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OPTIMIZE

CHANGE

ADVANCE

THE RECYCLING PLAYBOOK

TABLE OF CONTENTS

SECTION ONE: Playbook background (p. 3)

SECTION TWO: Definitions (p. 6)

SECTION THREE: How to use the playbook (p. 10)

SECTION FOUR: Guides by Packaging Format

- Bags, films, and pouches (p. 15)
- Bottles, jars, jugs, and tubs (p. 23)
- Boxes (p. 34)
- Canisters and cartons (p. 41)
- Cans [metal] (p. 47)
- Cushion, dunnage, and inserts (p. 49)
- Trays, clamshells, and thermoforms (p. 59)
- Others: Blister packs (p. 67); Plastic tubes (p. 69); Flat or small plastic containers (p. 71)

SECTION FIVE: Introduction to Compostable Packaging (p. 74)

SECTION SIX: Appendix (p. 79)

SECTION SEVEN: Glossary (p. 86)

The background of the slide is a light gray grid. The top row consists of three colored squares: green, pink, and yellow. Below these are three larger, lighter-colored squares in the same sequence: light green, light pink, and light yellow. The text "PLAYBOOK BACKGROUND" is centered across the middle of these three large squares.

PLAYBOOK BACKGROUND

INTRODUCTION

For companies setting recyclable packaging and recycled content goals, this document is a supplemental resource for your consideration. Information in this document is presented by packaging format (i.e., bottle, box, etc.) and is focused on the most common packaging formats found in Walmart stores. This document is not exhaustive for all packaging formats nor is the information intended to be prescriptive. For more general information on sustainable packaging, please refer to Walmart's Sustainable Packaging Playbook.

For each major packaging format, we have provided information which is designed to capture recyclability information based on existing infrastructure (with a focus on North America). This document also provides perspective on feasible recycled content levels based on current industry practice. We have also tried to identify design elements which can pose barriers or challenges to recycling.

Walmart encourages all suppliers to take a life cycle perspective when seeking to optimize package design. While we want to see all of our suppliers striving to minimize material usage and advance a circular economy for plastics, it is also important to consider potential trade-offs of material choices elsewhere in the life cycle and take those into consideration when making design choices (e.g., increased package weight impacting transportation greenhouse gas emissions, responsible sourcing of fiber based packaging, etc.).

Consider using consumer-friendly recycling labels, like the How2Recycle[®] label to make it easier for customers to know what they can and can't recycle. For more information, visit: members.how2recycle.info.

Thank you to [Pure Strategies](#), The [Association of Plastic Recyclers](#) (APR), and the [Sustainable Packaging Coalition](#) who were key partners in the development of this playbook. Additional information on plastic packaging is available in the *APR Design[®] Guide For Plastics Recyclability*.

Suppliers are reminded that they are responsible for the compliance of their products, including their products packaging, with all applicable laws and regulations, including laws and regulations applicable to recyclability and compostability, such as the FTC's Green Guides and California's Public Resources Code. Walmart does not give its suppliers legal advice. Suppliers should consult their own counsel with questions about the applicability of laws and regulations to their products and packaging.

SUSTAINABLE PACKAGING OVERVIEW

By optimizing design, sourcing sustainably and supporting recycling in packaging, companies can work to reduce greenhouse gas emissions through reduced weight in transportation, increased use of recycled content, and mitigating carbon from landfill. Designers, manufacturers and brands have a unique opportunity to help deliver more efficient, innovative, and sustainable packaging to shelf. **The Recycling Playbook is for companies setting recyclable packaging and recycled content goals.**





DEFINITIONS

WHAT DOES RECYCLABLE MEAN?

Walmart follows Ellen MacArthur Foundation's definition for recyclability. The definition is broken down into two steps:

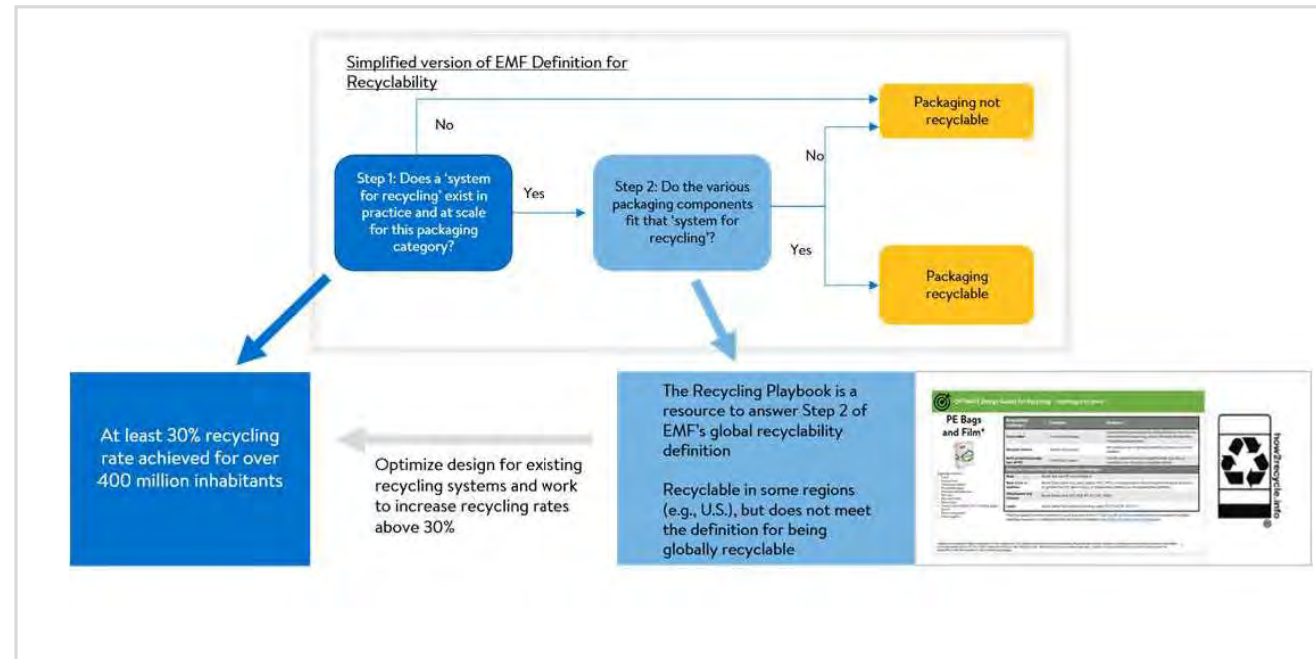
Step 1: Does a 'system for recycling' exist in practice and at scale for this packaging category (i.e., at least 30% recycling rate is achieved for over 400 million inhabitants)?

Step 2: Do the various packaging components fit that 'system for recycling'?

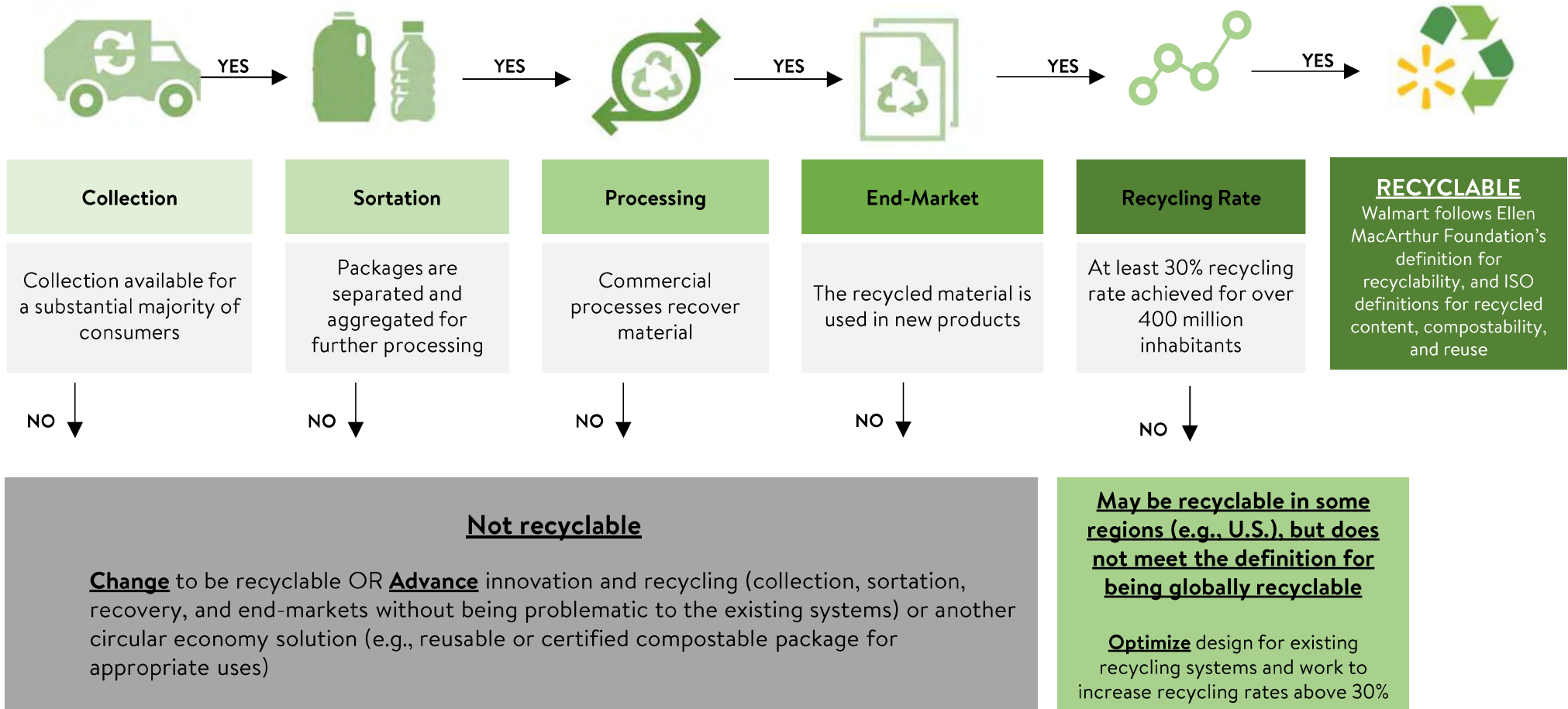
This guide focuses on Step 2 of Ellen MacArthur Foundation's Definition for Recyclability (i.e., providing information on packaging components that fit the "system for recycling").

Packages identified as recyclable in this playbook meet many local requirements for recyclable claims and have established systems for collection, sorting, processing, and use again.

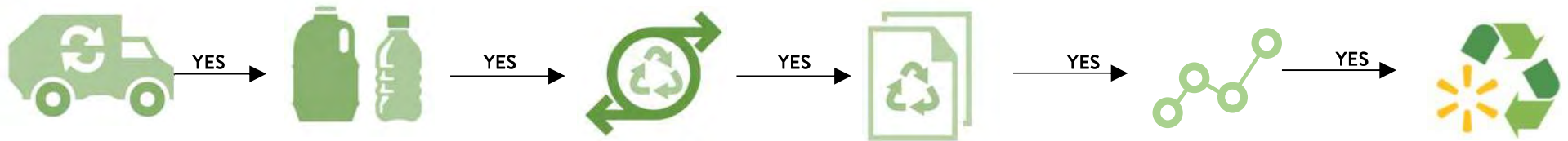
For those packages with less than 30% recycling rate achieved for over 400 million inhabitants (i.e., "at scale"), companies are encouraged to work to increase recycling rates to achieve Step 1 of Ellen MacArthur Foundation's definition.



A VIEW OF THE RECYCLING SYSTEM STAGES AND CONSIDERATIONS



EXAMPLES OF RECYCLING CHALLENGES FOR PACKAGING ACROSS THE SYSTEM



Collection	Sortation	Processing	End-Market	Recycling Rate	RECYCLABLE
<p><u>No collection for PET or PP films.</u></p> <ul style="list-style-type: none"> If mixed with store drop off (for PE) it gets discarded as waste. 	<p><u>Shrink sleeves can decrease the surface available to detect</u> the plastic type for sorting.</p> <ul style="list-style-type: none"> Undetected PET and HDPE packages get discarded as waste. 	<p><u>Paper labels on plastic often do not easily separate</u> in processing.</p> <ul style="list-style-type: none"> The paper is not recovered, and the plastic may get discarded as waste. 	<p>Very <u>small amounts of PVC</u> in PET is unacceptable for end markets.</p> <ul style="list-style-type: none"> The collected, sorted, and recovered PET with PVC is discarded as waste. 	<p><u>Collection is less than 30%</u> for PE plastic film through store drop off programs (collection needs to improve).</p>	<p>Walmart follows Ellen MacArthur Foundation's definition for recyclability and ISO definitions for recycled content, compostability, and reuse.</p>

Examples of recycling challenges at each stage



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HOW TO USE THE PLAYBOOK



OPTIMIZE

Recyclable packages

Small issues can be detrimental or make a package not compatible with recycling (e.g., color, labels)

ACTION: CHECK THE DESIGN GUIDES TO OPTIMIZE THE PACKAGE FOR RECYCLING



CHANGE

Packages that are not recyclable

Replace packages that contaminate high value recycling streams or have feasible replacements

ACTION: SWITCH TO A RECYCLABLE PACKAGE, SEE GUIDES FOR IDEAS



ADVANCE

Packages that are not recyclable

No feasible path to a recyclable package at this time

ACTION: SUPPORT DEVELOPMENT OF A RECYCLING, REUSE, TAKE-BACK, OR COMPOSTING SOLUTION

OPTIMIZE, CHANGE, OR ADVANCE PACKAGING AS APPLICABLE

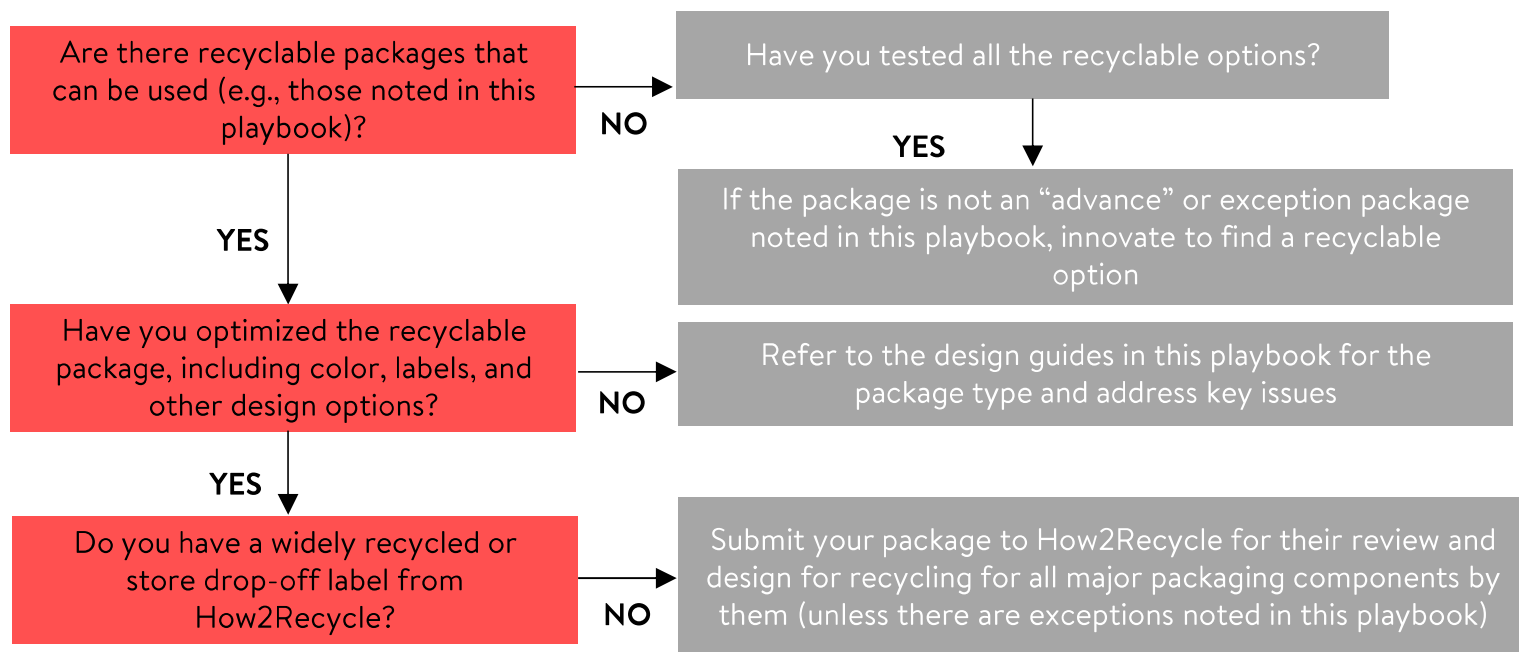
Review the following pages for guidance and ideas for optimizing packages that are potentially recyclable and changing packages that are not recyclable or advancing development to get to a circular economy solution.

OPTIMIZE Check the design guides to optimize the package for recycling	CHANGE Switch to a recyclable package, see guides for ideas	ADVANCE Support development of a recycling, reuse, take-back, or composting solution
Bags, films, and pouches: <ul style="list-style-type: none"> Paper Plastic*: PE, HDPE, MDPE, LDPE, and LLDPE 	Bags, films, and pouches: <ul style="list-style-type: none"> Made from multiple materials Plastic: nylon, PET, PP, PVC, PVDC 	Bags, films, and pouches: Heat-in-the-bag, some advanced barriers, meat film and soaker pads, customer demand, life cycle considerations
Bottles, jars, jugs, and tubs: <ul style="list-style-type: none"> Glass Plastic: HDPE, LDPE*, PET, PP 	Bottles, jars, jugs, and tubs: <ul style="list-style-type: none"> Plastic: acrylic, PETG, PC, PS, PVC, miscellaneous plastics, and multiple materials 	
Boxes: paperboard, corrugate, and molded fiber		
Canisters and cartons: paper-based including: <ul style="list-style-type: none"> Simple containers without metal (e.g., paperboard) Multi-layer containers for shelf-stable products (e.g., aseptic boxes) and coated containers for refrigerated products (e.g., gable top) 	Canisters and cartons: paper-based containers with metal tops or bottoms	Canisters and cartons: coated paper-based containers for frozen products
Cans: steel, aluminum (including aerosols and others)		
Cushion, dunnage, and inserts: <ul style="list-style-type: none"> Paper, corrugate, and molded fiber Plastic: PE* 	Cushion, dunnage, and inserts: expanded polystyrene and other resins, mushroom packaging	
Trays, clamshells, and thermoforms: <ul style="list-style-type: none"> Paper and fiber-based Plastic: PET* 	Trays, clamshells, and thermoforms: <ul style="list-style-type: none"> Plastic: EPS, PS, PVC 	
<i>*Plastic packages that have established recycling systems in the U.S., but not yet at rates consistent with the requirements for global reporting of progress according to the New Plastics Economy Global Commitment.</i>	Other: <ul style="list-style-type: none"> Blister packs (multiple materials) Flat plastic 	Other: <ul style="list-style-type: none"> Tubes made from plastic with multiple materials Small plastic containers (<2" in more than one dimension)



CHANGE TO A RECYCLABLE PACKAGE

Steps to take to “change” to a recyclable package and optimize its design for recycling

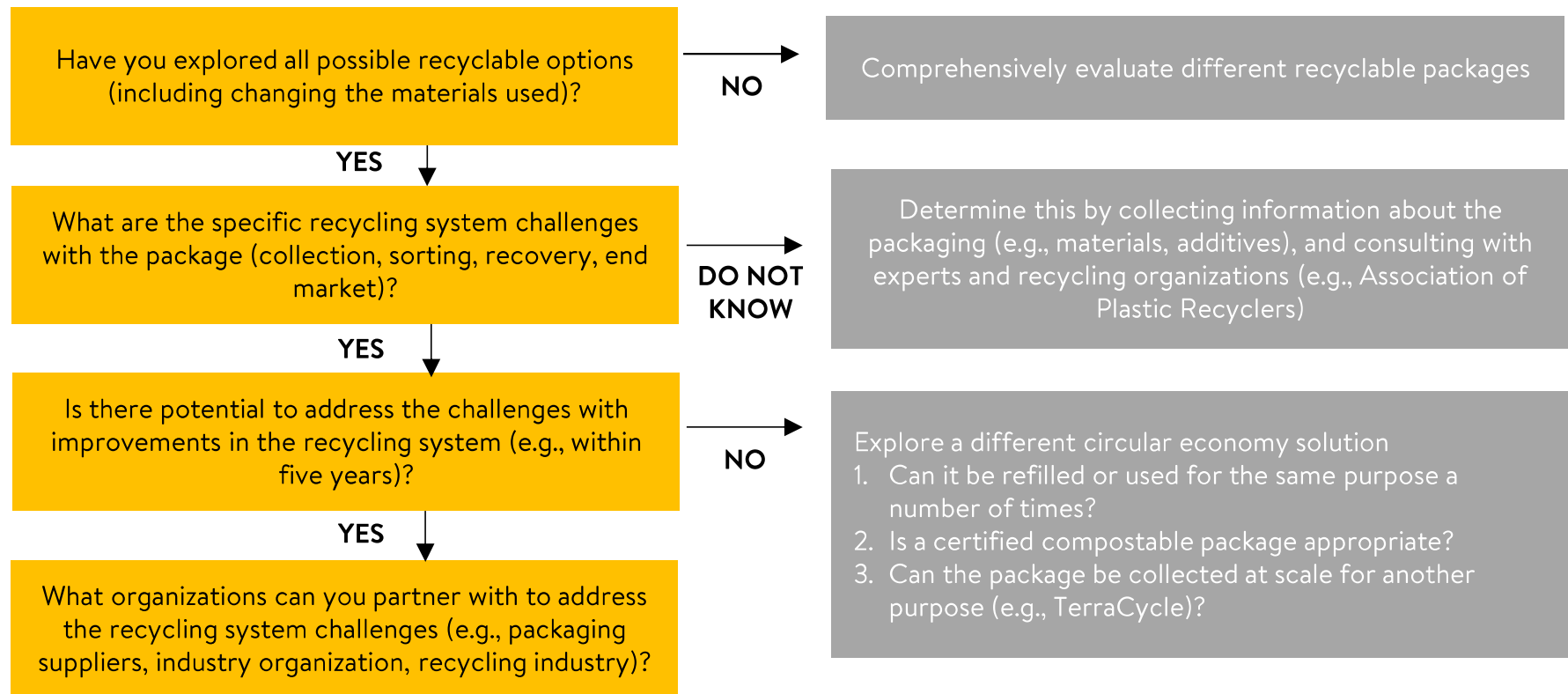


Walmart’s aspiration is zero plastic waste... not zero plastic. While we want to find ways to use less plastic, major packaging changes should be done with thought to ensure there aren’t major trade-offs, such as an increase in greenhouse gas (GHG) emissions. If you participate in [Project Gigaton](#), you can use the Project Gigaton packaging calculators to estimate potential GHG impacts for purposes of reporting in that program.



ADVANCE to a Circular Economy Solution (usually a longer-term approach)

Steps to take to “advance” your package by developing a recycling, reuse, take-back, or composting solution for the package



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OPTIMIZE

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GUIDES: BAGS, FILMS, AND POUCHES



OPTIMIZE Design Guides for Recycling – best practices

Paper Bags



Typically used for:

- Food
- Cleaning products
- Health and wellness (supplements, medicine)
- Pet care
- Arts and crafts
- General merchandise (DIY, sporting goods, automotive, home, kitchen, jewelry)
- Home and garden
- Party supplies
- Toys

Recyclable best practices: *Meets the following*

Material	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Wet Strength Additives	Compatible with recycling processing as confirmed by Western Michigan University testing
Coatings	Use no coatings or use clay coatings
Adhesives	Minimal adhesives and tape or hydrophobic adhesives
Attachments	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Labels and Graphics	Paper or direct printed

*For the purposes of Project Gigaton, [FSC-certified](#) virgin content from all countries is recognized; [SFI](#) from the U.S. and Canada only; [PEFC](#) from Anguilla, Belgium, Czech Republic, Denmark, Estonia, Germany, Hungary, Ireland, Latvia, Lithuania, Netherlands, Portugal, South Korea, Spain, Switzerland, or the UK.

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OPTIMIZE Design Guides for Recycling – challenges to avoid

Paper Bags



Typically used for:

- Food
- Cleaning products
- Health and wellness (supplements, medicine)
- Pet care
- Arts and crafts
- General merchandise (DIY, sporting goods, automotive, home, kitchen, jewelry)
- Home and garden
- Party supplies
- Toys

Recyclability challenges	Examples	Guidance
Frozen Food Cartons	Frozen foods	Develop an end market and systems for collection and recycling of material that can be recovered (e.g., fiber) or innovate to use recycling compatible options
Food-Contact and Oily/Liquid-Contact Products	Variety of products	Ensure that the package can be easily cleaned or have no/low contamination/residue otherwise find another recyclable package design (may also consider reviewing the compostable packaging information to see if that option applies)
Materials to avoid that present recyclability challenges		
Color, Layers, or Additives	Avoid: Plastic/polymer treatments or layers on fiber-based components (one side is better than both the outside and inside coated), treatments that require plastic/polymers (most holograms, high gloss), wax, UV coatings, metalized films, foils, wet strength additives that haven't passed Western Michigan University testing, dark colors, fragrances	
Attachments and Adhesives	Avoid: Metal, magnetic closures, electronics, RFIDs, PET, PLA, PP, PS, PVC, hot melt adhesives, stickers and adhesives (unless passes Western Michigan University testing)	
Labels	Avoid: Metal foil, metalized printing, PET, PLA, PP, PS, PVC	

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OPTIMIZE Design Guides for Recycling – best practices

PE Bags and Film*



Typically used for:

- Food
- Frozen food
- Cleaning products
- Household paper
- Personal and baby care
- Pet care
- Arts and crafts
- Electronics
- General merchandise (DIY, sporting goods, home)
- Home and garden
- Party supplies
- Ecommerce envelope

Recyclable best practices: *Meets the following or passed the applicable APR benchmark and definitive tests*

Film Resin	LDPE, MDPE, LLDPE, or HDPE film
Resin Color	Unpigmented is best or white or light colors
Resin Additives	No degradable or biodegradability additives or starch
Fillers	Ensure density of blend is less than 1.0
Layers	PE
Labels	PE or direct printed
Attachments	PE

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	No minimum PCR content, but may be added in the future
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**Plastic packages that have established recycling systems in the U.S., but not yet at rates consistent with the requirements for global reporting of progress according to the Ellen MacArthur Foundation [New Plastics Economy Global Commitment](#).*

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OPTIMIZE Design Guides for Recycling – challenges to avoid

PE Bags and Film*



Typically used for:

- Food
- Frozen food
- Cleaning products
- Household paper
- Personal and baby care
- Pet care
- Arts and crafts
- Electronics
- General merchandise (DIY, sporting goods, home)
- Home and garden
- Party supplies
- Ecommerce envelope

Recyclability challenges	Examples	Guidance
Food residue	Food and beverages	Ensure that the package can be easily cleaned or have no/low contamination/residue (e.g., bread) otherwise find another recyclable package design
Recycled content	Variety of products	No minimum due to limited availability of options currently available
Multi-material packages (not all PE)	Frozen food, wipes	Look for options that are compatible with recycling or innovate to use recycling compatible options
Materials to avoid that present recyclability challenges		
Resin	Avoid: Any non-PE resins mixed in	
Resin Color or Additives	Avoid: Dark colors (e.g., blue, green), PVC, PVDC, metalized layers, fillers that alter the blend density to be greater than 1.0, Starch resins, or Degradable additives (no biodegradability additives)	
Attachments and Closures	Avoid: Metal, foils, PET, PLA, PP, PS, PVC, RFIDs	
Labels	Avoid: Metal foil, metalized printing, paper, PET, PLA, PP, PS, PVC	

*Plastic packages that have established recycling systems in the U.S., but not yet at rates consistent with the requirements for global reporting of progress according to the Ellen MacArthur Foundation [New Plastics Economy Global Commitment](#).

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CHANGE to a Recyclable Package

Bags, Films, Pouches

Made from multiple materials
Plastic: nylon, PET, PP, PVC, PVDC



Typically used for:

- Arts and crafts
- Apparel
- Baby food and care
- Food (e.g., nuts, produce)
- Health & wellness
- General merchandise (DIY)
- Home décor (e.g., bedding)
- Home and garden
- Household paper
- Office
- Party supplies
- Personal care
- Pet food and care
- Toys

Challenges

- It is difficult for consumers to separate multiple materials
- Nylon, PET, PP, PVC, PVDC are not accepted in U.S. store-drop off recycling programs and can result in loss of recyclable plastic due to contamination

Guidance

Change to:

- A similar format with a PE material only (e.g., LDPE)
- A similar format with material mixtures compatible with store-drop off (e.g., HDPE, LDPE, LLDPE, MDPE)
- A different recyclable format (e.g., paperboard box, carton, HDPE tub)

For plastic, use coatings and additives proven to be compatible recycling (e.g., EVOH/compatibilizers), see [APR Design® Guide For Plastics Recyclability](#) and APR testing

See the applicable guides in this playbook to optimize the new design (e.g., labels, colors) and use the How2Recycle label

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CHANGE to a Recyclable Package

Bags, Films, Pouches

Made from multiple materials
Plastic: nylon, PET, PP, PVC, PVDC



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Examples that should use recyclable options; see next slide for exceptions to the below

	Product	Recyclable format to consider
Produce and fresh food	Produce, lettuce, salad mixes	PET clamshell, PE bag
	Dairy	PE bag
	Meat, poultry, fish	PET tray, PP tray (note that films used with these may not be recyclable)
Dry Grocery	Cookies, crackers	PE bag/wrap in box
	Bread, bagels, tortillas	PE bag
	Rice and coffee	PE bag
	Trail mix, nut mixes	PET tub, PE bag
	Bakery ingredients and supplies	Paper bag, PE bag
Beverages	Kids juice for lunch	Coated paper-based box (e.g., Tetrapak)
Frozen food	Frozen breakfast, snacks, appetizers	PE bag in box
	Frozen meals	Paper box with a paper or PP container
	Frozen pizza and meals	Paper box with PE film
	Frozen potatoes, meat, poultry, fish	PE bag
Pet food and snacks	Dry pet food and snacks	PE bag
Baby and personal care	Diapers	PE outerwrap, corrugate box
	Wipes without an integrated dispenser	PE bag
	Feminine and incontinence pads	PE outerwrap
Home care	Cleaning and laundry products	PE bag



ADVANCE to a Circular Economy Solution (usually a longer-term approach)

Bags, Films, Pouches

Made from multiple materials
Plastic: nylon, PET, PP, PVC, PVDC



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Examples that may not be feasible to switch to a recyclable option; work to advance innovation of recyclable packaging or the development of an appropriate circular economy solution.

Heat-in-the-bag

- Frozen foods that are heated in the bag (e.g., PP bags, multiple materials)
- Fresh vegetables that are heated in the bag (e.g., PP bags, multiple materials)

Advanced barriers for refrigerated or shelf-stable foods and beverages (e.g., to minimize oxygen and carbon dioxide transmission for fat/oil stability)

- Chips and crackers with fat/oil content (e.g., potato chips, tortilla chips, cheese crackers) (e.g., PP film with or without metallization)
- Lunchmeat, bacon, and hot dogs (e.g., PET film)
- Natural and processed cheese and related products (e.g., PET film)
- Boxed meals with cheese powders or food with significant cheese/dairy fat composition (e.g., metalized pouch)
- Dairy or meat-based snacks (e.g., candy, jerky) (e.g., PET metalized film)

Meat, poultry, and fish minor packaging components

- Film (e.g., PVDC)
- Soaker pad (e.g., multiple materials)

Product protection: Where testing proved that significant product loss would occur with all possible recyclable options

Life cycle impacts: A peer-reviewed life cycle assessment study demonstrates significant improvements across impacts (e.g., due to low packaging-to-product ratio)

Customer demand: Where testing proved that all possible recyclable options are not accepted by customers (e.g., baby food pouches, dispensers integrated in flexible wipe containers, coffee beans or ground coffee)

See the appendix for information on compostable packaging.

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**GUIDES:
BOTTLES, JARS, JUGS, AND TUBS**



OPTIMIZE Design Guides for Recycling – best practices

Glass Containers



Typically used for:

- Food jars
- Beverage bottles

Recyclable best practices: *Meets the following*

Materials	Container glass
Color	Clear, amber, green, and blue
Label	Direct print, paper

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	30%
Maximum	Up to 95% PCR

Materials that present recyclability challenges to avoid

Labels	Ensure that plastic labels are easy to remove or avoid them
Attachments, closures	Avoid: Anything molded into the glass or ceramic attachments/closures
Non-container glass	Avoid: Lead glass (e.g., crystal) and heat-resistant glass (e.g., Pyrex)

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OPTIMIZE Design Guides for Recycling – best practices

PET Bottles



Typically used for:

- Water and beverages
- Grocery (e.g., condiments, sauces)
- Health & wellness (e.g., supplements)
- Personal and baby care
- Cleaning products

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Recyclable best practices: *Meets the following or passed the applicable APR benchmark and definitive tests*

Resin	PET bottle grade with a crystalline melting point between 225 and 255°C
Resin Color	Clear or transparent light blue
Resin Additives	No degradable or biodegradability additives
Wrap Around Label or Cut & Stack	PP or PE (that float when printed)
Shrink Sleeve, Pressure Sensitive, or Direct Printed	An APR Preferred option (<i>Learn more at https://plasticsrecycling.org/recognition/recipients</i>)
Attachments	Clear if PET; colored ok for PP or PE
Closures, Pumps, and Sprays	PP or PE
Cap Liner	Liner made from PE, EVA, or TPE or no liner
Tamper Evidence	Easily fully removable, PET, PP, PE
Dimensions	Larger than 2" in two dimensions and largely 3-dimensional (vs. flat with one dimension <2")

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	25% PCR
Maximum	Up to 100% PCR



OPTIMIZE Design Guides for Recycling – challenges to avoid

PET Bottles



Typically used for:

- Water and beverages
- Grocery (e.g., condiments, sauces)
- Health & wellness (e.g., supplements)
- Personal and baby care
- Cleaning products

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Recyclability challenges	Examples	Guidance
Nylon layers	Sparkling mineral water, food jars, and juice bottles	Use the APR recognized options or innovate to use recycling compatible options
Oxygen scavenger (or other) additives	Juice, tea, and coffee	Use the APR recognized options or innovate to use recycling compatible options (e.g., EvOH at low percentage)
Paper labels	Many products	These are a low-cost option that either need to pass APR benchmark and definitive tests or be replaced with non-paper APR recognized options
Pressure sensitive and shrink sleeve labels	Many products	See below for more information; Use the APR recognized options (<i>Learn more at https://plasticsrecycling.org/recognition/recipients</i>)
Metal parts in cap, pump, or spray	Beverages, cleaning and personal care products	Look for all plastic caps, pumps, or sprays (some applications may have functional limitations and How2Recycle labels should be used to clearly communicate that the cap, pump, or spray with metal needs to be removed before recycling)
PETG	Beverages	PETG is not the same thing as PET and should be designed out of PET packaging
Materials to avoid that present recyclability challenges		
Resin	Avoid: PETG, other non-compatible resins mixed in (some EvOH levels are ok)	
Resin Color or Additives	Avoid: Transparent colors other than blue (green should be limited to compostable packaging based on guidance from the State of Washington), opaque colors, dark colors, optical brighteners, degradable additives or biodegradability additives	
Attachments/Closures	Avoid: Metal, foils, PS, PVC, PLA, TPE/silicon with density > 1, RFIDs	
Labels	Avoid the following for: <ul style="list-style-type: none"> • Materials: Metal foil, metalized printing, PS, PVC, PLA • Label coverage: Those that are not APR Preferred, does not pass APRs near infrared (NIR) Sorting Potential Test, greater than 60% label coverage of the container side wall section • Paper labels: Those that are not APR Preferred or that do not pass APR testing • Inks: Bleeding inks or direct printing that do not pass APR testing 	



OPTIMIZE Design Guides for Recycling – best practices

HDPE Bottles



Typically used for:

- Milk
- Baby formula
- Health and wellness (supplements, medicine)
- Personal and baby care
- Cleaning products

Recyclable best practices: *Meets the following or passed the applicable APR benchmark and definitive tests*

Resin	HDPE density 0.94-0.96
Resin Color	Unpigmented, translucent, opaque colors (not dark)
Resin Additives	No degradable or biodegradability additives
Layers	PE or EVOH less than 3%
Labels	PE, PP
Adhesives	Wash off cleanly or minimal/no adhesive
Attachments, Closures, Pumps and Sprays	PE, PLA, or PS
Cap Liner	PE, EVA or TPE
Tamper Evidence	PE, PETG

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	10% PCR for transparent/natural 25% PCR for colored
Maximum	Up to 100% PCR

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OPTIMIZE Design Guides for Recycling – challenges to avoid

HDPE Bottles



Typically used for:

- Milk
- Baby formula
- Health and wellness (supplements, medicine)
- Personal and baby care
- Cleaning products

Suppliers are reminded that they are responsible for the compliance of their products, including their products packaging, with all applicable laws and regulations, including laws and regulations applicable to recyclability and compostability, such as the FTC's Green Guides and California's Public Resources Code. Walmart does not give its suppliers legal advice. Suppliers should consult their own counsel with questions about the applicability of laws and regulations to their products and packaging.

Recyclability challenges	Examples	Guidance
Metal parts in cap, pump, or spray	Sometimes used for cleaning, personal care	Look for all plastic caps, pumps, or sprays (some applications may have functional limitations and How2Recycle labels should be used to clearly communicate that the cap, pump, or spray with metal needs to be removed before recycling)
Fillers	When fillers are added to change the density of the package so that it sinks	Adjust the use of the filler to ensure the package floats
Materials to avoid that present recyclability challenges		
Resin	Avoid: Other resins mixed in	
Resin Color or Additives	Avoid: Dark colors with L value less than 40 or near-infrared (NIR) reflectance less than or equal to 10% (can't be sorted), for non-mechanical oil products (which aren't collected for recycling), Optical brighteners, or Degradable additives (no biodegradability additives)	
Attachments and Closures	Avoid: Metal, foils, PP, PVC, floating silicone polymer, RFIDs	
Labels	Avoid the following for: <ul style="list-style-type: none">• Materials for any type of label: paper, PVC• Materials just for non-wash releasable labels: PLA, PS, metal foils• Label coverage: Those that are not APR Preferred, does not pass APRs near infrared (NIR) Sorting Potential Test, greater than 60% label coverage of the container side wall section	



OPTIMIZE Design Guides for Recycling – best practices

PP Containers



Typically used for:

- Yogurt containers
- Lunchmeat
- Frozen meals
- Heat in the cup foods
- Health and wellness bottles

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Recyclable best practices: *Meets the following or passed the applicable APR benchmark and definitive tests*

Resin	PP
Resin Color	Any color with an L value >40 or NIR reflectance >10%
Resin Additives and Layers	EVOH, workhorse additives (e.g., thermal stabilizers, UV stabilizers, nucleating agents, clarifying agents, antistatic agents, lubricants, pigments, impact improvers, chemical blowing agents), no degradable additives or biodegradability additives
In mold labels	PP
Non-Wash Releasable Labels	PP, PE – all with PP compatible adhesives
Wash Releasable Labels	PP, PE, PLA, PS, metal foil
Attachments	PP, PLA
Closures, Pumps, and Sprays	PP, PS
Cap Liner	Liner made from EVA or TPE or no liner
Tamper Evidence	PP, PE, PETG
Dimensions	Larger than 2" in two dimensions and largely 3-dimensional (vs. flat with one dimension <2")

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	25% PCR
Maximum	Up to 100% PCR



OPTIMIZE Design Guides for Recycling – challenges to avoid

PP Containers



Typically used for:

- Yogurt containers
- Lunchmeat
- Frozen meals
- Heat in the cup foods
- Health and wellness bottles

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Recyclability challenges	Examples	Guidance
Bags and films	Snacks	Explore PE bag and film options, innovative recyclable options, or advance an appropriate circular economy program.
Full body sleeves	Many products	Test for compatibility with sorting (see APR near infrared (NIR) sortation potential test). Covering no more than 60% of package surface helps
Food residue	Food products	Use the How2Recycle label that will include appropriate guidance for consumers to rinse the package before recycling
Materials to avoid that present recyclability challenges		
Resin Color or Additives	Avoid: Degradable additives, optical brighteners, dark colors with an L value <40 or NIR reflectance <=10%, fillers/additives that shift the density by more than 4%	
Attachments and Closures	Avoid: PE, metal, PVC, floating silicone polymer, RFIDs	
Labels	Avoid the following for: <ul style="list-style-type: none">• Materials for any label type: paper, PVC• Materials for only non-wash releasable labels: PLA, PS, metal foils• Label coverage: Those that are not APR Preferred, does not pass APRs near infrared (NIR) Sorting Potential Test, greater than 60% label coverage of the container side wall section	



OPTIMIZE Design Guides for Recycling – best practices

LDPE Containers*



Typically used for:

- Health and wellness bottles

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Recyclable best practices: *Meets the following*

Resin	LDPE density 0.917-0.93
Resin Color	Unpigmented, white, or light colors
Resin Additives	No degradable additives or biodegradability additives
Fillers	Ensure density of blend is less than 1.0
Layers	PE
Labels	PE, PP
Attachments, Closures	PE, PLA, or PS
Dimensions	Larger than 2" in two dimensions and largely 3-dimensional (vs. flat with one dimension <2")

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	25% PCR
Maximum	Up to 100% PCR

**Plastic packages that have established recycling systems in the U.S., but not yet at rates consistent with the requirements for global reporting of progress according to the Ellen MacArthur Foundation [New Plastics Economy Global Commitment](#).*



OPTIMIZE Design Guides for Recycling – challenges to avoid

LDPE Containers*



- Typically used for:
- Health and wellness bottles

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Recyclability challenges	Examples	Guidance
Full body sleeves	Variety of products	Test for compatibility with sorting (see APR near infrared (NIR) sortation potential test), covering no more than 60% of the package surface helps
Materials to avoid that present recyclability challenges		
Resin Color or Additives	Avoid: Dark colors with L value less than 40 or near-infrared (NIR) reflectance less than or equal to 10% (can't be sorted), for non-mechanical oil products (which aren't collected for recycling), optical brighteners, or degradable additives or biodegradability additives	
Attachments and Closures	Avoid: Metal, foils, PP, PVC, floating silicone polymer, RFIDs	
Labels	Avoid the following for: <ul style="list-style-type: none">• Materials for any label type: paper, PVC• Materials for just non-wash releasable: PLA, PS, metal foils• Label coverage: Those that are not APR Preferred, does not pass APRs near infrared (NIR) Sorting Potential Test, greater than 60% label coverage of the container side wall section	

**Plastic packages that have established recycling systems in the U.S., but not yet at rates consistent with the requirements for global reporting of progress according to the Ellen MacArthur Foundation [New Plastics Economy Global Commitment](#).*



CHANGE to a Recyclable Package

Bottles, Jars, Jugs, and Tubs

Made from acrylic, PETG, PC, PS, PVC, miscellaneous plastics, and multiple materials (e.g., tubes with different plastics and/or metal)



Typically used for:

- Arts and crafts
- Consumables (e.g., toothpaste, lotion)
- Food
- Health & wellness (e.g., medicine)
- Personal and hair care
- Pet food

Challenges

- It is difficult for consumers to separate multiple materials
- Acrylic, PETG, PC, PS (and high impact PS), PVC and miscellaneous plastics are detrimental to recycling of more common plastics (e.g., HDPE, PET, PP) and are not accepted by most communities for recycling

Guidance

Change to:

- A similar format made from HDPE, PET, PP for bottles, jars, jugs and tubs
- A different recyclable format (e.g., paperboard box, cartons, PE film)

For plastic, use coatings and additives proven to be compatible with recycling to add necessary functionality (e.g., EVOH/compatibilizers), see [APR Design® Guide For Plastics Recyclability](#) and APR testing

See the applicable guides in this playbook to optimize the new design (e.g., labels, colors) and use the How2Recycle label

See information on small plastic packages (i.e., less than 2” in more than one dimension) on another page

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OPTIMIZE

CHANGE

ADVANCE

GUIDES: BOXES



OPTIMIZE Design Guides for Recycling – best practices

Paperboard



Typically used for:

- Food
- Frozen food
- Cleaning products
- Health and wellness (supplements, medicine)
- Personal, hair, and baby care
- Cosmetics
- Pet care
- Office supplies
- Arts and crafts
- Apparel (shoes, baby, women, men)
- Electronics
- General merchandise (DIY, sporting goods, automotive, home, kitchen, jewelry)
- Home and garden
- Party supplies
- Toys

Recyclable best practices: *Meets the following*

Material	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Wet Strength Additives	Compatible with recycling processing as confirmed by Western Michigan University testing
Coatings	Use no coatings or use clay coatings
Adhesives	Minimal adhesives and tape or hydrophobic adhesives
Attachments	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Labels and Graphics	Paper or direct printed
Dunnage and Padding	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber options or PE film pillows and cushioning

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OPTIMIZE Design Guides for Recycling – challenges to avoid

Paperboard



Typically used for:

- Food
- Frozen food
- Cleaning products
- Health and wellness (supplements, medicine)
- Personal, hair, and baby care
- Cosmetics
- Pet care
- Office supplies
- Arts and crafts
- Apparel (shoes, baby, women, men)
- Electronics
- General merchandise (DIY, sporting goods, automotive, home, kitchen, jewelry)
- Home and garden
- Party supplies
- Toys

Recyclability challenges	Examples	Guidance
Frozen Food Cartons	Frozen foods	Develop an end market and systems for collection and recycling of material that can be recovered (e.g., fiber) or innovate to use recycling compatible options
Food-Contact and Oily/Liquid-Contact Products	Variety of products	Ensure that the package can be easily cleaned or have no/low contamination/residue (e.g., frozen waffles) otherwise find another recyclable package design (may also consider reviewing the compostable packaging information to see that option applies)
Materials to avoid that present recyclability challenges		
Color, Layers, or Additives	Avoid: Plastic/polymer treatments or layers on fiber-based components (one side is better than both the outside and inside coated), treatments that require plastic/polymers (most holograms, high gloss), wax, UV coatings, metalized films, foils, wet strength additives that haven't passed Western Michigan University testing, dark colors, fragrances	
Attachments and Adhesives	Avoid: Metal, magnetic closures, electronics, RFIDs, PET, PLA, PP, PS, PVC, hot melt adhesives, stickers and adhesives (unless passes Western Michigan University testing)	
Labels	Avoid: Metal foil, metalized printing, PET, PLA, PP, PS, PVC	
Dunnage and Padding	Avoid: EPS and other expanded resin materials (see cushion, dunnage, and insert guidance in this playbook)	

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OPTIMIZE Design Guides for Recycling – best practices

Corrugated Board



Typically used for:

- E-commerce shipping boxes

Recyclable best practices: *Meets the following*

Corrugated Box Material	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Color	Natural color
Coatings	Use no coatings or use clay coatings
Graphics	Direct printed
Adhesives	Minimal adhesives and tape
Attachments	Fiber
Shipping Labels	Paper or direct printed
Dunnage and Padding	Tree-based fiber options or PE film pillows and cushioning

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OPTIMIZE Design Guides for Recycling – challenges to avoid

Corrugated Board



Typically used for:

- E-commerce shipping boxes

Recyclability challenges	Examples	Guidance
Any addition that was not listed as recyclable	Variety of applications	Consider having the package tested by Western Michigan University
Materials to avoid that present recyclability challenges		
Color, Layers, or Additives	Avoid: Plastic/polymer treatments or layers on fiber-based components (one side is better than both the outside and inside coated), treatments that require plastic/polymers (most holograms, high gloss), wax, UV coatings, metalized films, foils, wet strength additives that haven't passed Western Michigan University testing, dark colors, fragrances	
Attachments	Avoid: Metal, magnetic closures, electronics, RFIDs, PET, PLA, PP, PS, PVC	
Labels	Avoid: Metal foil, metalized printing, PET, PLA, PP, PS, PVC	
Dunnage and Padding	Avoid: EPS and other expanded resin materials (see cushion, dunnage, and insert guidance in this playbook)	

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OPTIMIZE Design Guides for Recycling – best practices

Molded Fiber



Typically used for:

- Frozen food trays (for some applications)
- Produce trays
- Bakery trays

Recyclable best practices: *Meets the following*

Material	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Wet Strength Additives	Compatible with recycling as confirmed by Western Michigan University testing
Coatings	Use no coatings or use clay coatings
Adhesives	Minimal adhesives and tape or hydrophobic adhesives
Attachments	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Labels and Graphics	Paper or direct printed
Dunnage and Padding	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber options or PE film pillows and cushioning

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	Use certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Maximum	Up to 100% PCR

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OPTIMIZE Design Guides for Recycling – challenges to avoid

Molded Fiber



Typically used for:

- Frozen food trays (for some applications)
- Produce trays
- Bakery trays

Materials to avoid that present recyclability challenges

Color, Layers, or Additives

Avoid: Plastic/polymer treatments or layers on fiber-based components (one side is better than both the outside and inside coated), treatments that require plastic/polymers (most holograms, high gloss), wax, UV coatings, metalized films, foils, wet strength additives that haven't passed Western Michigan University testing, dark colors, fragrances

Attachments and Adhesives

Avoid: Metal, magnetic closures, electronics, RFIDs, PET, PLA, PP, PS, PVC, hot melt adhesives, stickers and adhesives (unless passes Western Michigan University testing)

Labels

Avoid: Metal foil, metalized printing, PET, PLA, PP, PS, PVC

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OPTIMIZE

CHANGE

ADVANCE

GUIDES: CARTONS AND CANISTERS



OPTIMIZE Design Guides for Recycling – best practices

Paperboard



Typically used for:

- Food
- Health and wellness (supplements, medicine)
- Personal, hair, and baby care
- Cosmetics
- Office supplies
- Arts and crafts
- General merchandise (DIY, sporting goods, automotive, home, kitchen, jewelry)
- Party supplies
- Toys

Recyclable best practices: *Meets the following*

Material	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Wet Strength Additives	Compatible with recycling processing as confirmed by Western Michigan University testing
Coatings	Use no coatings or use clay coatings
Adhesives	Minimal adhesives and tape or hydrophobic adhesives
Attachments	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Labels and Graphics	Paper or direct printed
Dunnage and Padding	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber options or PE film pillows and cushioning

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OPTIMIZE Design Guides for Recycling – challenges to avoid

Paperboard



Typically used for:

- Food
- Health and wellness (supplements, medicine)
- Personal, hair, and baby care
- Cosmetics
- Office supplies
- Arts and crafts
- General merchandise (DIY, sporting goods, automotive, home, kitchen, jewelry)
- Party supplies
- Toys

Recyclability challenges	Examples	Guidance
Rigid Canisters or Cartons	Variety of products	Very rigid paper packages that are more three-dimensional than two-dimensional may not be sorted with the paper recycling and end up as waste, therefore it is best to test for sorting and include any necessary instructions for flattening as needed
Frozen Food Cartons	Frozen foods	Develop an end market and systems for collection and recycling of material that can be recovered (e.g., fiber) or innovate to use recycling compatible options
Food-Contact and Oily/Liquid-Contact Products	Variety of products	Ensure that the package can be easily cleaned or have no/low contamination/residue otherwise find another recyclable package design (may also consider reviewing the compostable packaging information to see that option applies)
Materials to avoid that present recyclability challenges		
Color, Layers, or Additives	Avoid: Plastic/polymer treatments or layers on fiber-based components (one side is better than both the outside and inside coated), treatments that require plastic/polymers (most holograms, high gloss), wax, UV coatings, metalized films, foils, wet strength additives that haven't passed Western Michigan University testing, dark colors, fragrances	
Attachments and Adhesives	Avoid: Metal, magnetic closures, electronics, RFIDs, PET, PLA, PP, PS, PVC, Hot melt adhesives, Stickers and adhesives (unless passes Western Michigan University testing)	
Labels	Avoid: Metal foil, metalized printing, PET, PLA, PP, PS, PVC	
Dunnage and Padding	Avoid: EPS and other expanded resin materials (see cushion, dunnage, and insert guidance in this playbook)	

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OPTIMIZE Design Guides for Recycling – best practices and challenges to avoid

Canisters and Cartons

Coated paper for shelf-stable or refrigerated foods and beverages



Typically used for:

- Shelf stable broth, milk, wine, juice (sometimes referred to as aseptic boxes, bricks, or TetraPak)
- Refrigerated milk, juice (sometimes referred to as gable top)

Frozen food cartons are not currently recyclable.

Recyclable best practices: *Meets the following*

Material	Shelf stable cartons: primarily of paper with a thin layer of polyethylene and an additional layer of aluminum Refrigerated cartons: primarily of paper with a thin layer of polyethylene
Attachments	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	Use certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
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Recyclability challenges	Examples	Guidance
Frozen Food Cartons	Frozen foods	Develop an end market and systems for collection and recycling of material that can be recovered (e.g., fiber) or innovate to use recycling compatible options
Mixed materials	Beverages	Avoid using non-paper materials beyond those used in the carton itself - see materials above (e.g., no metal attachments/closures, RFIDs)

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CHANGE to a Recyclable Package

Canisters and Cartons

Paper-based containers with a metal top or bottom; Coated paper-based frozen food containers



Typically used for:

- Baby food
- Frozen juice concentrate
- Grocery (e.g., coffee, chips)
- Ice cream and related products

Shelf-stable and refrigerated cartons and bricks (e.g., TetraPak) are recyclable

Challenges

- It is difficult for consumers to separate multiple materials
- Metal can be detected during sorting in recycling systems, potentially losing the paper recycling value
- Rigid paper containers made not sort with paper, potentially losing the paper recycling value
- Double sided coated frozen paperboard containers may not be accepted for recycling

Guidance

Change to:

- A similar format with a single material and optimize for recycling (e.g., paperboard canister or box or HDPE tub)
 - Very rigid paper packages that are more three-dimensional than two-dimensional may not be sorted with the paper recycling and end up as waste, therefore it is best to test for sorting and include any necessary instructions for flattening as needed
- A different recyclable format (e.g., paperboard box, PE film, PET tub, PP tub), *coatings for paper-based packaging may need to validate recyclability with testing (e.g., through Western Michigan University tests)*

See the applicable guides in this playbook to optimize the new design (e.g., labels, colors) and use the How2Recycle label

(see next page for information on frozen food containers)

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ADVANCE to a Circular Economy Solution (usually a longer-term approach)

Canisters and Cartons

- Paper-based containers with a metal top or bottom
- Coated paper-based frozen food containers



Typically used for:

- Baby food
- Frozen juice concentrate
- Grocery (e.g., coffee, chips)
- Ice cream and related products

Shelf-stable and refrigerated cartons and bricks (e.g., TetraPak) are recyclable

Challenges

- It is difficult for consumers to separate multiple materials
- Metal can be detected during sorting in recycling systems, potentially losing the paper recycling value
- Double sided coated frozen paperboard containers may not be accepted for recycling

Examples that have potential to be recyclable without notable design changes if work is done to advance innovation of recyclable packaging.

Double sided coated paper-based frozen food containers:

- If not already widely recyclable, develop an end market, collection, and recycling of material that can be recovered (e.g., fiber) by collaborating across the industry; reach out to the [Carton Council](#) to learn how to develop a new recycling market like this (since they did this for refrigerated gable top cartons)
- If unsuccessful, switch to a recyclable option (e.g., PET or PP tub) or develop an appropriate circular economy solution (e.g., reuse or composting (see the appendix for more information on compostable packaging))

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OPTIMIZE

CHANGE

ADVANCE

GUIDES: CANS



OPTIMIZE Design Guides for Recycling – best practices and challenges to avoid

Metal Containers



Typically used for:

- Beverage cans
- Food cans
- Aerosol food cans
- Aerosol cleaning product cans

Recyclable best practices: *Meets the following*

Materials	Aluminum, steel
Labels	Lacquer printing on container
Attachments, closures	Same metal as package

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	70% aluminum, 20% steel
Maximum	Up to 100% PCR

Recyclability challenges	Examples	Guidance
Full body sleeves	Beverages	Avoid using or ensure compatible with removal during recycling (since a contaminant that reduces value of recycled metal)
Mixed materials	Beverages	Avoid using non-metal materials (e.g., no plastic)
Metal trays and pans	Frozen food	Shift to a recyclable option (e.g., light colored PP) or work to improve the acceptance of these for recycling (currently metal trays not collected by enough communities because they are difficult to separate from cans; limited value; can have food contamination)
Materials to avoid that present recyclability challenges		
Attachments and Closures	Avoid: Plastic, stickers	
Labels	Avoid: Stickers, full body plastic sleeves	

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OPTIMIZE

CHANGE

ADVANCE

GUIDES: CUSHION, DUNNAGE, AND INSERTS



OPTIMIZE Design Guides for Recycling – best practices

Paper Cushion

Paper-based air pillow
or paper sheets



Typically used for:

- General merchandise
- Home and garden
- Ecommerce

Recyclable best practices: *Meets the following*

Material	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Wet Strength Additives	Compatible with recycling processing as confirmed by Western Michigan University testing
Coatings	Use no coatings or use clay coatings
Adhesives	Minimal adhesives and tape or hydrophobic adhesives
Attachments	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Labels and Graphics	Paper or direct printed

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OPTIMIZE Design Guides for Recycling – challenges to avoid

Paper Cushion

Paper-based air pillow or paper sheets



Typically used for:

- General merchandise
- Home and garden
- Ecommerce

Materials to avoid that present recyclability challenges

Color, Layers, or Additives

Avoid: Plastic/polymer treatments or layers on fiber-based components (one side is better than both the outside and inside coated), treatments that require plastic/polymers (most holograms, high gloss), wax, UV coatings, metalized films, foils, wet strength additives that haven't passed Western Michigan University testing, dark colors, fragrances

Attachments and Adhesives

Avoid: Metal, magnetic closures, electronics, RFIDs, PET, PLA, PP, PS, PVC, Hot melt adhesives, Stickers and adhesives (unless passes Western Michigan University testing)

Labels

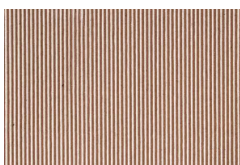
Avoid: Metal foil, metalized printing, PET, PLA, PP, PS, PVC

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OPTIMIZE Design Guides for Recycling – best practices

Corrugated Board



Typically used for:

- General merchandise
- Home and garden
- Ecommerce

Recyclable best practices: Meets the following

Corrugated Box Material	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Color	Natural color
Coatings	Use no coatings or use clay coatings
Graphics	Direct printed
Adhesives	Minimal adhesives and tape
Attachments	Fiber

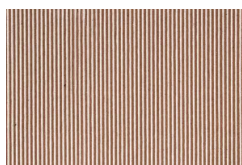
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OPTIMIZE Design Guides for Recycling – challenges to avoid

Corrugated Board



Typically used for:

- General merchandise
- Home and garden
- Ecommerce

Materials to avoid that present recyclability challenges

Color, Layers, or Additives	Avoid: Plastic/polymer treatments or layers on fiber-based components (one side is better than both the outside and inside coated), treatments that require plastic/polymers (most holograms, high gloss), wax, UV coatings, metalized films, foils, wet strength additives that haven't passed Western Michigan University testing, dark colors, fragrances
Attachments and Adhesives	Avoid: Metal, magnetic closures, electronics, RFIDs, PET, PLA, PP, PS, PVC, Hot melt adhesives, Stickers and adhesives (unless passes Western Michigan University testing)
Labels	Avoid: Metal foil, metalized printing, PET, PLA, PP, PS, PVC

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OPTIMIZE Design Guides for Recycling – best practices

Molded Fiber



Molded fiber could be used with the following:

- General merchandise
- Home and garden
- Ecommerce

Recyclable best practices: *Meets the following*

Material	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Wet Strength Additives	Compatible with recycling as confirmed by Western Michigan University testing
Coatings	Use no coatings or use clay coatings
Adhesives	Minimal adhesives and tape or hydrophobic adhesives
Attachments	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Labels and Graphics	Paper or direct printed

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	Use certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Maximum	Up to 100% PCR

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OPTIMIZE Design Guides for Recycling – challenges to avoid

Molded Fiber



Molded fiber could be used with the following:

- General merchandise
- Home and garden
- Ecommerce

Materials to avoid that present recyclability challenges

Color, Layers, or Additives

Avoid: Plastic/polymer treatments or layers on fiber-based components (one side is better than both the outside and inside coated), treatments that require plastic/polymers (most holograms, high gloss), wax, UV coatings, metalized films, foils, wet strength additives that haven't passed Western Michigan University testing, dark colors, fragrances

Attachments and Adhesives

Avoid: Metal, magnetic closures, electronics, RFIDs, PET, PLA, PP, PS, PVC, Hot melt adhesives, Stickers and adhesives (unless passes Western Michigan University testing)

Labels

Avoid: Metal foil, metalized printing, PET, PLA, PP, PS, PVC

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OPTIMIZE Design Guides for Recycling – best practices

PE Cushion*



Typically used for:

- General merchandise
- Home and garden
- Ecommerce

Recyclable best practices: *Meets the following or passed the applicable APR benchmark and definitive tests*

Resin	LDPE, MDPE, LLDPE, or HDPE film
Resin Color	Unpigmented is best or white or light colors
Resin Additives	No degradable or biodegradability additives or starch
Fillers	Ensure density of blend is less than 1.0
Layers	PE
Labels	PE or direct printed
Attachments	PE

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	No minimum PCR content, but may be added in the future
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**Plastic packages that have established recycling systems in the U.S., but not yet at rates consistent with the requirements for global reporting of progress according to the Ellen MacArthur Foundation [New Plastics Economy Global Commitment](#).*

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OPTIMIZE Design Guides for Recycling – challenges to avoid

PE Cushion*



Typically used for:

- General merchandise
- Home and garden
- Ecommerce

Recyclability challenges	Examples	Guidance
Recycled content	Variety of products	No minimum due to limited availability of options currently available
Materials to avoid that present recyclability challenges		
Resin	Avoid: Any non-PE resins mixed in	
Resin Color or Additives	Avoid: Dark colors (e.g., blue, green), PVC, PVDC, metalized layers, fillers that alter the blend density to be greater than 1.0, starch resins, or degradable additives or biodegradability additives	
Attachments and Closures	Avoid: Metal, foils, PET, PLA, PP, PS, PVC, RFIDs	

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CHANGE to a Recyclable Package

Foam Cushion, Dunnage, Inserts

Expanded polystyrene or other resins, nylon; Mushroom packaging



Typically used for:

- General merchandise
- Home and garden
- Ecommerce

Challenges

- Expanded polystyrene (EPS) and other foam (expanded PET, expanded PP), nylon, mushroom packaging for cushion, dunnage, or inserts are not accepted by most communities for recycling

Guidance

Change to:

- A design that doesn't have the need for cushion, dunnage, and inserts
- A material that is recyclable such as corrugate, paper and paperboard, PE air pillows, and molded fiber

See the applicable guides in this playbook to optimize the new design (e.g., labels, colors) and use the How2Recycle label

While mushroom packaging is often compostable, recyclable options are preferred for this type of packaging.

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OPTIMIZE

CHANGE

ADVANCE

**GUIDES:
TRAYS, CLAMSHELLS, AND
THERMOFORMS**



OPTIMIZE Design Guides for Recycling – best practices

Paperboard



Typically used for:

- Food
- Frozen food
- Cleaning products
- Health and wellness (supplements, medicine)
- Personal, hair, and baby care
- Cosmetics
- Pet care
- Office supplies
- Arts and crafts
- Apparel (shoes, baby, women, men)
- Electronics
- General merchandise (DIY, sporting goods, automotive, home, kitchen, jewelry)
- Home and garden
- Party supplies
- Toys

Recyclable best practices: *Meets the following*

Material	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Wet Strength Additives	Compatible with recycling processing as confirmed by Western Michigan University testing
Coatings	Use no coatings or use clay coatings
Adhesives	Minimal adhesives and tape or hydrophobic adhesives
Attachments	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Labels and Graphics	Paper or direct printed
Dunnage and Padding	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber options or PE film pillows and cushioning

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OPTIMIZE Design Guides for Recycling – challenges to avoid

Paperboard



Typically used for:

- Food
- Frozen food
- Cleaning products
- Health and wellness (supplements, medicine)
- Personal, hair, and baby care
- Cosmetics
- Pet care
- Office supplies
- Arts and crafts
- Apparel (shoes, baby, women, men)
- Electronics
- General merchandise (DIY, sporting goods, automotive, home, kitchen, jewelry)
- Home and garden
- Party supplies
- Toys

Recyclability challenges	Examples	Guidance
Frozen Food Cartons	Frozen foods	Develop an end market and systems for collection and recycling of material that can be recovered (e.g., fiber) or innovate to use recycling compatible options
Food-Contact and Oily/Liquid-Contact Products	Variety of products	Ensure that the package can be easily cleaned or have no/low contamination/residue (e.g., frozen waffles) otherwise find another recyclable package design (may also consider reviewing the compostable packaging information to see if that option applies)
Materials to avoid that present recyclability challenges		
Color, Layers, or Additives	Avoid: Plastic/polymer treatments or layers on fiber-based components (one side is better than both the outside and inside coated), treatments that require plastic/polymers (most holograms, high gloss), wax, UV coatings, metalized films, foils, wet strength additives that haven't passed Western Michigan University testing, dark colors, fragrances	
Attachments and Adhesives	Avoid: Metal, magnetic closures, electronics, RFIDs, PET, PLA, PP, PS, PVC, hot melt adhesives, stickers and adhesives (unless passes Western Michigan University testing)	
Labels	Avoid: Metal foil, metalized printing, PET, PLA, PP, PS, PVC	
Dunnage and Padding	Avoid: EPS and other expanded resin materials (see cushion, dunnage, and insert guidance in this playbook)	

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OPTIMIZE Design Guides for Recycling – best practices

Molded Fiber



Typically used for:

- Frozen food trays (for some applications)
- Produce trays
- Bakery trays

Recyclable best practices: *Meets the following*

Material	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Wet Strength Additives	Compatible with recycling as confirmed by Western Michigan University testing
Coatings	Use no coatings or use clay coatings
Adhesives	Minimal adhesives and tape or hydrophobic adhesives
Attachments	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Labels and Graphics	Paper or direct printed
Dunnage and Padding	Certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber options or PE film pillows and cushioning

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	Use certified responsibly sourced fiber (e.g., FSC*) and/or recycled fiber
Maximum	Up to 100% PCR

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OPTIMIZE Design Guides for Recycling – challenges to avoid

Molded Fiber



Typically used for:

- Frozen food trays (for some applications)
- Produce trays
- Bakery trays

Recyclability challenges	Examples	Guidance
Food-Contact and Oily/Liquid-Contact Products	Variety of products	Ensure that the package can be easily cleaned or have no/low contamination/residue (e.g., frozen waffles) otherwise find another recyclable package design (may also consider reviewing the compostable packaging information to see that option applies)
Materials to avoid that present recyclability challenges		
Color, Layers, or Additives	Avoid: Plastic/polymer treatments or layers on fiber-based components (one side is better than both the outside and inside coated), treatments that require plastic/polymers (most holograms, high gloss), wax, UV coatings, metalized films, foils, wet strength additives that haven't passed Western Michigan University testing, dark colors, fragrances	
Attachments and Adhesives	Avoid: Metal, magnetic closures, electronics, RFIDs, PET, PLA, PP, PS, PVC, hot melt adhesives, stickers and adhesives (unless passes Western Michigan University testing)	
Labels	Avoid: Metal foil, metalized printing, PET, PLA, PP, PS, PVC	

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OPTIMIZE Design Guides for Recycling – best practices

PET Thermoforms* (e.g., Boxes, Clamshells, Cups)



Typically used for:

- Bakery and deli
- Eggs
- General merchandise (sporting goods, automotive, home)

Recyclable best practices: *Meets the following or passed the applicable APR benchmark and definitive tests*

Resin	PET bottle grade with a crystalline melting point between 225 and 255°C
Resin Color	Clear
Resin Additives	No degradable or biodegradability additives
Label	PP or PE (that float when printed)
Attachments	Clear if PET; colored ok for PP or PE
Tamper Evidence	Easily fully removable, PET, PP, or PE
Dimensions	Larger than 2" in two dimensions and largely 3-dimensional (vs. flat with one dimension <2")

Feasible post-consumer recycled content levels based on current industry practice

Minimum (may increase over time)	25% PCR
Maximum	Up to 100% PCR

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OPTIMIZE Design Guides for Recycling – challenges to avoid

PET Thermoforms* (e.g., Boxes, Clamshells, Cups)



Typically used for:

- Bakery and deli
- Eggs
- General merchandise (sporting goods, automotive, home)

**Plastic packages that have established recycling systems in the U.S., but not yet at rates consistent with the requirements for global reporting of progress according to the Ellen MacArthur Foundation [New Plastics Economy Global Commitment](#).*

Recyclability challenges	Examples	Guidance
Black trays	Bakery and produce	Black currently isn't detected in sorting for PET, has no valuable end markets, it should be switched to clear or transparent light blue or green if it isn't 100% PCR
Non-PET clamshells	Variety of products	Look to switch to a recyclable format (e.g., paper, PET)
More 2-dimensional	Variety of products	Ensure that the size and shape are compatible with the sorting recycling processes by using the test from the Association of Plastic Recyclers
Blister packages (e.g., paper and plastic)	Toys, general merchandise, health and wellness	These are often hard to separate or are not used by recyclers, design or innovate to use a recyclable package (e.g., paper, PET, PE film/bag)
Materials to avoid that present recyclability challenges		
Resin	Avoid: PETG, or Other resins mixed in	
Resin Color or Additives	Avoid: Transparent colors (green should be limited to compostable packaging based on guidance from the State of Washington), opaque colors, dark colors, degradable additives or biodegradability additives	
Attachments/Closures	Avoid: Metal, foils, PS, PVC, PLA, RFIDs	
Labels and Adhesives	Avoid the following for: <ul style="list-style-type: none"> • Materials: Metal foil, metalized printing, PS, PVC, PLA • Label coverage: Those that are not APR Preferred, does not pass APRs near infrared (NIR) Sorting Potential Test, greater than 60% label coverage of the container side wall section • Paper labels: Those that are not APR Preferred or that do not pass APR testing • Inks: Bleeding inks or direct printing that do not pass APR testing 	

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CHANGE to a Recyclable Package

Trays, Clamshells, Thermoforms, Cases

EPS, PS, PVC, Acrylic



Typically used for:

- Arts and crafts
- Cosmetics
- Electronics
- Food (e.g., bakery, cookies, deli, frozen, meat)
- General merchandise
- Home Décor and Do It Yourself
- Office
- Personal care
- Toys

Challenges

- Acrylic, expanded polystyrene (EPS), polystyrene (PS), polyvinyl chloride (PVC) are not accepted by most communities for recycling
- These materials can be detrimental to the recycling of more common plastics and can result in losses due to contamination

Guidance

Change to:

- A similar format that is a recyclable option such as PET, PP, or molded fiber
- A different recyclable format (e.g., box, bag)

See the appendix for information on compostable packaging to see if this option applies

See the applicable guides in this playbook to optimize the new design (e.g., labels, colors) and use the How2Recycle label

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OPTIMIZE

CHANGE

ADVANCE

**GUIDES: OTHER PACKAGES: BLISTER
PACKS**



CHANGE to a Recyclable Package

Blister Packs

(usually with multiple materials such as PET/paper, PVC/metal)



Typically used for:

- Arts and crafts
- Consumables
- Health & wellness (e.g., supplements, medicine)
- Electronics
- General merchandise
- Home Décor and Do It Yourself
- Office
- Toys

Challenges

- It is difficult for consumers to separate multiple materials
- Commonly used PVC thermoforms are detrimental to plastic recycling

Guidance

Change to:

- A different format with a single material (e.g., paperboard box, PE bag)
- A similar format with materials that are easily separated and recyclable on their own (e.g., PET clamshell or tray with paper insert), or use the acceptable attachments noted in this playbook

Avoid materials that are detrimental to plastic recycling (e.g., PVC, PETG, foils), including adhesives that remain on the plastic that are not compatible with recycling

See the applicable guides in this playbook to optimize the new design (e.g., labels, colors) and use the How2Recycle label

Exception for Drugs: When drugs require individual dosing with tamper evidence and product protection that another option cannot provide, blister packs with multiple materials are acceptable, but the company should have a development pipeline that aims to replace this design with recyclable alternatives (supplements are not included in this exception)

Example recyclable formats to consider

Paperboard box	Paperboard display	PE bag	PET clamshell, tray

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OPTIMIZE

CHANGE

ADVANCE

GUIDES: OTHER PACKAGES: PLASTIC TUBES WITH MULTIPLE MATERIALS



ADVANCE to a Circular Economy Solution (usually a longer-term approach)

Tubes

Plastic and made of multiple materials
(aluminum, plastic)



Typically used for:

- Arts and crafts
- Consumables (e.g., toothpaste, lotion)
- Health & wellness (e.g., medicine)

Challenges

- It is difficult for consumers to separate multiple materials

Work to advance innovation of recyclable packaging or the development of an appropriate circular economy solution.

Develop package to be recycled in HDPE bottle or other stream

- Use a single plastic material with a recycling stream (e.g., HDPE)
 - Colgate Palmolive announced in 2019 that it has a toothpaste tube that is recognized by the Association of Plastic Recyclers (APR) for recyclability, using an HDPE design (when toothpaste tubes typically have multiple materials)
- For plastic, use coatings and additives proven to be compatible with recycling to add necessary functionality (e.g., EVOH at limited levels), see [APR Design® Guide For Plastics Recyclability](#)
- Consider a different package material and format that is recyclable (e.g., paperboard box, PE bag)

See the applicable guides in this playbook to optimize the new design (e.g., labels, colors) and use the How2Recycle label

If a recyclable option is not feasible, help advance the development of an appropriate circular economy solution (e.g., reuse, composting, take-back) for the current package, for packages such as:

- Packages with significant product residue detrimental to recycling or not compatible with recycling
- Packages smaller than 2” in more than one dimension

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OPTIMIZE

CHANGE

ADVANCE

**GUIDES: OTHER PACKAGES: FLAT OR
SMALL PLASTIC**



CHANGE to a Recyclable Package

Flat plastic

Flat plastic has 2 dimensions or is more 2-dimensional than 3-dimensional



Flat plastic found across the store as a window on a package or the package itself.

- Grocery (e.g., bakery, pasta)
- Consumables (e.g., cosmetics)
- General merchandise (e.g., electronic accessories)
- Toys

Challenges

- Flat plastic may end up with paper recycling in which case it potentially contaminates paper or does not get recycled

Guidance

Change:

- Design out flat plastic packaging components (e.g., windows)

For PET thermoforms that are not a window but more of a plastic box or container that could be more 2-dimensional than 3-dimensional, see PET thermoform guidance and:

- Ensure that the size and shape are compatible with the recycling process by using the [test](#) from the Association of Plastic Recyclers
- Or Change to a recyclable format (e.g., box, bag)

See the applicable guides in this playbook to optimize the new design (e.g., labels, colors) and use the How2Recycle label

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ADVANCE to a Circular Economy Solution (usually a longer-term approach)

Small plastic containers

Small packages are <2” in more than one dimension



- Small packages are typically used for:
- Arts and crafts
 - Consumables (e.g., toothpaste, lotion)
 - Health & wellness (e.g., medicine)
 - Cosmetics

Challenges

- Small sized packages can fall through recycling sorting steps to end up as waste
- Small packages can be made from multiple materials that are difficult for consumers to separate

Work to advance innovation of recyclable packaging or the development of an appropriate circular economy solution.

Design small packages to pass the test for sorting

- Ensure that the size and shape are compatible with the recycling process by using the [test](#) from the Association of Plastic Recyclers
- Also, ensure that the overall design is optimized for recycling the material (e.g., labels, color, caps)

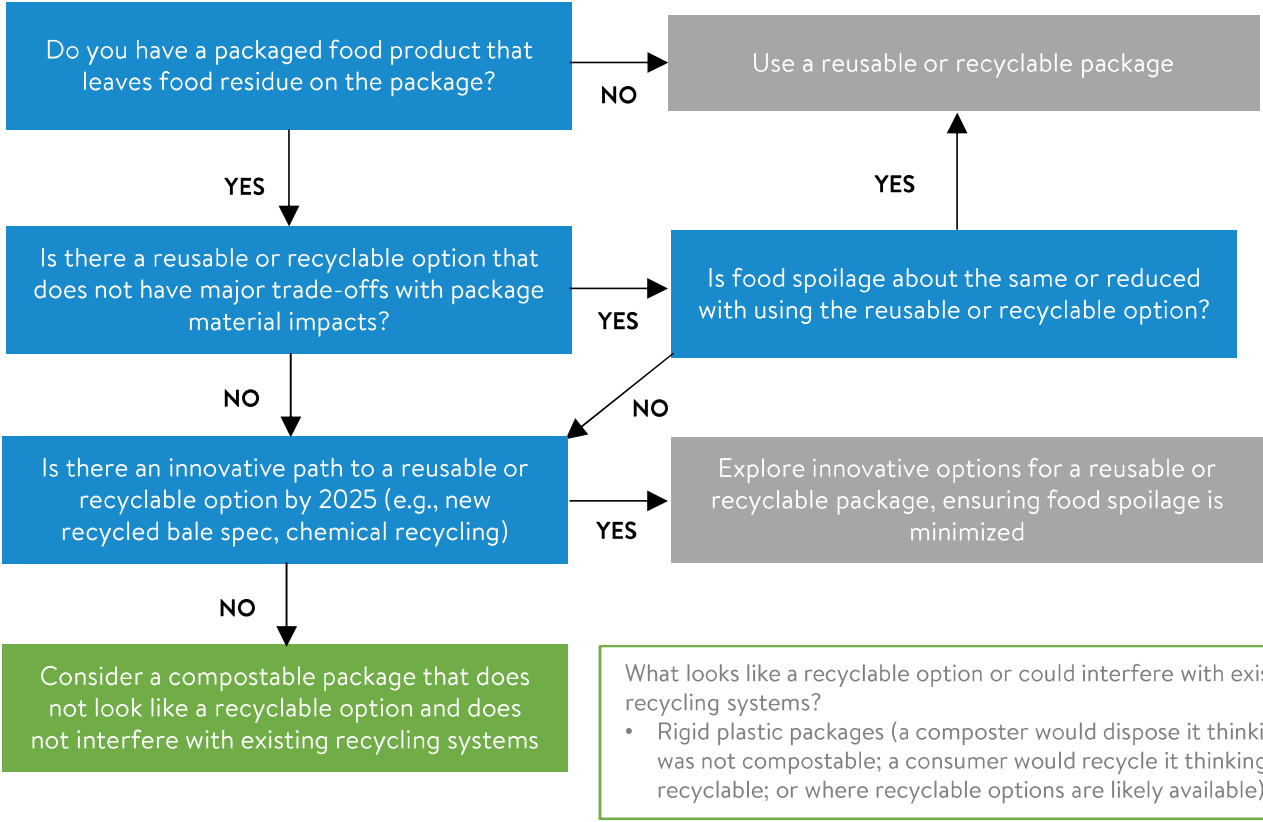
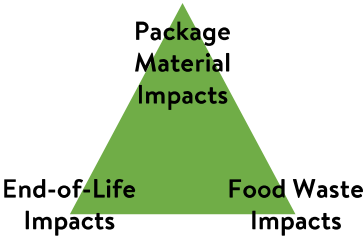
If cannot meet requirement for sorting, help advance the development of an appropriate circular economy solution

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COMPOSTABLE PACKAGING

WHEN IS COMPOSTABLE PACKAGING AN OPTION?

When packaging, food waste, and end-of-life impacts are balanced & reusable and recyclable options do not work



Example products that might consider compostable packaging:

- Single serve condiments
- Chips and snack foods

This information applies to retail product packaging (e.g., does not refer to food service, products)

WHAT TO WATCH FOR: COMPOSTABLE PACKAGING

Composting is a natural degradation process that produces a soil conditioner from organic materials

INDUSTRIAL COMPOSTING: **Consumers currently do not have enough access** to industrial composting programs

- Approximately 5% of U.S. households have access to curbside food waste collection; not all programs accepting compostable packaging
- Look for [Biodegradable Products Institute](#) (BPI) certified compostable packaging (or equivalent)

COMMUNITY AND HOME COMPOSTING: Usually **a long process with small volumes** and with some technical limitations

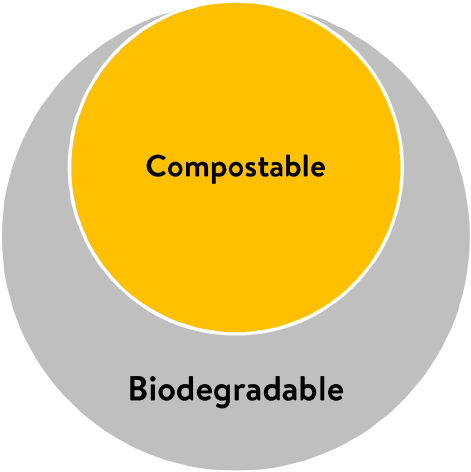
- Look for **BPI certified compostable packaging PLUS TUV's OK compost home certification**

If compostable packaging proves to be the best way to balance end-of-life management, packaging material impacts, and food waste be sure to* **support the expansion of composting access for consumers** (e.g., engage with and/or fund organizations, policy development, and other efforts increasing composting access)

**Applicable for countries with composting in countries that do not have any consumer composting access or that ban packaging in composting should not use compostable packaging (e.g., South Africa).*

COMPOSTABLE PACKAGING IS NOT THE SAME AS BIODEGRADABLE

Do not make claims about biodegradability of packaging, only refer to compostability (when applicable)



Compostable

Biodegrades into compost at a rate consistent with other known compostable materials and without visible residue as verified through standard tests.

Biodegradable

Under appropriate conditions, breaks down into carbon dioxide, minerals and other materials found in nature. *Note: packages can be biodegradable but are not compostable; biodegradation cannot expect to happen in a landfill; making biodegradable claims are not instructing a responsible end-of-life behavior and are confusing to consumers.*

Biodegradable additives: Used to help something partially biodegrade but does not enable compostability and should be avoided in packaging.

- Do not use in petroleum-based plastics since compromises the recycling stream (Source: [Sustainable Packaging Coalition](#)).
- Do not use in compostable packaging since they are not needed.

Marine degradability: This is a subset of biodegradability, where the material can effectively break down in marine environments, and while is a desirable attribute for some materials, this is not a claim that should be made on any packaging.

PFAS: Long and short chain per- and poly-fluorinated alky substances (PFAS) are often used to grease and water-proof fiber-based packaging and should be avoided. BPI compostable certification does not allow for intentional addition of PFAS. (Source: [BPI](#)).

Bio-based refers only to the source of the materials the package was made from and does not mean the package is compostable or biodegradable (e.g., bio-based PET is recyclable and not biodegradable) – look for certification to confirm compostability (e.g., BPI).

BEST PRACTICES: HOW TO LABEL COMPOSTABLE PACKAGING

1. **Clearly indicate that the package is industrially compostable** (e.g., BPI certification logo and/or the How2Compost label) with at least:
 - Indication that the package can be industrially composted
 - Information that it is certified to comply with applicable ASTM standards
 - Call out that compost facilities are not available to a majority of consumers or communities where the item is sold
2. **If you are using a compostable label, avoid making claims about any of the following**:**
 - Biodegradable
 - Decomposable
 - Degradable
 - Marine degradable
 - Oxo-degradable
 - Recyclable (recyclable packages should not be labeled with compostable labels since recyclable packages should be recycled)

***Adapted from [Washington State](#)*
3. **Follow applicable laws, such as (but not limited to):**
 - [US Federal Trade Commission Green Guides](#)
 - [Washington State](#) law on the marketing the degradability of products



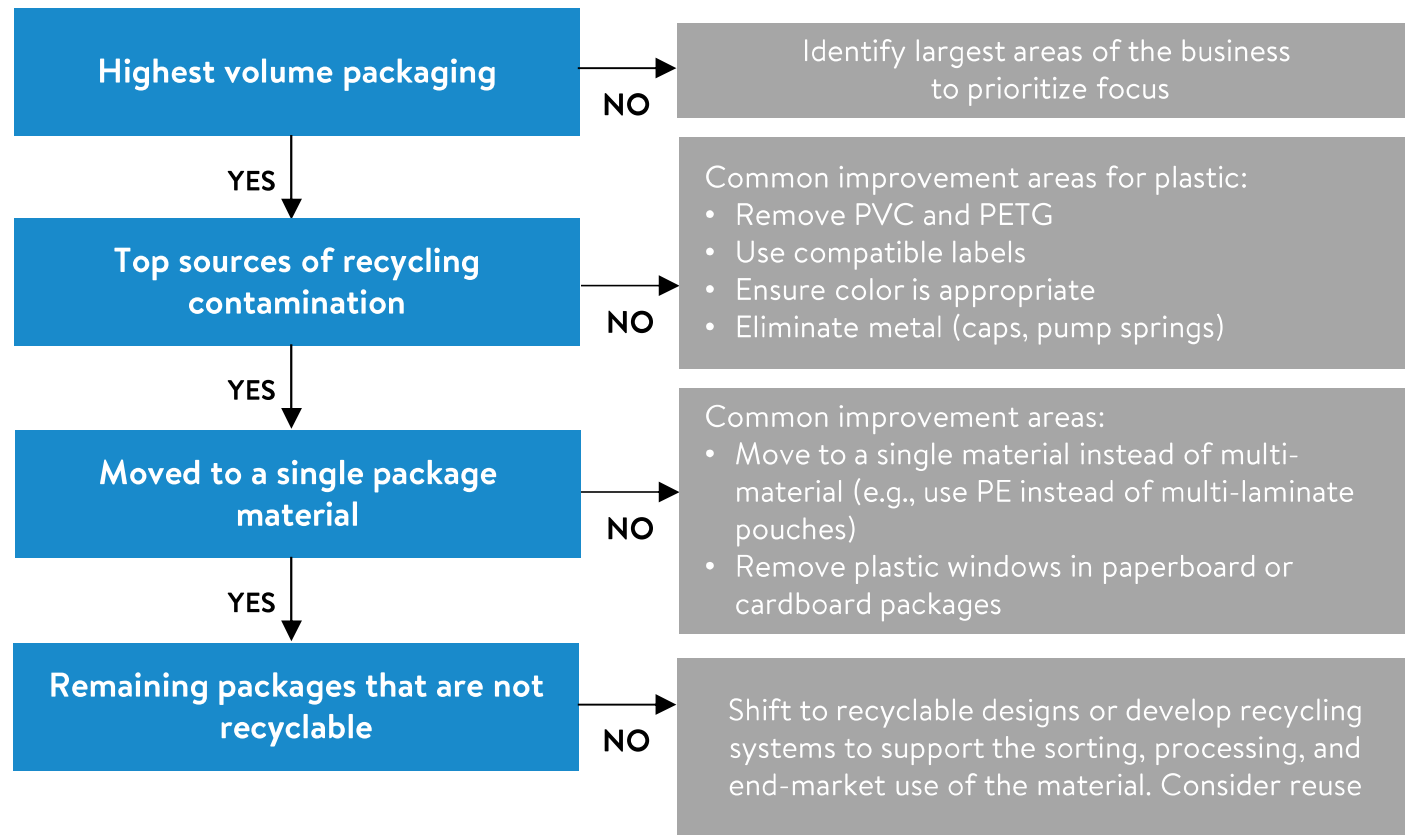
OPTIMIZE

CHANGE

ADVANCE

APPENDIX

HAVE YOU ADDRESSED?



Packages that are very minimal (e.g., product stickers) are low in priority to design for recyclability. Reduce cost by simplifying packaging, e.g., number of material types, weight, and components.

PACKAGING DESIGN CHANGE TIMEFRAMES

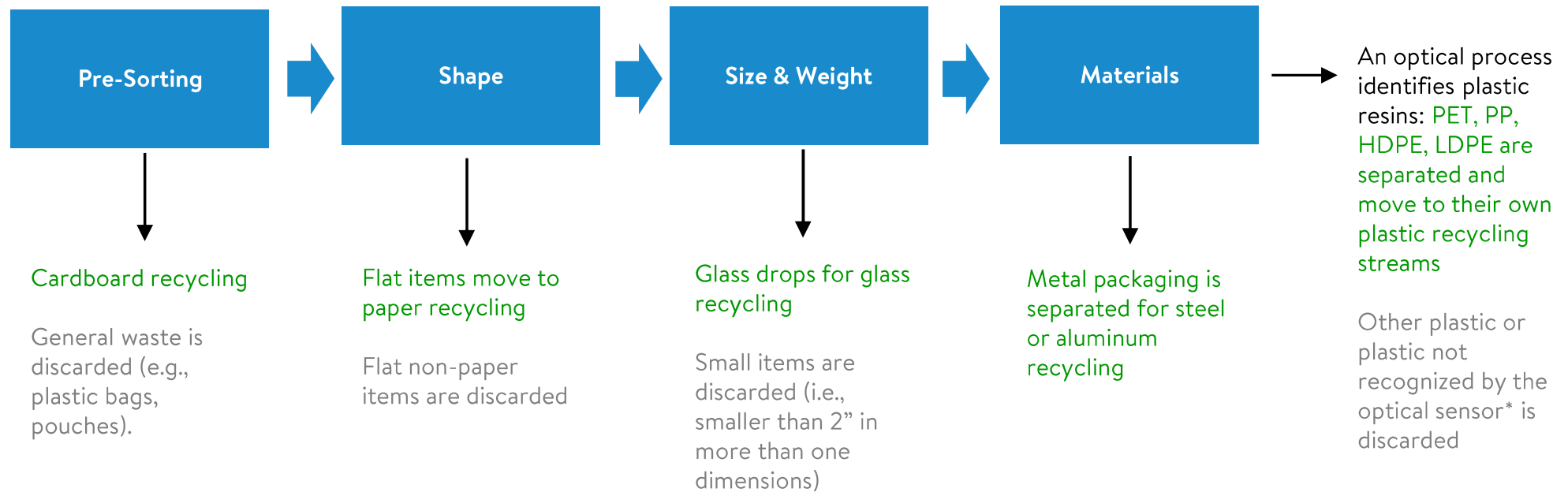
Packaging design (i.e., structural vs. label graphics) changes have a wide range of timelines, sometimes taking over 18 months. **Plan for the time to make the needed design changes** when looking to meet targets or launch dates.





A CLOSER LOOK AT SORTATION

After collection, packaging goes to a Material Recovery Facility (MRF) for sorting:

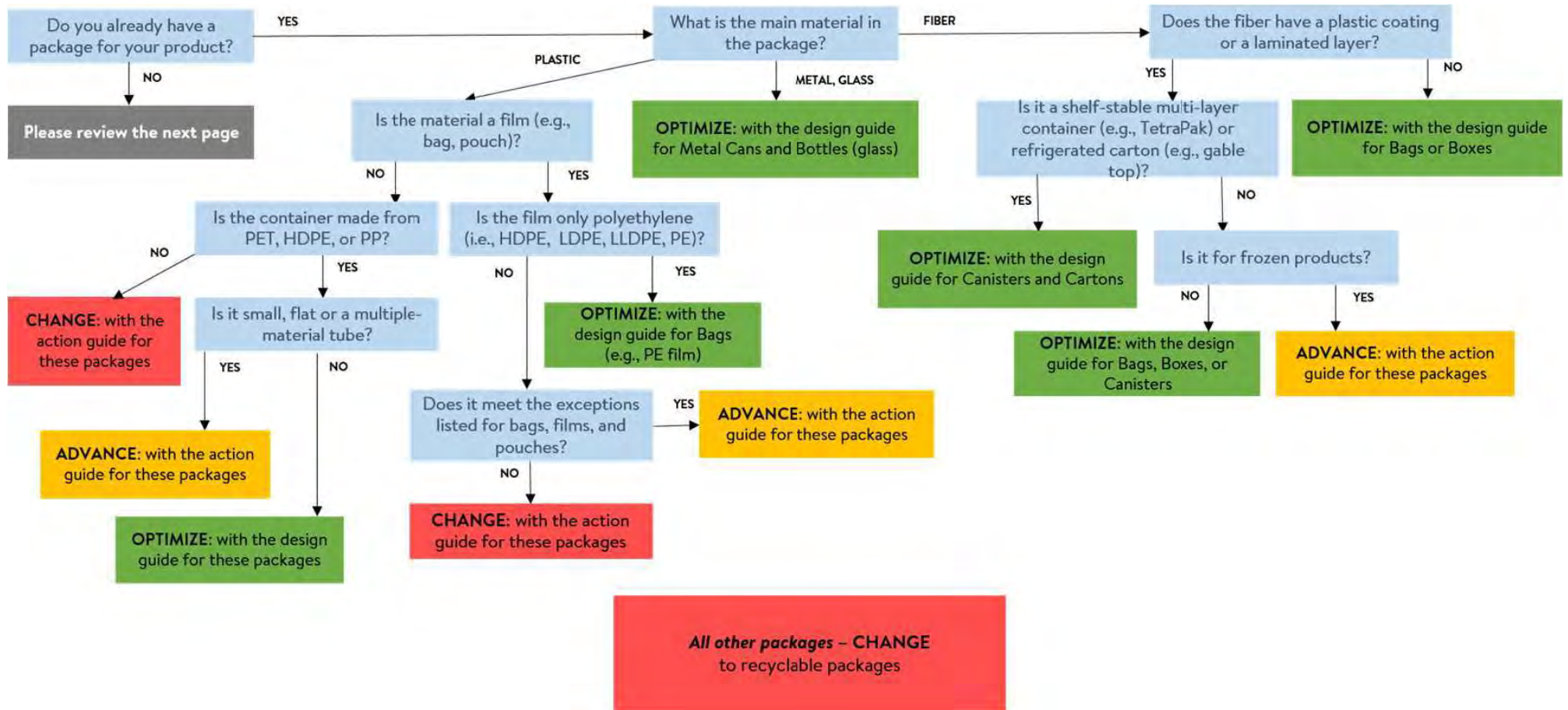


Components of a package are not separated at this stage of processing. If components of a package are not compatible with the material stream, it may contaminate it resulting losses. Refer to the appropriate guide in this playbook for more information.

Some facilities have a different order of sorting (e.g., glass sorted before paper)

**Labels, pigments, and inks can interfere with the optical sensor leading to PET or other recyclable plastic to be discarded, testing is recommended.*

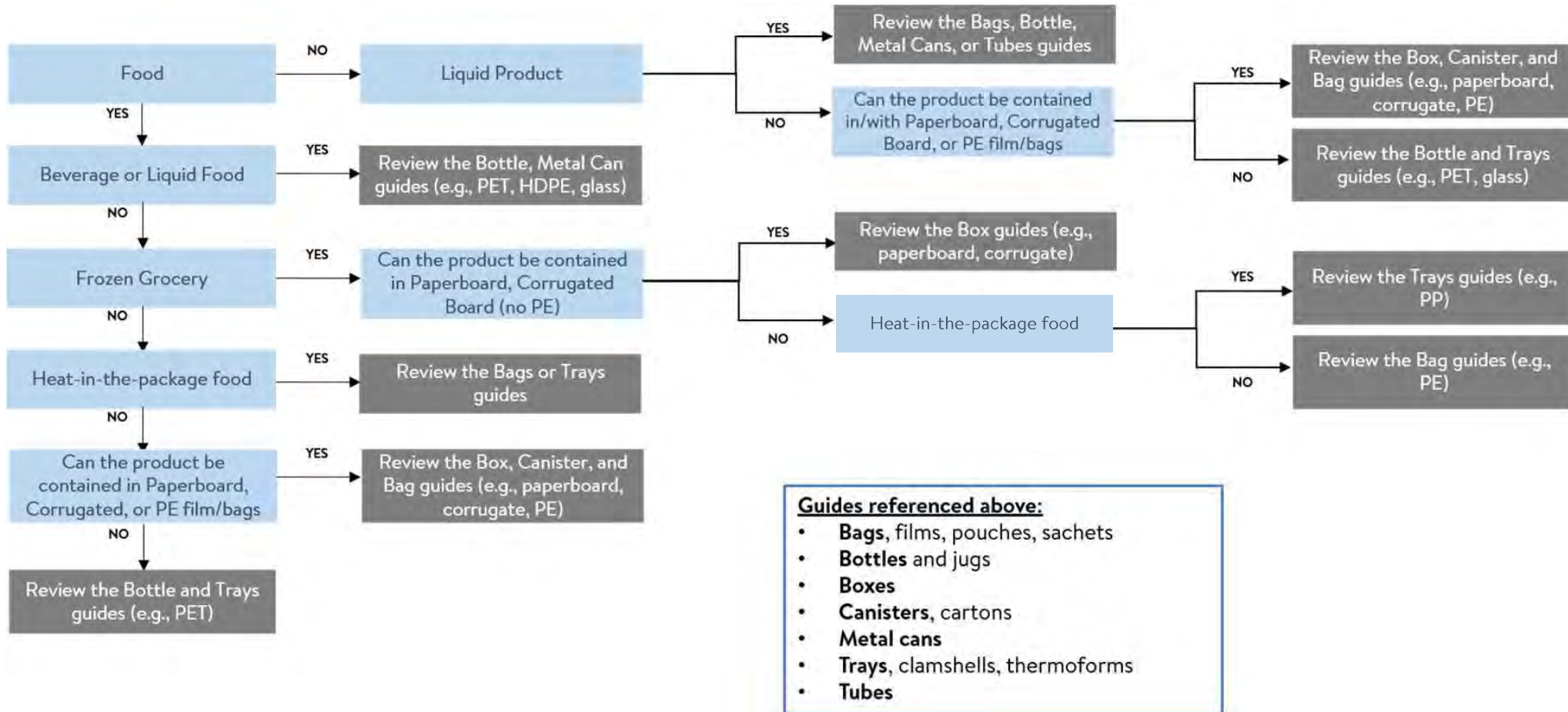
WHICH GUIDE TO START WITH?



Suppliers are reminded that they are responsible for the compliance of their products, including their products packaging, with all applicable laws and regulations, including laws and regulations applicable to recyclability and compostability, such as the FTC's Green Guides and California's Public Resources Code. Walmart does not give its suppliers legal advice. Suppliers should consult their own counsel with questions about the applicability of laws and regulations to their products and packaging.

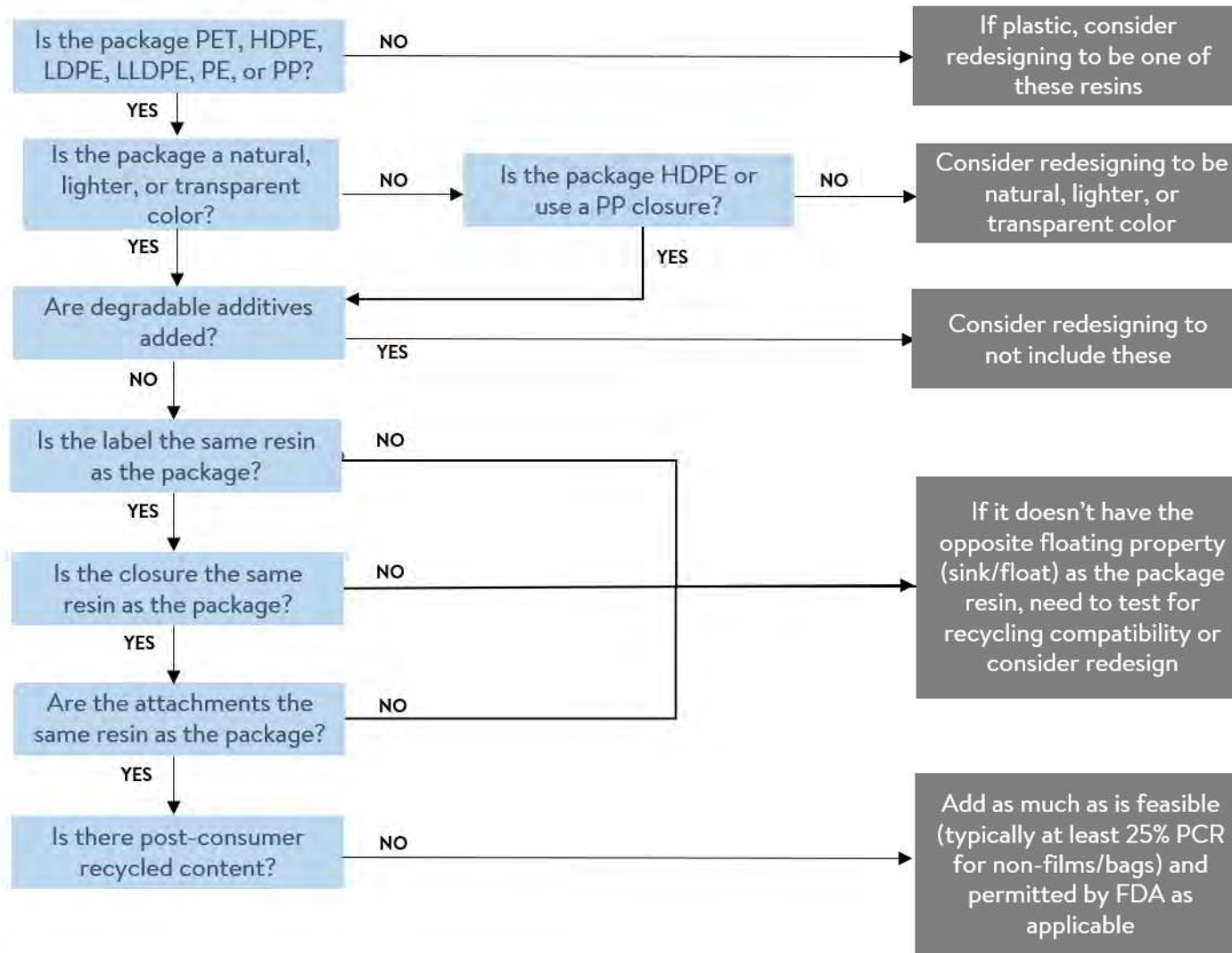
WHICH GUIDE TO START WITH?

If you don't have a package for your product



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QUICK TIPS FOR DESIGNING PLASTIC PACKAGING FOR RECYCLABILITY



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GLOSSARY

WALMART FOLLOWS ELLEN MACARTHUR FOUNDATION'S DEFINITION FOR RECYCLABILITY AND ISO DEFINITIONS FOR RECYCLED CONTENT, COMPOSTABILITY, AND REUSE.

The below are Walmart's simplified definitions. For the full definitions, please visit:

<https://www.ellenmacarthurfoundation.org/assets/downloads/13319-Global-Commitment-Definitions.pdf>

Recyclable

Definition: If its successful post-consumer collection, sorting, and recycling is proven to work in practice and at scale (1).

(1) In practice and at scale threshold: Does that packaging achieve a 30% post-consumer recycling rate in multiple regions, collectively representing at least 400 million inhabitants.

What to look for:

- Meets the "green pages" of the *Recycling Playbook* (though in practice and at scale may not be met in all cases)
- Reviewed by How2Recycle as *Optimally or Recyclable but needs improvement*

Post-Consumer Recycled (PCR) Content

Definition: Proportion, by mass, of post-consumer (1) recycled material in a product or packaging (ISO 14021:2016).

(1) Post-consumer recycled (PCR) content is material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product which can no longer be used for its *intended purpose*. This includes *returns* of material from the distribution chain.

- PCR material differs from pre-consumer in that pre-consumer consists of materials that were never in use before being recycled (e.g., Production scrap).

What to look for:

- Post-consumer not pre-consumer recycled content

Compostable

Definition: If it is in compliance with relevant international compostability standards and if its successful post-consumer collection, (sorting), and composting is proven to work in practice and at scale.

- Undergoes degradation by biological processes during composting to yield, carbon dioxide, water, inorganic compounds, and biomass (humus-like substance) at a rate consistent with other known compostable materials and leaves no visible, distinguishable or toxic residue (Source: ISO 17088: 2012, ISO 14021: 2016)

What to look for:

- BPI Certified industrially compostable (or equivalent*)
- BPI Certified plus TUV's OK compost Home

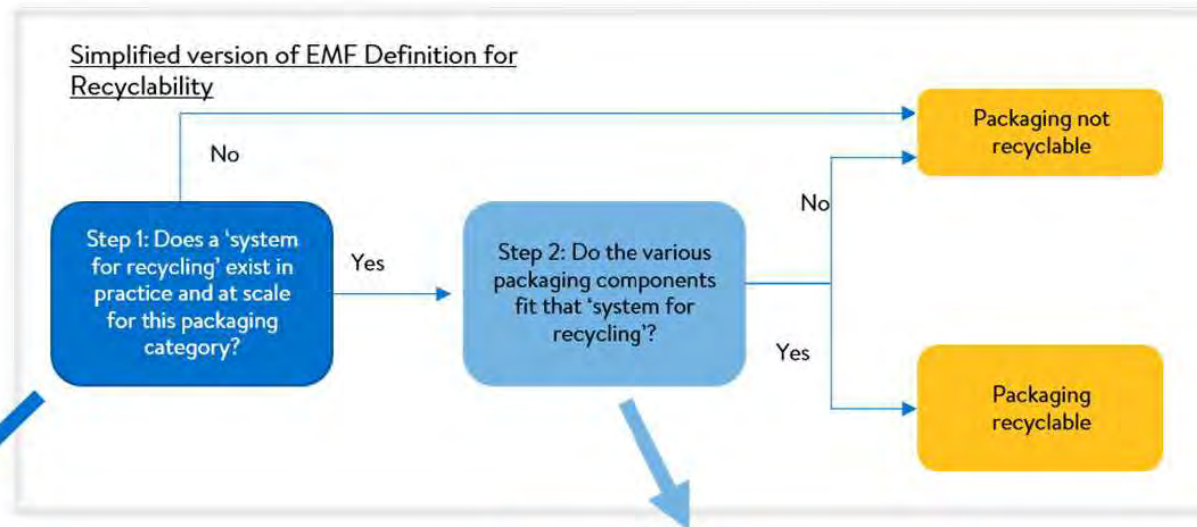
*Outside of the North America, BPI can be used or other programs that follow similar standards (e.g., ASTM D6400/D6868, EN 13432, or CAN/BNQ 0017-088) and prohibit added PFAS (e.g., TUV).

Reuse

Definition: Operation by which packaging is refilled or used for the same purpose for which it was conceived, with or without the support of auxiliary products present on the market, enabling the packaging to be refilled (ISO 18603:2013).

- Reusable packaging is packaging which has been designed to accomplish or proves its ability to accomplish a minimum number of trips or rotations in a system for reuse.

SIMPLIFIED VERSION OF ELLEN MACARTHUR FOUNDATION'S NEW PLASTICS ECONOMY GLOBAL COMMITMENT DEFINITION FOR RECYCLABILITY OF PLASTICS



At least 30% recycling rate achieved for over 400 million inhabitants

Optimize design for existing recycling systems and work to increase recycling rates above 30%

The Recycling Playbook is a resource to answer Step 2 of EMF's global recyclability definition

Recyclable in some regions (e.g., U.S.), but does not meet the definition for being globally recyclable



ADDITIONAL TERMS AND ACRONYMS

- **Biodegradable:** Breakdown of an organic chemical compound by micro-organisms in the presence of oxygen to carbon dioxide, water, and mineral salts of any other elements present (mineralization) and new biomass or in the absence of oxygen to carbon dioxide, methane, mineral salts, and new biomass (Source: ISO 18606: 2013).
- **Circular economy solution (for packaging):** Packaging that is recycled or composted (or both), ideally after several reuse cycles. This may include package deposit programs, take-back programs, municipal recycling, or other systems (e.g., educational campaign to encourage the placement of smaller packages into larger ones of same material composition, collection for chemical recycling) where the material is recovered and processed so the material is kept in use in the economy (Adapted from: Ellen MacArthur Foundation New Plastics Economy Global Commitment).
- **Miscellaneous plastics:** There are plastics that are not typically recyclable or are not commonly used in notable quantities, such as acrylonitrile butadiene styrene, polybutylene terephthalate, polylactic acid, polyoxymethylene, and styrene-acrylonitrile.
- **Package:** Any product to be used for the containment, protection, handling, delivery, storage, transport and presentation of goods, from raw materials to processed goods, from the producer to the user or consumer, including processor, assembler or other intermediary (Source: ISO 21067:2007).
- **Packaging components:** Part of packaging that can be separated by hand or by using simple physical means (Source: ISO 18601:2013).
- **Preferred:** Attributes that support recycling by the majority of the Materials Recovery Facilities and recyclers with minimal, or no, negative effect on the productivity of the operation or final product quality (Source: APR Design ® Guide for Plastics Recyclability)

- **ASTM:** American Society for Testing and Materials
- **BPI:** Biodegradable Products Institute
- **CAN/BNQ:** Canada Bureau de Normalisation du Québec
- **EN:** European Standards
- **EPS:** expanded polystyrene
- **EVA:** ethylene vinyl acetate
- **EVOH:** ethylene vinyl alcohol
- **FSC:** Forest Stewardship Council
- **HDPE:** high density polyethylene
- **LDPE:** low density polyethylene
- **LLDPE:** linear low density polyethylene
- **MDPE:** medium-density polyethylene
- **PE:** polyethylene
- **PET:** polyethylene terephthalate
- **PETG:** polyethylene terephthalate glycol
- **PC:** polycarbonate
- **PFAS:** Per and polyfluoroalkyl substances
- **PLA:** polylactic acid
- **PP:** polypropylene
- **PS:** polystyrene
- **PVC:** polyvinyl chloride
- **PVDC:** polyvinylidene chloride
- **RFID:** Radio-frequency identification
- **TPE:** thermoplastic elastomer
- **UV:** ultraviolet

Resin Identification Codes

