



RECYCLING 101 SERIES:

Recycled Plastic Scrap



Topics for Discussion

- Language of Plastic Recycling
- Key Elements of Plastic Value
- Plastic Identification
- Plastic Family Groups
- Global Plastic Scrap Standards
- Plastic Grade Coding System
- Commodity Market Indicator
- Plastic Films



The language of Plastic Recycling: Common Plastic Scrap Terms

- **Rigid Plastic Container:** A package (formed or molded container) which maintains its shape when empty and unsupported.
- **Plastic Bottle:** A rigid container which is designed with a neck that is smaller than the body. Normally used to hold liquids and emptied by pouring.
- **Plastic Film:** A thin flexible sheet which does not hold a particular shape when unsupported.
- **Recycled Plastic:** Plastics composed of either post-consumer or recovered material or both.
- **Recovered Plastic:** Plastic materials which have been recovered or diverted from the solid waste stream. Does not include materials generated from and commonly reused within an original manufacturing process.
- **Post-Consumer:** Products generated by a business or consumer that have served their intended end use and have been separated or diverted from the solid waste stream for the purpose of recycling.
- **Natural:** Plastics that have no color and are clear or slightly opaque such as milk jugs, and the typical clear uncolored water bottles. Natural is different from White.
- **Pigmented/Dyed:** Plastics that may be clear or opaque and are colored white, black or any other color. A clear water bottle that is green is considered pigmented. Additionally, white plastics are considered pigmented



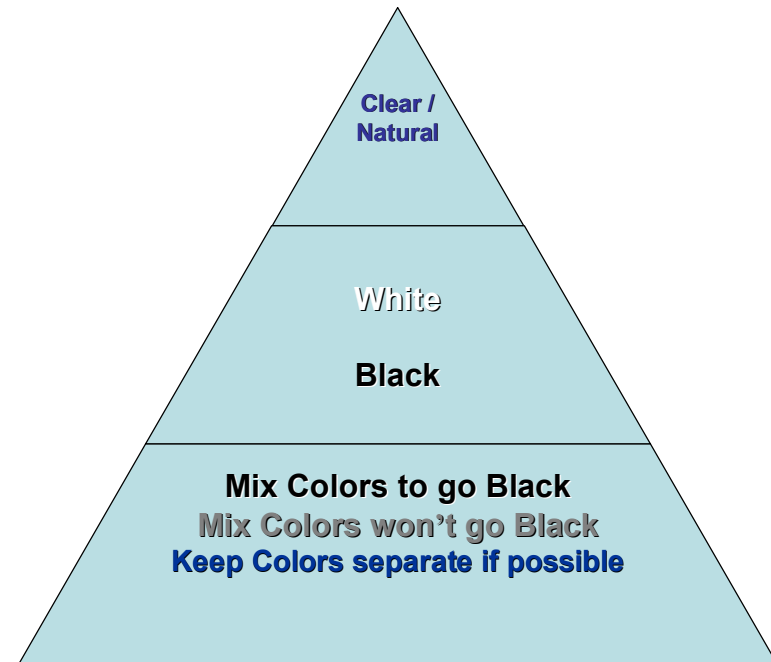
Key Elements of Plastic Value

- **Market Demand** – As with any commodity, prices rise and fall based on demand for the type of commodity being traded. With plastics, there are two big demand drivers:
 - **Resin Prices** – Since most plastic resin is made from refined crude oil byproducts, the price of oil significantly affects the raw material costs for plastics
 - **Demand** – Plastic manufacturing processes usually require very specific raw materials. As manufacturers find more uses for certain types of plastics and set up their process to use recycled resin, the consumer demand for their products will drive the manufacturing consumption of the material. For example, in the middle of the winter, most people living in the northern part of the country will not be installing a recycled plastic lumber patio deck. The demand in that region may decrease as companies like TREX reduce their consumption to adjust for sales projections. These demand fluctuations may influence the plastic pricing.



Key Elements of Plastic Value

- **Color/Pigmentation** – Since clear plastic can have pigment added to turn it into any color, natural plastic is the most valuable because it can be used for the widest range of recycled plastic products. If you want a lawn chair made from black recycled plastic, the only color that the chair will be is black. If you use natural or even white plastic, then the manufacturer has greater flexibility.





Key Elements of Plastic Value

- **Contamination** – Most recovered plastic bales only allow a 2% contamination of Non-specified plastic or non-plastic material. Under no circumstances do the end users want any free liquids in the plastic containers. In particular paper labels are a big source of contamination on plastic film since there is no automated process for removing them. In some applications such as plastic lumber manufacturing, they may allow some labels.
- **Quantity / Weight / Volume** – Since it takes an extremely large volume of plastic containers to make a ton, the single greatest impediment to recycling plastic containers is the logistical challenge of being able to collect and process the material at a lower cost than the value of the material itself. When gathering information to complete a proposal, it is very important that you get accurate information from the customer regarding how much they generate per period and whether the volumes are constant or significantly fluctuate.
- **Sorting** – Plastics that have been sorted into one specific grade are more valuable than a mixture of different grades of plastic. Most polymers cannot and should not be mixed in the recycling/manufacturing process.



Plastic Identification

- **What do you have and how much does the account generate?**
 - Look for the recycling symbol stamped on product / usually found on the bottom of the container
 - Visually inspect the color/pigmentation
 - Resin codes are usually associated with post-consumer, so if you are dealing with a pre-consumer manufacturers byproduct then ask for the Material Specification Data Sheet (MSDS)
 - When in doubt, get samples



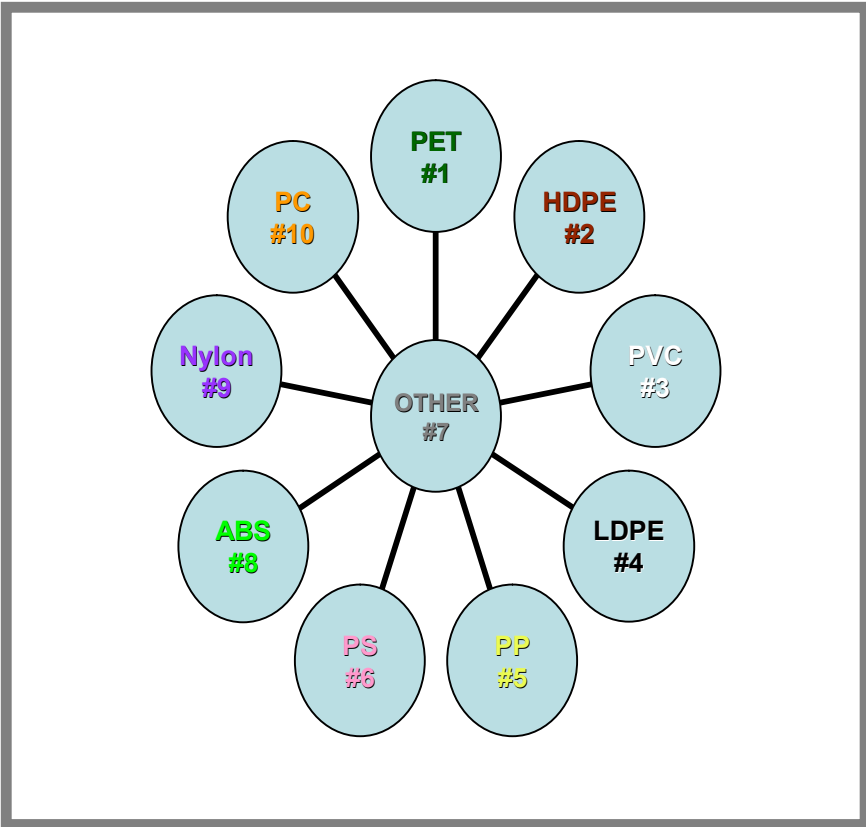
Plastic Family Groups (resin types)

- Over the years, thousands of types of plastics have been developed for different applications and products. Some have special fillers or other properties that were developed specifically for their applications such as being fire retardant, scratch resistant, chemical resistant, etc.. There are over 10,000 types of Polypropylenes alone. Just because a grade of plastic exists, there may not be a market for that type of material. The good news is that there are only a handful of different plastics that you will encounter in the Commercial Recycling Program and that you will be able to address.



Plastic Family Groups (resin types)

- Plastics are grouped by families based on the type of resin they contain. The plastic families are:





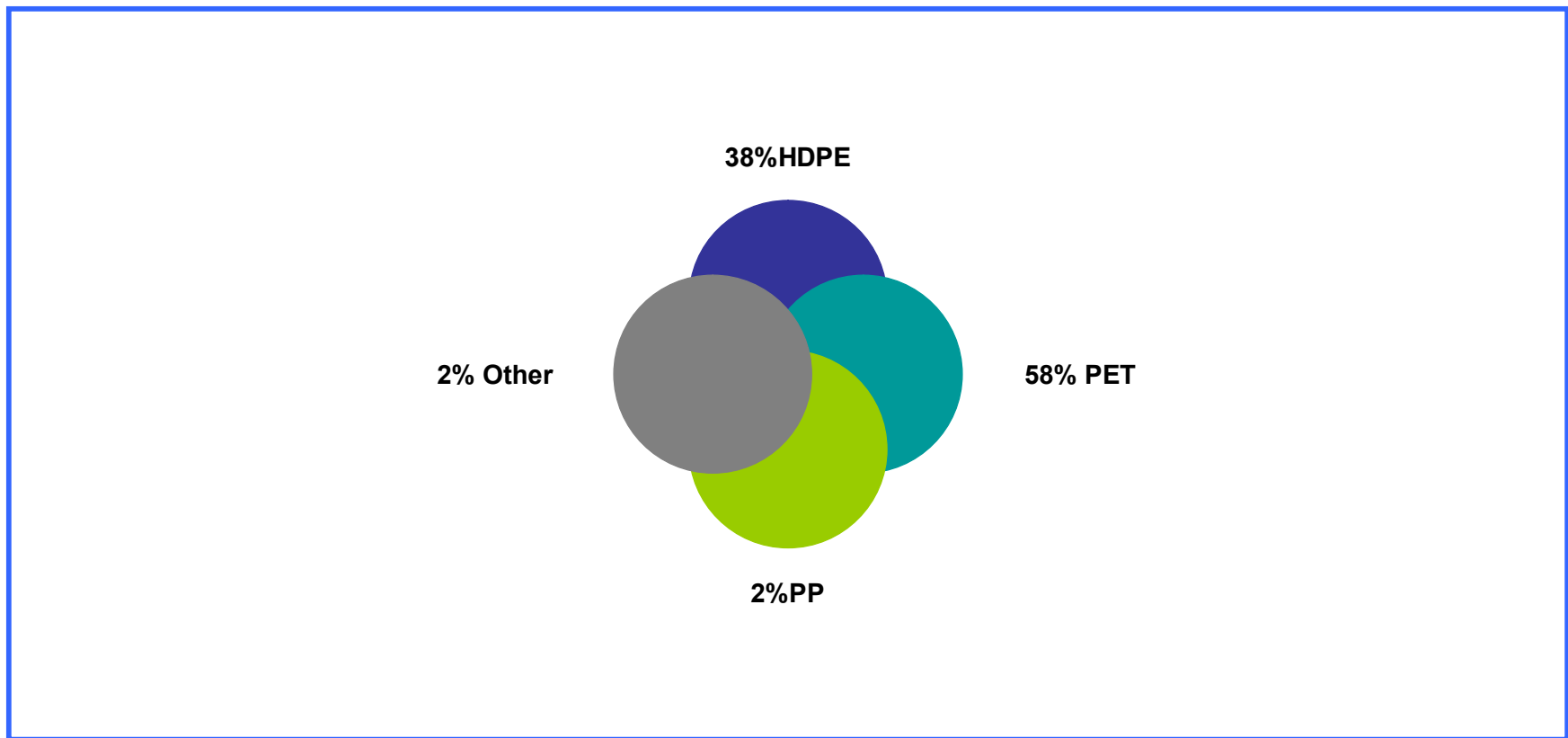
Plastic Family Groups (resin types)

- **#1 PET - Polyethylene**
- Beverage containers – soft drinks, beer and water, ketchup & salad dressing, peanut butter, pickles, jelly/jams and edible oils.
- Ovenable films and trays
- Carpet fiber and other fibers
- X ray and label stock
- Bottles, Bottle Flakes, Rigid Applications & Films





Plastic Bottle Manufacturing – Production by Resin





Plastic Family Groups (resin types)

- **#2 HDPE / High Density Polyethylene**
- Milk, water, cosmetic, shampoo, dish and laundry detergents.
- Yogurt & margarine tubs, cereal box liners, grocery, trash & retail shopping bags
- Milk crates, totes, recycle bins, 90 gal garbage carts and pallets
- Bottles, Bottle Flakes, Film & Bags, PC/HDPE



Plastic Family Groups (resin types)

HDPE
Natural –
Milk Jugs





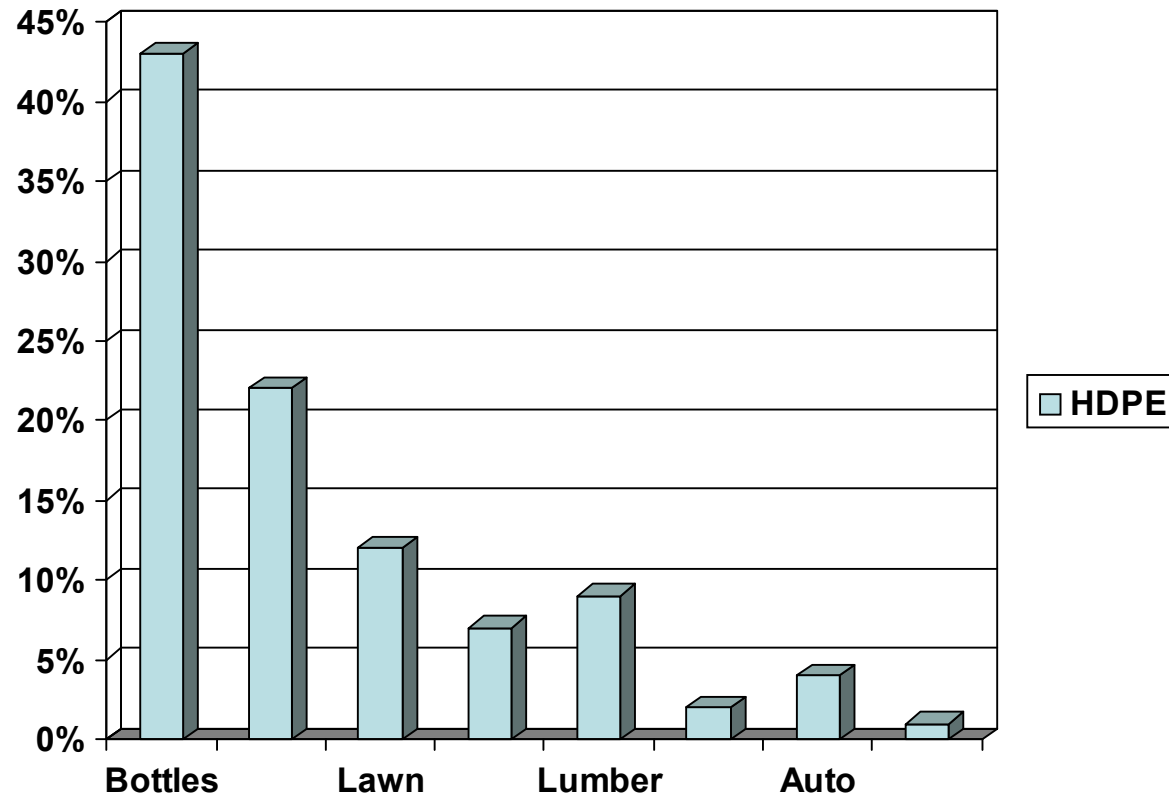
Plastic Family Groups (resin types)

- HDPE
Colored





Recycled HDPE Bottle End Use





Plastic Family Groups (resin types)

- **# 3 PVC Polyvinylchloride**
 - Clear food & non-food packaging, medical tubing, wire & cable insulation, film, & sheets, construction products such as pipe, fittings, siding, floor tile, carpet backing, windows & door frames, shower curtains & swimming pool liners. Bottles, Film.
- **#4 LDPE Low Density PE / Linear LDPE / Polyethylene Medium Density / MDPE**
 - Dry cleaner bags, bread and frozen food bags, squeezable bottles like ketchup, mustard, mayo and etc. Stretch wrap, shrink films and etc... Agricultural Films, Film, Bottles, Rigid Applications, Stretch/Shrink, Bags.
- **# 5 PP Polypropylene**
 - Ketchup bottles, yogurt and margarine tubs, medicine bottles, VCR jackets, carpet fiber and carpet backing, yarn carriers / cones, tubes and spools. Fabric Webbing, Vehicle Battery Casing, Rigid Packaging



Plastic Family Groups (resin types)

- **# 6 PS Polystyrene**
 - Compact disc cases, Styrofoam*, Expanded Polystyrene, jewel boxes, food services, grocery store meat trays, egg cartons, aspirin bottles, foam cups, cups, plates and cutlery and packaging.
- **# 7 Other Mixed Plastics/ Bottles / Coatings**
 - Engineering grades of plastics or resins, film with one or more layers. Also any mixture of the grades of 1-6 where the plastics have not been separated by grade.



Plastic Family Groups (resin types)

- **# 8 ABS / Acrylics / Acrylonitrile Butadiene Styrene**
 - Impact resistant, chemical resistant, can be made flame retardant. Automobile hub caps, wheel covers, pipe, appliances-refrigerator inside door panels. Plexiglass – great clarity and lens quality. Automobile taillight assemblies, room lighting fixtures, housewares, cosmetic packaging and signage
- **#9 Nylon**
 - High strength, can be made flame retardant, may contain filler or additives.
- **# 10 Polycarbonate / Makrolon, Lexan**
 - 5 gallon water bottles / blue and reels for ribbons / CD or DVD metalized and non-metalized. Baby bottles. Can be made flame retardant, best in clear applications. Automotive- taillight, appliance – clear or tinted parts like crisper drawers, and medical devices.



The Global Plastic Scrap Standards - ISRI Guidelines

- **ISRI – Institute of Scrap Recycling Industries**
 - Guidelines Publication: ISRI Scrap Specifications Circular 2007
- **The ISRI guidelines**
 - internationally accepted standards
 - facilitate the trading of plastic scrap commodities based on an agreement that each bale of the material will be made according to a specific recipe of material ingredients depending on the code (grade) used as the



The Global Plastic Scrap Standards Contamination Tolerance?

- Because certain plastics have a harmful effect on each other when reprocessed, there are very tight tolerances on the % of contamination allowed.
 - Typically, no more than 2% of total contamination from non-plastic or plastic not identified in the grade is allowed per bale.



Plastic Grade Coding System

- P 0 0 0 X X
 - The coding system for baled recycled plastic consists of a three digit number with a prefix letter “P” and a two-letter suffix. The prefix “P” designates the category of Plastics and differentiates the code from similar codes for metals and other materials. The first digit corresponds to the SPI resin identification code system and designates the primary plastic material. The second digit describes the plastic/product category. The third digit defines the color/appearance of the product. The first suffix letter indicates the type of recycled plastic. The second suffix letter indicates the source of the recycled plastic product.



Plastic Grade Coding System

P	0	0	0	X	X
Plastic	Resin Code	Product	Color	Type	Source
	0 Mixed Resins (1-7)	0—Bottles	0—Mixture	P—Post Consumer	M—Municipal
	1 PET	1—Rigids	1—Natural	R—Recovered	I—Industrial
	2 HDPE	2—Films	2—Pigment/Dyed		C—Commercial
	3 PVC	3-9 To be assigned	3-9 Designated within each category		S—Institutional
	4 LDPE				
	5 PP				
	6 PS				
	7 Other				
	8 To be assigned				
	9 To be assigned				

Based on the coding system above a bale of recovered HDPE rigid containers such as detergent or cat litter containers with various colors would be a P212PM



Plastic Scrap Commodities Market

There is a high correlation between plastic prices and oil prices. When oil prices are volatile, so are recovered plastic pricing. The example to the right is the Southcentral regional pricing from “Waste News – Secondary Materials Index”

**ANNOUNCED RECOVERED MATERIALS PRICES
HOUSTON (SOUTHCENTRAL USA) REGION
JUNE 13, 2008**
Prices in US currency

Grade	Description	Historical Data	Current Price	Previous Price
Plastics	PET (Baled, Cents/lb, picked up)	View	19-21	17-21
Plastics	Natural HDPE (Baled, Cents/lb, picked up)	View	35-37	37-38
Plastics	Colored HDPE (Baled, Cents/lb, picked up)	View	21-23	22-23
Plastics	LLDPE-Stretch Film (Baled, Cents/lb, picked up)	View	25-30	-



Plastic Films

Chart of
common
plastic
film
types

Plastic Grade	Typically Film Types	Contamination
#4 LDPE	Commercial bags & liners, T shirt bags, Packaging durable goods, Construction/Ag films bubble wrap/blister pack trash & garment bags	Labels, tape, fiber, moisture, dirt, grit, strapping, food residue Typically non-recoverable after used
#4 LLDPE	Stretch wrap, Merchandise bags, flat bags, trash bags	Labels, tape, strapping, fiber and typically non-recoverable after used
#2 HDPE	T Shirt / grocery bags, shopping bags, box & can liners, trash bags, patch handle & drawstring bags	Fiber and food residue Typically non-recoverable after used
#5 PP	Woven bags (feed / Seed) & tarping. Lumber wrap & garment bags	Labels, tape, dirt, food residue, moisture, wood fiber, staples and fiber
Multi-ply Poly Films	Woven film sheets & tarping, lumber wrap, food packaging Bubble wrap & blister pack	Labels, tape, moisture, wood fiber, staples, other resins and food residue



Plastic Films

Film type
characteristics
& identification

Resin Type	Visual	Burn Test	Strength/Stretch
Linear Low Density Polyethylene #4 LLDPE Stretch Wrap	Translucent, semi-shiny, usually clear. Has no slip. Stretch wrap is sticky to the touch	Smells like a blown out candle, white smoke, clear flame. Linear low density strands in molten state	Extremely hard to tear, very good stretch and strength. Hard to push through, wraps around objects.
Low Density Polyethylene #4 LDPE Commercial Bags	High clarity, semi-shiny, many colors. Has high slip.	Smells like a blown out candle, white smoke, clear flame. Low density strands in molten state	Irregular tear/curly edge moderate stretch & strength. Makes popping sound when punctured
Medium Density Polyethylene #4 MDPE Paper towel/tissue packaging	Moderate clarity, semi-Shiny, many colors	Smells like a blown out candle, white smoke, clear flame. Medium Density strands in molten state.	Irregular tear, poor stretch & strength. Tears while puncturing
#2 HDPE Grocery sacks, natural milk jugs, Shopping bags	Translucent, semi-shiny, many colors	Smells like blown out candle, white smoke, clear flame /not in molten state	Tears in a straight line. Low stretch, high strength. Hard to puncture
#5 PP / Polypropylene Garment bags	Shiny, crinkly, high clarity and clear	Clear flame, white smoke, sweet rosewood smell	No stretch, tends to rip in a straight line Medium Strength
#5 PP Woven/Non-Woven	Interlocking flat strands many colors	Same as above	Does not rip / tear High Strength



Thanks for your time!



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IT'S EASY. IT'S ABITIBI.**

*Recycling 101 Series
Plastic Grades & Indicators*

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