

Draft—Food Packaging Applications and Candidate Alternatives to PFAS for the Second Alternatives Assessment

Overview

In this document, we outline the definitions for the specific food packaging applications and alternatives we plan to use in this second per- and polyfluoroalkyl substances (PFAS) in food packaging alternatives assessment (AA). Chapter [70A.222](#)¹ RCW directs Ecology to evaluate “less toxic chemicals and nonchemical alternatives” for “specific food packaging applications.”

The statute does not define “specific food packaging applications,” nor does it specify which chemical or nonchemical alternatives should be included. Consequently, to establish the scope of the assessment work, we must define specific food packaging applications and specific chemical and nonchemical alternatives to PFAS.

For the first AA, which we published in 2021, we identified and defined ten food packaging applications based on specific examples of food packaging products. For the second AA, we defined food packaging applications based on the general functions of food packaging. This document presents new definitions for the five food packaging applications we are considering.

We will not significantly change the process for identifying specific chemical and nonchemical alternatives to PFAS (referred to as candidate alternative substances). Using that process, we have generated a list of candidate alternative substances for the second AA.

At the end of this document, we include a list of the types of information we are currently looking for to support our assessment. We are considering updating the methods we use to evaluate alternatives based on their chemical hazards, exposure potential, functional performance, cost, or availability. We invite stakeholders who may have relevant information to contact us.

Definitions of specific food packaging applications

This AA considers alternatives to PFAS in food packaging that is “intended for direct food contact and is comprised, in substantial part, of paper, paperboard, or other materials originally derived from plant fibers” (RCW [70A.222.010](#)²). This type of food packaging is typically designed to be single-use. It includes products intended for take-out or quick service, foodservice, and consumer packaged goods (Freedonia, 2017).

During a [July 2019 stakeholder update](#),³ we surveyed stakeholders to gather recommendations for prioritizing our review of alternatives to PFAS in food packaging. Based on the survey, we

¹ <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.222>

² <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.222.010>

³ https://www.ezview.wa.gov/Portals/_1962/Documents/PFAS-Food/PFAS%20AA%20July%202019%20update.pdf

concluded that we should look for alternatives to specific examples of food packaging (e.g., bowls, plates, food pails, etc.), not specific alternative materials or market sectors. This approach led us to use those examples to help define specific food packaging applications in the first AA.

Summary of changes from first alternatives assessment

In the first AA, we identified and defined ten food packaging applications selected from three food packaging categories (food contact paper, dinnerware, and take-out containers). We based these applications on specific examples of food packaging products that are offered for sale in the United States.

- **Food contact paper** (two applications):
 - Wraps and liners
 - Bags and sleeves
- **Dinnerware** (four applications):
 - Plates
 - Bowls
 - Trays (including cafeteria trays)
 - Food boats
- **Take-out containers** (four applications):
 - Pizza boxes
 - French fry cartons
 - Clamshells
 - Interlocking folded containers (also called food containers or pails)

We found safer alternatives for wraps and liners, plates, food boats, and pizza boxes (Ecology, 2021).

In the first AA, we only considered versions of these food packaging applications that are intended for serving or short-term storing, transporting, or holding freshly prepared food. The FDA and FoodSafety.gov recommend discarding leftover prepared food after three to four days—we consider any length of time beyond four days to constitute long-term storage or holding of food (FoodSafety.gov, 2019).

For the second AA, we plan to again only consider food packaging applications that are intended for serving or short-term storing, transporting, or holding freshly prepared food. These food packaging applications may still be used for long-term storing, but it is not required.

However, we are changing the definitions of the specific food packaging applications that will be the focus of the second AA. We propose these changes following a review of the definitions of the six food packaging applications from the first assessment where we did not identify safer alternatives that met all required criteria. By updating the definitions for the second AA, we intend to focus less on specific examples of food packaging products and more on the general functions of food packaging during the serving and transport of freshly prepared food. This change acknowledges that consumers use many specific examples of food packaging products interchangeably.

Definitions of selected food packaging applications for second AA

For this AA, we define “food packaging applications” based on the function food packaging products serve—instead of specific examples of food packaging products. These more broadly defined applications may include multiple products that package food in a similar manner for foodservice and/or transport. Each of these applications includes food packaging to which manufacturers intentionally add PFAS to provide oil and grease resistance (OGR) and leak resistance (RCW 70A.222.010).

The five food packaging applications we propose for the second AA include multiple food packaging product types that can be used interchangeably. They are:

- **Flat serviceware:** Shallow, flat-bottomed containers with large surface areas used for serving food. These products may have one large surface or multiple compartments to separate food items during food service. Examples include shallow trays, cafeteria-style trays, and plates.
- **Open-top containers:** Containers that enclose food on all but one side. They are designed to hold foods for serving or transportation. Examples* include food boats, French fry containers, and paper cones.
- **Closed containers:** Containers that enclose food on all sides. Interlocking pieces or overlapping walls hold the container closed for transport. Examples include clamshells, food pails, bakery boxes, and deli containers.
- **Bags & sleeves:** Containers made from flexible material. Flat-bottom bags are used to transport food from a foodservice establishment (bags). Sealed-end bags can hold food for service or can transport food from a foodservice establishment (sleeves). Sleeves are also referred to as pinch-bottom bags.
- **Bowls:** Open-topped containers with wide openings and bottoms that allow spooning of food. Typically designed to hold foods with a substantial liquid component (such as soup). Portion cups will also be included in this application.

*Bowls and bags & sleeves may be considered open-top containers but will be evaluated as separate food packaging applications. This is because not all open-top containers can serve the function of bowls, on the one hand, or of bags and sleeves, on the other.

We are considering, but have not yet decided, to add an additional food packaging application based on other products involved in serving or storing food for short periods of time, such as straws. While the majority of these products are made using plastic, concern over plastic waste has led to greater interest in plant-fiber-based straws. A recent study of commercially available drinking straws found that 36 out of 38 plant-fiber-based straw brands contained PFAS. However, the concentration of PFAS identified ranged widely—from tens of picograms to tens of nanograms per gram of straw (Timshina et al., 2021).

If we find potential safer alternatives for plant-fiber-based straws that meet our criteria for performance, cost, and availability, we may evaluate these alternatives in this AA. We will not consider disposable, petroleum-based plastic straws as potential safer alternatives.

Alternatives to PFAS in food packaging applications

Alternatives to PFAS in plant-fiber-based food packaging can be roughly divided into three groups: chemical treatments, base materials, and system alternatives (discussed previously at the [May 2019 Stakeholder Webinar](#)⁴). For the purposes of this assessment, they are defined as:

- **Alternative chemical treatments:** Dry-end coatings or wet-end additives that are applied to the plant-fiber base material to provide oil and grease resistant (OGR) properties to the product.
- **Alternative base materials:** Primary substrates that are manufactured to provide OGR properties to the product, either:
 - Plant-fiber based (such as mechanically densified paper or paperboard).
 - Non-fiber based (such as plastics and aluminum).
- **System alternatives:** Alternatives that package food in a manner consistent with a specific food packaging application and provide OGR properties, but are operationally distinct from alternative chemical treatments or base materials. The primary system alternative for this assessment is reusable packaging (such as washable dishes).

Summary of changes from first alternatives assessment

Below are the changes differentiating the first and second AA, organized into three main categories:

- 1) Identifying candidate alternative substances: We are not changing the process for identifying candidate alternative substances to PFAS for this second AA.
- 2) Alternative substances included: In the first AA, we evaluated ten alternative substances. They included plant-fiber base material products that had not been surface treated with a substance to create a barrier to moisture and oil. We will include those substances again in this second AA, as well as others that meet our prioritization criteria. As with the first AA, we are not evaluating all potential alternatives to PFAS.
- 3) Assessing molded fiber: We plan to assess alternatives to PFAS in molded fiber food packaging in this second AA. We did not evaluate the alternative chemical treatments or base materials used in these products in the first AA.

Identifying candidate alternative substances

The law does not require an alternatives assessment to include all existing and emerging alternatives, only that the assessment evaluate “less toxic chemicals and nonchemical alternatives” (RCW [70A.222.070](#)).⁵ Similar to the first AA, we identify potentially less toxic alternatives (candidate alternative substances) using the following principles:

⁴ https://www.ezview.wa.gov/Portals/_1962/Documents/PFAS/PFAS%20AA%20Webinar_05152019.pdf

⁵ <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.222.070>

- **Safer alternatives:** We will prioritize alternative substances found on the Safer Chemicals Ingredients List (SCIL) or comprised of materials known to be of low concern (e.g., paper or other plant fibers, aluminum).
- **Available alternatives:** We will prioritize alternative substances used in PFAS-free food packaging products that are widely available in Washington state or the U.S. The alternative substance may be used in one or many examples of food packaging products.
- **Information transparency:** We will prioritize alternative substances with publicly available information about hazard, exposure, performance, and availability.
- **Environmental performance standards:** We will prioritize alternative substances that meet state efficiency and environmental performance standards and local mandates for recyclable and compostable products.

Proposed candidate alternative substances

The chemical and base material alternatives we included in the first AA will also be considered in this assessment. We are also looking at new alternative substances that were not included in the previous assessment using the above criteria.

Our proposed candidate alternative substances for this assessment are not a comprehensive list of all possible PFAS-free alternatives available on the U.S. market. We are focused on alternatives used in food packaging products that meet the definition of at least one of our current food packaging applications.

Recently, several food packaging manufacturers introduced plant-fiber-based food packaging products that are promoted as PFAS-free. When we can identify the type of chemical treatment, we include that alternative in this list. Otherwise, it is listed as a proprietary treatment.

Chemical treatment alternatives

- Bio-based coatings
 - Waxes
 - Polylactic acid (PLA)
- Plastic coatings
 - Acrylics
 - Polyvinyl alcohol (PVOH) and ethylene vinyl alcohol (EVOH) copolymer
 - Polyethylene (PE) and polyethylene terephthalate (PET)
- Paraffin wax
- Clay
- Siloxanes
- Proprietary treatments

Base material alternatives

- Treated plant fiber (e.g. bamboo, sugarcane, vegetable parchment)
- Biologically derived plastics
 - PLA
 - Polyhydroxyalkanoate (PHA)

- Aluminum

System alternatives

- Reusable food contact products
 - Reusable rigid plastics
 - Washable food wraps and bags
 - Reusable siloxanes (food-grade silicone)
 - Reusable dishware

If we receive updated information about the current use of an alternative, we may add or remove alternative substances from this list. We may also evaluate mixtures or multi-layered composites that use multiple alternative substances if there is evidence that all are necessary to serve the OGR, leak resistance, or other essential function of PFAS (see molded fiber alternatives).

Alternative substances not currently considered in this AA

As with the first AA, we are not considering single-use, petroleum-derived plastics as alternative base materials in this assessment. This exclusion is based on Executive Order 20-01 issued by Governor Jay Inslee, which requires state agencies to consider reducing solid waste and toxics in products in state purchasing (EO 20-01, 2020). Most single-use plastic food packaging is not recycled into new products and is disposed of in landfills (Ellen MacArthur Foundation, 2017; Ecology, 2020; EPA, 2021). (The biologically derived plastics included above are used in products that may be composted industrially.)

We also are not including polystyrene products in this assessment. They would be considered regrettable substitutions based on polystyrene's environmental impact. Furthermore, [E2SSB 5022](#)⁶ was signed into law by Governor Inslee in May 2021. This law prohibits the sale and distribution of polystyrene food service products beginning June 1, 2024. There is significant overlap between the definition of food service products included in the law and the food packaging applications defined here.

There are many other alternative substances we are unable to confirm are used in food packaging products within our current scope of work. These include (DTSC, 2019; Glenn et al., 2021; OECD, 2020):

- Highly refined cellulose in greaseproof paper.
- Carboxymethyl cellulose.
- Alginates.
- Aqueous dispersions of copolymers such as styrene and butadiene.
- Aqueous dispersions of waxes.
- Water-soluble hydroxyethylcellulose.

⁶ <http://lawfilesexst.leg.wa.gov/biennium/2021-22/Pdf/Bills/Session%20Laws/Senate/5022-S2.SL.pdf#page=1>

- Chitosan.
- Zein for other food packaging.

We may include one or more of these substances in our current assessment if we are able to find information linking them to relevant food packaging that is available on the market.

Additionally, there are many substances used in food packaging that may contribute to OGR or moisture resistance but do not replace other chemical treatments. These substances include internal sizing agents such as alkyl succinic anhydride (ASA), styrene acrylic emulsion (SAE), talc-filled aqueous polyacrylate, and rosin (OECD, 2020).

Alternative substances used in molded fiber

Molded fiber or molded pulp is a type of paperboard packaging where an aqueous slurry of plant fiber pulp is formed into products using a three-dimensional, screened mold (Robertson, 2012). In the first AA, we did not assess alternatives to PFAS in molded fiber products. Several manufacturers now have (or soon will have) relevant PFAS-free molded fiber products available on the market that we can include in this assessment.

In molded fiber products, PFAS may be intentionally added to provide oil, grease, and moisture resistance to the product, or as a manufacturing process aid to prevent the product from sticking to the mold (DTSC, 2020). When PFAS is added as a mold release agent during the manufacturing process, it can transfer to molded fiber products. For the purposes of this assessment, this arguably constitutes an intentional addition of PFAS. Therefore, as we evaluate molded fiber alternative products, we may also need to evaluate alternative mold release agents to replace PFAS in the manufacturing process.

Information we are looking for about alternatives

Per RCW 70A.222.070, our second AA will evaluate the chemical hazards, exposure, performance, cost, and availability of alternatives for the food packaging applications we defined here. To complete these evaluations, we are looking for information available from:

- Scientific literature.
- Product and chemical databases.
- Chemical and food packaging manufacturers.

Information about products that use specific alternatives

We will continue to use the information sources below to identify potential food packaging products that use specific alternative chemical treatments, base materials, and systems. Knowing the specific alternative used in a food packaging product helps us determine that safer alternatives to PFAS are used in food packaging products offered for sale.

- **Manufacturers and users:** Stakeholders may voluntarily provide information on their products to support the AA. Stakeholders, including chemical producers, product

manufacturers, and end-users can provide information on alternative products that we can verify or assess.

- **Standards and certifying programs:** We will consider information from established standards for materials, products, and services that meet high technical quality and market relevancy. Standards and certification programs can help to identify products that are PFAS-free and available in the market, which we can then assess further.
- **Literature search:** We will review scientific literature to supplement our understanding of chemicals used in food packaging.

Additionally, we are actively seeking information to support our evaluation of the hazards, exposure potential, technical performance, cost, and availability of specific alternatives or food packaging products that use a specific alternative.

The information we are interested in collecting is based on the evaluation methods used in the first AA. We are considering updating the methods we use to evaluate alternatives in our second AA. If we update our evaluation methods during the assessment, we may pursue other types of information than those listed below. We encourage any parties who are interested in sharing information to contact us.

- Information about a specific alternative substance (such as a chemical treatment or base material that provides OGR or moisture resistance to a product) that may be used to conduct a comparative hazard or comparative exposure assessment.
 - Chemical identity of substances.
 - Chemical or product hazard assessments that use a relevant hazard assessment method and may be reviewed by technical staff.
 - Physiochemical properties or exposure data for a substance.
- Information about a product made using a known alternative substance that can be used to evaluate the product's performance.
 - Product testing data or a certificate that confirms the product is PFAS-free or contains low or no fluorinated chemicals.
 - Promotional materials or technical data sheets that indicate the product provides OGR, leak resistance, or moisture resistance.
 - Information from product consumers about specific product performance.
 - Case studies of product use, especially for companies of different sizes or markets.
- Information about a product made using a known alternative substance that can be used to evaluate the product's cost and availability.
 - General cost or availability information about food packaging, such as:
 - Market or price information about the comparative cost of reusable food container programs, alternative chemical treatments or base materials.
 - The lifecycle costs associated with the use of different types of food packaging.
 - Case studies of PFAS-free food packaging use, especially for companies of different sizes or in different markets.
 - Product cost or availability information, such as price differences between similar products.

- The availability of reusable food container programs in restaurants and similar settings.
- The availability of specific alternative chemical treatments or base materials for use in food packaging products.

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