PFAS Uses and Avoiding Regrettable Substitutes

Liz Harriman, Toxics Use Reduction Institute

NEWMOA PFAS Webinar Series

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PFAS Uses and Avoiding Regrettable Substitutes

TURA and TUR approach

PFAS and uses

Strategies for avoiding regrettable substitutes

Examples

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

- Scientific recommendations

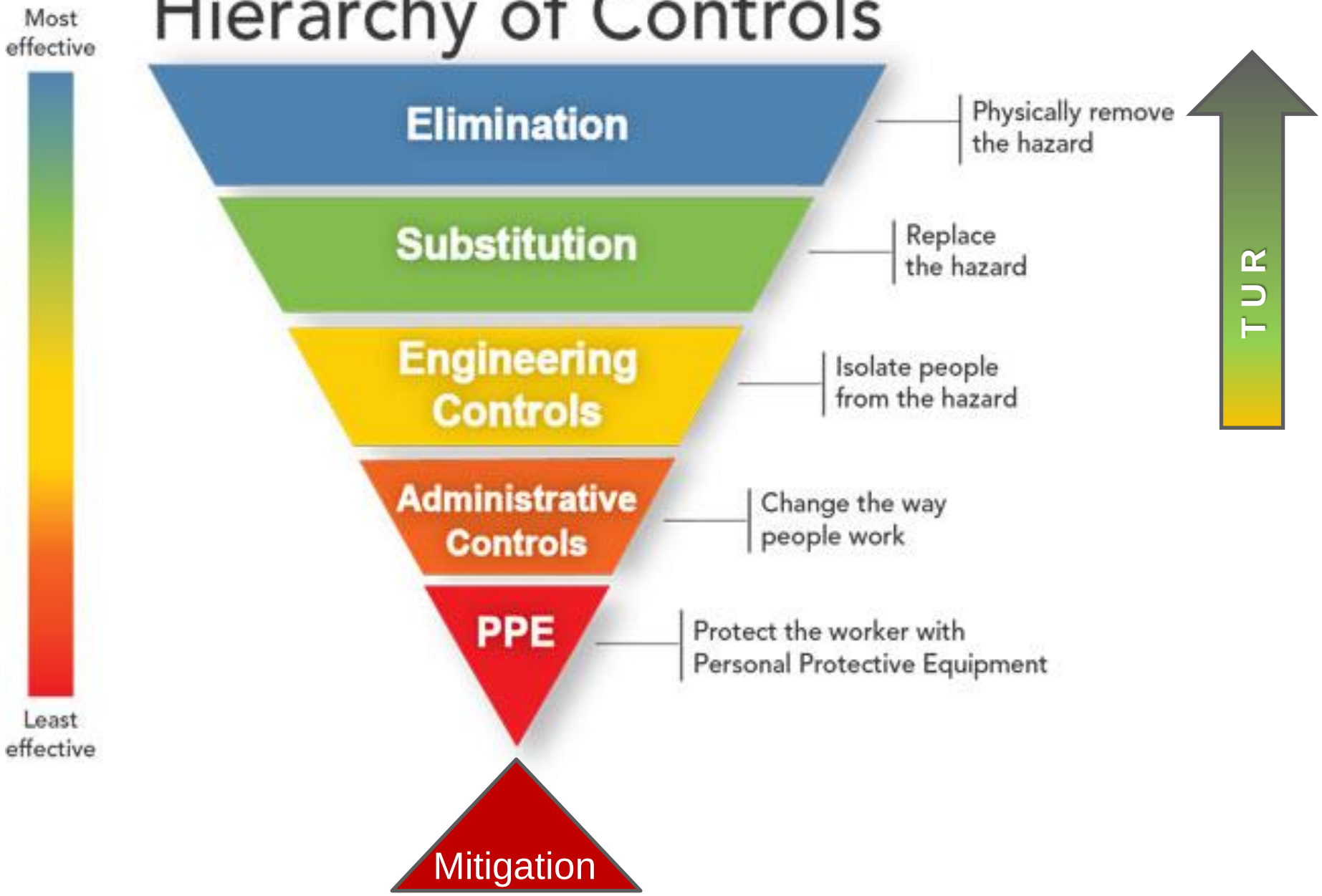
Advisory Committee

- Multi-stakeholder policy input

Administrative Council

- Votes on policy initiatives (e.g. listing chemicals)

Hierarchy of Controls



Primary Prevention

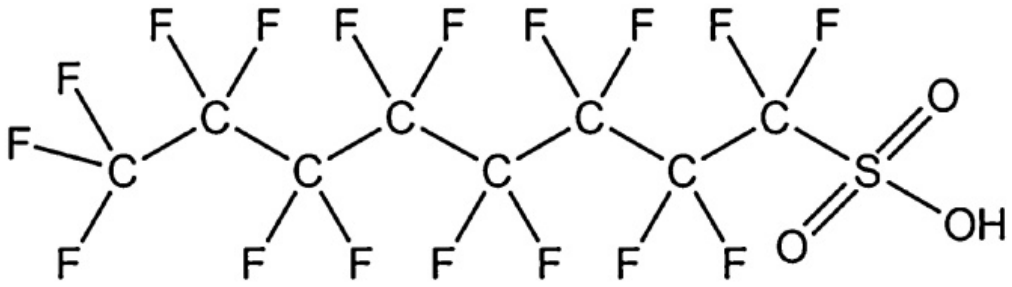
Secondary Prevention

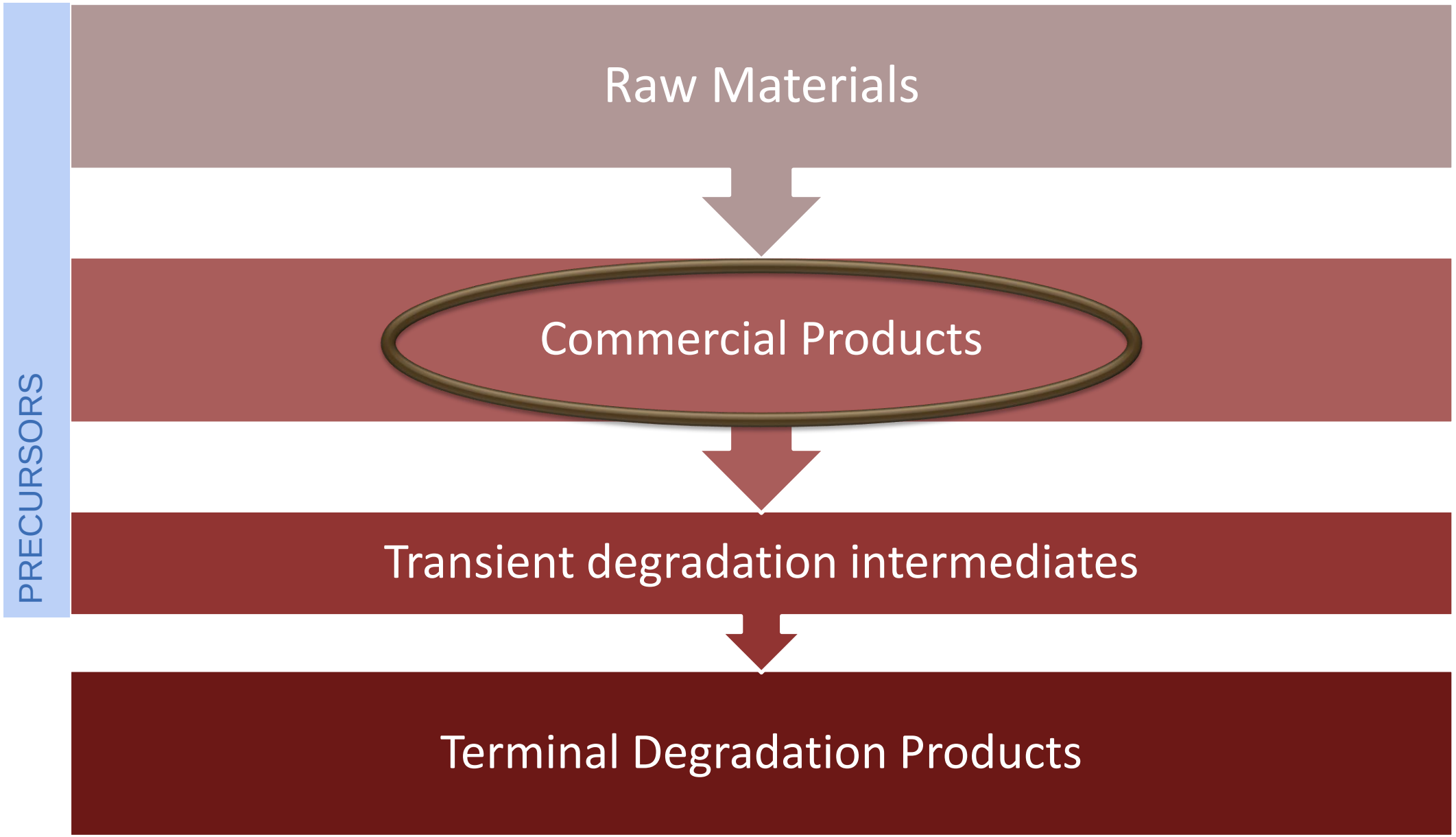
Tertiary Prevention

What are PFAS?

- Fluorinated carbon chain
- Large class of chemicals - 4,700 identified by OECD

Example – PFOS:

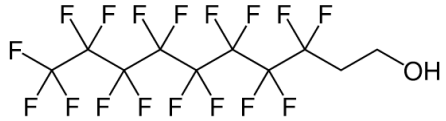




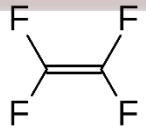
PRECURSORS

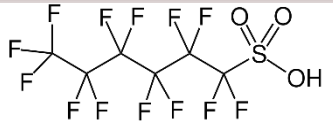
Raw Materials

8:2 FTOH



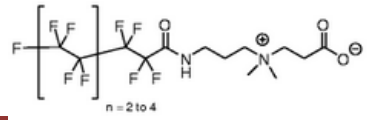
TFE and PFAAs



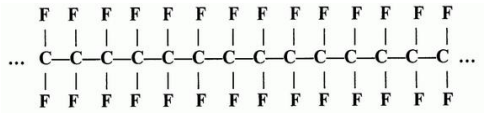


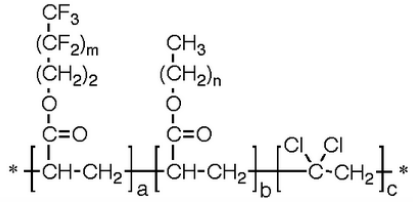
Commercial Products

Surfactants, e.g., AFFF



PTFE (Teflon); side chain polymers

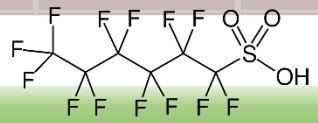




Transient degradation intermediates

Terminal Degradation Products - PFAAs

PFBA	PFBS	PFHxA	PFHxS	PFHpA	PFOA	PFOS	PFNA	GenX	PFPAs



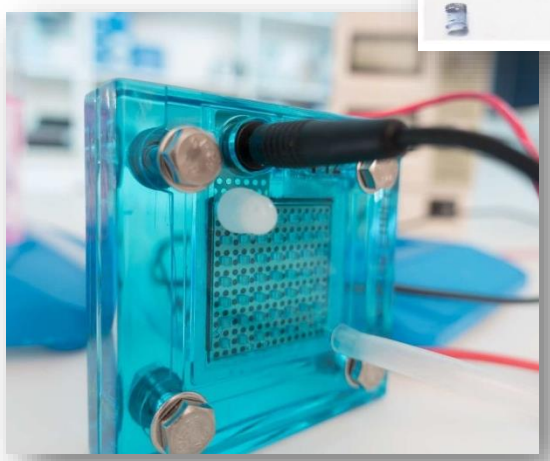
Some Uses and Sources of PFAS

- Oil & water repellency
- Lubricant, emulsifier
- Surfactant, film former
- Non-reactive/low surface tension

Source: Green Science Policy Institute, used with permission. www.greensciencepolicy.org

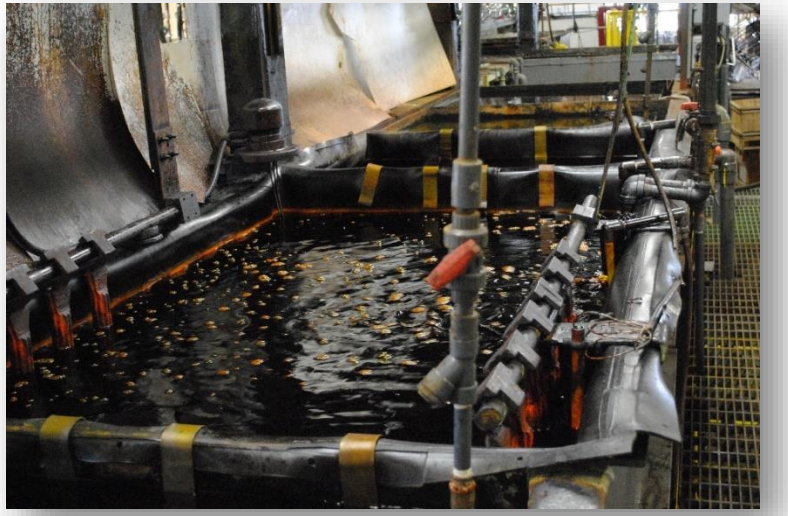
Industrial Uses

- Polymers and Resins
  - Fluoropolymers, and as feedstock and processing aids in their manufacture (e.g., PTFE, PVDF, FEP)
  - Side-chain fluoropolymers
  - Non-fluorinated resin processing aids
  - Fluorination of HDPE containers
  - Additives in coatings
  - Membranes (e.g., Nafion)



Industrial Uses

- Metal finishing
  - Surfactants - Fume/mist suppressants
  - Bath additive in nickel, copper and tin plating
- Solvents - HFE's (hydrofluoroethers),
- Solvents, blowing agents, refrigerants - HFO's, HFC's
- Surfactants, lubricants, coatings in many industries



Prevention Approach:
Avoiding Regrettable Substitutes

Use an Alternatives Assessment framework

Evaluate use and function. Is it necessary?

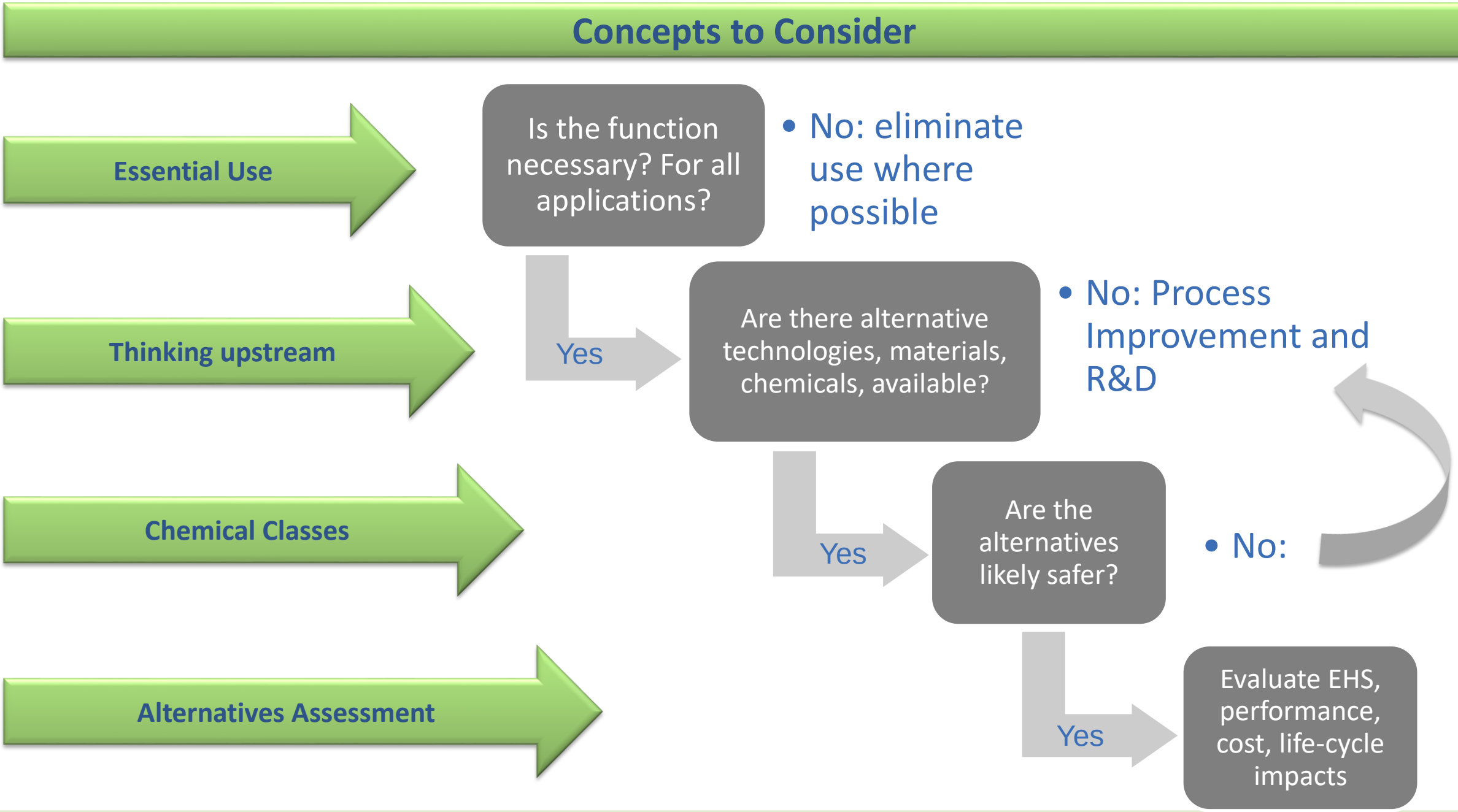
Essential uses concept

Evaluate safer alternatives

Class approach, life-cycle thinking

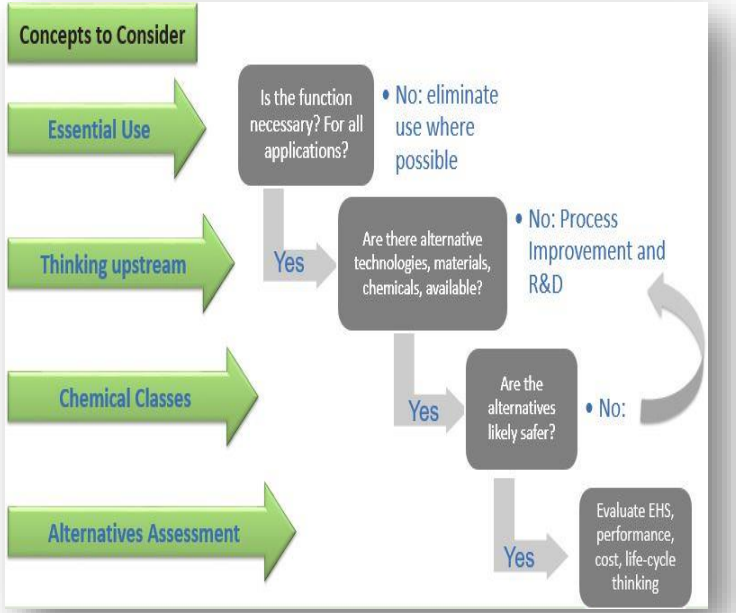
If use is essential and no safer alternatives available, look for process improvements, eliminating emissions and exposure. Move to R&D.

Concepts to Consider

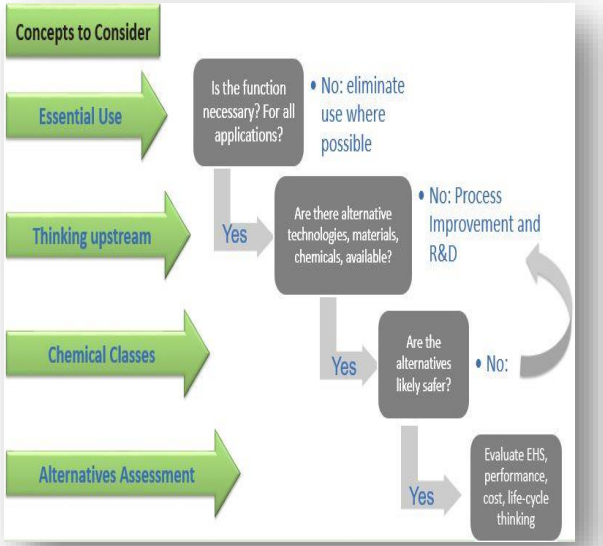


Ski Wax

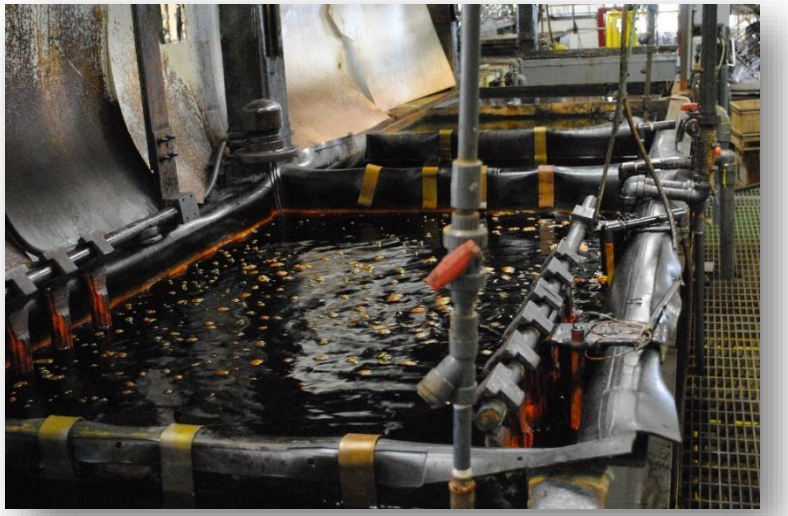
- Function
  - Low friction, water resistant coating
- Essential? For all or some applications?
  - Performance criteria varies with application
- Alternatives
  - Drop in/alternative coatings
    - Hydrocarbon wax
    - C6 fluorowax (same chemical class)
    - Novel non-fluorowaxes (e.g., SWIX Pro)
  - Alternative ski material or surface topography
- Assess alternatives for hazard, specific performance requirements, cost, life cycle impacts



Hex Chrome Fume/Mist Suppressants

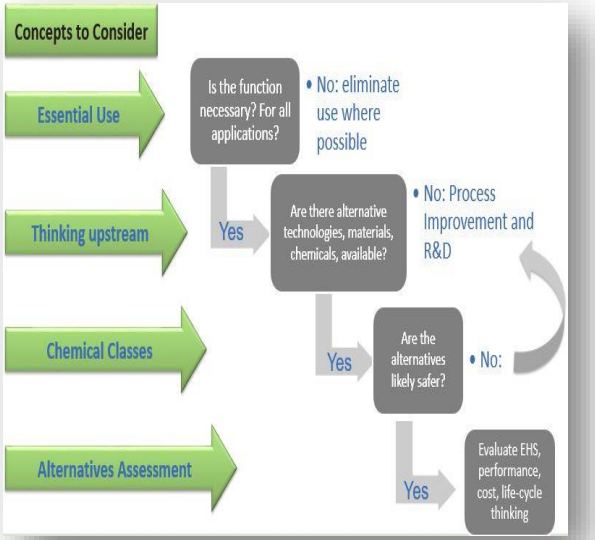


- Function – low surface tension
  - Limits release of Cr^{+6} from metal finishing baths
- Essential? For all or some applications?
  - Performance criteria vary somewhat with application
- Alternatives
  - Non-hex chrome metal finishing
  - Closed systems
  - Drop in alternatives
    - C6 fluorinated surfactants (same chemical class)
    - Non-fluorinated surfactants



- Need for continued R&D for Cr^{+6} metal finishing alternatives and non-fluorinated fume suppressants

DWR Textile Coatings



- Function
  - Water and oil repellant
- Essential? For all or some applications?
  - Fit for Purpose – wide range of performance needs
    - Roofing membranes, yurts, tents, sails, upholstery
    - Outdoor wear, children's fleece, footwear, leather
- Alternatives
  - Alternative textile materials, weaving and fiber modification
  - Alternative coatings: fluorinated, siloxanes/silicones, hydrocarbons, polyurethane, nanomaterials, dendrimers,
  - Effective water repellency; challenges with oil repellency
- Assess alternatives for hazard, specific performance requirements, cost, life cycle impacts

Selected Resources

- Glüge, et al, 2020. An overview of the uses of per- and polyfluoroalkyl substances (PFAS) , *Environ. Sci.: Processes Impacts, 2020, 22, 2345* - With extensive supplementary information
- Buck and Korzeniowski, 2019. The PFAS Universe Webinar
- Cousins, et al, 2019. The concept of essential use for determining when uses of PFASs can be phased out, *Environ. Sci.: Processes Impacts, 2019, 21, 1803*
- Global PFAS Science Panel www.pfassciencepanel.org/
- Cousins, et al 2021. The High Persistence of PFAS is Sufficient for their Management as a Chemical Class, *Environ Sci Process Impacts. 2020 Dec 16; 22(12): 2307–2312*.
- Bălan, et al, 2021. Regulating PFAS as a Chemical Class under the California Safer Consumer Products Program, EHP Commentary
- Green Science Policy Institute – upcoming report*: Building a Better World: Eliminating Unnecessary Uses of PFAS in Building Materials*.
- Industry Fluoropolymer Use information: Performance Fluoropolymer Partnership
- Draft PFAS Category Policy Analysis for TURA program – Oct 2020
- EU Commission DG Environment, 2019. *The use of PFAS and fluorine-free alternatives in textiles, upholstery, carpets, leather and apparel*, Doc Ref. 42054-WOOD-XX-XX-RP-OP-0004_S4_P01.3

Thank you

Liz Harriman
harriman@turi.org

978-934-3387

www.turi.org

Toxics Use Reduction Institute
University of Massachusetts Lowell