

4. Buyers and Specifications for Waste Plastics

4.1 Buyers of Waste Plastic

Recovered plastic can be marketed for reuse in a number of ways:

- By directly dealing with a company which uses waste plastic in manufacturing
- By directly dealing with a plastic processor which will buy waste plastic and market the cleaned and decontaminated product
- By listing the recovered waste plastic in a waste exchange for marketing
- By marketing the recovered waste plastic through a scrap resin broker

Waste exchanges are typically sponsored by a state and provide a waste listing free of charge. The purpose of such a service is to serve as an information clearinghouse, directory and marketing facilitator so that waste materials may be reused or reprocessed in some manner. This often includes manufacturing by-product, surplus material, off-specification material, industrial waste and hazardous waste. Such exchanges are one route to marketing waste plastic. The waste exchange listing will typically include the waste product or desired product, the primary constituent(s), amount and frequency of generation, and the operation the material is a by-product from, if applicable. Samples are generally available upon request. Because of the extensive number of sources and types of plastics in waste, waste exchanges should generally be utilized only after other marketing methods (e.g., scrap resin brokers, plastic recycling companies) have been tried. The Illinois Environmental Protection Agency and the Illinois State Chamber of Commerce sponsor an Illinois based waste exchange (Industrial Material Exchange Service, 2200 Churchill Rd., #31, P.O. Box 19276, Springfield, IL, 62704-9276, phone (217) 782-0450). The waste exchanges in the U.S. and Canada are listed in Table 4.1.

A resin broker (a company which buys/sells off-grade resins, off-specification resins, regrind, obsolete or surplus virgin resins) or a plastic scrap handler (a company which may grind, clean, densify, pelletize, extrude, fabricate or process waste plastic in some way) is typically where plastic scrap is marketed after being collected at post consumer, post commercial, or industrial scrap level. Shipments in truckload quantities are typically preferred, but smaller loads down to bales are usually accepted with an accompanying reduction in price paid. According to the 1990-91 Directory of U.S. & Canadian Scrap Plastics Processors and Buyers, there are approximately 14 resin brokers

Table 4.1 U.S. and Canadian Waste Exchanges

Alberta Materials Waste Exchange
 Industrial Development Department
 Alberta Research Council
 P.O. Box 8330, Postal Station F
 Edmonton, Alberta
 Canada T6H 5X2
 (403) 450-5461

California Waste Exchange
 Department of Health Services
 Toxic Substances Control Division
 714 P Street
 Sacramento, CA 95814

Canadian Waste Materials Exchange
 Ortech International
 Sheridan Park Research Community
 Mississauga, Ontario
 Canada L5K 1B3
 (916) 324-1807

Industrial Materials Exchange Service
 P.O. Box 19276
 2200 Churchill Road, #31
 Springfield, IL 62794-9276
 (217) 782-0450

Indiana Waste Exchange
 Purdue University
 School of Civil Engineering
 West Lafayette, IN 47907
 (317) 494-5036

Montana Industrial Waste Exchange
 P.O. Box 1730
 Helena, MT 59624
 (406) 442-2405

Northeast Industrial Waste Exchange
 90 Presidential Plaza, Suite 122
 Syracuse, NY 13202
 (315) 422-6572

RENEW
 Texas Water Commission
 P.O. Box 13087
 Austin, TX 78711
 (512) 463-7773

Pacific Materials Exchange
 South 3707 Godfrey Blvd.
 Spokane, WA 99204
 (509) 623-4244

Resource Exchange & News
 400 Ann Street NW, Suite 301A
 Grand Rapids, MI 49505
 (616) 363-3262

Southeast Waste Exchange
 Urban Institute, UNCC Station
 Charlotte, NC 28223
 (704) 547-2307

Southern Waste Info Exchange
 P.O. Box 960
 Tallahassee, FL 32302
 (800) 441-7949

or scrap handlers in Illinois, with 11 in the Chicago metropolitan area, 2 in Joliet and 1 in Decatur. Five of the companies in metro Chicago are strictly brokers of plastic scrap. There are 20 additional brokers/processors in states neighboring Illinois: 8 in Wisconsin, 7 in Michigan, 2 in Iowa, 1 in Indiana, 1 in Kentucky and 1 in Missouri. The name, address and contact names of each handler/broker in Illinois and neighboring states along with the type of plastic each accepts is listed in Appendix A. The cross-listing addresses the following resins: ABS, Acetals, Acrylics, Engineering thermoplastics, HDPE, LDPE, Mixed thermoplastics, Nylons, PET, Polyolefins, PP, PS and PVC. While a majority of the brokers/handlers accept scrap plastic from manufacturers and processors, not all accept post-consumer material.

Additional information on markets for recycled plastics is available in the Illinois Recycled Materials Market Directory (ILENR/RR-87/01), and the accompanying update, available from the Illinois Department of Energy and Natural Resources, Office of Solid Waste and Renewable Resources, Springfield, Illinois. The State of Wisconsin Department of Natural Resources, Bureau of Solid Waste Management (Madison, WI.) also makes available a Wisconsin State Plastic Recycling Directory.

4.2 Specifications for Waste Plastic

Each of the above mentioned brokers/handlers generally have their own specifications regarding non-plastic contaminants and other plastic contaminants, and therefore should be consulted for acceptable levels. As may be expected, higher prices are paid for material with lesser amounts of contamination. All but a few require that plastic types be separated out from each other and pay more with clear/color sortation (as with HDPE bottles). A common request is that only baled material be shipped (rather than granulated) to allow for a final manual removal of contaminants. Although the price paid for granulated material is higher because of the cost of granulating, it is typically allowed by the buyer only after verification of cleanliness by inspecting incoming material in a baled form. Limits for non-plastic contaminants are typically:

- no metals
- <0.005% - <3% non-plastic
- must be clean

Limits for plastic contaminants are typically:

- <1% - <5% other plastic
- <1% color on clear/natural bottle loads
- no motor/vegetable oil bottles
- no PVC bottles

While 1% contamination of foreign material (other plastic or non-plastic) in an otherwise uniform load appears small, it can have a tremendous effect on the secondary plastic application. Foreign material on the order of 2 - 10% may be acceptable for plastic wood, but not for producing multilayer coextruded bottles. Rubbermaid, one of the largest U.S. purchasers of recycled plastic, has indicated that less than half of the waste plastic offered to the company is of a high enough quality for the company to recycle it into a new product. The cleanest material Rubbermaid receives is from integrated processors which grind, clean and produce pellets in one operation [Hill, 1990]. Table 4.2 shows a comparison between the physical properties of typical virgin and recycle composite grades of homopolymer and copolymer resin, and what a blow molder might specify in terms of melt index and resin density. Also shown in Table 4.2 are recycled material standards for properties of recycled clear and colored HDPE. Higher quality recycled plastic users also have difficulty with injection mold containers mixed in with blow molded containers because this results in manufacturing and product problems. Midwest Plastics, a company which produces HDPE piping from blow mold grade HDPE will produce a pipe with stress fractures if injection mold material is mixed into the batch.

One method of addressing plastic contamination in general is to link recycle product prices to product quality on a commonly accepted standardized system such as The American Society for Testing Materials (ASTM). The ASTM D-20 Committee addresses plastic recycling and degradable plastics. There are four draft standards regarding waste plastic contamination and recycling:

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| ASTM X-95-1-3 | Guide for Development of Standards Relating to the Proper Use of Recycled Plastics (1/15/89) |
| ASTM X-95-2-6 | Standard Practice for Generic Making of Plastic Products (4/15/90) |
| ASTM X-12-73 | Proposed Standard Specification for Polyethylene Plastics Molding and Extrusion (7/20/90) |
| ASTM X-95-3-1 | Proposed Standard Guide for Determining Visible Contaminant Content of Recycled Plastic Materials (9/24/90) |

Table 4.2 Typical Physical Properties of Virgin and Recycled HDPE ^a

Parameter	Homopolymer		Copolymer	
	Virgin	Recycled Composite	Virgin	Recycled Composite
Melt Index (g/10 min.)	0.70	0.62	0.30	0.20-0.62
Density (g/cm ³)	0.96	0.96	0.954	0.965
Flexural modulus (psi)	219	223	186	189
Tensile strength ^b (psi)	4,290	4,340	3,840	4,020
Notched Izod Impact (J/cm)	1.3	1.5	1.3	0.9
<i>Recycled Material Standards</i>				
Melt Index (g/10 min.)	<i>Unpigmented HDPE Bottles</i> ^c 0.5-1.0		<i>Colored HDPE Bottles</i> ^d 0.2-0.5	
Density ^e (g/cm ³)	>0.958		≤0.959	
Antioxidant added	Specify level		Specify level	
Tensile strength (psi)	≥2,900		≥2,030	
Secant modulus (psi)	≥97,150		≥89,900	
<i>Typical Blow Molder Specifications</i> ^f				
	<i>Homopolymer</i>		<i>Copolymer</i>	
Melt Index (g/10 min.)	0.5-0.9		0.3-0.8	
Density (g/cm ³)	0.958-0.965		0.947-0.955	

a. ASTM testing to be utilized for all properties specified.

b. Tensile strength at yield.

c. Unpigmented HDPE bottles are typically homopolymer.

d. Colored HDPE bottles are typically copolymer.

e. Colored plastics shall be corrected for colorant to reflect density of unpigmented base plastic.

f. Blow molder specifications shown for either virgin or recycled composite material.

In addition to developing commonly accepted ASTM standards for classifying recycled plastics, four quality grades of secondary plastics have been proposed by industry: superior grade - eligible for use in plastics packaging; high grade - eligible for use in structural quality; medium grade - eligible for use in higher end value added products such as flower pots, drain pipe, traffic cones, etc.; and low grade - for use in plastic lumber. The following quality testing to set differences between grades of material should be established [Rennie, 1990]:

- Surface contaminants - run tests on clean flake and specify the insolubles and inorganics allowed
- Soluble contaminants - run tests on clean flake indicating the amount of soluble product residue and degree of polymer degradation
- Polymer degradation - determine polymer degradation with respect to a virgin polymer and also determine the cross-contamination

The differences in the way products are molded also need to be addressed. This is particularly important with separated HDPE where loads may contain tubs such as soft drink base cups, deli containers, butter and yogurt which are injection molded, and bottles such as milk, water, juice, detergent and oil which are blow molded. The kind of HDPE that works best for blow molding is fractional melt resin, material that is stiff like taffy when melted for forming. The stiffness allows the material to be blown up like a balloon to form the shape of the inside of the blow mold. Injection molding material is runny like syrup when it is melted for forming. The runniness of injection molding material allows it to be forced into the injection mold under pressure which forms sharp corners and thin walls. The differently molded products are individually usable, but when mixed together they are not good for injection molding or blow molding due to the different melt indexes. To help resolve this, it has been proposed that the Society of the Plastics Industry numbering system for HDPE, which is coded as "2", be upgraded to "2-B" for blow molded containers and "2-I" for injection molded containers.