Avoiding Hidden Hazards

A Purchaser's Guide to Safer Foodware

CEH CENTER for ENVIRONMENTAL HEALTH

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About CEH

The Center for Environmental Health (CEH) is a nonprofit organization committed to protecting people from toxic chemicals by working with communities, consumers, workers, government, and the private sector to demand and support business practices that are safe for public health and the environment. CEH assists large purchasers from government, education, healthcare, and private businesses to prefer healthier products and leverages their buying power to move the market towards safer products.

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Executive Summary

Over the past two decades, the class of chemical compounds known as perfluoroalkyl and polyfluoroalkyl substances (PFAS) has come under increasing scrutiny from toxicologists, ecologists, and regulators given their persistence and connection to serious potential health effects, including kidney and testicular cancer, thyroid disruption, attention-deficit hyperactivity disorder (ADHD), delayed puberty and obesity. Based on the growing evidence of fluorinated compounds in foodware products and current efforts by leading manufacturers to find alternatives, we expect the market to shift to better alternatives and believe institutional purchasers can play a critical role in expediting the market change we need. In that vein, this report is aimed at institutional purchasers of foodware. It focuses on the use of fluorinated compounds in disposable food serviceware; offers recommendations and resources to help purchasers procure safer foodware products; and equips purchasers with tools to push manufacturers away from these harmful compounds and towards safer products.

CEH tested plates, bowls, clamshells and multi-compartment food trays for their total fluorine content. In total, over 130 products representing 39 manufacturers/brands were tested and classified as "non-fluorinated" or "fluorinated." Fifty-seven percent of these products were fluorinated.

Products made of the following materials consistently tested as no or low-fluorine: bamboo, clay-coated paper or paperboard, clear PLA (polylactic acid), paper-lined with PLA, palm leaf, paper with unknown coatings, and uncoated paper. **Products made of the following materials consistently tested as fluorinated:** all molded fiber products such as wheat fiber (wheat straw or wheat stalk), "blend of plant fibers", silver grass (miscanthus), and sugarcane waste (bagasse) including molded recycled paper and PLA-lined molded sugarcane (bagasse).

Based on these findings, CEH recommends avoiding molded fiber foodware at this time and urges manufacturers to prioritize the removal of PFAS from their products and to ensure that any replacement materials or chemicals are safe for human and environmental health. We also recommend that purchasers avoid polystyrene (both rigid plastic and foam) foodware.

Reusable foodware is the best choice for environmental and health reasons. Even the "best" non-fluorinated disposable foodware creates avoidable waste, depletes natural resources, and raises concerns about other toxic chemicals, the environment, and human health. While disposables are not recommended, we recognize that some purchasers cannot avoid them. In these cases, purchasers should select non-fluorinated products that will be properly managed at end-of-life, either through composting or recycling.

How this Report is Organized

This report is organized into 3 main sections

Section 1

This section contains a brief description of the class of fluorinated compounds (PFAS) found in disposable foodware, the uses of these chemicals, and their effects on human health. It also describes our study design, including the test method and protocol, our findings (namely, the types of disposable foodware that do or do not contain fluorinated additives), a summary of CEH's recommendations for selecting food service ware, a link to the database, and brief instructions.

Section 2

This section provides guidance for purchasers on avoiding fluorinated products and using their buying power to motivate manufacturers to remove these problematic and highly persistent compounds from the disposable food serviceware market.

Section 3

This section offers more detailed information on a range of foodware products by material type. We list some benefits and considerations for each type, taking into account how the products are likely to be disposed of. We also touch upon the role of third-party verifiers of compostability and their position on PFAS.

Section 1

Introduction

The purpose of this report is to help purchasers sort through the surprisingly complicated topic of disposable foodware and to equip them with the tools and resources they need to procure healthier options.

Over the course of our study, it has become clear that reusable foodware is the preferred choice and that single-use foodware is by definition a non-sustainable option, even if the materials are compostable or recyclable. With foodware, we are particularly concerned about the use of additives that contain fluorine, which are used to impart water- and grease-resistance to single-use products. Chemicals in this "family" are highly persistent. The body of science regarding the health effects of the currently used fluorinated chemicals is limited, but recent research suggests that many of these chemicals are hazardous to human and environmental health. In addition, disposable foodware poses a range of other concerns throughout their life cycle.

We hope the report's findings and recommendations will encourage an increased adoption of reusables and when that option is not viable, provide guidance for purchasers seeking non-fluorinated disposables. The disposable foodware market is at a "tipping point", and collectively purchasers can leverage their buying power to accelerate the transition to safer foodware options.

Human and Environmental Health Concerns Posed By Fluorinated Chemicals (PFAS)

The report's focus is on the family of chemicals known as "per- and polyfluoroalkyl substances" or PFAS.[1] It includes carbon-based compounds in which the hydrogen atoms on at least one carbon have been replaced by fluorine atoms. Throughout this report, when we use the term "fluorinated additives" or "fluorinated compounds," we are referring to the PFAS family of chemicals. For foodware, they are primarily used to impart water and grease-resistance properties to single-use disposable foodware products. They can migrate out of products and get into our air, dust, water and bodies. These pervasive chemicals are linked to serious health problems, are highly persistent (which means they break down very slowly, if at all, in the environment), and can build up in the environment and our bodies.

Over the past two decades, this group of fluorinated compounds has come under increasing scrutiny from toxicologists, ecologists, and regulators because of their pervasiveness, persistence in the environment, and toxicity.

Purpose of Fluorinated Compounds

This class of synthetic chemicals is used to impart water-, stain-, and/or grease-resistance to a wide variety of products including non-stick cookware, carpets, cosmetics, textiles, and disposable foodware and food packaging. Fluorinated compounds are also used in firefighting foam, lubricants, and a number of industrial processes.[2]

Current Research and Regulations on Fluorinated Compounds

For most fluorinated compounds, very little health and safety testing is publicly available. The most well-studied PFAS are long-chain compounds such as perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA).[3] PFOS was a key ingredient in 3M's original Scotchgard, a fabric protector; while PFOA was used

for making Dupont's Teflon for non-stick cookware. Exposure to PFOA has been linked to kidney and testicular cancer, elevated cholesterol, decreased fertility, thyroid problems, and changes in hormone functioning in adults as well as adverse developmental effects and decreased immune response in children.[4,5,6] Although PFOS and PFOA have been largely phased out in the U.S. due to concerns about their toxicity, they have often been replaced by less well known short-chain "chemical cousins" (that are structurally similar) which are also fluorinated.[7,8] The long-chain compounds are also still being used in products made in other countries, including many that are imported into the U.S.

There are estimated to be hundreds of these replacement fluorinated compounds used in a variety of products. Research on the health risks and environmental impacts of these replacement chemicals is particularly lacking. However, what we do know from recent studies is concerning. These molecules all contain carbon-fluorine bonds, which are one of the strongest bonds in chemistry, making them highly persistent. This means that they break down very slowly, if at all, in the environment. Some of these compounds break down into substances that are also persistent.[9] Some replacement compounds have frequently been found in breast milk.[10]

Specific Concerns Regarding Fluorinated Compounds in Foodware Products

A recent study of 16 replacement fluorinated compounds used in food containers and food packaging showed that some can act like the hormone estrogen, while others cause liver damage in animal studies.[12] The shorter-chain fluorinated compounds move from foodware into water and other liquids under laboratory conditions.[13] Thus, it is likely that they move into food when foodware containing fluorinated compounds are used, creating a direct exposure pathway through ingestion.

"A recent study of 16 replacement fluorinated compounds used in food containers and food packaging showed that some can act like the hormone estrogen, while others cause liver damage in animal studies."

Because many of the foodware products discussed in this report are compostable, the possibility that the replacement fluorinated compounds could end up in compost is a concern. This issue was first documented about a decade ago in a study of commercial composting facilities in Switzerland.[14] Recently, fluorinated compounds were found in samples of U.S. compost, contact Heather Trim at info@zerowastewashington.org for details. In addition, research using a food crop found that the short-chain compounds are more readily taken up by plants than the long-chain compounds.[15] Nevertheless, CEH still strongly supports and encourages composting as it offers numerous benefits and plays a critical role in the move towards more sustainable food systems and zero waste goals. We should focus our attention upstream to get this class of harmful and problematic fluorinated compounds out of consumer products in the first place.

Fluorinated compounds from foodware may end up in our water; once these short-chain compounds get into our water, these chemicals are difficult to remove. One recent study indicated that the treatments typically used to purify water do not remove the short-chain fluorinated compounds, and that only a relatively expensive treatment option successfully cleans up the contamination.[16]

Study Design

We collected disposable foodware products from a range of manufacturers, including a variety of product and material types. A total of 138 products - representing 39 manufacturers and/or brands - were tested for fluorine content. We focused on four items commonly used by institutional purchasers (plates, bowls, clamshells and multi-compartment food trays), and that were suspected to contain fluorinated additives based on previous testing by others. We also tested four food boats that were submitted by purchasers. For all categories, a single sample of each product was tested once using the protocol described below; a small subset of products was also tested using a secondary protocol to verify the initial test results.

Note: CEH did not test cold or hot paper cups, or plastic or compostable utensils as other testing efforts had not found fluorinated additives present in these product types.

The product samples were either provided by purchasers from government, education, health care, or private business facilities or obtained by CEH directly from manufacturers or retailers. A dozen of the samples were submitted for testing to Dr. Peaslee's lab by our partners, including the Responsible Purchasing Network (RPN) and the San Francisco Department of the Environment (SFDOE), and their data are included in the accompanying list of test results.

CEH's database of products includes the test results for fluorine content and the following information about each product (when available). In some instances product information was provided by the purchaser; and in others, it was obtained by CEH from a manufacturer's or retailer's website, the product packaging, or calls to the manufacturer.

- Manufacturer/Brand
- Product Type (Plate, Bowl/Soup Container, Clamshell, Food Tray or Food Boat)
- Product Number/SKU
- Product Description
- Product Material Type
- BPI Certification and/or Cedar Grove Accepted (for compostability)
- Recycled Content (may be post-industrial/pre-consumer)
- Price*
- Website URL** (manufacturer, distributor, or retailer website)
- Other Product Information
- Testing Laboratory
- Partner Provided Tested Results

Note: *Product prices can vary greatly based on factors such as volume of products purchased or rates negotiated through contracts. Whenever available, we compiled prices provided online by the manufacturer; otherwise, we pulled price data from a range of online retailers. (The price columns list the dates on which we compiled the data). For the few products we purchased in brick-and-mortar stores, we included the price and the date on which we purchased the items. We suggest that you verify all information directly with your supplier to confirm current price and other product information. **URL provided is for product identification only and is not a recommendation for where products should be purchased.

Testing Methods and Protocol

Dr. Graham Peaslee of the University of Notre Dame Department of Physics carried out the testing of disposable foodware products and classification of results for fluorine content on behalf of CEH and our partners.

Analytical Testing Methodology

The fluorine content of the disposable foodware products was measured using particle-induced gamma-ray emission (PIGE) spectroscopy. Details of this procedure can be found here.[18] This technique has been used in other studies of papers and textiles,[19,20] and has been validated with more expensive LC-MS/MS (liquid chromatography–mass spectrometry) methods including Total Oxidizable Precursor assay.[21]

In addition, in five instances products were sent to a second lab (Galbraith Laboratories) to verify the initial findings using a secondary protocol. Galbraith Laboratories uses pyrohydrolysis, another method that measures total fluorine count. Details of the method are available at Galbraith Laboratories' website.[22] For the products that were tested using both protocols, results were consistent for those found with high fluorine content and varied minimally for those with low fluorine content levels.

Classification System for Fluorine Testing Results

Dr. Peaslee developed a classification system based on the fluorinated content of the products. Products were classified as either:

- No detectable fluorine or "**No F**"
- Low fluorine content or "**Low F,**" possibly resulting from clay containing naturally-occurring fluorine or low levels of contamination in the product manufacturing process, or
- High fluorine or "F," which likely contain fluorinated additives

Products with a high fluorine content had on average 10-fold higher levels of fluorine than those with low fluorine content. Please see Appendix A for more details about the ranges established for these classification levels.

Study Findings

In CEH's database of 138 products, test results for the fluorine content of disposable foodware products were separated into:

- "Non-fluorinated" or No F and Low F (59 products) OR
- "Fluorinated" or F (79 products)

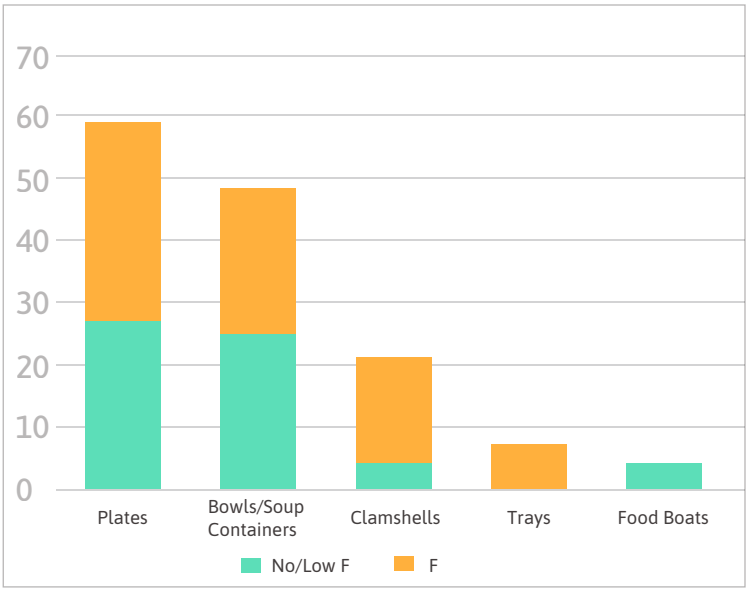
Results by Product Type

Of the five types of products tested, we found non-fluorinated options available for plates, bowls and food boats, with a limited number for clamshells. All the food trays tested were fluorinated but it should be noted that only four items were tested in this product category. We expect that more non-fluorinated foodware options will come on the market as public awareness increases demand. In recent conversations with manufacturers, it is clear that purchaser demand for healthier foodware products is already spurring them to actively seek non-fluorinated solutions.

Table 1: Fluorine (F) Test Results by Product Type

Product Type	No/Low F	F	#Tested
Plates	27	32	59
Bowls/Soup Containers	24	23	47
Clamshells	4	17	21
Trays	0	7	7
Food Boats	4	0	4
Total Tested	59	79	138

Chart 1: Fluorine Results by Product Type



Results by Product Type

All products made out of the following materials consistently tested as non-fluorinated:
bamboo, clay-coated paper or paperboard, clear PLA (polylactic acid), paper-lined with PLA, palm leaf, paper with unknown coatings, and uncoated paper.

Testing of a black rigid PLA plate revealed an atypical finding of a high level of fluorine. In discussions with the manufacturer, they discovered that while fluorinated compounds are not being added to the product itself, a fluorinated chemical was used in the manufacturing process as a "mold release agent." The company indicated that they have requested a non-fluorinated substitute for this use.

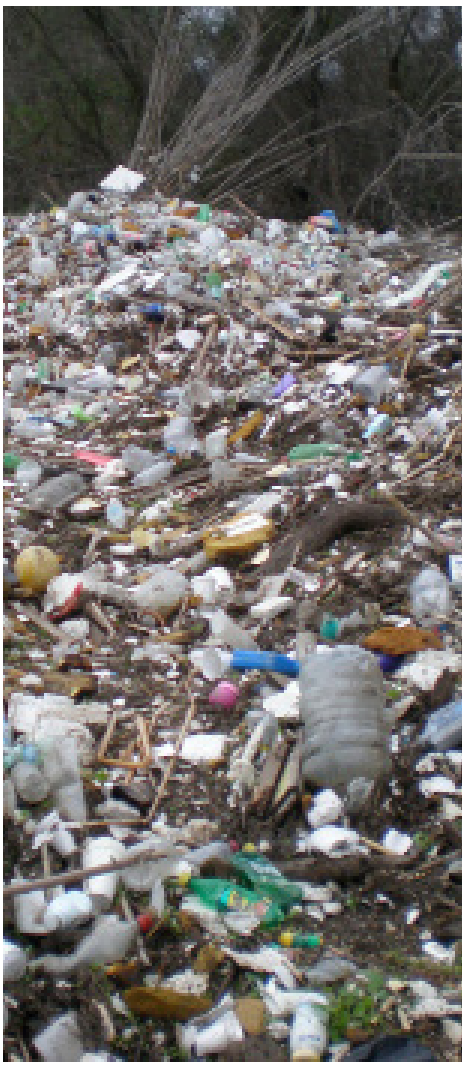
All products made out of the following materials consistently tested as fluorinated:
All molded fiber products such as wheat fiber (wheat straw or wheat stalk), "blend of plant fibers", silver grass (miscanthus), and sugarcane waste (bagasse) including molded recycled paper and PLA-lined molded sugarcane (bagasse).

Molded fiber foodware typically does not contain a visible liner. Instead, fluorinated compounds are often mixed into the molded fiber slurry. This imparts grease- and water-resistance to the foodware product.

Table 2: Summary of Product Materials and their Fluorine Test Results

Material Type Tested:	Non-Fluorinated	Fluorinated	# of Products Tested
All Molded Fibers including: Recycled Paper, Wheat Straw/ Wheat Stalk, Silver Grass (Miscanthus), Sugarcane Waste (Bagasse), Blend of Plant Fibers		X	73
Paper with Unknown Coatings	X		25
PLA-Lined Paper and Paperboard	X		8
"100% Renewable Resources Lined with PLA"	X		5
PLA	X	1-exception	5
Clay-Coated Paper and Paperboard	X		5
Palm Leaf	X		5
Untreated/Uncoated (Non-Molded) Paper	X		4
PLA-lined Molded Sugarcane/ Bagasse		X	3
Plastic-Lined Paper	X		2
Unknown materials		X	2
Bamboo	X		1

Ongoing Testing: Please note that these results are based on the products tested to date and is not an exhaustive survey of the market. CEH will continue to test additional products in 2018 and update these findings as new results are available. If you have products that you would like to have tested for fluorine content, please see Appendix C for instructions on how to submit samples. Manufacturers are actively working on non-fluorinated alternatives and new products are expected to be on the market within the coming year.



Long-Term Threat to Public Health and Environment

Disposable foodware has become a common and widely used product that has accompanied an overall shift towards an increasingly "on-the-go" lifestyle. According to the Freedonia Group's 2015 report on the food service disposables market, "Demand for foodservice disposables in the US is projected to increase 3.9 percent per year to $21.9 billion in 2019."[23] While single use products such as plates, bowls, food trays, and clamshell (take-out) containers offer some "convenience," including less maintenance and clean-up, there are significant health and environmental costs associated with the life cycle of all disposable foodware products.

CEH believes that single-use foodware is by definition a non-sustainable option even if the materials are compostable or recyclable. While purchasers may have need for such products at times, there should be no illusion that using these products is "good for the environment." We encourage institutions to first ask the question, "is it necessary?" before purchasing disposable foodware. While this report does not evaluate the full life cycle impacts of the various products, it is still worth highlighting a few major areas of concern to place our project's findings within this broader context. Disposable foodware can result in:

- Generation of an enormous amount of waste that is often landfilled, incinerated or ends up in our waterways.
- The use of toxic and untested chemicals that can end up in our food and compost.
- Consumption of energy (typically from fossil fuels) and creation of air and water pollution from the manufacturing, shipping, use and disposal of these products.
- Fossil fuel-based products such as non-biobased plastics are non-renewable resources that create adverse environmental and human health concerns.
- Utilization of genetically modified (GMOs) and/or pesticide-treated crops.

CEH Recommendations for Non-Fluorinated Foodware Options

Prefer Reusables: Reusables are the environmentally preferable foodware option and each organization should start by carefully assessing the viability of reusables for their foodware needs. Transitioning to reusable foodware provides you the opportunity to save money, reduce waste, limit your impact on the environment, and protect public health. Refer to Section 3 for a more detailed discussion on the benefits of reusable foodware products, additional considerations, as well as resources.

If Reusables Are Not Possible, Prefer Non-Fluorinated Single-Use Products That Will Be Properly Managed at End-of-Life.

Following a thorough assessment of your institution's food serviceware needs, if you still have some situations where reusables will not work, this report provides some considerations for a variety of single-use products, but they are by no means a comprehensive list. Further information is provided in Section 3 on a number of single-use products by material type. As noted earlier, research on non-fluorinated alternatives is rapidly advancing, and some companies are actively working to develop new product lines, so the recommendations in this report reflect our findings at this time. We will continue to test and add the results from more foodware products to our database, so please contact Sue Chiang (foodware@ceh.org) if you would like to be alerted when there are significant updates to our test results, or please check CEH's website at ceh.org/disposablefoodware.

- **If reusables are not viable, start by contacting your local jurisdiction (typically, the department responsible for managing solid waste, such as Public Works) to determine whether the foodware products you are considering will be composted or recycled.** This is a crucial step as items for composting or recycling vary considerably by facility and jurisdiction.

- **If you have access to a commercial composting facility, select single-use foodware that is accepted by your composting facility.** Some composting facilities do not accept any compostable foodware, while others may only accept certain types of compostable materials or only products that are verified to be compostable by a third-party (such as BPI-Certified or Cedar Grove Accepted)*.

    - **Choose BPI-Certified or Cedar Grove Accepted compostable products that do NOT contain fluorinated additives** (identified in our database as "no or low F"). Note: At this time, products certified to BPI or accepted by Cedar Grove may contain fluorinated additives so it is important to refer to the database to ensure the product is non-fluorinated. See Section 3 for further information.

- **Confirm that these particular products will be accepted at the composting facility you are planning to use.** The compostability certification is helpful for guiding your selection but you still need to confirm that the facility will be able to compost particular products. This step helps to ensure that your products do not get sent to a landfill, where they will not break down properly and can create methane, an extremely potent greenhouse gas.

**It should be noted that 18 of the non-fluorinated products were certified by BPI and/or verified by the Cedar Grove Composting Facility as compostable. While the number of non-fluorinated products in our database that are listed under BPI or Cedar Grove is somewhat limited at this time, purchasers can help to expand this number by sending us any samples that you have from BPI or Cedar Grove's lists that we haven't yet tested, and by urging compostability/sustainability certifiers to promptly adopt restrictions on these fluorinated additives. BPI should be recognized for quickly establishing a new policy and a goal of only having products that meet the 100 ppm fluorine requirement on their certified list by the end of 2019.*

- **Select single-use foodware that can be handled by your local recycling facility. If you do not have access to a composting facility, but do have access to recycling services:**

  - **Choose products made of materials that are accepted by your recycling facility that do NOT contain fluorinated additives.**

  AND

  - **Confirm the level of food waste contamination that the recycling facility will allow on these products.** Recycling of food-contaminated products seems to be fairly uncommon, so it is essential to investigate this issue with the recycling facility. In some cases, food may need to be scraped off before products are sent for recycling.

Note: It is not only important to ask whether a product is recyclable, but also to confirm that it will be recycled. Several solid waste experts noted that while some recyclers may "accept" all of an organization's plastic waste to secure their business, they may actually recycle only the most desirable plastics and landfill the remainder.

- **Advocate for local composting and/or recycling services: If organizations do not have access to either composting or recycling services**, it is important for purchasers to advocate for these services as demand can hasten their development.

How to use CEH's Database

The test results (ceh.org/disposablefoodware) are provided in a downloadable Excel file, which will allow you to search and sort the data. We have filled in as much information as we have available for each product. In some cases this information was provided by the purchaser supplying the sample; and in other cases, the information was obtained by CEH from manufacturer or retailer websites, calls to the manufacturers, or the product packaging. Categories for which no information was available are marked "unknown."

Use our database to select **non-fluorinated** products, which are listed as either containing no fluorine (No F) or low levels of fluorine (Low F). CEH has created multiple tabs to assist with searching through the results. The first is a listing of all products divided by fluorine content. There are additional tabs for each of the product types tested: plates, bowls, clamshells, and food trays/food boats.

Check the CEH website or sign up to receive updates as we will continue to accept and test products in 2018. We would like to hear from you about what additional information or tools would be useful for your institution. If you have any questions about our project or would like to receive occasional alerts about new batches of test results, please contact Sue Chiang at foodware@ceh.org.

Section 2

Take Action: What Purchasers Can Do

Whether you are an individual consumer or a large institutional purchaser, you can use your purchasing dollars to obtain healthier products and in doing so help move the entire market toward safer options. Companies want and need to meet the needs of their customers. Many companies have reported that, outside of regulatory changes, the single largest driver of change within their company is the voice of their customers. But without market pressure, companies may ***want*** to initiate changes, but it can be difficult for them to make the business case for why they ***need*** to invest in research and development if customers are not asking for the change. In numerous instances purchasers' preferences have moved the market much faster and farther than any government regulation or legislation.

Below are five steps purchasers can take to move the market toward healthier foodware products.

1. Send us your products to test
If you are using a single-use foodware product that is not listed on the CEH database, we encourage you to send us a sample of any bowl, plate, clamshell, multi-compartment food tray, or food boat for free testing for the presence of fluorine. Once the testing has been completed, we will contact you with the results and help identify alternatives for any fluorinated products. We are not testing cups or utensils as these have not been found to contain fluorinated additives.

Product testing can be very helpful as you engage in discussions with your suppliers about environmentally preferable products. Having your products tested also contributes to the growing body of knowledge about which products do and do not contain fluorinated additives, thereby making it easier for purchasers to identify healthier products.

If you would like to participate in CEH's testing program, please refer to Appendix C for instructions on how to submit samples.

2. Contact your suppliers
Your suppliers are valuable partners. It is important that you let them know about your concerns and preferences for healthier foodware. CEH has a sample letter that you can send to your suppliers. If your company prefers to meet with your suppliers, this letter can be used as talking points for your meeting and/or be sent ahead of time. A unified request for healthier products from numerous and varied customers will send a powerful message to suppliers that will help spur innovation.

Despite an eagerness on the part of consumers and industry to move away from fluorinated chemistry as soon as possible, manufacturers should be encouraged to conduct robust alternative assessments to ensure that any replacement chemicals or materials don't pose a threat to human health and the environment. Purchasers can play an important role in ensuring safer substitutions and safer product ingredients overall by requesting information about the company's chemical hazard assessment process and findings. Please contact Sue Chiang at foodware@ceh.org to request a copy of the Letter to Suppliers.

3. Adopt existing specifications

The State of New York (NY), with the assistance of the Responsible Purchasing Network, has recently revised model specifications for disposable foodware. The updated specification encourages the use of reusables and establishes environmental and health standards for single-use food service containers and packaging. Notably, the NY State specifications expressly prohibit the purchase of foodware containing PFAS or polystyrene.

The City and County of San Francisco recently completed a solicitation for disposable food containers that includes specifications prohibiting PFAS as well as polystyrene. These specifications can be adopted for use by other purchasers.

Both the State of New York and the City of San Francisco have model specifications for disposable foodware that can be adopted by other purchasers.

4. Contact organizations that certify compostable/sustainable foodware

Environmental standards for foodware, especially those that are third-party verified, can be important tools that help purchasers identify environmentally preferable products. In order for these certifications and standards to have real value to purchasers, they must address the significant health and environmental concerns related to the product category. As mentioned above, the most commonly used certifiers of compostable Foodware, BPI and Cedar Grove Composting Facility, do not yet prohibit approved products from containing fluorinated additives. BPI will start to phase in PFAS restrictions in early 2019. More information about the positions of the certification/approval organizations is provided in Appendix B.

"...manufacturers should be encouraged to conduct robust alternative assessments to ensure that any replacement chemicals or materials don't pose a threat to human health and the environment."

CEH will continue to track the progress of these certification bodies on this issue. If needed, we will develop a letter that purchasers can sign to express your desire for the organizations to promptly adopt and implement requirements for foodware products to be non-fluorinated. Signing this letter is another effective way that you can leverage your position as purchasers to move the market towards safer products and meaningful standards. Please contact Sue Chiang at foodware@ceh.org to request this letter and we will send it once it is available.

5. Purchase non-fluorinated products

Once your organization has decided that you don't want fluorinated chemicals in your product, the next step is to take action through your purchasing decisions. You can do this by purchasing foodware that is consistent with the guidelines in this report.

As discussed, use reusable foodware products whenever possible. This eliminates large volumes of waste that need to be managed, reduces the consumption of valuable natural resources needed to produce disposable products, and can save you money.

If reusables are not possible, purchase products that are: 1.) certified compostable, 2.) do not contain fluorinated additives and 3.) are accepted by the composting facility you will be using.
If your organization does not have composting services available, you can consider recyclables that: 1.) do not contain fluorinated additives or polystyrene, 2.) are made of materials that your local collection service and recycling facility have confirmed they will actually recycle. Confirm what level of food waste contamination is acceptable, if any.

If you do not have commercial composting or recycling services available, we encourage you to reach out to your local waste management authority and let them know of your interest in this service. Demand for these services can incentivize their development.

Use CEH's spreadsheet to help you identify alternative products that are non-fluorinated and support those companies making safer products.

"Once your organization has decided that you don't want fluorinated chemicals in your product, the next step is to take action through your purchasing decisions. "

Section 3

Reusable Foodware: Saves Money, Protects Health, Reduces Waste

As mentioned above, from an overall sustainability perspective, reusables are by far the most preferable option. While transitioning to reusables may initially seem difficult to achieve, if your facility is regularly serving food on site, offering reusable foodware and minimizing disposable options will save money and minimize your impact on the environment and public health. In addition, reusables will allow you to avoid unnecessary transportation, reduce energy consumption, and cut emissions from packaging, production, and waste transport. This, in turn, protects natural resources and limits the amount of waste that goes into landfills, incinerators or ends up as pollution in our neighborhoods, local waterways, and the ocean.

Even though there is an upfront investment needed to purchase reusable products and an ongoing cost to support a reusable operation, the original investment can be quickly returned and significant cost savings can be achieved annually from avoided disposable foodware purchases and decreased waste hauling services (in terms of bin size and frequency of pickup).

Consider the example of one reusable coffee mug that is designed for 3,000 uses compared to purchasing and disposing 3,000 disposable coffee cups designed for one use (with all of the associated packaging such as lids and sleeves).[24] Clean Water Action's Rethink Disposable program offers numerous case studies demonstrating how business and institutional dining food operators have successfully implemented source reduction practices to conserve resources, save money and cut down on waste and greenhouse gas emissions by reducing disposables and transitioning to reusable foodware.[25] The *Rethink Disposable* program provides consultation, tools and resources to implement cost-saving practices in food service, such as packaging and waste elimination, payback period, annual cost savings, and greenhouse gas emissions reduction.

". . . if your facility is regularly serving food on site, offering reusable foodware and minimizing disposable options will save money and minimize your impact on the environment and public health. "

Some organizations have used creative approaches to reduce their need for disposable foodware. For example, some facilities offer a deposit-based container exchange program, where reusable take-out containers can be returned by users who regularly visit the site such as the *GoBox* service.[26] Many college campuses have implemented a reusable container system for dining facility take-out. Other options include offering incentives such as a discount for customers who bring in their own reusable mug or a disincentive such as charging a fee for disposable take-out products. Some businesses have implemented simple changes in their food service operations. These include always asking whether a meal is for here or to-go and issuing the appropriate foodware at the point of sale, distributing straws by request only, and organizing disposable foodware at a self-serve station to allow customers to take only what they need, rather than having it automatically handed to them.

Benefits of Reusables

- Durability.
- Less environmental impact from extraction, production, manufacturing, and transportation (such as energy, water, materials, waste).
- No ongoing disposable purchasing and waste hauling fees.
- Once the pay-back period (Return on Investment) is reached, cost savings will accrue with every use of a reusable product. See Clean Water Action's *ReThink Disposable* 11 business and two institutional case studies and business video testimonials available at rethinkdisposable.org.
- Facilities have reduced the use of disposables and incorporated reusables without additional labor costs, and in some cases, without mechanized dishwashers.

Considerations

- "Buy-in" (identification and early engagement) of all necessary stakeholders such as contracted food vendors/business owners, sustainability or green team employees, facilities and maintenance (especially waste management and janitorial staff), and purchasing and communications/ marketing departments.
- Initial investment for the purchase of infrastructure and reusable foodware, plus money budgeted for purchase of lost or damaged reusables.
- Careful consideration about the best way to structure the business operation to support an ongoing reusable service.
- Development of a plan for regularly training food service and janitorial staff to maintain a successful reusable foodware operation, in addition to implementing a communications strategy for employees and customers to increase participation and reduce loss.
- Potentially increased cost for labor, soap, water, and energy to wash reusables, which can be quantified in a cost benefit (or total cost of ownership) analysis.

Disposable Foodware

For applications where reusables are not feasible, we have highlighted some benefits and considerations of the various disposable foodware options. We recommend you select compostable or recyclable products that can be processed by your local facilities. We recommend you avoid molded fiber paper (at this time) and polystyrene products. Each of these recommendations are discussed in detail below.

Compostable Disposable Foodware and Certifications/Standards

Benefits of Composting and Compostable Foodware

Composting of food and "green" waste (plant debris or agricultural waste) offers numerous benefits to the soil by increasing fertility and reducing the use of chemical fertilizers, pesticides, and irrigation. It also has a climate benefit by helping store carbon and diverting organic material from landfills, where they can generate methane - an extremely potent greenhouse gas. Composting also prevents food waste from being sent to incinerators, which can generate toxic chemical emissions and ash. Compostable foodware facilitates the collection of food scraps because both the food and foodware can be placed in the compost stream without sorting. To maximize the positive benefits of composting, we must eliminate toxic chemicals such as fluorinated additives from foodware products.

Composting Certifications and Standards for Disposable Foodware Currently Don't Restrict Fluorinated Compounds (PFAS)

Independent third-party certification of products are an important resource for purchasers. It is important that purchasers be aware that unverified marketing claims for products such as "biobased" or made from "renewable resources" provide no guarantee that the disposable foodware will be compostable.[27] In addition, some products claiming that they are PFOA-free or as compliant with the Food & Drug Administration may still contain other fluorinated treatments that remain on FDA's effective food contact substances inventory.[28]

There are four organizations that verify either the compostability certification or sustainability of disposable foodware. The two most commonly utilized resources are **Biodegradable Products Institute (BPI) Compostability Certification** and **Cedar Grove List of Accepted Products**. The Cradle to Cradle Products Innovation Institute and Green Seal also have certifications that apply to disposable foodware, although there are few foodware products currently certified to these standards.

As mentioned earlier, none of these organizations' standards yet fully restrict the use of this class of fluorinated compounds in the foodware that they certify. However, within the last several months,

there has been significant movement within the certification and standards world and BPI should be commended for already taking steps to revise its standards and incorporate restrictions on fluorinated compounds. See Appendix B for an update on the positions of each entity on the presence of fluorinated additives in foodware."

Choose BPI-Certified or Cedar Grove Accepted Compostable Products That Do Not Contain Fluorinated Additives (containing No or Low F)

The best way to make sure a product will actually break down in a commercial composting process is to choose a third-party certified or verified compostable product (that does not contain fluorinated additives). Because composting conditions vary widely across the country, it is important that you contact your facility to determine the compostability of the desired products in your local system, even if your preferred products are BPI-certified or Cedar Grove accepted.

Currently neither BPI's Compostability Certification nor Cedar Grove's Accepted list prohibits the use of fluorinated compounds.

To identify non-fluorinated certified- or verified-compostable products, check the CEH database. If you don't see the products that you are interested in among our tested items, you can submit them to us for testing. See Appendix C for instructions on how to submit samples for testing.

Other helpful features to look for in non-fluorinated compostable products include:

- Products that are clearly labeled as "compostable" on each item to assist with proper sorting and disposal.
- Products that contain recycled content or agricultural waste to reduce the amount of virgin materials needed.

"The best way to make sure a product will actually break down in a commercial composting process is to choose a third-party certified or verified compostable product (that does not contain fluorinated additives). "

Compostable Foodware From CEH's Database

100% Polylactic Acid (PLA)

There are different types of bioplastics on the market. Many of the foodware products that we tested were made out of PLA or Ingeo™, a trademarked brand of PLA. **All of the clear PLA products were classified as non-fluorinated.**

The one PLA exception is a product that has the appearance of a black rigid plastic. It was sent to two different labs which both classified the product as fluorinated. As noted earlier, the product manufacturer has indicated that fluorinated compounds were used as a "mold release agent" in the manufacturing process and that they are requesting that a non-fluorinated alternative be used.

Benefits

- Many PLA products are BPI-certified compostable and Cedar Grove accepted. Check with your local composting facility to assess whether PLA products compost sufficiently in their facility.
- All of the clear PLA products that we tested did not contain fluorinated additives.
- Because PLA products are compostable and can generally be commingled with food waste, they can help capture more food scraps.
- If your facility has control over the products used on site (such as a restaurant or theatre) and only compostables are used, no sorting of foodware is needed, eliminating the risk of contaminating the compost stream.
- PLA is rated by Clean Production Action's Plastics Scorecard as having the lowest "chemical footprint," followed by polypropylene and polyethylene which also have lower chemical footprints than other plastics such as polystyrene and PVC.[29]

Considerations

- Typically more expensive than molded fiber products.
- Clear PLA products usually can only be used for cold foods.
- PLA can be confused with other clear plastics such as polyethylene terephthalate or PET (potentially contaminating the recycling stream) and are not likely to be accepted for recycling.
- Not all PLA products compost sufficiently so you should check with your provider.
- No recycled content.
- More needs to be known about the additives, use of GMOs, and pesticides (varies by supplier).
- Commercial composting or recycling facilities may not be available in your community. Talk with your waste management department to express your desire for these types of facilities.

PLA-Lined Paper Products

All of the test results classified PLA-lined paper products as non-fluorinated. They can typically be composted in a commercial composting facility, which is the preferred end-of-life option for these products and captures the associated food waste on the product. However, if commercial composting is not available, these products might be accepted for recycling, but only if they aren't too contaminated with food. If you have a local recycling facility, confirm that it will accept these products and the level of acceptable food contamination.

Benefits

- Most are BPI-certified compostable and some are Cedar Grove accepted products.
- Some products contain recycled paper content.
- Because PLA-lined paper products are compostable and can generally be commingled with food waste, they can help capture more food scraps.
- If your facility has control over the products used on site (such as a restaurant or theatre) and only compostables are used, no sorting of foodware is needed, and eliminating the risk of contaminating the compost stream.
- Cups and non-food contaminated products may be accepted for recycling.
- Typically less expensive than 100% PLA products.

Considerations

- Typically more expensive than molded fiber products.
- Non-recycled paper uses virgin materials.
- Bleached paper can generates toxic emissions and waste during the manufacturing process.
- More needs to be known about the additives, use of GMOs, and pesticides (varies by supplier).
- Commercial composting or recycling facilities may not be available in your community. Talk with your waste management department to express your desire for these types of facilities.

Clay-Coated Paper Products

All of the test results for clay coated paper products indicated that they do not contain highly fluorinated compounds. Very low levels of fluorine may be found in some products; it is hypothesized that this may be from naturally occurring fluorine in the clay.

Benefits

- Some are BPI-certified compostable and/or Cedar Grove accepted products.
- Because clay-coated paper products are compostable and can generally be commingled with food waste, they can help capture more food scraps.
- Clay-coated paper products can handle hot or cold foods.
- Typically less expensive than PLA-lined paper.

Considerations

- Typically more expensive than molded fiber.
- Typically made from virgin fibers without recycled content, which contributes to deforestation.
- Bleached paper can generates toxic emissions and waste during the manufacturing process.
- More information is needed about any chemical additives used.
- Commercial composting or recycling facilities may not be available in your community. Talk with your waste management department to express your desire for these types of facilities.

Untreated/Uncoated (Non-Molded) Paper Products

Untreated/uncoated paper (such as regular paper plates) and paperboard products are typically non-fluorinated but should be tested for fluorine and assessed to see if they can serve the performance requirements needed.

Benefits

- Some are BPI-certified compostable and/or Cedar Grove accepted products.
- May be competitively priced.
- May contain recycled content.

Considerations

- May not perform well for all applications.
- Non-recycled paper uses virgin materials, which contributes to deforestation.
- Bleached paper can generate toxic emissions and waste during the manufacturing process.

Other Product Materials - Palm Leaf and Bamboo

CEH tested products from only one to two manufacturers for each of these product material types and limited information was obtained.

Palm Leaf Products

Benefits

- Made from agricultural waste.
- Can be used for hot and cold products.

Considerations

- Typically more expensive than PLA products.

Bamboo Products

Benefits

- Some are accepted by Cedar Grove.
- Can be used for hot and cold products.

Considerations

- Typically more expensive than PLA products.

Recyclable Disposable Foodware

If composting is not available in your community, recyclable products may be an option if you have commercial recycling services. Importantly, the actual recycling rate for these types of products is uncertain and those contaminated with food often cannot be recycled. Some exceptions may exist, so it is not only important to ask whether a product is "accepted" for recycling, but also to confirm that it will be recycled. Several solid waste experts noted that while some recyclers may "accept" all of an organization's plastic waste to encourage their business, they may actually recycle only the most desirable plastics and landfill the remainder.

Recyclable Plastic

Petroleum-based plastic products are less preferred because 1) they are made from a non-renewable resource and 2) they are often downcycled (into a lower quality of plastic) rather than recycled back into the same type of products.

Among petroleum-based plastics, polypropylene (PP) and polyethylene (PE, may be used as a liner for paper foodware) are considered to have the lowest chemical footprint.[30] Polyethylene terephthalate (PET) has a higher chemical footprint than PP and PE but is considered preferable to Polystyrene (PS) and is more commonly recycled. Please check with your local recycling facility to determine if your desired products are accepted for recycling, including the tolerated level of food contamination.

CEH did not test these products in this first round of testing as they are not believed to contain fluorinated additives. If you are interested in having products tested, please see Appendix C for instructions on how to submit samples.

Benefits

- Some types may contain recycled content.

Considerations

- Typically more expensive than molded fiber.
- Some products may not work for hot applications.
- Plastics are typically made from fossil fuels which have significant environmental and human health concerns.
- Some may be "downcycled" at end of life.
- Unlikely to be recycled if contaminated with food waste.

Products with Unknown End-Of-Life Options

Paper Products with Unknown Coatings

While all of the paper products with unknown coatings were non-fluorinated, we do not know the chemical constituents of the coating used and therefore do not know if there are potential health risks or how this product should be handled at end-of-life.

We encourage manufacturers to identify the materials they are using, any associated health hazards, and the appropriate end-of-life options for their products.

Plastic-Lined Paper Foodware

Few recycling collection services currently recycle plastic-lined paper foodware, especially those that have food contamination. Some exceptions may exist, so it is important to check with your recycling facility and collection service to ensure these products will not only be collected, but the paper will actually be recycled. Plastic-lined paper cups are more likely to be recycled as they tend to be free of food waste.

Other Product Considerations

In addition to selecting products that are accepted by your local composting or recycling service provider and that are non-fluorinated, here are a few additional positive factors to be considered when selecting environmentally preferable products:

- **Sustainably sourced paper/wood** (Forest Stewardship Council (FSC) certification)[31]. Some paper products contain fiber that is certified as sustainably sourced by the Forest Stewardship Council (FSC). Purchasing FSC-certified foodware helps ensure that the fiber was grown in and harvested from a sustainably managed forest. While there is no easy-to-navigate list of FSC-certified products that purchasers can use to identify FSC-certified products, many FSC-certified products have the FSC logo affixed to their packaging or marketing materials.
- **Chlorine-free bleaching**. Some products claim that their manufacturing process is totally chlorine-free (TCF) or process chlorine-free (PCF), which means they use no elemental chlorine or chlorinated compounds to process or whiten paper pulp. These methods go beyond what is required by law - elemental chlorine-free (ECF) production, which restricts the use of elemental chlorine gas but allows for the use of chlorinated compounds to manufacture or whiten paper pulp.
- **Water-based inks/glues.** These environmentally preferable inks and glues are generally safer to produce than equivalent solvent-based products and facilitate safer end-of-life management of foodware products and packaging.
- **Feedstock and final product are produced in North America.** This reduces transportation impacts of foodware products.

Disposable Foodware Products to Avoid

Molded Fiber Products

All of the molded fiber products tested by CEH and our partners, including those made from recycled paper, sugarcane waste (bagasse), wheat straw and/or silver grass (miscanthus), found high levels of fluorine, indicating the use of fluorinated additives. While we generally support the principle of using agricultural waste and recycled paper to make foodware, until these materials can be used without fluorinated additives or other harmful chemical substitutes, we recommend avoiding them.

Reminder: High fluorine content, indicating likely fluorinated additives, was found in molded fiber products that are certified/approved by BPI, Cedar Grove, the Cradle to Cradle Products Innovation Institute, and GreenSeal. Consequently, certification and/or approval of these products, while helpful to ensure compostability or achievement of other sustainability criteria, do not mean they are free of fluorinated compounds. For more information on these certifications and ecolabels, see page 23.

Manufacturers are actively researching non-fluorinated additives and surface treatment alternatives for molded fiber products, and we expect that alternatives will be emerging over the coming year. In order to avoid harmful substitutions, manufacturers should conduct robust alternative assessments to ensure that they are not simply moving from one harmful chemical to an unknown and potentially harmful substitute. Purchasers can play an important role in relaying these messages through conversations with manufacturers about their products. CEH's Letter to Suppliers can be used to convey this important message.

Most molded fiber products provide the additional benefit of using agricultural waste or recycled paper. Once non-fluorinated molded fiber products are available in the US marketplace, they will likely represent a viable compostable foodware option.

Polystyrene - Expanded Polystyrene (EPS) Foam or Rigid Polystyrene

Because of numerous concerns regarding the health risks and environmental impacts linked to the life cycle of polystyrene products, we did not test products in this category. Instead, we recommend that purchasers simply avoid it.

Styrene, which is used to manufacture disposable polystyrene foodware, is "reasonably anticipated to be a human carcinogen," according to the National Toxicology Program's "*Report on Carcinogens*."[32,33]

- Typically made of fossil fuels and synthetic chemicals, small amounts of styrene can be transferred to food.[34]
- A growing number of cities and counties across the country have passed ordinances prohibiting the sale or use of EPS or in some cases, all polystyrene foodware products.[35]
- Generally not accepted by recycling facilities. Industry may claim it is technically recyclable, but the reality is that very few or only a small number of recycling facilities accept these products. Polystyrene products contaminated with food typically cannot be recycled (For example, in 2017 New York City determined that Food-Service Foam or Post-Consumer Food-Service Foam "cannot be recycled in a manner that is economically feasible or environmentally effective" for their jurisdiction).[36]
- Slow to degrade; instead it can break into smaller pieces and end up in the marine environment, where it can be mistaken for food.[37]

Appendix A: Testing Methods and Protocol

Dr. Graham Peaslee of the University of Notre Dame Department of Physics, measured the total fluorine content of a wide array of single-use foodware products using particle-induced gamma-ray emission (PIGE) spectroscopy. Details of this procedure can be found here.[18] This technique has been used in other studies of papers and textiles,[19,20] and has been validated with more expensive LC-MS/MS (liquid chromatography–mass spectrometry) methods including Total Oxidizable Precursor assay.[21] Dr. Peaslee classified products as either:

a.) no detectable fluorine ("No F"),

b.) low fluorine content or "low F" (possibly fluorine or low levels of contamination in the product manufacturing process), or

c.) high fluorine content or "F" (likely treated with fluorinated compounds)

For this study, these ranges were established to be:

a.) **Non-fluorinated (No F):** Products that had both surfaces register total fluorine counts pe microCoulomb of beam of less than ~150 were characterized as non-fluorinated.

b.) **Low Fluorine (Low F):** Products that had at least one surface register total fluorine counts per microCoulomb of beam of greater than ~150 and less than ~500 were characterized as low fluorine. In all cases the fluorine signature had to be statistically significant at 3X above background.

c.) **Fluorinated (F):** Products that had at least one surface register total fluorine counts per microCoulomb of beam of greater than ~500 were characterized as fluorinated. In all cases the fluorine signature had to be statistically significant at 3X above background.

Products that were identified as likely containing fluorinated compounds had significantly higher (on average 10-fold higher) levels of fluorine than those identified as low fluorine.

Appendix B:
Status of Standards and Certification Bodies' Plans to Restrict PFAS in Disposable Foodware

Below is information collected by CEH regarding the positions of BPI, Cedar Grove, the Cradle-to-Cradle Products Innovation Institute and Green Seal on fluorinated additives in foodware.

The Biodegradable Products Institute (BPI) label certifies that a product is "compostable," which means that they meet the ASTM compostability specifications (D-6400 or D-6868) among other requirements to compost satisfactorily in large scale aerobic municipal or industrial composting facilities.

BPI announced in November 2017 that beginning in 2019, new products that contain more than 100 ppm of fluorine will not be able to be certified as compostable. BPI is to be commended for being the first organization to develop restrictions on the use of fluorinated compounds in the foodware products they certify. By the end of 2019, all BPI-Certified products will meet the 100 ppm fluorine restrictions; products that were already BPI-certified that do not meet these restrictions will no longer be able to use the BPI logo nor be marketed as BPI-certified. Until then, use the CEH product database to identify no or low fluorine products that are BPI certified compostable.

Cedar Grove's "Accepted Commercial Items" List identifies foodware products that meet specific requirements for constituent materials or have been shown through field testing to have successfully composted in their commercial composting facility in Washington State or by another member of the Compost Manufacturing Alliance. Products on Cedar Grove's list that contain bioplastic are either BPI-certified or independently verified by Cedar Grove to meet the same ASTM compostability standards prior to being field tested at Cedar Grove for consideration and acceptance.

In conversations held with Cedar Grove in December 2017, they expressed interest in implementing similar restrictions to BPI and the company is working to finalize guidelines preventing products containing PFAS from being approved. There is currently no deadline for any restrictions. Use the CEH spreadsheet to identify no or low fluorine products that are accepted for composting by Cedar Grove.

Cradle to Cradle (C2C) Certified™ assesses the sustainability of a product through five categories — material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness. Products can achieve one of 5 certification levels in each category - Basic, Bronze, Silver, Gold or Platinum. Under the current Cradle to Cradle Certified standard (version 3), only certification at the Gold or Platinum level in the Material Health category ensures

that products do not contain fluorinated treatments. There are currently no Gold or Platinum level foodware products on the C2C Product Registry. Conversations held with the Cradle to Cradle Products Innovation Institute in December 2017 revealed that restrictions on fluorinated treatments as a class of chemicals are being proposed for the next version of their standard at certification levels in Material Health below Gold. The revised standard (version 4) is currently under development and is not likely to be in place until the end of 2018 or early 2019. Products that have been certified to version 3 will likely have a transition period of up to two years to meet version 4; therefore, purchasers will need to verify fluorine content with the manufacturer prior to purchasing.

Green Seal Certification covers products and services in a wide variety of categories that meet a set of environmental leadership standards specific to that category. GS-35: Green Seal's Standard for Food Service Packaging, establishes environmental requirements for food-service packaging, which includes single-use containers for packaging or carry-out of products from restaurants and other retail food service establishments. The standard addresses sustainability attributes such as recycled content, unbleached fiber, compostability and toxics in packaging and inks; but it does not restrict the use of highly fluorinated compounds.

As of this writing, Green Seal has indicated that their GS-35 certification, which currently applies only to one product, is not scheduled for revision; therefore, foodware products with fluorinated treatments will continue to be eligible for Green Seal certification.

Appendix C:
Instructions for Participating in CEH'S Disposable Foodware Testing

Thank you for your interest in participating in CEH's testing project. We are offering ***free testing of disposable food serviceware*** for government, healthcare, higher education, K-12, and private businesses for the presence of fluorinated compounds, which are used to impart water- and grease-resistance properties. This data will help purchasers identify non-fluorinated foodware products. We hope that as purchasers begin to specify and prefer non-fluorinated products, this will drive manufacturers towards producing safer alternatives.

What products are CEH testing?
We are studying the disposable foodware products listed in the bullets below. We are particularly interested in all paper and molded fiber disposable products including those that are labeled as compostable or biodegradable. Please only send products for which you have the brand information so that we will be able to identify safer brands by name.

- **Bowls**
- **Plates**
- **Clamshell containers**
- **Multi-compartment food trays**
- **Food boats**

Items that should <u>not</u> be submitted for testing:

- No disposable foodware products made from polystyrene (either rigid plastic #6 or foam/Styrofoam).
- No disposable cups as those products do not typically have fluorinated treatments.
- No disposable foodware for which brand information is unknown.

Sample Collection:

- Place the product along with the submission form and seal it in a Ziploc bag. Please write your organization name on the outside of the Ziploc bag.
- If you are submitting more than one product for testing, please repeat the process and complete a separate submission slip for each sample.

Submission Process:

- Mail the sample(s) and submission form(s) to:
  Caroline Cox, Center for Environmental Health, 2201 Broadway Suite 302, Oakland, CA 94612-3017.
- E-mail a photo of the product and the packaging it came in to caroline@ceh.org and cc: foodware@ceh.org

For More Information: Call Sue Chiang at 510-655-3900 ext. 311

Submission Slip
CEH'S Disposable Foodware Testing

Name and Contact Information of Person Submitting Sample:

Name: _____

Telephone Number: _____

Email Address: _____

Name of Organization Submitting Sample: _____

Description of Item: (Please send photo of product and any packaging/labels)

Type of disposable product (Circle one of the following):

bowl plate clamshell multi-compartment food tray food boat

Brand: _____

Name/Description of Product: _____

Product SKU: _____

Manufacturer/Distributor(found on packaging label): _____

Marked or labeled as biodegradable? _____Yes _____No

Marked or labeled as compostable? _____Yes _____No

Price: $ _____ per_____

Product URL: _____

Name of supplier: _____

Do you know if the product is BPI-Certified or Cedar Grove Accepted for compostability?

_____

Please complete all sections and place this form in the Ziploc Bag surrounding the sample.

THANK YOU!

ENDNOTES

[1] Buck, Robert C et al. "Perfluoroalkyl and Polyfluoroalkyl Substances in the Environment: Terminology, Classification, and Origins." Integrated Environmental Assessment and Management 7.4 (2011): 513–541. PMC. Web. 17 Jan. 2018.

[2] "Basic Information about Per- and Polyfluoroalkyl Substances (PFASs)." United States Environmental Protection Agency. Web. 17 Jan. 2018.

[3] "Fact Sheet PFOA & PFOS Drinking Water Health Advisories." United States Environmental Protection Agency. 01 Nov. 2016. Web. 17 Jan. 2018.

[4] Grandjean, Philippe et al. "Estimated Exposures to Perfluorinated Compounds in Infancy Predict Attenuated Vaccine Antibody Concentrations at Age 5-Years." Journal of Immunotoxicology 14.1(2017): 188–195. PMC. Web. 17 Jan. 2018.

[5] "Registry of Toxic Effects of Chemical Substances (RTECS)." The National Institute for Occupational Safety and Health (NIOSH). Centers for Disease Control and Prevention, 7 March 2017. Web. 17 Jan. 2018

[6] "C8 Probable Link Reports." C8 Science Panel. Web. 17 Jan. 2018.

[7] New Jersey Drinking Water Quality Institute Health Effects Subcommittee."Health-based Maximum Contaminant Level Support Document: Perfluorooctanoic Acid (PFOA)." Nj.gov, 27 June 2016. Web. 17 Jan. 2018.

[8] Wang, Zhanyun et al. "A Never-Ending Story of Per- and Polyfluoroalkyl Substances (PFASs)?" Environ.Science & Technology 51.5 (2017): 2508-2518. ACS Publications. Web. 17 Jan. 2018.

[9] Ibid

[10] Kang, Habyeong et al. "Elevated Levels of Short Carbon-chain PFCAs in Breast Milk Among Korean Women: Current Status and Potential Challenges." Environ Res.148 (2016): 351-359. Science Direct. Web. 18 Jan. 2018.

[11] Rosenmai AK et al. "Fluorinated Alkyl Substances and Technical Mixtures Used in Food Paper-Packaging Exhibit Endocrine-Related Activity in Vitro." Andrology 4.4 (2016): 662-672. Wiley Online Library. Web. 18 Jan. 2018.

[12] Sheng, Nan et al. "Comparative Hepatotoxicity of 6:2 Fluorotelomer Carboxylic Acid and 6:2 Fluorotelomer Sulfonic Acid, Two Fluorinated Alternatives to Long-Chain Perfluoroalkyl Acids, on Adult Male Mice." Archives of Toxicology 91.8 (2017): 2909-2919. Springer Link. Web. 18 Jan. 2018.

[13] Yuan, Guanxiang et al. "Ubiquitous Occurrence of Fluorotelomer Alcohols in Eco-Friendly Paper-Made Food-Contact Materials and Their Implication for Human Exposure." Environ. Science & Technology Letters 50.2 (2016): 942-950. ACS Publications. Web. 18 Jan. 2018.

[14] Kupper, Thomas; et al "Compost and Digestate: Sustainability, Benefits, Impacts for the Environment and for Plant Production." Codis (2008): 23-34. Fibl. Web. 18 Jan. 2018.

[15] Bizkarguenaga, Ekhine et al. "Uptake of 8:2 Perfluoroalkyl Phosphate Diester and its Degradation Products By Carrot and Lettuce from Compost-Amended Soil." Chemosphere 152(2016): 309-317. Science Direct. Web. 18 Jan. 2018.

[16] Appleman, Timothy D. et al. "Treatment of Poly- and Perfluoroalkyl Substances in U.S. Full-scale Water Treatment Systems." Water Research 51(2014): 246-255. Science Direct. Web. 18 Jan. 2018.

[17] WebstaurantStore Web. 18 Jan. 2018.

[18] Ritter, Evelyn E. et al. "PIGE as a Screening Tool for Per- and Polyfluorinated Substances in Papers and Textiles." Nucl. Instr. Meth. 407(2017): 47-54. Science Direct. Web. 18 Jan. 2018.

[19] Schaider, Laurel A. et al. ""Fluorinated Compounds in U.S. Fast Food Packaging." Environ. Science & Technol. Letters 4.3(2017): 105-111. ACS Publications. Web. 18 Jan. 2018.

[20] Lang, Johnsie R. et al. "Release of Per- and Polyfluoroalkyl Substances (PFASs) from Carpet and Clothing in Model Anaerobic Landfill Reactors." Eviron. Science & Technol. Letters 50.10(2016): 5024-5032. ACS Publications. Web. 18 Jan. 2018.

[21] Robel, Alix E. et al. "Closing the Mass Balance on Fluorine in Papers and Textiles." Environ. Science & Technol. Letters 51.16(2017): 9022-9032. ACS Publications. Web. 18 Jan. 2018.

[22] "Fluorine by Pyrohydrolysis and Ion-Selective Electrode." GLI Method Summary. Galbraith.com. Web. 18 Jan. 2018.

[23] Foodservice Disposables" Freedonia. Market Research. Web. 18 Jan. 2018.

[24]"Report of the Starbucks Coffee Company/ Alliance for Environmental Innovation Joint Task Force." Alliance for Environmental Innovation. Business.edg.org, 15 April 2000. Web. 18 Jab. 2018.

[25] Rethink Disposable. Clean Water Action and Clean Water Fund. Web. 18 Jan. 2018.

[26] "Enjoy Takeout With Less Waste." Go Box. Web. 18 Jan. 2018.

[27] "Confused by the Terms Biodegradable & Biobased." BPI World. Web. 18 Jan. 2018

[28] "Inventory of Effective Food Contact Substance (FCS) Notifications." U.S. Food & Drug. U.S. Department of Health and Services. Web. 18 Jan. 2018.

[29] "Plastic Scorecards Version 1.0." BizNGO For Safer Chemicals & Sustainable Materials. Clean Production Action. Web. 18. Jan. 2018.

[30] "Plastics Scorecard." Resource. Clean Production Action. Web. 18 Jan. 2018

[31] "FSC Certification." Forests For All Forever. Forest Stewardship Council. Web. 18. Jan. 2018.

[32] "14th Report On Carcinogens." National Toxicology Program. National Institutes of Health. Web. 18 Jan. 2018.

[33] "Review of the Styrene Assessment in the National Toxicology Program 12th Report on Carcinogens." Board on Environmental Studies and Toxicology. The National Academies of Sciences, Engineering, and Medicine. Web. 18 Jan. 2018.

[34] "Styrene-ToxFAQ's." Atsdr.cdc.gov. June 2012. Web. 18 Jan. 2018.

[35] "Polystyrene Ordinances." Surfrider Foundation. Web. 18 Jan. 2018.

[36] Gracia, Kathryn. "Determination on the Recyclability of Food-Service Foam Pursuant to Local Law 142 of 2013." New York City Department of Sanitation. Nyc.gov, 12 May 2017. Web. 18 Jan. 2018.

[37] "Facts About Styrofoam Litter." Clean Water Action. Web. 18 Jan. 2018.

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