BioSpecs for Food Service Ware

(BioSpecs v.1.0)

Environmentally Preferable Specifications for Compostable Biobased Food Service Ware

Prepared by:

2011

Acknowledgements

The *BioSpecs for Food Service Ware: Environmentally Preferable Specifications for Compostable Biobased Food Service Ware*, or simply, the *BioSpecs*, reflect the ideas, efforts, and input of many individuals and their organizations. The *BioSpecs* evolved from a series of documents that provided the foundation for defining sustainability criteria for biobased materials, including:

- *Sustainable Biopolymer Purchaser Guidelines* (Healthy Building Network et al., 2006)
- *Choosing Environmentally Preferable Food Service Ware: Reusable and Sustainable Biobased Plastics* (Health Care Without Harm, 2007)
- *Guidelines for Sustainable Bioplastics* (Sustainable Biomaterials Collaborative, 2009)

The *BioSpecs* were also informed by a market survey, conducted in 2008, of 45 biobased food service products made by 22 manufacturers. We thank all the producers who participated in our survey, provided detailed data on their products, and answered our many follow-up questions. A special acknowledgement goes to Arielle Tozier of the Oregon Center for Environmental Health for coordinating the survey and to Health Care Without Harm for supporting the survey work.

We especially appreciate the time and counsel provided by our Technical Advisory Committee: Clinton S. Boyd of the Sustainable Research Group, Dr. Joseph Greene of California State University at Chico, Lee Kane of Whole Foods Market, Susan Kinsella of the Green Purchasing Institute, Tom Lent of the Healthy Building Network, Jack Macy of the City and County of San Francisco, Josephine Miller of the City of Santa Monica, Dr. Ramani Narayan of Michigan State University, and Tom Wright of Sustainable Bizness Practices.[1]

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The beta version of the *BioSpecs* v.1.0 was made available for public comment in fall 2009. We received over 70 comments from people involved in various fields and of varying backgrounds. We thank all the people who took the time to read over the *BioSpecs* and give us their feedback. The *BioSpecs* were revised based upon the feedback we received and will be further updated as the industry and our understanding of the opportunities and challenges of manufacturing sustainable biobased products evolve.

About the Sustainable Biomaterials Collaborative (SBC)

The Sustainable Biomaterials Collaborative is a network of organizations working together to advance the introduction and use of biomaterials that are sustainable from cradle to cradle. A project of the Institute for Local Self-Reliance, the SBC seeks to advance the development and diffusion of sustainable biomaterials by creating guidelines, engaging markets, and promoting policy initiatives. The SBC works with a wide range of stakeholders, which include green product businesses, social investment firms, recycling professionals, local governments, academics, and environmental health advocates. The SBC Steering Committee includes Mark Rossi of Clean Production Action; David Levine of the American Sustainable Business Council; Jim Kleinschmit of the Institute for Agriculture and Trade Policy; Brenda Platt and Heeral Bhalala of the Institute for Local Self-Reliance; and Cathy Crumbley of the Lowell Center for Sustainable Production, University of Massachusetts Lowell.

For more information about the Sustainable Biomaterials Collaborative, visit www.sustainablebiomaterials.org.

[1]Organizations' names are listed for affiliation purposes only and do not imply organizational endorsement of the *BioSpecs*.

About the Technical Advisory Committee

The Technical Advisory Committee consists of 16 members from varying expertise and backgrounds that was formed to create and analyze the *BioSpecs* criteria for necessity and practicality and to review the comments received on the beta version of the *BioSpecs for Food Service Ware*. The Committee includes representatives from NGOs, academia, local government, and retail: Brenda Platt and Heeral Bhalala (Institute for Local Self-Reliance), Mark Rossi (Clean Production Action), Jim Kleinschmit and Julia Olmstead (Institute for Agriculture and Trade Policy), David Levine (American Sustainable Business Council), Cathy Crumbley (Lowell Center for Sustainable Production), Clinton Boyd (Sustainable Research Group), Jack Macy (City and County of San Francisco), Dr. Ramani Narayan (Michigan State University), Lee Kane (Whole Foods Market), Tom Wright (Sustainable Bizness Practices), Dr. Joseph Green (California State University at Chico), Tom Lent (Healthy Building Network), Susan Kinsella (Green Purchasing Institute), and Josephine Miller (City of Santa Monica).

For more information on the *BioSpecs*, visit: http://www.sustainablebiomaterials.org or contact Heeral Bhalala, Coordinator, Sustainable Biomaterials Collaborative, at hbhalala@ilsr.org.

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Executive Summary

Drawing a Road Map of Best Practices

The *BioSpecs for Food Service Ware* outline sustainability criteria and recognition levels for food service ware made from compostable biobased materials. They provide a framework to assess the sustainability of these products during three stages of their life cycle: (1) biomass production, (2) manufacturing, and (3) end of product life. "Sustainability" encompasses issues of environmental protection, health, and social and economic justice, as well as material resources. The purpose of the *BioSpecs* is to encourage the market development of biobased food service ware that meet the highest sustainability standards and to prevent the "greenwashing" of partially or wholly biobased products that nevertheless fail to meet environmental, worker protection, and consumer standards.

Product manufacturers and sellers can use the *BioSpecs* as a road map to guide them in improving the sustainability of the products they offer. These specifications are not intended to evaluate the full range of food service ware, such as durable ceramic plates or metal cutlery. They are applicable only within the biobased product category. Indeed, durable, reusable food service products are environmentally preferable to single-use biobased products and should be considered as a first option.

The *BioSpecs* reflect the current collective wisdom of a wide range of organizations and businesses that are addressing the potential benefits and challenges of biomaterials. These criteria were developed under the leadership of the Sustainable Biomaterials Collaborative. They are informed by an extensive market survey, conducted in 2008, of 45 biobased food service products representing 22 manufacturers. Developing the technology and markets for sustainable bioplastics may take time. Certain performance challenges may exist, and there may sometimes be a need for blends of biobased and fossil-fuel-based materials to meet performance criteria in the short term. However, the *BioSpecs* have been developed in order to chart a course toward sustainability in the long term. the *BioSpecs* will be updated as the industry and market evolve.

Addressing Significant Issues in the Bioplastic Life Cycle

Biobased food service ware are becoming increasingly available and offer an alternative to fossil-fuel-derived plastics, which are non-renewable, often threaten public health, have devastating impacts on marine life, and increase reliance on imported feedstocks. The development of bioplastics has the potential to mitigate these problems by offering renewability, biodegradability, and a path away from harmful additives. Bioplastics are not, however, an automatic panacea. Modern industrial agriculture creates a host of health, environmental, and social and economic justice issues, including the use of genetically modified (GM) organisms in the field, toxic pesticides, high fossil-fuel energy use, and the destruction of family farms. Increased demand for agricultural products to be used in the production of energy and materials may well exacerbate the problems posed by modern agriculture while increasing pressure on ecologically sensitive land and raising food security concerns.

The manufacture, use, and discard of products made from bioplastics can also create problems such as hazardous emissions, particularly if the bioplastic is mixed with fossil-fuel-based chemicals. While many bioplastic products are certified compostable, in many cases the requisite collection services and composting infrastructure have yet to be developed. The infrastructure necessary for collecting and processing recyclable bioplastic products may also be lacking, or these products may stress existing recycling systems.

Recognition Levels

In order to appropriately recognize and reward different levels of performance, three tiers have been established, reflecting increasingly higher levels of product sustainability that manufacturers can claim recognition for biobased food service products. The tiers include Bronze, Silver, and Gold and can only be reached in that progressive succession. All of the criteria listed for Bronze must be met in order for a manufacturer or distributor to claim any level of recognition for a product. To meet the Silver level, the product must meet the Bronze and Silver criteria. To achieve a Gold recognition level, the product must meet the criteria for Bronze, Silver, and a minimum of five Gold criteria. For detailed information on how manufacturers can access conformance to the criteria, refer to the companion document, *Conformance Guide: BioSpecs for Compostable Biobased Food Service Ware*.

Recognition Levels for the *BioSpecs for Food Service Ware*

Prerequisites: Products must comply with all applicable laws and regulations throughout their life cycle.

Bronze Criteria

Biomass Production

- 1. a.1 Non-cutlery products must contain at least 90% biobased (organic) carbon content
- 1. a.1.a Cutlery must contain at least 70% biobased (organic) carbon content
- 1. b.1 No plastics may be made directly in plants
- 1. b.2 Genetically modified crops are allowed in the field with offsets
- 1. c.1 Forest- and brushland-derived biomass must be sustainably harvested with adequate documentation

Manufacturing

- 2. b.1 Declare whether nanomaterials are present in product
- 2. c.1 Non-food-contact products must contain 100% recycled and 40% post-consumer recycled content
- 2. c.2.a Food-contact products, excluding cups, must contain 45% total recycled content
- 2. a No organohalogens may be intentionally added to the product or used in coatings

End of Product Life

- 3. a Product must be commercially compostable
- 3. b.1.a The logo of the verification agency must be displayed on the product
- 3. b.1.b Labeling must distinguish compostable from non-compostable plastic products
- 3. b.2 Product must have additional labeling when sold in an area where no commercial composting is available

Silver Criteria

Biomass Production

- 1. a.2 Non-cutlery products must contain at least 95% biobased (organic) carbon content
- 1.a.2.a Cutlery must contain at least 85% biobased (organic) carbon content
- 1. b.3 No genetically modified biomass is allowed in the field

Manufacturing

- 2. b.2.a No Proposition 65 chemicals may be used in the product
- 2. d No chlorine or chlorine compounds may be used in production processes

End of Product Life

- 3. c The product must be compostable at mesophilic temperatures, typical of some backyard/home composting systems

Gold Criteria Options

*Must meet **5** of the following criteria to attain Gold level.*

Biomass Production

- 1. a.3 Non-cutlery products must contain at least 99% biobased (organic) carbon content
- 1. c.2 Agricultural biomass must be produced according to sustainable farming practices
- 1. d Feedstocks are from perennial cellulosic crops or agricultural co-products or residues that currently have no higher value alternative markets
- 1. e Biomass production workers must be protected under fair labor standards

Manufacturing

- 2. b.2.b No chemicals of high concern may be used in the product
- 2. b.3 All additives must be tested for hazards to human health and the environment
- 2. c.2.b Cups must contain 10% post-consumer recycled content
- 2. e Workers and the environment must be protected in manufacturing
- 2. f Local ownership and production must be promoted

End of Product Life

- 3. d.1 Product must be biodegradable in a marine environment
- 3. d.2 Product must be biodegradable in freshwater

Introduction

In recent years, biobased products have re-emerged as an alternative to conventional fossil-fuel-based products, considerably in the food service ware sector. Biobased products are made, in whole or in part, from renewable materials, such as corn, potatoes, sugar cane waste, and perennial grasses. Though not new to the market, paper and other products made from renewable forestry materials are also biobased. The renewability of agricultural and forestry resources is a significant environmental attribute. However, biobased content alone is not an adequate measure of sustainability. Like any other products, biobased products can have environmental and health impacts throughout their life cycle, from production and use to discarding after use. The environmental footprint of biobased products depends on the methods used to produce and harvest the renewable materials, the toxicity and persistence of the chemical additives or other modifiers used, the recovery systems available for discarded products, and many other factors. For these reasons, it is important to choose biobased products carefully.

The *BioSpecs for Food Service Ware* outline sustainability criteria and recognition levels for food service ware made from compostable biobased materials. They provide a framework to assess the sustainability of these products during three stages of their life cycle: (1) biomass production, (2) manufacturing, and (3) end of product life. Recognizing the many challenges to sustainability across a product's life cycle, the developers of the *BioSpecs* designed a three-tiered rating system – Bronze, Silver, and Gold – to reward continued improvement. A companion document, *Conformance Guide: BioSpecs for Compostable Biobased Food Service Ware*, details how a manufacturer can access conformance to each criterion. The *BioSpecs* reflect the current collective wisdom of a wide range of organizations and businesses that are addressing the potential benefits and challenges of biomaterials. The Sustainable Biomaterials Collaborative (SBC), a project of the Institute for Local Self-Reliance, developed these criteria in close coordination with the Business-NGO Working Group for Safer Chemicals and Sustainable Materials. The *BioSpecs* are informed by an extensive market survey, conducted in 2008 by the Business-NGO Working Group and Health Care Without Harm, of 45 biobased food service products representing 22 manufacturers.

Scope and Purpose

These specifications focus on compostable and biobased food service ware. Biobased food service ware have proliferated in recent years and represents an important product category for promoting the transition from fossil-fuel-based products to products made from sustainably grown biomass and produced in a manner that reflects the highest occupational and environmental health standards and practices. By outlining sustainability criteria for biobased food service ware, these specifications will enable manufacturers to more fully evaluate the environmental and health implications of the products they make and will encourage the development and use of sustainable biobased products.

These specifications are not intended to evaluate the full range of food service ware, such as durable ceramic plates or metal cutlery. They are applicable only within the biobased product category. Indeed, durable, reusable food service ware is environmentally preferable to single-use biobased products and should be considered as a first option.

The sustainability criteria presented in these specifications provide a threshold for the recognition and promotion of a biobased product as sustainable. The scope of the criteria includes the major stages of a product's life cycle: (1) biomass production, (2) manufacturing, and (3) end of product life. Purchasing decisions can influence the life cycle. For example, transportation is not addressed as a separate item in the life cycle, but encouraging the use of locally grown and produced materials and products affect the product's life cycle. Compliance with these criteria enables a product to gain positive recognition in the green market economy. Three progressively higher levels of recognition – Bronze, Silver, and Gold – distinguish among products and encourage higher levels of environmental performance.

Food service ware that meet baseline sustainability criteria are recognized at the Bronze level. To achieve Silver level, the product must meet the criteria of both Bronze and Silver. To reach Gold, products must meet a minimum of five Gold criteria, in addition to all the Bronze and Silver criteria. Only a few products may reach this level of excellence. Those that do, may benefit significantly from this unique designation in the green market economy.

How to Use These Specifications:
Manufacturers of biobased products can use these *BioSpecs* as a road map for improving the sustainability of their products. Refer to our voluntary process and companion report, *Conformance Guide: BioSpecs for Compostable Biobased Food Service Ware*, on how to assess product conformance with each criterion. Third-party certifications may exist for some of the individual criteria, such as product compostability. In other cases, such as biobased product content, standards and reputable testing labs may be readily available. For other criteria, such as ensuring that products are free of toxic additives, validation may be more challenging.

Any purchaser of biobased food service products can also use these specifications to guide purchasing but may prefer to use the SBC's purchasing specifications. Buyers should ask their suppliers for data on each criterion along with supporting documentation.

Comments and Early Adopters of BioSpecs:
The public comment period for the first version of the *BioSpecs for Food Service Ware* lasted from September 30, 2009 to April 16, 2010. Over 70 comments were submitted. All comments were considered and addressed as needed by the BioSpecs Technical Advisory Committee, which was created specifically for this task. The *BioSpecs* have been updated based on the public comments received and will be further revised as the industry and market evolve. A summary of comments received and how each was addressed along with future revisions of the *BioSpecs* are posted at www.SustainableBiomaterials.org.

In addition, we are currently seeking buyers and manufacturers to beta test these specifications. Those interested should contact Heeral Bhalala at hbhalala@ilsr.org.

Sustainability Criteria by Life Cycle Stage

The criteria are organized to provide guidance for the three critical stages of the product life cycle: (1) biomass production, (2) manufacturing, and (3) end of product life. The criteria and their corresponding levels are presented below. To qualify for a level, all Bronze level criteria must be met. To qualify for the Silver level, all the Bronze and Silver criteria must be met. To achieve the Gold level, all Bronze and Silver criteria must be met along with five of the listed Gold criteria. As a prerequisite, manufacturers and products must comply with all applicable environmental and occupational health and safety regulations. A description of the criteria, intent, and basic requirements for validating each criterion is included in later sections of this document. A companion document, *Conformance Guide: BioSpecs for Compostable Biobased Food Service Ware*, details how a manufacturer can access conformance to each criterion.

1. Biomass Production

1.a Biobased (organic) carbon content
- 1.a.1 Non-cutlery products must contain at least 90% biobased (organic) carbon content *(Bronze)*
  - 1.a.1.a Cutlery must contain at least 70% biobased (organic) carbon content *(Bronze)*
- 1.a.2 Non-cutlery products must contain at least 95% biobased (organic) carbon content *(Silver)*
  - 1.a.2.a Cutlery must contain at least 85% biobased (organic) carbon content *(Silver)*
- 1.a.3 Non-cutlery products must contain at least 99% biobased (organic) carbon content *(Gold)*

1.b Use of genetically modified plants (biomass)
- 1.b.1 No plastics may be made directly in plants *(Bronze)*
- 1.b.2 Genetically modified crops are allowed in the field with offsets *(Bronze)*
- 1.b.3 No genetically modified biomass is allowed in the field *(Silver)*

1.c Biomass must be sustainably grown
- 1.c.1 Forest -and brushland-derived biomass must be sustainably harvested with adequate documentation *(Bronze)*
- 1.c.2 Agricultural biomass must be produced according to sustainable farming practices *(Gold)*

1.d Feedstocks are from perennial cellulosic crops or agricultural co-products or residues that currently have no higher value alternative markets *(Gold)*

1.e Biomass production workers must be protected under fair labor standards *(Gold)*

2. Manufacturing

2.a No organohalogens may be intentionally added to the product or used in coatings *(Bronze)*

2.b Additives and contaminants of high concern
- 2.b.1 Declare whether nanomaterials are present in the product *(Bronze)*
- 2.b.2 Eliminate use of toxic additives
  - 2.b.2.a No Proposition 65 chemicals may be used in the product *(Silver)*
  - 2.b.2.b No chemicals of high concern may be used in the product *(Gold)*
- 2.b.3 All additives must be tested for hazards to human health and the environment *(Gold)*

2.c Paper or paper-based products
- 2.c.1 Non-food-contact products must contain 100% recycled and 40% post-consumer recycled content *(Bronze)*
- 2.c.2 Food-contact products made from paper or paper-based
  - 2.c.2.a Food-contact products, excluding cups, must contain 45% total recycled content *(Bronze)*
  - 2.c.2.b Cups must contain 10% post-consumer recycled content *(Gold)*

2.d No chlorine or chlorine compounds may be used in production processes *(Silver)*

2.e Workers and the environment must be protected in manufacturing *(Gold)*

2.f Local ownership and production must be promoted *(Gold)*

3. End of Life

3.a Product must be commercially compostable *(Bronze)*

3.b Product must be labeled for compostability
- 3.b.1 Product must be clearly labeled "commercially compostable" if a composting infrastructure exists
  - 3.b.1.a The logo of the verification agency must be displayed on the product *(Bronze)*
  - 3.b.1.b Labeling must distinguish compostable from non-compostable products *(Bronze)*
- 3.b.2 Product must have additional labeling when sold in an area where no commercial composting is available *(Bronze)*

3.c The product must be compostable at mesophilic temperatures, typical of some backyard/home composting systems *(Silver)*

3.d Product must be biodegradable in an aquatic environment
- 3.d.1 Product must be biodegradable in a marine environment *(Gold)*
- 3.d.2 Product must be biodegradable in freshwater *(Gold)*

Sustainability Criteria by Life Cycle Stage

This section gives a detailed description and intent behind each criterion under the three product life cycle stages – biomass production, manufacturing, and end of product life. A brief description of the verification requirements for substantiating claims is also provided here. For more detail on verification, refer to the companion document, *Conformance Guide: BioSpecs for Compostable Biobased Food Service Ware.*

Prerequisites

The product must comply with all applicable laws and regulations throughout its life cycle

Compliance to "prerequisites" must be met in order to reach the entry level or initial performance levels of the sustainability criteria.

For products to be eligible for recognition under the *BioSpecs*, manufacturers of food service ware must be in compliance with all relevant agricultural, environmental, health, and safety laws and regulations. Product manufacturers must disclose all government violations or allegations on the federal, state, or local level regarding environmental, health, and safety laws or regulations with respect to the facilities in which the products are manufactured.

Manufacturers must be able to state that they have had no violations in the last three years that have not been corrected or disclose all open cases.

1. Biomass Production

1.a Biobased (organic) carbon content

The product must maximize the use of organic carbon content from biobased materials. Specifically, with the exception of cutlery, food service ware must have a minimum of 90% biobased (organic) carbon content from biobased materials. Cutlery must have a minimum of 70% biobased (organic) carbon content.

Intent: This criterion promotes the use of biobased products and ensures that carbon content comes from renewable resources, not fossil-fuel resources. Most biobased food service ware marketed today contains little if any fossil-fuel-based material, though some paper and fiber products are coated with fossil-fuel-based plastic. The market survey conducted in 2008 by the Oregon Center for Environmental Health indicates that a significant number of products on the market have a percent biobased content of 90% or higher, including coatings. Cutlery is the one exception to this. There are few cutlery products currently available that can meet the 90% biobased content.

There are three levels for minimum biobased content, which correspond to the three recognition levels. The goal is to maximize the use of organic carbon content made from biobased materials. Biobased content is the amount of biobased carbon in the material or product as a fraction weight (mass) or percent weight (mass) of the total organic carbon in the material or product. ASTM Method D6866 is the U.S. government-approved method for determining the renewable/biobased content of biobased products.

1.a.1 Bronze: Non-cutlery products must contain at least 90% biobased (organic) carbon content

1.a.1.a Bronze: Cutlery must contain at least 70% biobased (organic) carbon content

1.a.2 Silver: Non-cutlery products must contain at least 95% biobased (organic) carbon content

1.a.2.a Silver: Cutlery must contain at least 85% biobased (organic) carbon content

1.a.3 Gold option: Non-cutlery products must contain at least 99% biobased (organic) carbon content

Verification Requirements: Documentation must provide the radiocarbon data for the product (not resin) and explicitly reference ASTM D6866: Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis.

1.b Use of genetically modified (GM) plants (biomass)

This set of criteria only pertains to feedstocks that are commercially available in genetically modified varieties. Check GMO databases to see if product feedstock applies.

1.b.1 Bronze: No plastics may be made directly in plants

Product materials may not be derived from biomass that was genetically modified for the express purpose of making the material.

Intent: The aim is to prevent the design and cultivation of plants solely for the purpose of creating bioplastic. An example is the use of GM switch grass, where genes are modified to enable switch grass to produce plastic in the field. This process is still in the research and development phase. GM biomass has not been adequately assessed for potential adverse effects on human and animal health and on the environment in which it is produced. Also of concern is the threat that genetic engineering poses to environmentally sustainable food production and to the livelihood of farmers practicing sustainable food production.

Verification Requirements: Documentation must verify that the product was not harvested from a plant and that the plant was grown for use as a feedstock for making bioplastics.

1.b.2 Bronze: Genetically modified crops are allowed in the field with offsets

Product materials derived from biomass that was genetically modified (GM) must be offset through an acceptable GM offset program or a sustainable agriculture program that addresses non-GM biomass.[2]

Intent: In North America, many of the biomass crops currently in production have been genetically modified, primarily for resistance to herbicides or insects. For example, 85% of all field corn planted in the U.S., 91% of the soybeans planted in the U.S., and 85% of the canola planted in Canada in 2009 were genetically modified. This profusion of GM crops on the landscape makes it difficult to directly source non-GM crops for industrial production, despite concern among potential buyers about the potential environmental and health impacts of GM crops. A GM offset program to support non-GM crop production can help address these concerns. Offsets can either be direct or indirect. The direct approach involves the sourcing of non-GM crops by the refinery at some point for processing (without any guarantee that these non-GM crops will be directly processed into the biomaterial). The indirect, or certificate, approach involves the "purchase" of quantified environmental and health benefits of non-GM crop production by biomaterial users, rather than the sourcing of the non-GM crop by the refinery.

This criterion allows for the use of GM organisms but ensures against the irresponsible introduction of additional biotechnology for the purpose of bioplastics production. The widespread use of GM biomass crops has resulted in a documented increase in the use of herbicides and the spread of herbicide-resistant plants. There remain many under-addressed and under-researched environmental, biodiversity, and health concerns about the introduction, use, and dissemination of GM biomass crops.

Verification Requirements: Offset programs for GM organisms include the Working Landscapes Certificate program (www.workinglandscapes.org) and NatureWorks GM Offset program (http://www.natureworksllc.com/the-ingeo-journey/raw-materials/source-options.aspx). The Working Landscapes Certificate program supports farmers growing corn (the current feedstock for most U.S. bioplastics) according to sustainable farming criteria, which include a GM prohibition. The "sustainable production" aspects are quantified and linked to the amount of corn used in the production of a bioplastic product. This approach provides bioplastic customers with an affordable option for supporting more sustainable agriculture and offers bioplastic manufacturers and farmers the financial support needed to utilize more-sustainable farming practices, without the added expense and constraints that direct sourcing of feedstocks would impose on both parties.

[2]Criterion 1.b.2. applies only to products manufactured from types of biomass for which genetically modified varieties have been approved for use and sale and are commonly used or "commercialized" in the country of origin.

1.b.3 Silver: No genetically modified biomass is allowed in the field
Feedstocks or material for bioplastics are not to be derived from any genetically modified (GM) biomass.

Intent: Product materials may not be derived from biomass that has been intentionally genetically modified for any purpose. There remain many environmental, biodiversity, and health concerns about the introduction, use, and dissemination of GM organisms. The goal is to prefer biomass generated from seed or plant stock that was not intentionally genetically modified, without penalizing producers for unintentional contamination.

Verification Requirements: This criterion applies only to products manufactured from types of biomass for which genetically modified varieties have been approved for use and sale and are commonly used or "commercialized" in the respective country of origin. Certification programs for biomass grown without the intentional use of GM seeds include the Non-GMO Project Verified (www.nongmoproject.org), CERT ID Non-GMO Certification (http://www.genetic-id.com/services/certification), and independent documentation (such as seed labels) of non-GM seed use.

1.c Biomass must be sustainably grown

1.c.1 Bronze: Forest- and brushland-derived biomass must be sustainably harvested
Forest- and brushland-derived biomass used in food-contact products must be sustainably harvested.

Intent: This criterion promotes sustainable harvesting practices for wood and other cellulose fibers and requires chain-of-custody documentation to prove compliance.

Verification Requirements: Acceptable documentation includes the FSC certificates, "FSC 100%" and "FSC Mixed Sources." Alternative certification must cover, at a minimum, the broad principles of the FSC (http://www.fsc.org/pc.html).

1.c.2 Gold option: Agricultural biomass must be produced according to sustainable farming practices
Agricultural biomass used in biobased product manufacture must be sustainably grown, with a preference for utilizing non-food agricultural resources, including perennial biomass crops and sustainably harvested residues.

Intent: This criterion promotes sustainable farming practices for biomass production. To qualify as sustainably grown, biomass production must conserve, protect, and build soil; conserve nutrient cycles; protect air and water access and quality; promote biological diversity; reduce the impacts of energy use; and reduce transportation impacts.

Verification Requirements: Existing programs for verification of sustainable agricultural production that could serve as models include the Nordic Ecolabeling program (http://www.ecolabel.nu/nordic_eco2/) and the Food Alliance's sustainable certification program (http://www.foodalliance.org/). In addition, the U.S. Department of Agriculture's new Conservation Stewardship Program (CSP) (http://www.nrcs.usda.gov/Programs/new_csp/csp.html) will provide guidance on the best sustainable practices on working agricultural landscapes. Farms that rate high according to the CSP's criteria may be good choices for certification.

1.d Gold option: Feedstocks are from perennial cellulosic crops or agricultural co-products or residues that currently have no higher value alternative markets
Products should be made from either feedstocks that are perennial cellulosic crops or have no higher value alternative markets.

A perennial cellulosic feedstock is a woody or herbaceous crop (usually a grass) with a high cellulose content that lives for two years or more (without replanting) grown specifically for processing into biomaterials or bioenergy. An agricultural co-product is a byproduct from processing that can technically not be avoided. Co-products are generally seen as having value in the market, such as scrap industrial materials from one process that are subsequently used as a raw material in a different manufacturing process. Agricultural crop residue is plant material remaining after harvesting, including leaves, stalks, roots. These materials often have value from an ecological perspective, providing nutrients, protecting soil from erosion, and improving soil health and biodiversity.

Intent: Since materials have an intrinsic value to provide nutrients and have a potential economic value, the intent of this criterion is to provide a rationale for alternative material use. The goal of this criterion is to promote the use of the most sustainable feedstocks available, which includes both perennial cellulosic crops (which generally have the best environmental footprint among feedstocks) and existing agricultural residues or byproducts that are not needed for soil protection or nutrient values, have no higher value alternative markets, and are already being produced yet are often considered "waste."

Verification Requirements: Must provide a letter signed by the appropriate officer that states what is being used as feedstock, its source location, and why they consider this the best use of the feedstock.

1.e Gold option: Biomass production workers must be protected under fair labor standards

Biomass production workers must be protected beyond the required levels of applicable environmental, health, and safety compliance and practice by incorporating fair labor standards.

Intent: This criterion aims to increase protection for workers engaged in biomass production.

Verification Requirements:

Demonstrate protection "beyond compliance" by adopting one of the four following practices:

- Option 1: Union contract and documentation of practices that protect workers from exposure to hazardous chemicals that exceed environmental, health, and safety regulations
- Option 2: Contract negotiated with an independent workers' association that addresses fair labor standards and practices
- Option 3: Independent certification or verification of social justice or domestic fair trade programs through a third-party organization
- Option 4: Adherence to the criteria of the *Social Accountability 8000 (SA8000) Standard* and *Social Stewardship Standards in Organic and Sustainable Agriculture*

2. Manufacturing

2.a Bronze: No organohalogens may be intentionally added to the product or used in coatings

Organohalogens, due to their negative environmental and human health impacts, should not be added to food service ware products.

Intent: The goal is to avoid halogenated organic compounds, which are nonmetallic chemicals that contain a halogen element, such as fluorine, chlorine, bromine, iodine, or astatine bonded to carbon. The organohalogens, especially the organochlorines, organofluorines and organobromines, have been a focus of international concern for many decades, because they are associated with many negative environmental and human health impacts. Organofluorines are used in food service ware to make products grease-resistant. Examples of organohalogens restricted by international treaties, such as the Stockholm Convention on Persistent Organic Pollutants, include polychlorinated biphenyls (PCBs), DDT, dioxins and furans, and pentabromodiphenyl ether (penta-BDE).

In general, organohalogens are persistent and bioaccumulative (see Criterion 2.b.1). Over the course of their life cycle, they can contribute to the formation and dispersion of chemicals of high concern – especially persistent, bioaccumulative, and toxic compounds, such as dioxins and furans – into the environment and humans. Organohalogens are now commonly found in all humans, including newborns, who are exposed when these chemicals cross the placenta.

Verification Requirements: Targeted analysis using XRF spectroscopy technology is available for heavy metals and organohalogens.

2.b Additives and contaminants of high concern

2.b.1 Bronze: Declare whether nanomaterials are present in the product

Since testing protocols do not currently exist, a declaration of the presence of engineered nanomaterials in the product is mandatory.

Intent: Engineered nanotechnology refers to the manipulation of matter at the scale of atoms and molecules. It is used to improve the performance and appearance of products. The impacts of engineered nanomaterials, especially to human health and the environment, are still unknown due to a

lack of research and inappropriate oversight systems. Since this technology is being used without proper risk assessments, this criterion is for protecting workers and consumers through transparency.

Verification Requirements: Companies are responsible for providing a written declaration that states whether or not engineered nanomaterials are intentionally added to their products. If added, the type of engineered nanomaterial must be mentioned in the statement.

2.b.2 Eliminate use of toxic additives

No chemicals of high concern to human or environmental health may be intentionally added to the product or may constitute part of the product except at levels consistent with background levels in the environment.

Intent: The goal is to protect workers, consumers, the public, and the environment from exposure to hazardous materials that may cause, or are known to cause, adverse health effects and to prevent these substances from further bioaccumulating in the environment.

2.b.2.a Silver: No Proposition 65 chemicals may be used in the product

Verification Requirements: Product manufacturers must verify that no chemicals included in the California Proposition 65 list of chemicals were used in the product.

2.b.2.b Gold option: No chemicals of high concern may be used in the product

Verification Requirements: Product manufacturers must verify that the product is made with no chemicals included in the "Red List of Chemicals" listing on the Green Screen for Safer Chemicals developed by Clean Production Action and Healthy Building Network.

2.b.3 Gold option: All additives must be tested for hazards to human health and the environment

All additives must be comprehensively tested for the hazards they pose to human health and the environment.

Intent: The goal is to prevent the use of hazardous chemicals in a product. Basic toxicity testing is defined as sufficient to qualify under the Organization for Economic Cooperation and Development (OECD) Screening Information Dataset (SIDS) for High Volume Production (HPV) Chemicals.

Verification Requirements: Product manufacturers must have written verification from suppliers that chemicals used have completed the full battery of OECD SIDS testing.

2.c Paper or paper-based products

2.c.1 Bronze: Non-food-contact products must contain 100% recycled and 40% post-consumer recycled (PCR) content

Non-food-contact products must maximize the use of biobased organic carbon made from recycled content materials and include a higher percent of PCR content. Recycled content levels are based on existing recycled content certifications for food service ware.

Intent: The goal is to minimize the depletion of forest resources and maximize the use of post-consumer recyclables. Single-use food service ware made from virgin wood fiber depletes forest resources. Pre-consumer waste (left over from the manufacturing process) and post-consumer waste (materials discarded by consumers) both displace the use of virgin wood fiber. Pre-consumer materials have historically been recovered, and markets are readily available. Stipulating post-consumer content creates markets for post-consumer materials, helping to maintain and expand cost-effective municipal recycling programs.

Verification Requirements: Recycled-content claims must comply with Green Seal's GS-9: Paper Towels and Paper Napkins standard, Forest Stewardship Council's "FSC Recycled 100%" certification, or be validated with Scientific Certification System's "SCS Recycled Content" certification.

2.c.2 Food-contact products made from paper or that are paper-based
Paper or paper-based food contact products must have recycled content. Recycled content levels are based on existing recycled content certifications for food service ware.

Intent: The goal is to minimize the depletion of forest resources by reducing the use of virgin wood fiber. Use of recycled paper fiber – whether pre-consumer or post-consumer – displaces use of virgin wood fiber. Stipulating post-consumer recycled (PCR) content creates markets for municipal recyclables. The criteria for food-contact products reflect federal restrictions on the use of PCR content in materials that contact food.

2.c.2.a Bronze: Food-contact products, excluding cups, must contain 45% total recycled content

2.c.2.b Gold option: Cups must contain 10% post-consumer recycled content

Verification Requirements: Recycled-content claims must comply with Green Seal's GS-35: Environmental Standard for Food Service Packaging (this certification only applies to hinged containers, two-part containers, and single-use plates and bowls) or be validated with Scientific Certification System's "SCS Recycled Content" certification.

2.d Silver: No chlorine or chlorine compounds (including chlorine dioxide) may be used in production processes
No chlorine or chlorine compounds may be used for bleaching, disinfection of the material itself, or other uses in the production of any component of the final product, including the base materials, coatings, and additives (although recycled materials may have been previously manufactured using chlorine-containing compounds).

Intent: The goal is to prevent the formation of organochlorine compounds caused by the use of elemental chlorine or chlorine compounds during processing. Organochlorine compounds are of concern because they are a type of organohalogen (see Criterion 2.a) and can contribute to the formation of chlorinated dioxins and furans as well as other organochlorines across their life cycle.

Verification Requirements: Unbleached products do not have to be certified as chlorine free. Chlorine-free certification must be provided for bleached products. The following agencies can substantiate chlorine-free claims: the Chlorine Free Products Association; Green Seal (GS-35), which applies to hinged containers, two-part containers, and single-use plates and bowls, including soup-type bowls; and Environmental Choice (CCD 145), which applies only to food containers made from agricultural waste and stipulates that the product "cannot contain or be manufactured with halogenated organic compounds."

2.e Gold option: Workers and the environment must be protected in manufacturing
Production workers and the environment must be protected beyond the required levels of applicable environmental, health, and safety compliance and practice.

Intent: The goal is to increase protections for workers engaged in food service ware manufacturing.

Verification Requirements:
Demonstrate protection "beyond compliance" by adopting one of the following practices:
- Option 1: Attain International Organization for Standardization (ISO) 14000 certification and compliance with International Labor Organization (ILO) standards
- Option 2: Publish corporate social responsibility (CSR) report that conforms to G3 Guidelines of the Global Reporting Initiative (GRI)

2.f Gold option: Local ownership and production must be promoted
Bringing the consumer closer to the producer is a key facet of a homegrown and sustainable bioeconomy that also supports local farmers.

Intent: Local ownership and regional production support the use of indigenous resources, reduce the environmental impacts resulting from transportation, and generate more jobs and greater economic benefits than absentee ownership, thus making the economy more sustainable.

Verification Requirements:
Meet two of the following four criteria:

- Biomass Source: Biomass should be sourced in the United States or locally at a distance of no more than 500 miles from the resin producer.
- Processing of Biomass: The resin should be produced regionally, either in the same state as the converter, in neighboring states or provinces, or no more than 500 miles away.
- Product Manufacturing: The final product should be produced regionally, either in the same state as the consumer, in neighboring states or provinces, or no more than 500 miles away.
- Ownership: Opportunities should be created for local ownership of the production facility, such that more than half of the ownership stake is regionally based. The percentage of the ownership stake must be based on measurable data. The following metrics could be used: 51% of the capital investment, 51% of the revenues/profits, or 51% of the number of owners.

3. End of Product Life

3.a Bronze: The product must be commercially compostable
The finished product, in its entirety, must be 100% commercially compostable; composting claims must be substantiated and validated; and product labeling should be qualified. Products labeled simply as "compostable" imply an ability to biodegrade in home composting systems. If the product cannot be home composted, the labeling should be qualified accordingly.

Intent: The goal is to promote the composting of biobased food service ware once it has served its original intended function; to help capture food discards for composting; and to ensure that composting claims are substantiated and qualified with appropriate labeling. Appropriate product labeling is essential to ensure that the product, not just the resin, is certified; to ensure that the product purchasers as well as the users are educated on the proper end-of-life options; and to assure composters that the products they receive are indeed compostable. One benefit of making the transition from disposable products to compostable food service ware is the opportunity to capture discarded food scraps for composting or anaerobic digestion, thereby increasing waste diversion and decreasing methane emissions from landfills. Because used food service ware is contaminated with food residuals, it generally cannot be recycled. These specifications therefore encourage the production and use of compostable biobased food service products. Future specifications for non-food service ware, such as bottles, will include criteria for recycling.

Verification Requirements: The product must be certified as commercially compostable, using either ASTM D6400, ISO 17088, DIN EN 13432, or AS 4736, by a third-party verification agency. The product must meet the full requirements of the standard used. Third-party verification agencies include:

- Biodegradable Products Institute (North America)
- AIB Vinçotte Inter (Belgium)
- Din Certco (European Union)
- Australian Environmental Labeling Association (Australia)
- Japan Bioplastics Association (Japan)

3.b Product must be labeled for compostability

3.b.1 Product must be clearly labeled "commercially compostable" if a composting infrastructure exists

Intent: This criterion provides for unambiguous labeling on the product and accompanying materials and declarations in order to ensure proper separation and recovery of the compostable product. Clear labeling helps the consumer to place a used product into the proper curbside or drop-off collection receptacle and enables collection and end-of-life processing handlers to distinguish compostable from non-compostable products.

3.b.1.a Bronze: The logo of the verification agency must be displayed on the product to confirm the compostable certification. Third-party verification agencies include:

- Biodegradable Products Institute (North America)
- AIB Vinçotte Inter (Belgium)
- Din Certco (European Union)
- Australian Environmental Labeling Association (Australia)
- Japan Bioplastics Association (Japan)

3.b.1.b Bronze: Labeling must distinguish compostable from non-compostable products, such as clear plastic cups, tubs, or other food service containers. Labeling must be displayed on the product using biobased ink and must be readily and easily identifiable for users as well as for those handling the products once they are discarded.

- For products that are made of porous materials, the word "compostable" should be stamped or embossed on product. The letters must be at least one-quarter inch in height and appear on both sides of the face of the container. If it is a product with a lid, the lid should also be labeled.
- For cups and tubs, the word "compostable" should appear in green color lettering or in visible color lettering against a green background. The letters must be at least one-quarter inch in height and must appear on both sides of the face of the container. The container bottom and lid must be embossed with the word "compostable."
- For other containers, the words "compostable" in green lettering at least one-quarter inch in height, or in visible color lettering at least one-quarter inch in height within a green band, should be printed either on the face of each piece, on the large side of the container, or on an adhesive compostable sticker. The word "compostable" should be embossed on the molding of each piece.
- Other labeling options can be pursued to allow for customization if both users and end-of-life handlers agree that the labeling is effective for appropriately identifying the products for end-of-life composting. Existing programs that have a labeling system for easy identification accompanied with an end-of-life handler includes Cedar Grove Composting in Seattle, Washington, USA with its brown "Cedar-Grove Approved" logo.

Verification Requirements:
Ensure that product manufacturers:

- Directly label products
- Directly label product packaging
- Make adequate environmental product declarations that are easily accessible (for example, on their product website)
- Provide product package insert declarations
- Use biobased inks for labeling

3.b.2 Bronze: Product must have additional labeling when sold in an area where no commercial composting exists

If the product is sold or used in an area with no infrastructure for commercial composting, the packaging or accompanying descriptive materials must also display qualifying language such as "Commercial composting facilities may not exist in all areas."

Intent: This criterion helps consumers understand that labeling of a product as compostable does not mean that the product can actually be composted in their community.

Verification Requirements: Must comply with Federal Trade Commission (FTC) marketing guidelines. A product can be labeled "compostable" if the composting infrastructure exists. If the infrastructure does not exist, additional explanatory qualifying language is required. If the product is "home compostable" by Vinçotte "OK Home Compost" certification (Belgium), then the packaging and accompanying descriptive materials can be labeled simply as "compostable."

3.c Silver: The product must be compostable at mesophilic temperatures, typical of some backyard/home composting systems

The product, in its entirety, must be third-party certified as compostable within the mesophilic temperature range of 20-30°C.

Intent: The intent is to facilitate wider composting of biobased products than is currently possible due to the lack of commercial composting facilities that accept such products. Composting essentially takes place within two temperature ranges in which certain microorganisms thrive: mesophilic (10-40°C) and thermophilic (over 40°C). Not all products that meet the ASTM D6400 composting standard will biodegrade and disintegrate at lower mesophilic temperatures. Backyard composting systems can reach thermophilic conditions, but not all do.

Products that can compost in a variety of backyard/home systems greatly increase the opportunities for waste diversion, given that many regions of the country lack commercial composting facilities. (Although mesophilic temperatures and microorganisms can allow effective composting given sufficient time, it should be noted that

thermophilic temperatures destroy more pathogens, weed seeds, and fly larvae in the composting materials. Higher temperatures also speed the composting process and facilitate thermophilic fungi and bacteria favorable for effective composting.)

Verification Requirements: Compostability within the mesophilic range must be demonstrated using Vinçotte's "OK Compost HOME" third-party certification. To meet Vinçotte's criteria, the product must biodegrade within one year. Vinçotte is the only existing third-party certifier of products that can compost in typical backyard settings. A home/backyard composting standard is currently being developed by ASTM.

3.d The product must be biodegradable in an aquatic environment
The entire finished product must meet specified test methods for marine or freshwater biodegradation.

Intent: The goal is to reduce the impact of plastics on aquatic ecosystems. Plastics that do not biodegrade in water harm aquatic ecosystems and create a litter problem. While these plastics can fragment into minute pieces, they may not biodegrade completely and are mistaken for food by the tiniest of species as well as by larger marine animals. Research now reveals that parts of the Pacific Ocean have six times more plastic particles than plankton, the base of the marine food web.

3.d.1 Gold option: The product must be biodegradable in a marine environment
According to ASTM D7081, marine biodegradable means the product will biodegrade within 180 days at 30°C.

Verification Requirements: Biodegradability in the marine environment must be determined according to ASTM D7081, Standard Specification for Non-Floating Biodegradable Plastics in the Marine Environment.[3] For credibility, a reputable lab, such as the U.S. Army Natick Soldier Research Development & Engineering Center (NSRDEC), should verify marine biodegradability with ASTM D6691.

3.d.2 Gold option: The product must be biodegradable in freshwater
Freshwater biodegradable, according to Vinçotte's certification, means the product will biodegrade within 56 days at temperatures at 21°C.

Verification Requirements: Biodegradability in freshwater must be determined according to Belgium Vinçotte's "OK Biodegradable WATER" certification. Vinçotte in Belgium is the only existing third-party certifier for products that biodegrade in freshwater.

[3] ASTM D7081 specifies that samples use the laboratory test ASTM D6691 to demonstrate that 30% or more of the organic carbon is converted to CO2 within 180 days at 30°C when compared to a positive control. ASTM D6691 is the Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials in the Marine Environment by a Defined Microbial Consortium.

Glossary

Additive includes chemical substances or engineered nanomaterials that are mixed into the product, surface treatments, or applied printing.

Agricultural biomass represents crops such as plants and trees that are intentionally planted for short-term harvesting.

Agricultural co-product is a byproduct from processing that can technically not be avoided. Co-products are generally seen as having value in the market, such as scrap industrial materials from one process that are subsequently used as a raw material in a different manufacturing process.

Agricultural crop residue is plant material remaining after harvesting, including leaves, stalks, roots. These materials often have value from an ecological perspective, providing nutrients, protecting soil from erosion, and improving soil health and biodiversity.

Biobased refers to products or materials in which the organic carbon is derived from renewable forestry materials, agricultural crops or animals, or marine materials.

Biobased content is the amount of biobased *carbon* in the material or product as a fraction weight (mass) or percent weight (mass) of the total organic carbon in the material or product. ASTM Method D6866 is the U.S. government-approved method for determining the renewable/biobased content of biobased products.

Biobased material(s) are organic material(s) in which the carbon comes from contemporary (non-fossil) biological sources.

Biobased product means a commercial or industrial product (not derived from food or feed) that utilizes biological products or renewable agricultural (plant, animal, or marine) or forestry materials.

Biomass is biological material derived from living or recently living organisms.

Bioplastics are plastics in which 100% of the carbon is derived from renewable agricultural and forestry resources such as cornstarch, soybean protein, and cellulose. Bioplastics are not a single class of polymers but a family of products that can differ significantly from one another. They differ from traditional plastics, which are derived from fossil fuels or non-renewable carbon.

Brushland is an area with a combination of grass, shrubs, and trees in which deciduous or coniferous tree cover comprises from one- to two-thirds of the area, or shrub cover comprises more than one-third of the area. These areas are often found adjacent to hay, pasture, grassland or forested areas and vary greatly in shape and extent.

Chemicals of high concern are chemicals that would meet the "Red List of Chemicals" listing on the Green Screen for Safer Chemicals developed by Clean Production Action and Healthy Building Network. These include chemicals that are persistent, bioaccumulative, and toxic substances (PBTs), carcinogens (probable and known), mutagens, reproductive or developmental toxicants, very persistent and toxic, very bioaccumulative and toxic, very persistent and very bioaccumulative, neurotoxic, or endocrine disruptors.

Compostable product refers to a product that is capable of undergoing biological decomposition in a compost site, such that the product is not visually distinguishable; breaks down to carbon dioxide, water, inorganic compounds, and biomass at a rate consistent with those of known compostable materials (e.g., cellulose); and leaves no toxic residue. See Criteria 3.a and 3.b for how compostability should be verified and how compostable products should be labeled. Not all commercially compostable products are biodegradable in typical backyard settings.

Forest refers to an area where two-thirds or more of the total canopy cover is composed of predominantly woody deciduous and coniferous species and areas of regenerated or young forest.

Forest- and brushland-derived biomass refers to biomass that is harvested from forests.

Food service ware is a term used for utensils, containers, napkins, straws, lids, plates, cups, bowls, trays, cartons, and other items that are designed for take-out or for holding and serving prepared foods.

Genetically modified (GM) organisms are organisms that have been created through the gene-splicing techniques of biotechnology (also called genetic engineering or GE). This relatively new science allows DNA from one species to be injected into another species in a laboratory, creating combinations of plant, animal, bacterial, and viral genes that do not occur in nature or through traditional crossbreeding methods. (See http://www.nonGMproject.org/consumers/about-GMs/.)

Inorganic carbon refers to carbon-based compounds that are derived from geological or soil parent sources (inorganic materials). Inorganic compounds include elemental carbon (e.g., graphite), oxides of carbon (e.g., carbon dioxide), and carbonates (e.g., calcium carbonate).

Nanomaterial, engineered: A nanoparticle (NP) is a microscopic particle whose size is measured in nanometers, typically one hundred nanometers or smaller. Engineered nanoparticles (ENPs) are intentionally produced to perform desired technological functions in numerous applications. In contrast to natural and incidental NPs, which often exhibit variable and irregular morphologies (shapes and sizes), ENPs are characterized by regular, reproducible particle morphologies. Depending on the particular class and manufacturing process, ENPs can have different shapes, including solid or hollow spheres, rings, tubes, wires, horns, and sheets, and they can be synthesized in various sizes.

Nanotechnology refers to research and development at the atomic, molecular, or macromolecular level using a length scale of approximately one to one hundred nanometers in any dimension; the creation and use of structures, devices, and systems that have novel properties and functions because of their small size; and the ability to control or manipulate matter on an atomic scale. (See http://www.epa.gov/osa/pdfs/nanotech/epa-nanotechnology-whitepaper-0207.pdf.)

Native forests are largely naturally regenerated forests of any age consisting of a mix of tree species typical and natural for the region and forest type.

Non-food contact products refer to food service items that are not intended for serving food directly but may come in contact with food (e.g., napkins and trays).

Organic carbon refers to carbon-based compounds where the element, carbon, is attached to other carbon atoms, hydrogen, oxygen, nitrogen, sulfur, phosphorus, or other elements in a chain, ring, or other three-dimensional structure. Organic carbon can be either biobased or fossil-based.

Organohalogen is a nonmetallic chemical compound that contains a halogen element, such as fluorine, chlorine, bromine, iodine, or astatine bonded to a carbon.

Perennial cellulosic feedstock is a woody or herbaceous crop (usually a grass) with a high cellulose content that lives for two years or more (without replanting) grown specifically for processing into biomaterials or bioenergy.

Post-consumer recycled (PCR) material is material discarded for recycling by a residential, commercial, or institutional consumer (as opposed to industrial scrap, which is discarded by the producer and, if recycled, is considered pre-consumer recycled material).

Propostition 65 chemicals are those chemicals found by the California law, The Safe Drinking Water and Toxic Enforcement Act of 1986, to cause cancer or reproductive toxicity.

Recycled content refers to the proportion (measured by mass) of recycled material in a product or packaging. Only pre-consumer and post-consumer materials are considered as recycled content.

Total carbon is the sum of the organic carbon and inorganic carbon content of a material.

Total recycled content equals post-consumer recycled content plus pre-consumer recycled content.

Additional Resources

This section lists additional resources for each of the criteria listed in the *BioSpecs for Food Service Ware*.

Biomass Production

1.b Use of genetically modified (GM) plants (biomass)

- The U.S. Biotechnology Industry Organization maintains a searchable database that contains information regarding the regulatory and commercial status of agricultural biotechnology products by country (http://www.biotradestatus.com/).
- Other databases containing information on the regulatory status, but not necessarily the commercial status, of biotechnology products can be found at the U.S. Regulatory Agencies Unified Biotechnology website (http://usbiotechreg.nbii.gov/index.asp).
- Genetically Modified Organisms (GMO) Food Database (http://www.gmo-compass.org).
- Health Care Without Harm, "Position Statement on Genetically Engineered Food" (http://www.noharm.org/details.cfm?ID=1540&type=document)
- World Health Organization (http://www.who.int/entity/foodsafety/publications/biotech/en/20questions_en.pdf)
- Food and Agriculture Organization of the United Nations (http://www.fao.org/Biotech/stat.asp)

1.c.1 Forest- and brushland-derived biomass must be sustainably harvested with adequate documentation

- Sustainable Packaging Coalition, Definition of Sustainable Packaging, version 1.0, October 2005 (http://www.sustainablepackaging.org/)
- IKEA Sustainability Report, 2008 (http://www.ikea.com/ms/en_US/about_ikea/pdf/Sustainability_report_2008.pdf)

1.c.2 Agricultural biomass must be sustainably grown

- Food Alliance (http://www.foodalliance.org/)
- Nordic Ecolabeling (http://www.ecolabel.nu/nordic_eco2/)
- USDA's Conservation Stewardship Program (http://www.nrcs.usda.gov/Programs/new_csp/csp.html)

Manufacturing

2.a No chlorine or chlorine compounds (including chlorine dioxide) may be used in production processes

- Joe Thornton. 2000. *Pandora's Poison: Chlorine, Health, and a New Environmental Strategy*. Cambridge, Mass.: The MIT Press.

2.b Additives and contaminants of high concern

- Clean Production Action – Green Screen (http://www.cleanproduction.org/Greenscreen.php)
  High-Definition X-Ray Fluorescence applications (http://www.hindawi.com/journals/xroi/2008/709692.html)
- Stockholm Convention on Persistent Organic Pollutants (http://chm.pops.int/)
- Joe Thornton. 2000. *Pandora's Poison: Chlorine, Health, and a New Environmental Strategy*. Cambridge, Mass.: MIT Press.
- Environmental Working Group, "Body Burden – The Pollution in Newborns" (http://www.ewg.org/reports/bodyburden2/execsumm.php)
- Terry Collins, "Towards Sustainable Chemistry," *Science*, January 2001, v. 291, no. 5501, pp. 48-49.
- Hindawi. 2008. *High-Definition X-Ray Fluorescence: Applications* (http://www.hindawi.com/journals/xroi/2008/709692.html)
- Ecology Center, *Survey of Presence and Breakdown of Brominated Flame Retardants (BFRs) in Vehicle Interior Components via Photodegradation* (http://www.ecocenter.org/media/www.healthycar.org/doc/DecaPhotolysis2.pdf)
- Environmental Working Group, *Credibility Gap: Toxic Chemicals in Food Packaging and DuPont's Greenwashing,* "New Food Packaging Chemical: No Health Data" (http://www.ewg.org/reports/teflongreenwash)
- Environmental Working Group, *PFC Dictionary*, November 2006 (http://www.ewg.org/pfcdictionary)
- U.S. Food and Drug Administration, *Title 21 - Sec. 170.39 - Threshold of regulation for substances used in food-contact articles* (CFR - Code of Federal Regulations Title 21)

2.b.3 No engineered nanomaterials may be added to the product without being assessed for health risks

For more information on the potential risks of nanotechnology, see:

- U.S. Environmental Protection Agency (EPA), Nanotechnology White Paper (http://www.epa.gov/osa/nanotech.htm)
- Action Group on Erosion, Technology, and Concentration (ETC Group), "Nanotechnology" (http://www.etcgroup.org/en/issues/nanotechnology.html)
- Friends of the Earth (http://www.foe.org/search/node/nanotechnology), "Nanotechnology" search results
- Natural Resources Defense Council, "Nanotechnology: Small Science, Big Consequences" (http://www.nrdc.org/health/science/nano/contents.asp)
- National Institute for Occupational Safety and Health, "Nanotechnology at NIOSH" (http://www.cdc.gov/niosh/topics/nanotech/)
- Project on Emerging Nanotechnologies at the Washington-based Woodrow Wilson International Center for Scholars (http://www.nanotechproject.org/)
- Institute for Local Self-Reliance, "Bioplastics and Nanotechnology" (http://www.sustainableplastics.org/bioplastics/bioplastics-and-nanotechnology)

2.b.4 All additives must be tested for hazards to human health and the environment

For case studies on how to gather data on chemicals in products, see:

- Tim Greiner et al., *Healthy Business Strategies for Transforming the Toxic Chemical Economy* (http://www.cleanproduction.org/Green.Healthy.php)
- Mark Rossi et al., 2006, "Design for the Next Generation: Incorporating Cradle-to-Cradle Design into Herman Miller Products." *Journal of Industrial Ecology* (10):193-210.

2.c Paper or paper-based products

- Health Care Without Harm fact sheet, *Choosing Environmentally Preferable Food Service Ware* (http://www.noharm.org/details.cfm?ID=1456&type=document)
- Canadian Standards Association - PLUS 14021, Environmental Claims: A Guide for Industry and Advertisers (http://www.csagroup.org/%5Crepository%5Cca%5CPLUS_14021-08EN.pdf)

2.f Local ownership and production must be promoted

- U.S. Green Building Council (USGBC), Leadership in Energy and Environmental Design (LEED) 2009 for New Construction and Major Renovation Rating System, Materials & Resources (MR) Credit 5: Regional Materials, p. 53 (www.usgbc.org/ShowFile.aspx?DocumentID=5546). The 500-mile standard is based on the USGBC credit for using building products sourced regionally.

End of Product Life

3.b.1 The product must be clearly labeled as commercially compostable if a composting infrastructure exists

- Californians Against Waste, AB 2147 (Harman), Compostable Plastics Labeling – Support (http://www.cawrecycles.org/issues/current_legislation/ab2147_06)
- San Francisco – Food Waste Reduction Ordinance (http://www.sfenvironment.org/our_programs/interests.html?ssi=3&ti=6&ii=127
- NAPCOR Statement – NAPCOR Refutes Claims That PLA Can Be Recycled with PET (http://www.napcor.com/pdf/NAPCOR_PLA.pdf)

3.b.2 Product must have additional clear labeling when sold in an area where no commercial composting is available

- FTC – Part 260 – Guides for the Use of Environmental Marketing Claims (http://www.ftc.gov/bcp/grnrule/guides980427.htm)