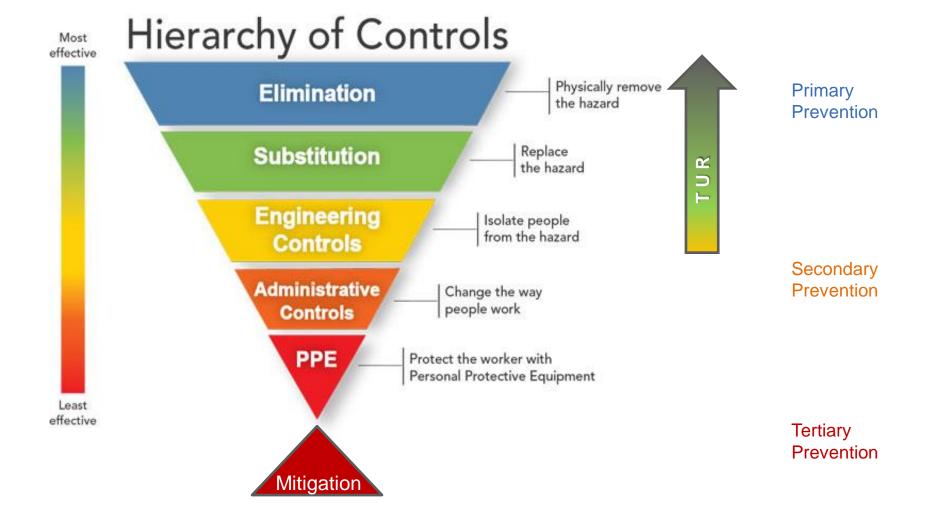
Massachusetts Toxics Use Reduction Institute (TURI): Training, grants, research, alternatives assessment, Science Advisory Board, policy analysis, technical support, laboratory, library

Science Advisory Board

Advisory Committee

Administrative Council

- Scientific recommendations
- Multi-stakeholder policy input
- Votes on policy initiatives (e.g. listing chemicals)



OECD 2018

OECD ENV/JM/MONO(2018)7 Toward A New Comprehensive Global Database Of Per- And Polyfluoroalkyl Substances (Pfass): Summary Report On Updating The OECD 2007 List Of Per- And Polyfluoroalkyl Substances (Pfass)

- perfluoroalkyl carboxylic acids (PFCAs), C_nF_{2n-1}-COOH 102 perfluoroalkane sulfonic acids (PFSAs), C_nF_{2n-1}-SO₃H 202 perfluoroalkyl phosphonic acids (PFPAs), C_nF_{2n-1}-PO_nH₂ 302 perfluoroalkyl / per- and polyfluoroalkylether - perfluoroalkyl phosphinic acids (PFPiAs), (C_nF_{2n-1})(C_mF_{2m-1})-PO₂H 303 acids (PFAAs) per- and polyfluoroether carboxylic acids (PFECAs), e.g. C₂F₅OC₂F₄OCF₂COOH 502 L per- and polyfluoroether sulfonic acids (PFESAs), e.g. C₆F₁₃OCF₂CF₂SO₃H 503 side-chain fluorinated polymers 204 e.g. (meth)acrylate, urethane or oxetane polymers perfluoroalkane sulfonyl fluorides (PASFs) \rightarrow PASF-based substances $C_nF_{2n+1}SO_2F$ 201 \rightarrow $C_nF_{2n+1}SO_2-R$ 200 C_nF_{2n+1}SO₂F 201 non-polymers R = NH, NHCH₂CH₂OH, etc. 203, side-chain fluorinated polymers 403 Fluorotelomer-based e.g. (meth)acrylate, urethane or oxetane polymers PFASs — PFAA precursors C_nF₂₀₊₁CH₂CH₂-R non-polymers R = NH, NHCH, CH, OH, etc. 402,404 402 Per- and polyfluoroether-based substances, e.g. C₄F_eOC₂F₄OC₅-CH₂OH (CAS number 317817-24-6) 504–507 polytetrafluoroethylene (PTFE), polyvinylidene fluoride (PVDF), fluorinated ethylene propylene (FEP), 801,802,803 fluoropolymers (FPs) perfluoroalkoxyl polymer (PFA), polyvinyl fluoride (PVF), etc. 804 805 etc. other PFASs perfluoropolyethers (PFPEs), e.g. HOCH₂O-(C_mF_{2m}O)_n-CH₂OH 507 b) Other highly fluorinated substances that match the definition of PFASs, but have not yet been commonly regarded as PFASs perfluorinated alkanes (C_nF_{2n+2}) 604 perfluorinated alkenes (C_nF_{2n}) and their derivatives (e.g. [(CF₃)₂CF]₂C=C(CF₃)(OC_cH_dSO₃Na), CAS number 70829-87-7) 605 $perfluoroalkyl\ alcohols\ (C_nF_{2n+1}OH; e.g.\ (CF_3)_3C-OH,\ CAS\ number\ 2378-02-1),\ perfluoroalkyl\ ketones\ (e.g.\ C_nF_{2n+1}O(O)C_mF_{2m+1})\ and\ semi-fluorinated\ ketones\ (e.g.\ C_nF_{2n+1}O(O)C_mH_{2m+1})$ side-chain fluorinated aromatics, e.g. C_nF_{2n-1}-aromatic rings 705 some hydrofluorocarbons (HFCs, e.g. C_nF_{2n+1} - C_mH_{2m+1}), hydrofluoroethers (HFEs, e.g. C_nF_{2n+1} 0 C_mH_{2m+1}) and hydrofluorocelfins (HFOs, e.g. C_nF_{2n+1} -CH=CH₂) that have a negleonally chain of certain length $\frac{703}{703}$ that have a perfluoroalkyl chain of certain length 701

Figure 2. Schematic overview of the structure categories of identified PFASs

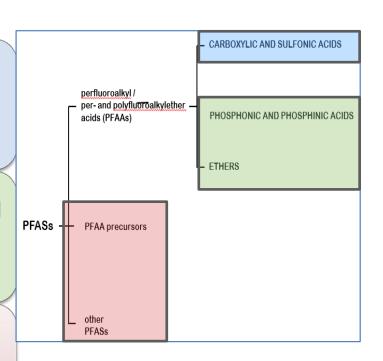
a) Commonly recognised per- and polyfluoroalkyl substances (PFASs)

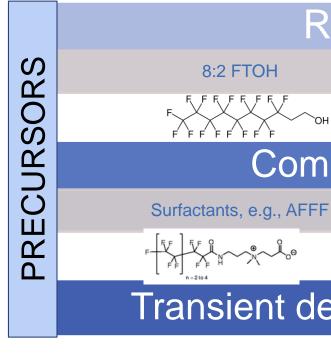
TURA SAB PFAS Evaluation

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.





Transient degradation intermediates

Terminal Degradation Products - PFAAs

PFBA PFBS PFHxA PFHxS PFHpA PFOA PFOS PFNA GenX PFPAs

TURA listed category: Certain PFAS NOL

Those PFAS that contain:

a perfluoroalkyl moiety with three or more carbons

• (e.g.,
$$-C_nF_{2n}-$$
, $n \ge 3$; or $CF_3-C_nF_{2n}-$, $n \ge 2$) or

a perfluoroalkylether moiety with two or more carbons

• (e.g.,
$$-C_nF_{2n}OC_mF_{2m}$$
 – or $-C_nF_{2n}OC_mF_m$ –, n and m ≥ 1), and

- wherein for the example structures shown, the dash (–) is not a bond to a hydrogen and may represent a straight or branched structure, and
- that are not otherwise listed

More information:

https://www.turi.org/Our_Work/Toxic_Chemicals/Chemical_Information/Per-_and_poly-fluoroalkyl_substances_PFAS/PFAS_Tracking_Required_Under_TURA

Why designate a category or class?



ADVERSE SUBSTITUTIONS



INCOMPLETE LIST OF CAS NUMBERS



SIMILAR HAZARDS ACROSS A GROUP



BUSINESS INFORMATION

Prevention Approach: Avoiding Regrettable Substitutes

Use an Alternatives Assessment framework

Evaluate use and function. Is it necessary?

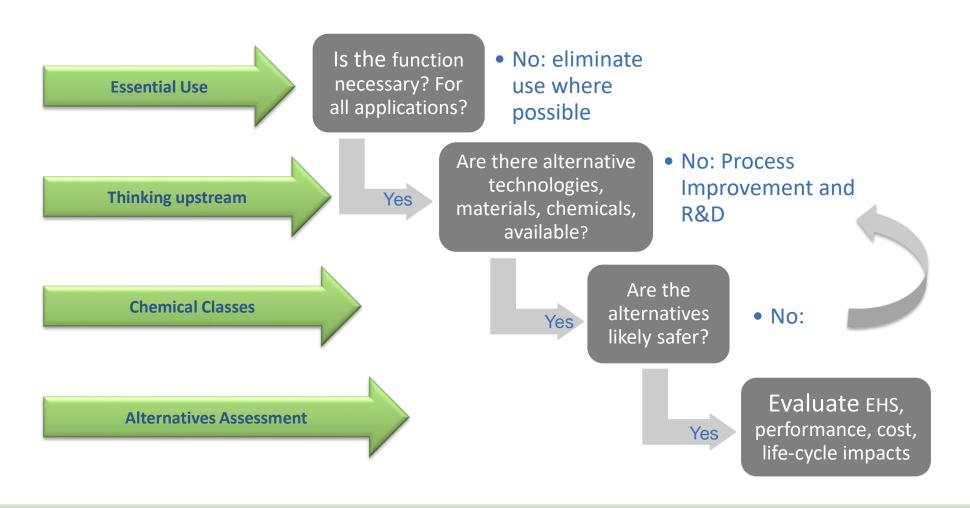
Essential uses concept

Evaluate safer alternatives

Class approach, life-cycle thinking

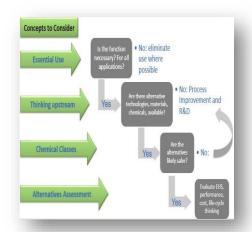
If use is essential and no safer alternatives available, look for process improvements, eliminating emissions and exposure. Move to R&D.

Concepts to Consider

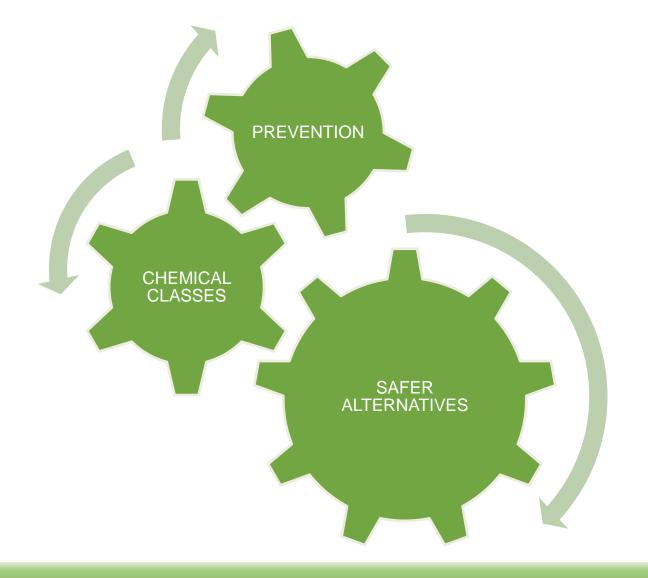


Hex Chrome Fume/Mist Suppressants

- Function low surface tension
 - Limits release of Cr⁺⁶ from metal finishing baths
- Essential? For all or some applications?
 - Performance criteria vary somewhat with application
- Alternatives
 - Non-hex chrome metal finishing
 - Closed systems
 - Drop in alternatives
 - C6 fluorinated surfactants (same chemical class)
 - Non-fluorinated surfactants
- Need for continued R&D for Cr⁺⁶ metal finishing alternatives and nonfluorinated fume suppressants









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