

The webinar will begin shortly.

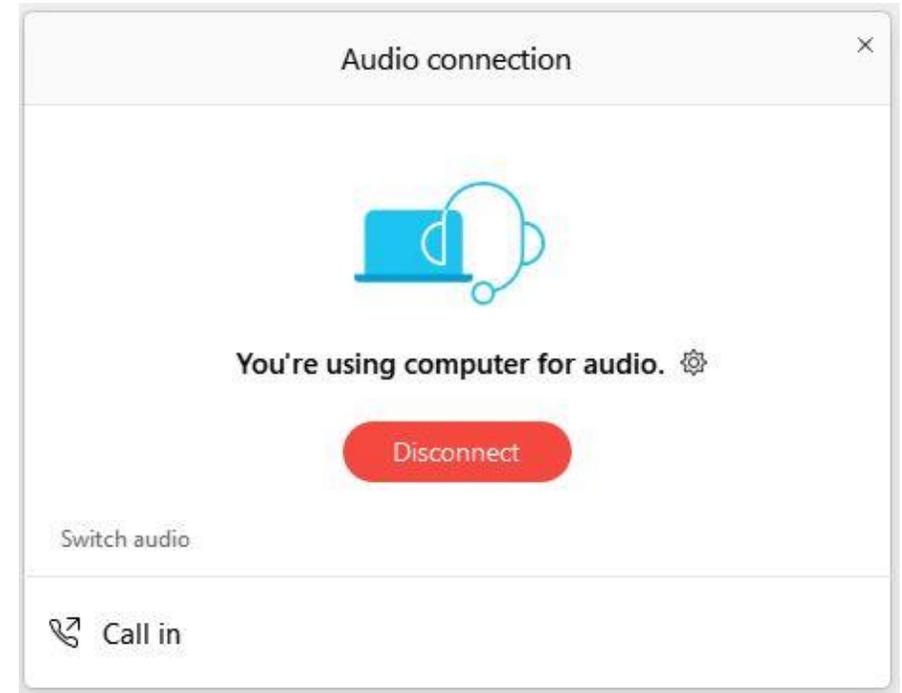
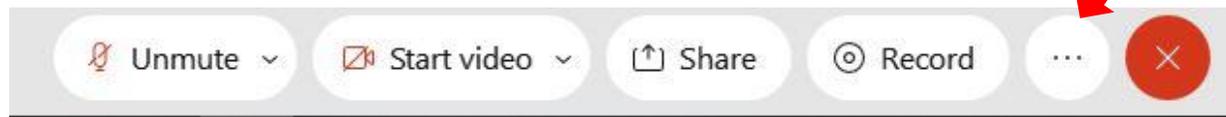


Per- and Polyfluoroalkyl Substances in Food Packaging Alternatives Assessment

March 23, 2021

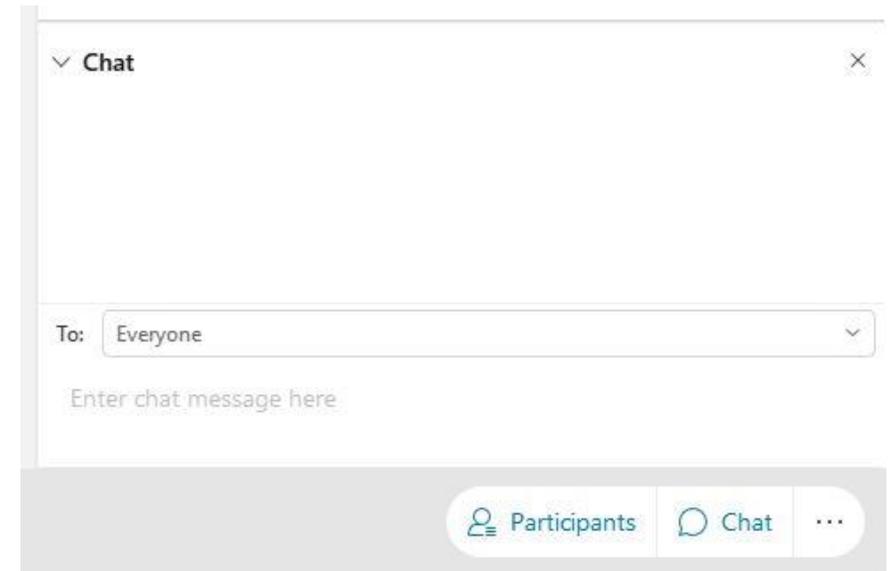
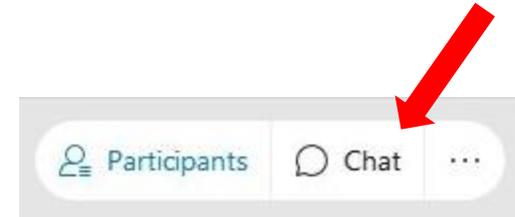
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Webinar logistics

- All lines are muted.
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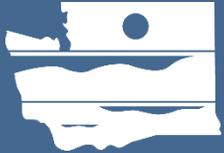


Per- and Polyfluoroalkyl Substances in Food Packaging Alternatives Assessment

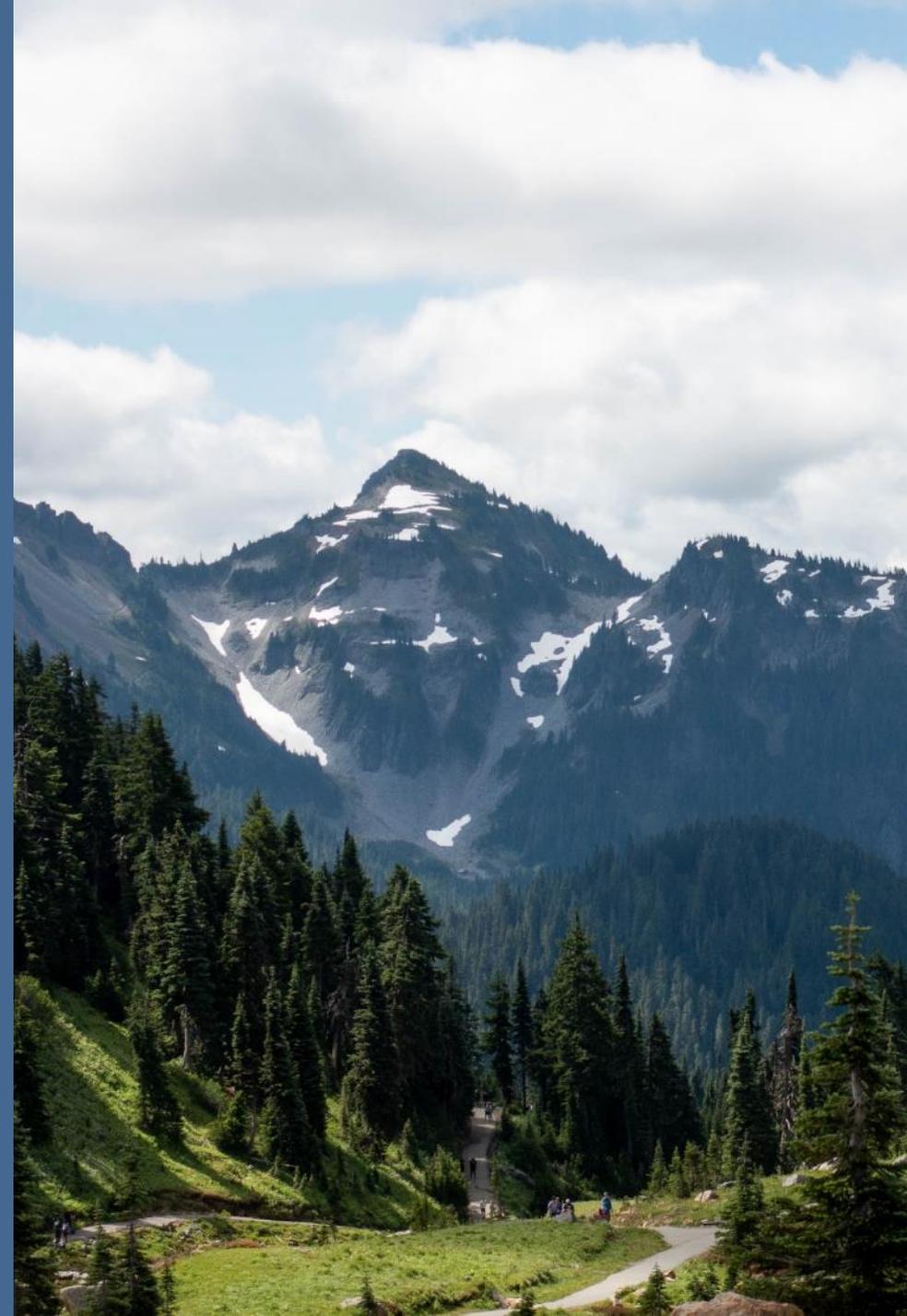
March 23, 2021

Topics for today

1. Regulatory overview and statutory requirements
2. Background and scope
3. Assessment findings
4. Implementation and future steps



Regulatory overview and statutory requirements



ESHB 2658 (2018) – what it does

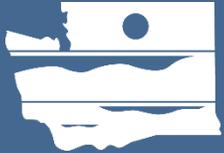
- Codified at [RCW 70A.222.070](#).
- In WA, prohibits sale of food packaging with intentionally added PFAS.
- Prohibitions are by “specific food packaging application,” not all packaging generally.
- **BEFORE** restriction can take effect, Ecology must:
 - Identify safer alternatives are available.
 - Publish findings in Washington State Register.
 - Submit report to the Legislature.

Statutory elements – determinations

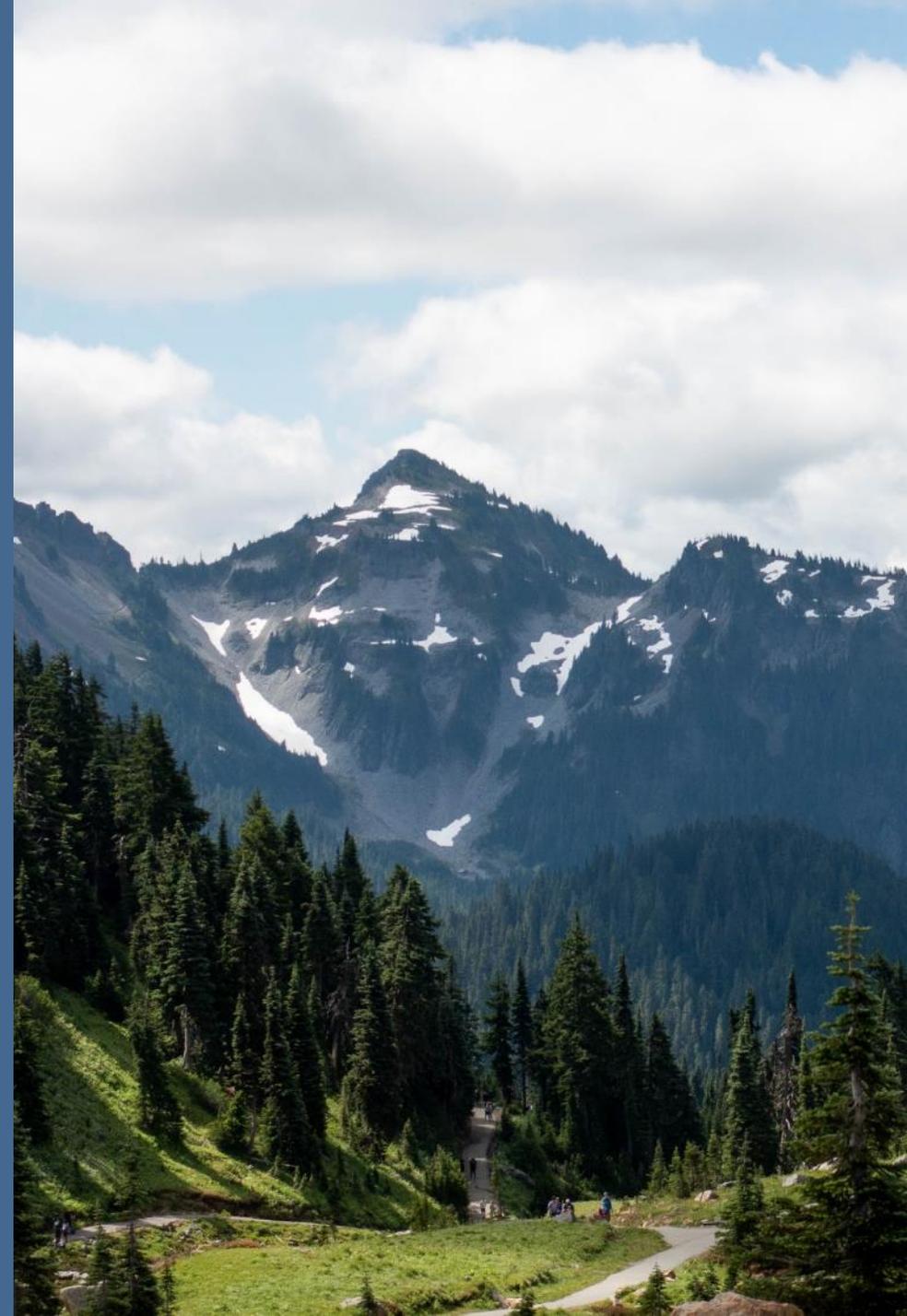
- Determinations must be made using alternatives assessment.
 - Must evaluate less toxic chemicals and nonchemical alternatives.
 - Must follow Interstate Chemicals Clearinghouse (IC2) guidelines.
 - Must use IC2 modules to evaluate potential alternatives for:
 - Chemical hazards
 - Exposure
 - Performance
 - Cost
 - Availability
- Results must be supported by external peer review
 - Washington State Academy of Sciences

Statutory elements – effective dates

- Ecology did not submit findings in 2020.
 - Prohibition in [RCW 70A.222.070\(1\)](#) does not take effect in 2022.
- Instead, we follow provisions in [RCW 70A.222.070\(5\)](#):
 - If no safer alternatives identified by January 1, 2020, Ecology directed to repeat assessment process annually starting January 1, 2021.
 - Prohibition takes effect two years after Ecology submits the report.
- Ecology published and submitted first set of findings to the Legislature in February 2021.



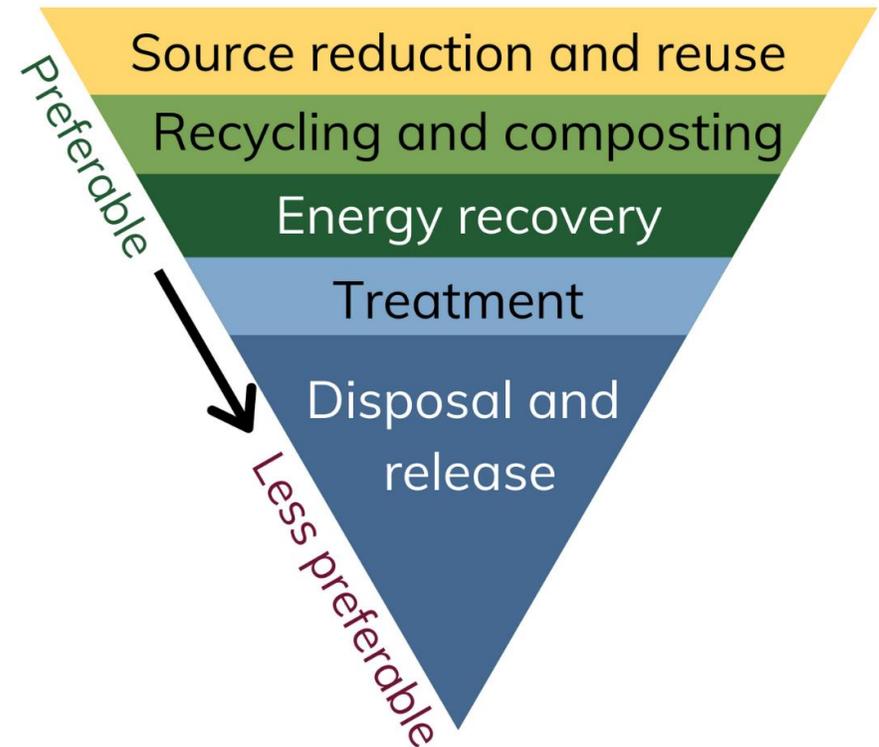
The First PFAS in Food Packaging Alternatives Assessment



Alternatives assessments

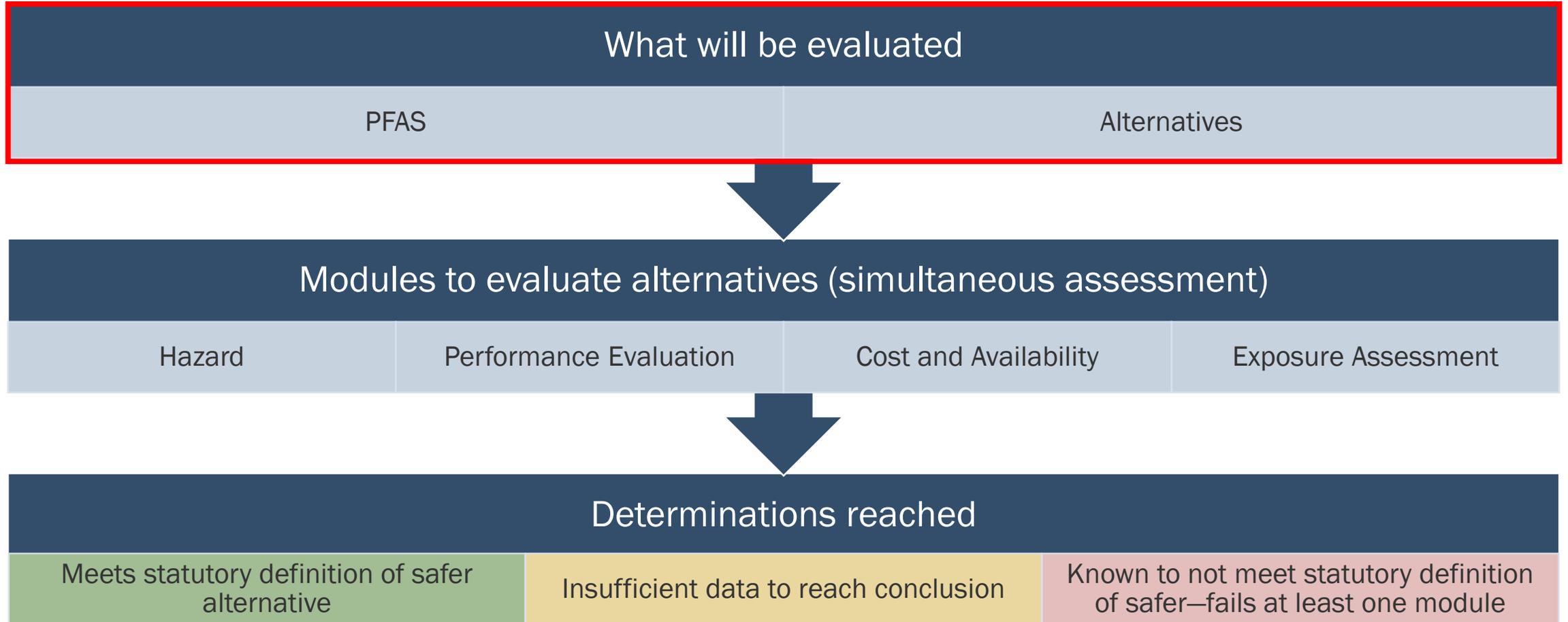
- The alternatives assessment framework focuses on reducing risk by avoiding exposure to hazardous chemicals.
- Prioritizes safer alternatives that are commercially available and technically and economically feasible.

Waste Management Hierarchy



$$\downarrow \text{Hazard} \times \text{Exposure} = \downarrow \text{Risk}$$

IC2 AA Guide 1.1 Evaluation Process



Stakeholder involvement

- Followed IC2 Guide Level 2 Stakeholder Involvement Module
- Stakeholders included:
 - Chemical and packaging manufacturers
 - NGOs
 - Trade organizations
 - State, local, federal government
 - Product users
- Provided input on:
 - Project scope
 - Evaluation methodologies
 - PFAS and alternative technologies



Definitions

- "Perfluoroalkyl and polyfluoroalkyl substances" or "PFAS chemicals" means:
 - A class of fluorinated organic chemicals containing at least one fully fluorinated carbon atom.
- Definition of food package:
 - Intended for direct food contact.
 - Comprised, in substantial part, of paper, paperboard, or other materials originally derived from plant fibers.

Scope: PFAS in food packaging

- PFAS provide oil, grease, and water resistance to packaging.
- Applied to surface or into plant fiber slurry.
- Considered PFAS common in fiber-based food packaging:
 - Side-chain fluorinated polymers.
 - Chemical manufacturers have begun voluntarily phasing out several of these side-chain fluorinated polymers.
 - Perfluoropolyethers.
 - Residual PFAS.



Final AA scope

Identified ten food packaging applications from three original categories.

Category 1:

Food contact paper

- Wraps & liners
- Bags & sleeves

Category 2:

Dinnerware

- Plates
- Bowls
- Trays
- Food boats

Category 3:

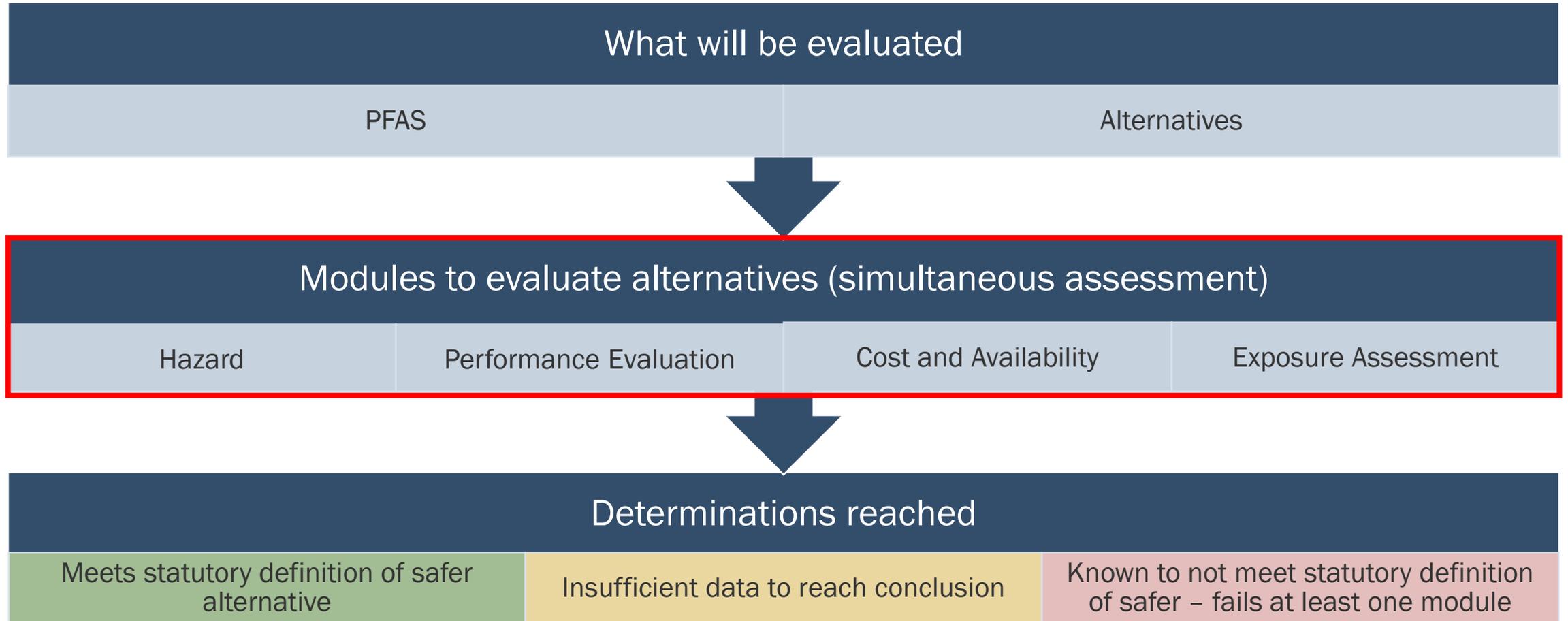
Take-out containers

- Pizza boxes
- French fry cartons
- Clamshells
- Interlocking folded containers

Alternative substances reviewed

Alternative substance	Alternative substance type
Uncoated paper	Process
Petroleum-based waxes	Chemical
Bio-based waxes	Chemical
Kaolin clay	Chemical
PVOH – polyvinyl alcohol	Chemical
Siloxanes (based on vinyl silicone polymer)	Chemical
PLA – polylactide (based on degradation and residual breakdown products)	Chemical or material
PE – polyethylene	Chemical
PET– polyethylene terephthalate	Chemical
EVOH – ethylene vinyl alcohol	Chemical

IC2 AA Guide 1.1 Evaluation Process



Different definitions of alternatives

PLA Foam

- Alternative substance
- Hazard
- Exposure

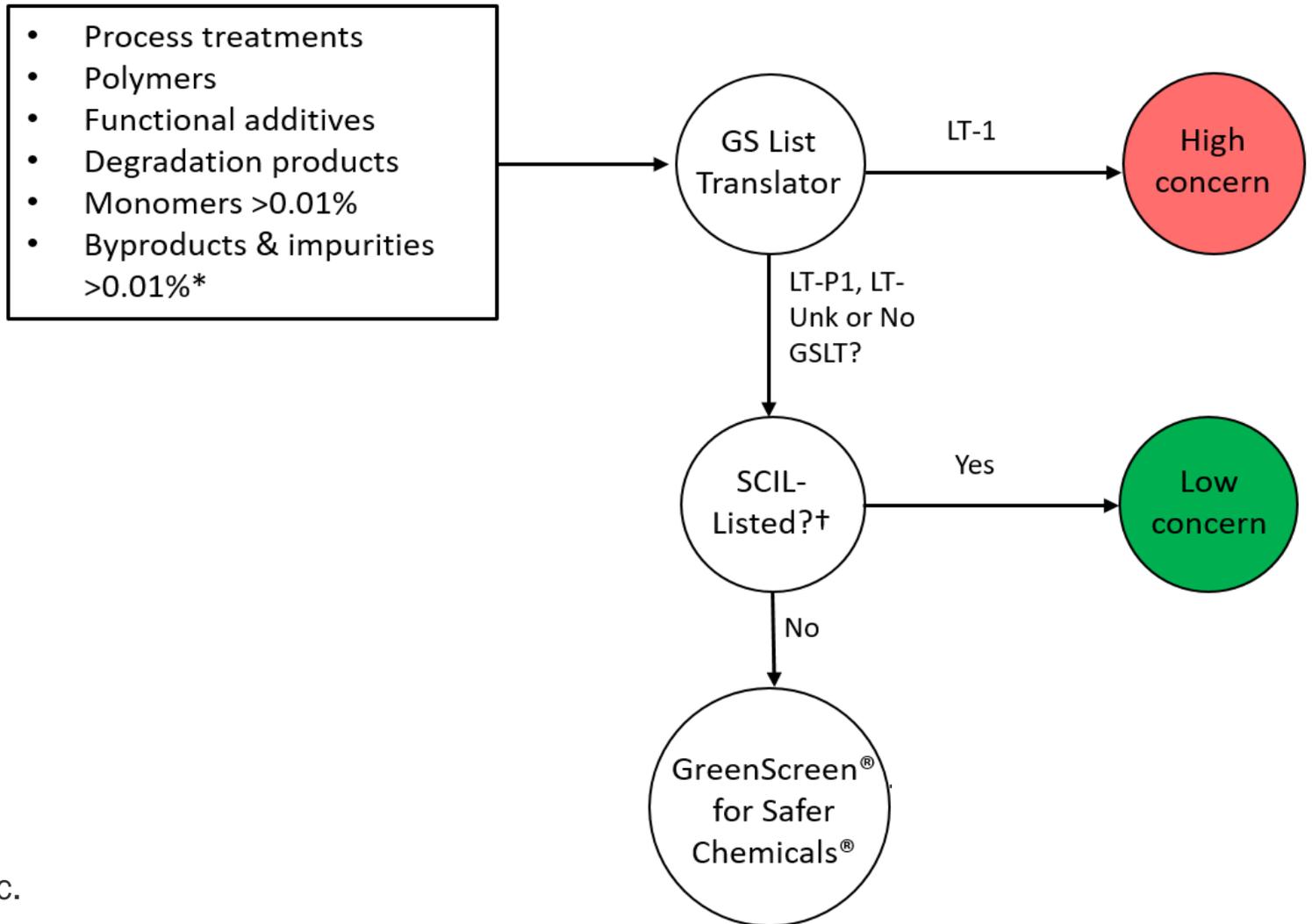
PLA Foam Tray

- Alternative product
- Performance
- Cost
- Availability



Hazard Module

Based on IC2
Guide Level 2
Hazard Module



See an [accessible version](#) of this graphic.

Findings – Hazard Module

EPA Safer Chemicals Ingredients List

- Assessed using EPA Safer Choice hazard criteria.
- Only chemicals listed with “green circle” were designated low concern.

Alternative substance	Determination
Uncoated paper	Low concern
Petroleum-based waxes	Low concern
Bio-based waxes	Low concern
Kaolin clay	Low concern
PVOH – polyvinyl alcohol	Low concern

Hazard Module

GreenScreen for Safer Chemicals® evaluation

- Based on EPA Safer Choice hazard criteria.
- 18 endpoints for human and environmental health.
- Translates into four benchmarks from 1 (Avoid) to 4 (Prefer).



Hazard Module

TABLE 1. Example GreenScreen Hazard Summary Table for a Chemical

Group I Human					Group II and II* Human								Ecotex		Fate		Physical		
C	M	R	D	E	AT	ST		N		SnS*	SnR*	IrS	IrE	AA	CA	P	B	Rx	F
						SINGLE	REPEATED*	SINGLE	REPEATED*										
DG	L	L	M	M	DG	L	L	M	M	L	L	L	L	L	L	vH	M	L	L

Glossary of GreenScreen* Hazard Endpoint Abbreviations

AA Acute Aquatic Toxicity	D Developmental Toxicity	M Mutagenicity and Genotoxicity	SnS Sensitization (Skin)
AT Acute Mammalian Toxicity	E Endocrine Activity	N Neurotoxicity	SnR Respiratory Sensitization
B Bioaccumulation	F Flammability	P Persistence	ST Systemic/Organ Toxicity
C Carcinogenicity	IrE Eye Irritation	R Reproductive Toxicity	
CA Chronic Aquatic Toxicity	IrS Skin Irritation	Rx Reactivity	* Repeated exposure

See an [accessible version](#) of this graphic.

Findings – Hazard Module

- We conducted or reviewed GreenScreen® hazard assessments for two alternative substances.
- Assessed components of PLA in absence of PLA formulation information.
- Unable to use similar process for other polymer coatings.

Alternative substance	Determination
Siloxanes (based on vinyl silicone polymer)	<p align="center">Benchmark-1 (Avoid—Chemical of Concern)</p>
PLA – polylactic acid (based on components of polymer)	<p align="center">Consistent with Benchmark-3 (Use but still opportunity for improvement)</p>

Findings – Hazard Module

- Did not receive GreenScreen® hazard assessment for the side-chain fluorinated polymer PFAS prior to peer review.
- Reviewed publicly available GreenScreen® hazard assessments for two PFAS associated with side-chain fluorinated polymers used in food packaging.
- Benchmark scores are 1 (Avoid Chemical of High Concern).

Substance	Determination
6:2 Fluorotelomer alcohol	<p align="center">Benchmark-1 (Avoid—Chemical of Concern)</p>
Perfluorohexanoic acid	<p align="center">Benchmark-1 (Avoid—Chemical of Concern)</p>

Findings – Hazard Module

Alternative substance	Determination
Uncoated paper	Less hazardous than PFAS
Petroleum-based waxes	Less hazardous than PFAS
Bio-based waxes	Less hazardous than PFAS
Kaolin clay	Less hazardous than PFAS
PVOH – polyvinyl alcohol	Less hazardous than PFAS
Siloxanes (based on vinyl silicone polymer)	NOT less hazardous than PFAS
PLA – polylactide (based on components of polymer)	Less hazardous than PFAS
PE – polyethylene	Insufficient data to draw conclusion
PET– polyethylene terephthalate	Insufficient data to draw conclusion
EVOH – ethylene vinyl alcohol	Insufficient data to draw conclusion

Exposure Module

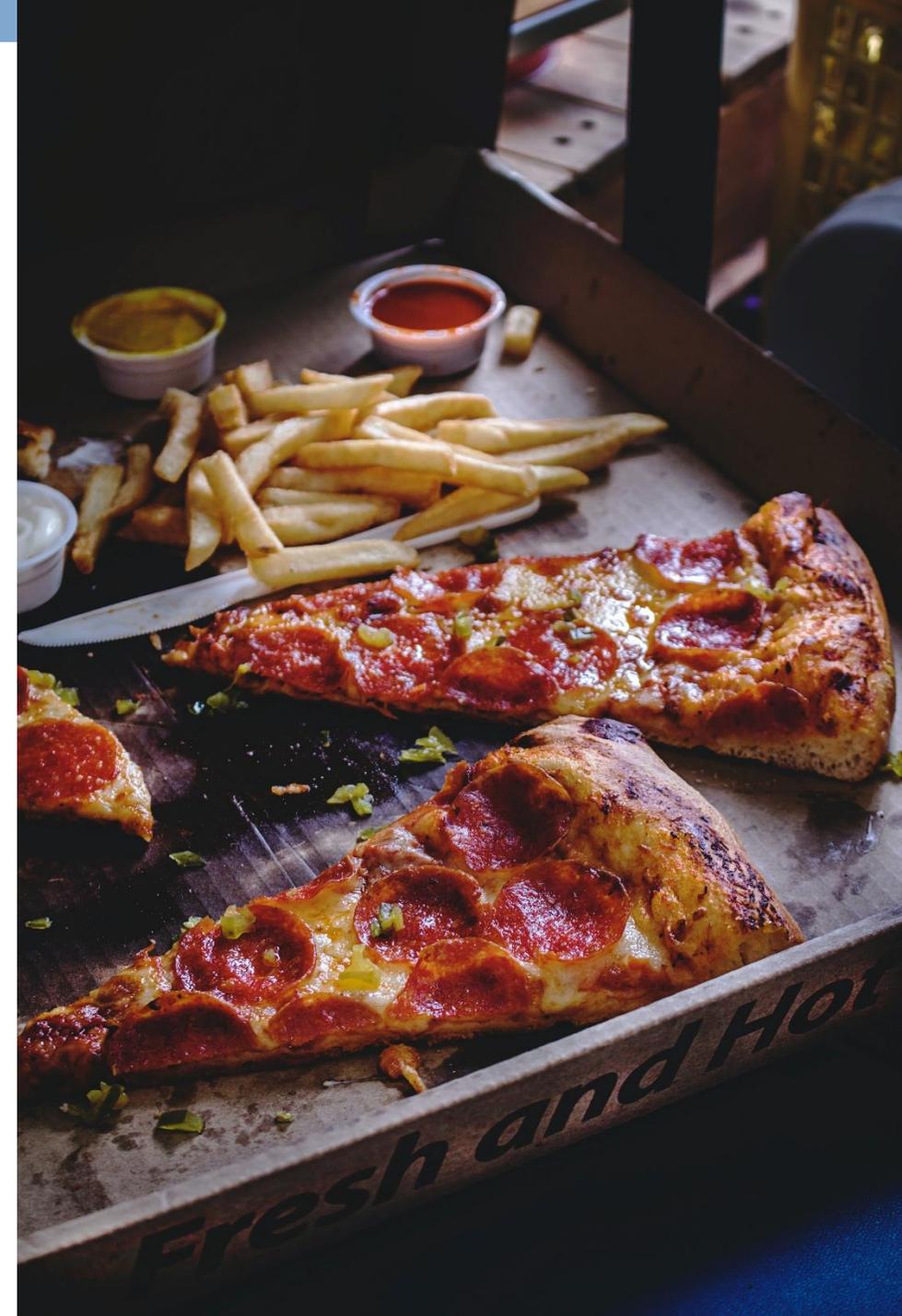
- Based on IC2 Guide Level 1 Exposure Assessment Module.
- Compares chemicals by evaluating differences in:
 - Chemical properties.
 - Exposure pathways.
 - Exposure concerns.
- Using the IC2 Guide, the exposure evaluation may be unnecessary if:
 - The alternative was determined to be of low concern during the hazard evaluation (EPA SCIL green circle, Benchmark-3 or -4).
 - The alternative has persistent, bioaccumulative, and/or toxic properties of concern.

Performance Module

- Based on the IC2 Guide Level 1 Performance Assessment Module:
 - Is the alternative being used for the same or similar function?
 - Is the alternative available on the commercial market?
 - Do promotional materials state this alternative provides the desired function?
- If performance was unclear after answering these questions, we answered more guiding questions.
- Consideration beyond IC2 Guide: alternatives should “perform as well as or better than PFAS chemicals.”

Findings – Performance Module

- Performance requirements:
 - Oil and grease resistance (all).
 - Leak/spill resistance (as applicable).
- Findings:
 - Generally found alternative substances functionally equivalent to PFAS-containing food packaging.
 - A few PFAS-free molded fiber or polylactic acid (PLA) plastic products had limited performance for high heat or very oily substances.



Cost & Availability Module

- Based on the IC2 Guide Level 1 Cost & Availability Module:
 - Is the alternative currently used in the application of interest?
 - Is the alternative currently offered for sale for the application of interest?
 - Is the price of the alternative close to the current?
- Considerations beyond Level 1:
 - “Safer alternatives must be readily available in sufficient quantity and at a comparable cost.”

Availability assessment

- IC2 Guide questions to identify a favorable alternative:
 - Is the alternative currently used in the application of interest?
 - Is the alternative currently offered for sale for the application of interest? **Will it be relatively easy to obtain the alternative from a supplier? Are there other options or suppliers if one supplier cannot meet demand?**
- Referenced the Ontario Toxics Reduction Program reference tool.

Example – Availability assessment

Bowls made using PLA as a barrier:

Food packaging type	Alternative coating or material	Number of large manufacturers identified*	Number of other manufacturers identified
Bowls	PLA-coated	3 identified <ul style="list-style-type: none"> • Earthchoice (Pactiv) • Eco-Products (Novolex) • Solo (Dart) 	15 identified
Bowls	PLA foam	0 identified	1 identified

*Identified in an industry market report.

Findings – Availability assessment

- Found PFAS-free food packaging products offered for sale in all food packaging applications we considered.
- Some alternative products are available in sufficient quantities.
- Evidence indicating a current PLA raw material shortage.



Findings – Cost assessment

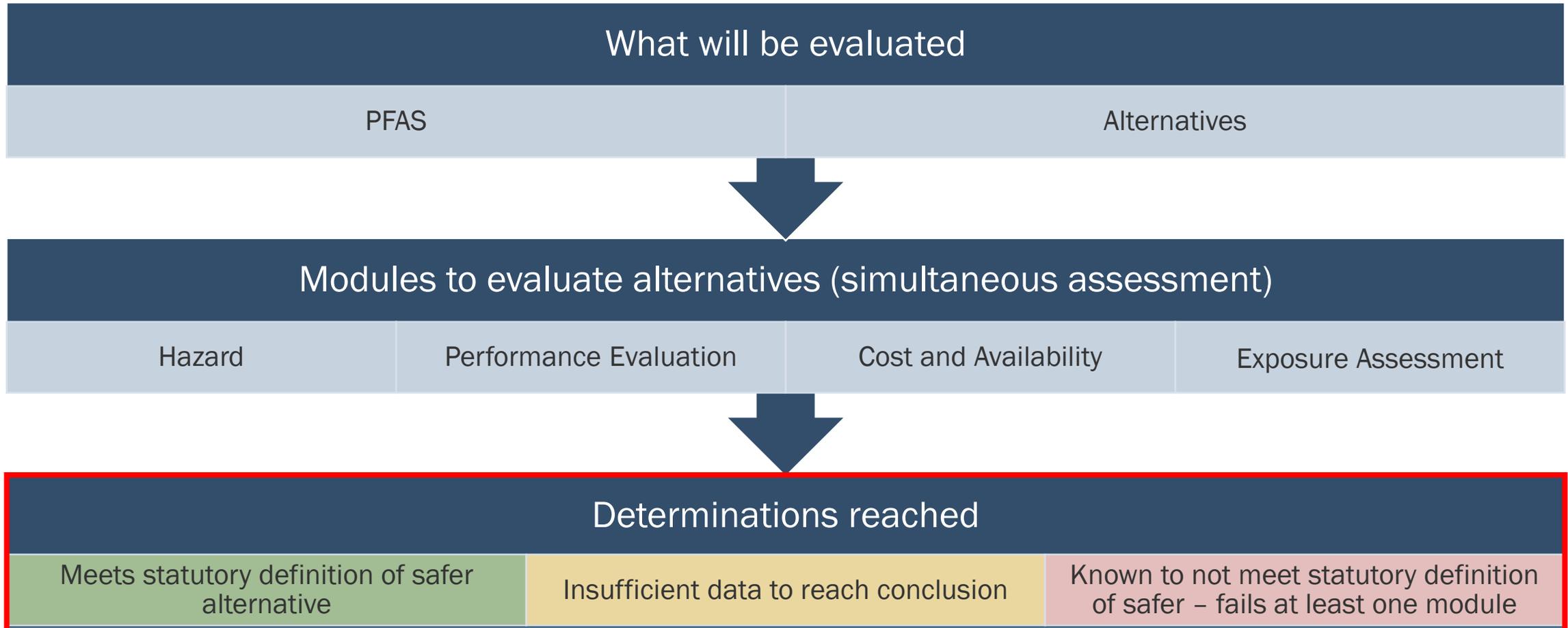
- Followed IC2 Guide and statutory requirements to assess cost:
 - Requirement for safer alternatives to be “readily available... at a comparable cost.”
 - IC2 guide: Is the price of the alternative close to the current?
- Defined “comparable cost” as a 10% price increase between comparable products (e.g. 10” inch plates).
- Findings:
 - Some alternative products were price comparable with similar PFAS-containing products.
 - Information availability (both PFAS-containing and alternatives) impacted our assessment.

Reusable options

- Findings:
 - Availability of reusable options depends on:
 - Food packaging type.
 - Location.
 - Access to additional equipment.
 - Reusable dinnerware is readily available
 - Switching from disposable to reusable dinnerware is cost comparable for many businesses.
- Conclusion: Reusable plates, bowls, trays, and food boats are an available, cost comparable option for some.



IC2 AA Guide 1.1 Evaluation Process



Findings – Simultaneous assessment

To qualify as a safer alternative, a product/substance:

- Is less hazardous than the PFAS option.
- Has a better exposure evaluation than the PFAS option (if required).
- “Performs as well or better than the PFAS option.”
- Is “readily available in sufficient quantity.”
- Is available “at a comparable cost.”

Example – Simultaneous assessment

Alternative product: wax-coated wraps and liners

Application and alternative reviewed	Hazard Module	Exposure Assessment Module	Performance Evaluation Module	Cost and Availability Module	Determination
Wraps and liners, wax-coated	U.S. EPA Safer Choice—Low concern	Low concern— Not applicable	Favorable	Favorable	Wax-coated alternatives meet criteria

Findings – Food packaging applications

Application reviewed	Determination
Wraps and liners	Wax-coated alternatives safer
Bags and sleeves	Insufficient information available
Plates	Clay-coated and reusable alternatives safer
Bowls	Insufficient information available
Trays	Insufficient information available
Food boats	Clay-coated and reusable alternatives safer
Pizza boxes	Uncoated alternatives safer
French fry cartons	Insufficient information available
Clamshells	Insufficient information available
Interlocking folded containers	Insufficient information available

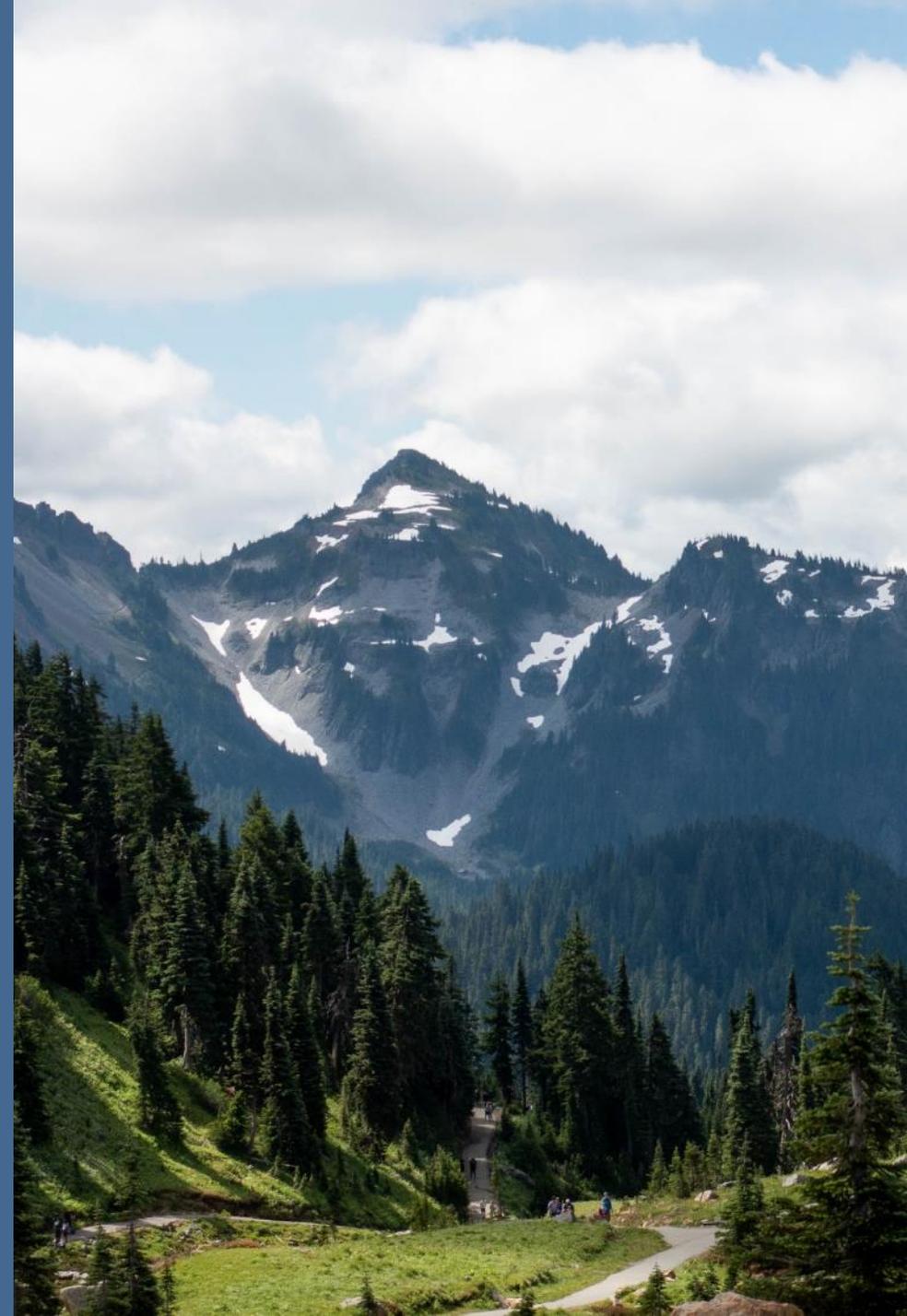
Assessment challenges

- Knowledge of fundamental product information:
 - Does the product contain PFAS?
 - Identity of the alternative product (when labeled generically).
- Access to proprietary information:
 - Specific alternative substance formulations.
 - Product pricing information.
- We will continue working with food packaging and chemical manufacturers to get this information.





Implementation and future steps



Sale and distribution prohibition

- Ecology submitted report in February 2021.
- Effective date of prohibition is February 2023.
- Applies only to:
 - Wraps and liners
 - Plates
 - Food boats
 - Pizza boxes



Implementation and outreach

- Still developing implementation plan.
- Outreach to affected stakeholders about restrictions:
 - Manufacturers.
 - Grocers and other retailers.
 - Hospitality associations.
 - Restaurants, food service organizations, and other end users.
- Will continue to provide updates through:
 - Stakeholder webpage at bit.ly/pfas-food-aa
 - Email lists (signup on stakeholder site).
 - Regular webinars.

Next steps – Our second assessment

- Review and refine scope:
 - Modify definitions included in AA scope.
 - Identify changes in availability of food packaging materials.
- Collect new information:
 - Availability
 - Cost
 - Performance
 - Chemical composition and hazard information



Expected Timeline

Action	Expected timeframe
Planning	Now
Revising scope (if needed)	Now
Identify additional food packaging chemicals or materials to include, if any	Now
Collect new information (cost, availability, performance, etc.)	Now – End 2021
Assess need for further PFAS in food packaging alternatives assessments	Now – Early 2022

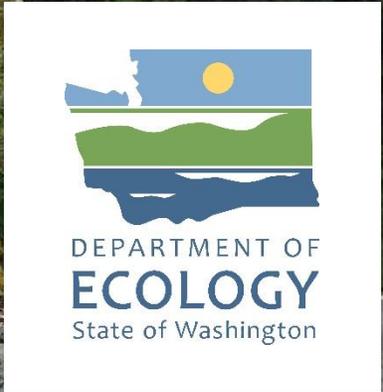
Get involved!

- If you haven't already, join our mailing list.
- Public webinar:
April 14 from 2 – 3:30 PM PST
 - Provide feedback about the first AA.
 - Give us suggestions for the second AA.
- Comment on draft documents:
 - Draft documents for second AA scope expected late spring 2021.



Alternatives assessment team

- Ecology team:
 - Rae Eaton, Ken Zarker, Marissa Smith, Craig Manahan, Kimberly Goetz, Lauren Tamboer, Katya Kniazeva, Kasia Patora, Amber Sergent
- Washington State Department of Health:
 - Holly Davies
- SRC, Inc. (contractors for first PFAS AA):
 - Cathy Rudisill, Courtney Hard, Jennifer Rhoades-Hamacher



Questions?

Contact us!

Webpage:
bit.ly/pfas-food-aa

Rae Eaton:
rae.eaton@ecy.wa.gov

Evaluating alternatives

Assessment module	IC2 Guide level used	Products or substances evaluated?	Information collected
Hazard Assessment	Level 2	Substance	Previous hazard assessments, toxicological data, authoritative chemical lists, physical characteristics of substance
Exposure Evaluation	Level 1	Substance	Exposure data, physical characteristics of substance
Performance	Level 1	Product	Promotional information, opinions of consumers
Cost and Availability	Level 1*	Product	Price information, product manufacturer information, case studies

* Modified to include additional statutory requirements.

Hazard Module

- GreenScreen List Translator
 - Screens chemicals against set of authoritative lists.
 - Only chemicals that score “List Translator 1 (LT-1)” were designated high concern.
- EPA Safer Chemicals Ingredients List
 - Originally Design for the Environment program.
 - Assessed using EPA Safer Choice hazard criteria.
 - Compare toxicity data against GHS thresholds.
 - Only chemicals listed with “green circle” were designated low concern.

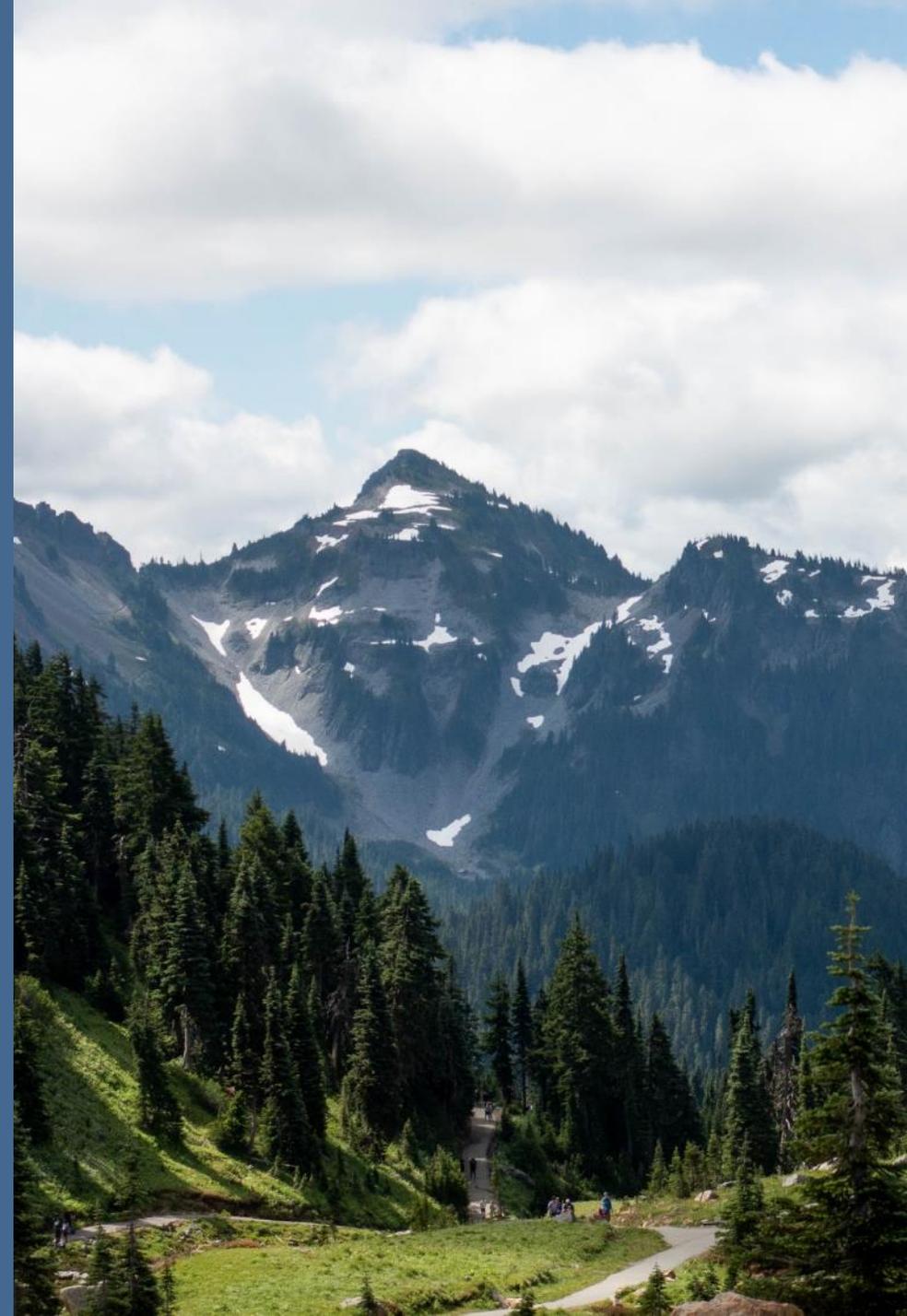
Findings – Hazard Module

EPA SCIL identified these alternative substances with green circles—considered low concern.

Alternative substance	Determination
Uncoated paper	Low concern
Petroleum-based waxes	Low concern
Bio-based waxes	Low concern
Kaolin clay	Low concern
PVOH – polyvinyl alcohol	Low concern



End of presentation.



Simultaneous decision framework

- The general process of a simultaneous decision framework has four sequential steps:
 - Identifying the scope of the assessment
 - Collecting information for the assessment modules
 - Performing a simultaneous analysis of the information collected.
 - Drawing conclusions about the alternatives based on that analysis.
- For this assessment, the scope was defined both by what potential alternatives were evaluated and what PFAS the alternatives were compared against. Information was collected for four assessment modules simultaneously: hazard, exposure, performance, and cost and availability.
- During the simultaneous analysis, the results of each assessment module were then compared to the pre-defined criteria for a safer alternative.
- Each alternative was determined to be a safer alternative, not a safer alternative, lacking the data needed to complete the analysis.

Hazard module

- A flow chart describing the approach used to assess the hazards of chemical mixtures used to provide oil and grease resistance to food packaging. For each mixture, which could either contain PFAS or one of the chemical alternatives identified in Section 3, the following chemical components could have been included in the assessment:
 - Polymers.
 - Functional additives.
 - Degradation products.
 - Monomers that have greater than a 0.01% concentration.
 - Byproducts or impurities that have greater than a 0.01% concentration.
 - Base materials consisting paper, paperboard, and plant-based pulp are assumed to low concern and were not assessed under this approach.
- (Text description continued on the next slide.)

Hazard module continued

- First, each chemical was screened using the GreenScreen List Translator™. If the chemical is determined to have a list translator score of 1 (LT-1) then it is a chemical of high concern and the chemical mixture is not evaluated further. If the chemical receives any other score the hazard assessment continues.
- Next, the remaining chemicals are screened using the EPA Safer Chemical Ingredients List (SCIL). Chemicals that are designated with a green circle on SCIL is considered a chemical of low concern. If the chemical is identified as low concern, then the hazard evaluation for that chemical is finished. If a chemical is not on that list, then the assessment continues.
- Finally, the remaining chemicals undergo GreenScreen® evaluation. The chemical will be assigned a benchmark score of 1 to 4 or a benchmark score of U (unknown) if there are inadequate data to evaluate the chemical under the benchmark criteria. Both the final benchmark score and the GreenScreen® evaluation report may be used to determine whether an alternative substance is safer than PFAS.

Example GreenScreen® evaluation

- An example GreenScreen® evaluation showing:
 - Data gaps for carcinogenicity and acute mammalian toxicity.
 - Very high persistence.
 - Moderate bioaccumulation, neurotoxicity (single and repeat), developmental toxicity, and endocrine activity.
 - Low across all other endpoints:
 - Mutagenicity
 - Reproductive toxicity
 - Systemic toxicity (single and repeat)
 - Skin and respiratory sensitization
 - Skin and eye irritation
 - Acute and chronic aquatic toxicity
 - Reactivity
 - Flammability

Stakeholder representation

