



Association of Postconsumer Plastic Recyclers
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Champions for Change

Critical Issues Guidance for Innovations

APR recognizes that packaging innovation drives the growth of bottles available for recycling and growth of supply of bottles is essential to the well being of the plastic bottle recycling industry. APR also recognizes that some innovations may create bottles that are problematic for recycling.

This document represents a screening tool to help the innovator understand the approximate effect of the innovation on plastic bottle recycling in several concentration scenarios. It strives to accomplish the following:

- a. Limited number of critical, testable properties for PET and HDPE bottles. Other issues may also be important. The properties listed are deliberately few and represent key concerns.
- b. Define test samples and test methods.
- c. Provide critical guidance values for interpreting test results
- d. Set the stage for further investigations into the effects on specific end uses after completion of this initial, critical issues examination.

~~This document is not a specification~~ and does not imply in its definitions, procedures, or values fitness for use, market acceptability, or any guarantee or warranty. Inability of an innovative bottle to meet specific critical values does not imply recycling failure, but should be a clear message that a significant issue exists and mitigation of the issue is needed to avoid degrading the value of the stream of recyclable bottles.

While sorting capability may address the effect of problematic bottles on the current stream of recyclable bottles, innovators are cautioned not to rely on either automatic sorting or dilution as justification for introducing a problematic bottle. The former speaks to decreased yields and increased costs. The second speaks to overall degradation of the recyclables stream.

This document lists testing at 0%, 50%, and 100% innovation material. The 0% innovation testing is baseline or control testing. Commercial reality is that from time to time, reclaimers will be offered truckloads, which could be 100% innovation bottles. Innovators should consider the impacts of high levels of their innovations on the bottle reclaiming industry.

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HDPE Copolymer Critical Issues Guidance for Innovations

(generally colored HDPE)

*(Testing intended to represent severe occurrence in the post consumer material stream, a
“worst case” evaluation)*

For 100% Innovation bottles, unless otherwise stated, after normal reclaim processing, described below. PCR means post consumer HDPE.

Tests on extruded pellets or plaques from PCR bottles with Innovation		
Property	Test Method	Critical Value
% Ash	ASTM D5630	Less than 0.10%
Melt Index	ASTM D1238	0.2 to 0.7 gm/10 minutes
Density	ASTM D1505	Test bottle material is +/- 0.010 gm/cm ³ compared to 100% typical PCR. Always less than 0.995 gm/cm ³
% polypropylene		Less than 4%, measured by spectroscopic means

Tests on cleaned flake from PCR HDPE bottles	
Screen pack life	With 50% test material mixed with typical PCR, less than 10% higher pressure after extruding through 150 mesh for 30 minutes compared to 100% typical PCR. No buildup on screen. Rate at least 500 gm/cm ² per hour.
% Volatiles in washed flake	With 50% test material mixed with typical PCR, less than 0.1% difference after exposure to 115° C for 2 hours and 100 torr or less compared to 100% typical PCR.

<p>General Issues: No additional fuming or smoking compared to typical PCR during extrusion No sticking between flakes No fouling of process equipment No creation of unsafe conditions, such as increased fire potential.</p>
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Notes, HDPE Copolymer Critical Issues Guidance:

Normal Reclaim Processing is to include, but not necessarily in this order nor limited to the following:

1. Grinding of whole bottles or strips to nominal $\frac{1}{4}$ to $\frac{1}{2}$ inch size flake.
2. Air elutriation to remove light fractions with one pass and with less than 1% HDPE flake loss.
3. Wash in highly agitated water at least 60° C for 10 to 15 minutes. Water may contain surfactants and have a pH of 12 to 13. Report wash solution composition.
4. Specific gravity separation in water of materials with density greater than 1.0
5. Drying and extrusion, including melt filtration, to produce product pellets.

MEETING THESE GUIDELINES DOES NOT OBLIGATE APR MEMBERS TO BUY BOTTLES CONTAINING THE INNOVATION. INNOVATORS ARE REQUESTED TO CONDUCT ADDITIONAL TESTING UNDER THE CHAMPIONS FOR CHANGE COOPERATIVE TESTING PROGRAM

This protocol does not purport to address all of the safety issues, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

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HDPE Homopolymer Critical Issues Guidance for Innovations

(generally translucent or natural HDPE)

(Testing intended to represent severe occurrence in the post consumer material stream, a "worst case" evaluation)

For 100% Innovation bottles, unless otherwise stated, after normal reclaim processing, described below. PCR means post consumer HDPE.

Tests on extruded pellets or plaques from PCR bottles with Innovation		
Property	Test Method	Critical Value
L*	Hunter LAB on plaques	For natural HDPE, greater than 63
A*	Hunter, LAB on plaques	For natural HDPE, greater than -4.5
B*	Hunter, LAB on plaques	For natural HDPE, less than 13
% Ash	ASTM D5630	Less than 0.10%
Melt Index	ASTM D1238	0.5 to 0.9 gm/10 minutes
Density	ASTM D1505	Test bottle material is +/- 0.010 gm/cm ³ compared to 100% typical PCR. Always less than 0.995 gm/cm ³
% polypropylene		Less than 4%, measured by spectroscopic means

Tests on cleaned flake from PCR HDPE bottles	
Screen pack life	With 50% test material mixed with typical PCR, less than 10% higher pressure after extruding through 150 mesh for 30 minutes compared to 100% typical PCR. No buildup on screen. Rate at least 500 gm/cm ² per hour.
% Volatiles in washed flake	With 50% test material mixed with typical PCR, less than 0.1% difference after exposure to 115° C for 2 hours and 100 torr or less compared to 100%

General Issues:

No additional fuming or smoking compared to typical PCR during extrusion

No sticking between flakes

No generation of black specks in natural HDPE

No fouling of process equipment

No creation of unsafe conditions, such as increased fire potential.

Notes, HDPE Homopolymer Critical Issues Guidance:

Normal Reclaim Processing is to include, but not necessarily in this order nor limited to the following:

1. Grinding of whole bottles or strips to nominal $\frac{1}{4}$ to $\frac{1}{2}$ inch size flake.
2. Air elutriation to remove light fractions with one pass and with less than 1% HDPE flake loss.
3. Wash in highly agitated water at least 60° C for 10 to 15 minutes. Water may contain surfactants and have a pH of 12 to 13. Report wash solution composition.
4. Specific gravity separation in water of materials with density greater than 1.0
5. Drying and extrusion, including melt filtration, to produce product pellets.

Color measurement

1. Color is to be measured in reflectance from nominal 2 mm natural plaques or chips (50 +/- 10 per gram).
2. Measurements should be made with a Hunter Miniscan XE or equivalent using d65 light and 2° observation angle. The reported number should be the average of at least four color measurements, rotating the sample container 90 degrees with each measurement.

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This protocol does not purport to address all of the safety issues, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.