



THE APR DESIGNTM GUIDE FOR RECYCLABILITY:

An Executive Summary

Technical Guide for Creating Recyclable Plastics

October, 2014



The Association of Postconsumer
Plastic Recyclers



Note to the Reader

This document has been prepared by the Association of Postconsumer Plastic Recyclers (APR). It is:

- A quick reference for package designers, engineers, brand managers, and decision makers.
- Focused on the most commonly reclaimed postconsumer packaging items: PET, polyethylene, and polypropylene bottles and containers.
- It contains key points to consider from the APR Design for Recyclability Guidelines.

The complete APR guidelines may be found at:

<http://www.plasticsrecycling.org/market-development/apr-design-guide-for-plastics-recyclability>

The information contained herein reflects the input of APR members from a diverse cross-section of the plastics recycling industry, including professionals experienced in the recycling of all post-consumer plastic packaging, discussed in this guideline.

APR members are committed to ensuring our guidelines are compatible with the most current general practice in recycling technology. As a result, these guidelines are dynamic; they are updated as needed to confirm they reflect the most current best management practices in the plastics recycling industry.

These guidelines describe how a package design might:

- Impact conventional mechanical plastics recycling systems
- Be improved to avoid recycling problems, and
- Be optimized to make plastic packages more compatible with current recycling systems.

Because new packaging technological developments are always being made, this guide cannot anticipate how these new developments might impact plastic bottle recycling. Thus, while the information in this guide is offered in good faith by APR as an accurate and reliable discussion of the current challenges faced by the plastics recycling industry, it is offered without warranty of any kind, either expressed or implied, including WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, which are expressly disclaimed. APR and its members accept no responsibility for any harm or damages arising from the use or reliance upon this information by any party. APR intends to update this document periodically to reflect new developments and practices.

APR guidelines support the inclusion of 25% or more postconsumer recycled content in all plastic packaging for which such inclusion is appropriate.



HOW TO USE THIS GUIDE

This APR Design for Recyclability Guidelines Executive Summary is a quick reference tool for bottle packaging designers. It is not intended to be exhaustive, rather it is designed to aid in the design process when considering the recyclability of a bottle or container.

- For full guidelines and protocols, please refer to:
<http://www.plasticsrecycling.org/market-development/apr-design-guide-for-plastics-recyclability>
- For more information about PET Critical Guidance visit:
<http://www.plasticsrecycling.org/pet-resins>
- For more information about Polyethylene and Polypropylene Critical Guidance visit:
<http://www.plasticsrecycling.org/pe-pp-resins>

- Caps and Closures
- Inks
- Labels
- Colorants
- Additives/Layers/Fillers



The Association of Postconsumer
Plastic Recycler



Caps and Closures



GENERAL BEST PRACTICES

- Caps and closures should be designed without liners.
- Caps and closures should not leave residual rings or any other attachments on the bottle after removal.
- Polypropylene is the preferred material for caps and closures across all base resin types.
- Pumps, which are considered a closure, should avoid the use of metal springs and silicone polymers.

FAQ:

Why is silicone a problem to recycling?

Answer: The first steps of the recycling process include grinding and washing. Ground silicone is not easily washed away and can remain during the next phase of recycling: melting and extruding plastic pellets. The remaining silicone contaminates the plastic affecting the melt flow and the final product.

PET Bottles



IDEAL

Caps and closures that:

- Are made from PP, HDPE, and LDPE
- Are designed without the use of liners
- Leave behind no residual rings or attachments



Avoid contaminating the recycling stream by:

Avoiding caps and closures that:

- Are made from PVC
- Leave behind attachments that are not easily removed
- Utilize any aluminum, steel, thermoset plastic, polystyrene, or silicone polymer components



Natural HDPE Milk & Water Bottles (Un-Pigmented Homo-Polymer Resin)

IDEAL

Caps and closures that:

Are made from PP, HDPE, LDPE

Are designed without the use of liners

Leave behind no residual rings or attachments

Are designed to snap on

Avoid contaminating the recycling stream by:

Avoiding caps and closures that:

Utilize paper liners

Are made from PVC, steel, or thermoset plastic

Have silicone polymer components

Pigmented HDPE Laundry Detergent & Household Chemicals Bottles

IDEAL

Caps and closures that:

Are made from PP, HDPE, LDPE

Are designed without the use of liners

Leave behind no residual rings or attachments

Are designed to snap on

Avoid contaminating the recycling stream by:

Avoiding caps and closures that:

Utilize paper liners

Are made from PVC, steel, or thermoset plastic

Have silicone polymer components

Use excessively large polypropylene caps



Polypropylene PP Bottles

IDEAL

Caps and closures that:

- Are made from PP
- Are designed without the use of liners
- Are designed to snap on
- Leave behind no residual rings or attachments

Avoid contaminating the recycling stream by:

Avoiding caps and closures that:

- Utilize paper liners
- Are made from PVC, steel, or thermoset plastic
- Have silicone polymer components





GENERAL BEST PRACTICES

- Label inks should firmly adhere to label substrate and not discolor wash water.
- In general, all direct printing other than date coding is known to increase contamination in the recycling process and should be avoided with PET or natural HDPE, and natural PP.
- The APR has developed a testing protocol to assist label manufacturers in evaluating whether a label ink will bleed in conventional reclamation systems. For more information about PET Tests For Innovators visit: <http://www.plasticsrecycling.org/pet-resins/tests-for-pet-innovators>. For more information about Tests for Polyethylene and Polypropylene Innovators visit: <http://www.plasticsrecycling.org/pe-pp-resins/specific-tests-for-pe-pp-innovators>.

FAQ:

Recycling takes a lot of heat. Why don't the inks burn off?


Answer: It is true that there's a lot of heat involved in recycling. For example, PET is recycled and extruded into pellets at about 270 degree Celsius. The purpose of that level of heat is to melt the plastic without burning. The recycle process blends and mixes the ink into the molten plastic.



IDEAL

Inks that:

- Are printed on labels that float for PET packages
- Do not bleed onto or stain base resin
- Have passed the APR's Ink Testing Protocol



Avoid contaminating the recycling stream by:

Avoiding:

- Directly printing ink on the container
- Using inks that bleed in hot caustic water
- Using inks that spall*

*Flakes of a material that are broken off a larger solid body.



GENERAL BEST PRACTICES

- The label and adhesive should come off cleanly during the wash process.
- The APR has developed a testing protocol to assist label manufacturers in evaluating whether a label ink will bleed in conventional reclamation systems. For more information about PET Tests For Innovators visit: <http://www.plasticsrecycling.org/pet-resins/tests-for-pet-innovators>. For more information about Tests for Polyethylene and Polypropylene Innovators visit: <http://www.plasticsrecycling.org/pe-pp-resins/specific-tests-for-pe-pp-innovators>.
- If tamper resistance is required in specific product applications, it should be an integral design feature of the bottle. The use of tamper resistant or tamper-evident sleeves or seals is discouraged as they can act as contaminants if they do not completely detach from the bottle, or are not easily removed in conventional separation systems.
- Metalized labels, across all base resins, increase contamination and should be avoided.
- Steps should also be taken to ensure that labels do not delaminate in conventional wash systems.

FAQ:

What's the trouble with full bottle shrink sleeve labels?

Answer: After collection and before recycling, containers are sent to a Material Recovery Facility (MRF) for sortation. Plastics are often sorted using an optical sorter, or a technology that uses beams of light and jets of air to identify and separate different types of plastic containers from one another. If the label fully covers the container and is made of a different material than the container, the optical sorter may misinterpret the correct resin of the container. The APR has developed Critical Guidance on sleeve labels for PET bottles: <http://www.plasticsrecycling.org/pet-resins/pet-bottles>. The APR has also completed a study to determine technical issues related to shrink sleeve labels and their impact on PET container recycling. For this study, visit the APR's website at <http://www.plasticsrecycling.org/pet-resins/pet-bottles>.

Why does the floatability of the resin matter?

Answer: During the recycling process, recycling facilities first grind the recovered containers and then use float/sink baths of water to help sort out the contaminants. PET sinks, HDPE and PP float. When additives change the float or sinkability, good plastic can be lost as waste or contaminated.

PET Bottles

IDEAL

Labels that incorporate the following features:

Allow for automatic sorting equipment to properly identify the proper bottle resin type

Are designed as a shrink label with perforations

Are made of PP, OPP, PE or other materials that float

Do not delaminate in conventional wash systems

Completely detach from the bottle with conventional methods

Avoid contaminating the recycling stream by:

Avoiding labels that:

Are made from Paper or PVC

Sink in water

Are difficult to remove with conventional separation methods

Are metalized

Delaminate in a conventional wash system

Are made of PS; these labels should completely detach with conventional separation methods

Do not allow for automatic sorting equipment to properly identify the bottle resin type

Natural HDPE Milk & Water Bottles (Un-Pigmented Homo-Polymer Resin) AND Pigmented HDPE Laundry Detergent & Household Chemicals Bottles

IDEAL

Labels that incorporate the following features:

Allow for automatic sorting equipment to properly identify the bottle resin type

Completely detach with conventional methods

Are made of PP, OPP, PE or other materials that float

Do not delaminate in conventional wash systems

Avoid contaminating the recycling stream by:

Avoiding labels that:

Are made from Paper or PVC

Are metalized

Delaminate in a conventional wash system

Do not allow for automatic sorting equipment to properly identify the bottle resin type



Polypropylene PP Bottles

IDEAL

Labels that incorporate the following features:

Allow for automatic sorting equipment to properly identify the bottle resin type

Are made of PP, OPP, HDPE, MDPE, LDPE, LLDPE, or PS

Completely detach with conventional methods

Do not delaminate in a conventional wash system

Avoid contaminating the recycling stream by:

Avoiding labels that:

Are made from paper or PVC

Are metalized

Delaminate in a conventional wash system

Do not allow for automatic sorting equipment to properly identify the bottle resin type





Colorants



GENERAL BEST PRACTICES

- Generally, un-pigmented clear plastic is preferred as it offers more potential applications and may yield higher marketability.
- The APR has developed a testing protocol to assist label manufacturers in evaluating whether a label ink will bleed in conventional reclamation systems. For more information about PET Tests For Innovators visit: <http://www.plasticsrecycling.org/pet-resins/tests-for-pet-innovators>. For more information about Tests for Polyethylene and Polypropylene Innovators visit: <http://www.plasticsrecycling.org/pe-pp-resins/specific-tests-for-pe-pp-innovators>.
- The amount of pigment used should not cause pieces of HDPE or PP bottles to sink in water.

FAQ:

What is the issue with colored PET?

Answer: Colors outside the current norm pose the potential for contamination of existing color PET streams. While most colors can be separated, without a critical mass, they have little value, and may end up in landfill. Those who introduce non-market color PET should consider how to partner with APR to develop a marketable use for it.

PET Bottles

IDEAL

Colorants that:

Are un-pigmented

Are transparent*: green tinted, light blue, or amber

Avoid contaminating the recycling stream by:

Avoiding colorants that are:

Opaque white, particularly containing TiO₂

Other opaque colors and translucent* colors

Translucent* colors other than light blue, green and amber

Fluorescers

Hazing agents in otherwise clear PET

*transparent = clear
translucent = frosted



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Pigmented HDPE Laundry Detergent & Household Chemical Bottles

IDEAL

Colorants that:

Are matched between the internal layers and the base color of the bottle

Avoid contaminating the recycling stream by:

Avoiding colorants that:

Are not matched between the inner layers and the base color of the bottle

Polypropylene PP Bottles

IDEAL

Colorants that:

Are natural uncolored resin

Avoid contaminating the recycling stream by:

Avoiding colorants that:

Are pigmented to highly loaded white PP bottles

Polyvinyl Chloride PVC Bottles - No information in Guidelines provided regarding colorants



GENERAL BEST PRACTICES

- The APR has developed a testing protocol to assist label manufacturers in evaluating whether a label ink will bleed in conventional reclamation systems. For more information about PET Tests For Innovators visit:

<http://www.plasticsrecycling.org/pet-resins/tests-for-pet-innovators>.

For more information about Tests for Polyethylene and Polypropylene Innovators visit:

<http://www.plasticsrecycling.org/pe-pp-resins/specific-tests-for-pe-pp-innovators>.

- When using additives or fillers, the density of PP and PE must remain below 1 so that the ground flake from these bottles can float in water.
- EVOH, nylon multi-layer structures may be acceptable if demonstrated by APR Critical Guidance Testing.
- Avoid additives that change the color of the natural base resin.

FAQ:

Are containers with degradable additives recyclable?

Answer: No. Based on a lack of mitigating data seen for our questions, the APR does not recommend the use of degradable additives in any items that are or could be recycled.

The APR Guidance Documents form a necessary but not sufficient basis for test program design for degradable additives. Aging under specific environmental exposure is needed for the technical assessment of the initial bottle. The next use application must be treated under conditions specific time and exposure to assure full service life and subsequent next use recycling.



PET Bottles

IDEAL

Layers that:

Are PET-based

Minimize non-PET materials to retain maximum PET yield

Additives that pass APR test protocols

Avoid contaminating the recycling stream by:

Avoiding layers that:

Are non-PET layers and do not separate easily

Avoiding additives that:

Cause PET to discolor or haze

Are blended resins

Are optical brighteners

Are degradable

Natural HDPE Milk & Water Bottles (un-pigmented Homo-polymer resin)

IDEAL

The use of:

No layers or additives

Additives that pass APR test protocols

Avoid contaminating the recycling stream by:

Avoiding layers that:

Are non-HDPE layers and do not separate easily

Avoiding additives that:

Are degradable



The Association of Postconsumer Plastic Recyclers

The Association of Postconsumer Plastic Recyclers is the North American trade association representing companies that acquire, reprocess and sell the output of more than 90% of the postconsumer plastic bottle processing capacity in North America. Its membership includes independent recycling companies of all sizes and the recycling interests of many other companies.

APR strongly advocates the recycling of all postconsumer plastic packaging and recommends the use of postconsumer plastics in products, where possible. APR strives to eliminate obstacles to plastic recycling with technical programs and guidelines. These initiatives have been produced in response to a need to provide information to the plastic packaging industry on what elements of package design may or may not affect the recycling of that package in current systems.

The APR is open to dialog and discussing viable ways to expand the infrastructure. We are doing this today with the Rigids Committee and the new Films Committee.

If you are a brand owner operating in an area where we recommend AVOIDING, we invite you to partner with us to find a viable solution. Please join the APR and be part of the recycling solution. If you have any questions please call us at 202-316-3046, or visit us at www.plasticsrecycling.org