

Glass Recycling Through Curbside Collection and Container Deposit Legislation

Prepared by the Oregon Department of Environmental Quality
June 20, 2008

The value and uses of glass for recycling depend strongly on the purity and condition of the glass collected, and this in turn depends strongly on the manner in which the glass is collected.

Bottle Bill Glass

In Oregon (and throughout the country), glass collected under the bottle bill has very little contamination. People returning containers for deposit only bring in beverage containers, and do not include ceramics dishes, Pyrex or Visionware glass, light bulbs, window glass, or other types of materials that can cause significant problems at glass plants. The main contaminants are bottle caps, metallics on labels, and very rarely ceramic closures for certain beer bottles. Some bottles are collected whole and can be easily sorted by color, but much glass collected by reverse vending machines is broken into a 3-color mix. However, three of the larger beverage container processors have optical sorting equipment that can sort almost all of this mixed glass back into the three color grades (clear, green, and brown) meeting glass plant specifications.

Curbside Collection Glass

Glass collected through curbside programs varies widely based on how it is collected and how it is processed.

Color-sorted collection

Glass collected color-separated has the highest value of all the curbside glass, and can be sold to glass container manufacturers. Care has to be taken to avoid collection of and remove ceramics, Pyrex, and other damaging contaminants, and whole loads have been rejected at the Owens Illinois glass plant in Portland due to the presence of very small amounts of these contaminants. Outside of the Portland Metro area, many programs that are not simply using their glass as aggregate collect the glass color-sorted or sort the glass by color into their trucks so they can sell it to the Portland glass plant.

Color-mixed collection

In the Portland Metro area and in parts of the state where most glass is used as aggregate, most curbside glass is collected color-mixed but separate from other recyclables. The most common Oregon curbside collection system by far now is to collect most of the recyclables commingled in a roll-cart or bin, but collect glass in a separate bin on the side. Glass collected in this manner is relatively clean but again has more ceramics and other serious contaminants than does bottle-bill glass. Theoretically this glass could be processed through optical sorting to produce color-separated glass that can be sold to local glass container manufacturers, but at this time none of the commingled recycling processing facilities in Oregon have decided to invest in optical sorting technology for glass, based on the cost of the technology and the comparatively low volume of glass that each handles. This glass could also potentially be delivered to one of the bottle bill processors to be color-sorted using their equipment, but neither CRINC nor BROCO, the two largest processors, have been known to accept this curbside material. Recently a bottle bill processor in the Bend area has been accepting glass from the local curbside programs and color-sorting it.

With the exception of the Bend-area bottle bill container processor, there is no other processing facility in Oregon that accepts color-mixed curbside glass and cleans it to standards where it can

be used for high-valued applications such as making fiberglass and glass containers. Much of the curbside glass from the Willamette Valley and Portland Metro region gets sent to Strategic Materials receiving facility in Portland, where it is shipped to Strategic's processing facilities in California. Both Strategic Materials and Owens Illinois will pay for color-separated glass, but Owens Illinois will not accept color-mixed glass and Strategic Materials charges on the order of \$18 per ton to receive relatively clean color-mixed glass. In the past, most glass that Strategic Materials received from Oregon curbside programs was sold to fiberglass manufacturers, which is a high-end recycling use that results in at least as much energy and resource savings as does recycling glass back into bottles. Strategic Materials used their optical sorting equipment color-sorted their California glass for the container market due to the "Quality Incentive Payments" they receive under California law for color-sorting the California glass, but since Oregon glass did not qualify for these payments, they used it instead to supply their fiberglass markets with (color-mixed) glass. Recently though the demand for container glass has risen, so much Oregon glass is now being run through the optical sorters to produce sorted glass for the large wine bottle makers. It should be noted that when glass is processed in this manner, the glass fines (small pieces of glass smaller than 3/8 inch) are screened out, because the optical sorters do not identify and reject smaller pieces of contaminating material. For glass from clean sources such as bottle bill glass and glass collected separate from other materials, these fines are still pretty clean and can be recycled into fiberglass, but for more contaminated glass the fines can only be used as aggregate or disposed.

Although much curbside glass is sent to California for processing, much is also used locally in Oregon in very low grade uses such as being used in landfills to provide the drainage layer for leachate collection systems or used as aggregate for road base - particularly for temporary landfill roads. Even in Portland - the location of the Strategic Material receiving facility - a substantial amount of glass ends up being used at the Hillsboro landfill for drainage layer construction. Cost seems to play an influential role. While Strategic Material charges on the order of \$18 per ton to receive glass to be shipped to California, the Hillsboro Landfill will only charge on the order of \$10 per ton for the same glass.

Although almost all curbside programs in Oregon direct people to put their glass in a separate bin, in fact, many people do not do so. DEQ does not have firm numbers on this, but local industry sources indicate that 20% or more of the glass set out at the curb in Oregon is included in the commingled mix rather than set separately to the side in a bin. This glass causes significant problems to the processors and also to the paper industry, where some of the glass ends up as broken shards that cause significant damage to equipment. Some recycling processors attempt to separate out this glass, but much of it is broken and not recoverable by the time it gets on the sorting belt. When separated, this broken glass is so highly contaminated with paper shreds, lids, stones, and other small contaminants that it usually is landfilled.

Mixed Container Collection

There are many programs throughout the United States that collect paper and containers as two separate streams of commingled recyclables. The mixed containers usually include glass bottles and jars, metal cans, plastic bottles, and sometimes other types of plastic and metal. Generally these programs sort out mixed -color glass from the other containers. The glass is not as clean as is obtained from separate collection, but some can be recovered for use as glass through optical sorting. Much of the glass collected this way ends up being used for aggregate if optical sorting is not available. It is difficult to hand-sort the glass due to the large amount of breakage. Few Oregon programs currently collect mixed containers as a separate stream. Instead, most

programs are moving to collecting all materials except for glass commingled, and collecting glass and other limited materials such as used oil through a separate collection.

Single Stream Commingled Collection Including Glass

At least in name, no publicly-sponsored Oregon collection programs use this collection method or any collection method that purposefully mixes glass with paper. But throughout the rest of the country this collection method is common and is becoming more common. For example, Seattle recently announce that they are moving to this collection method from one that kept glass separate.

Except in California, few programs that use this collection method recover significant amount of glass that can be used for high-end uses such as manufacturing glass containers or fiberglass. Much more common is to use much or all of the glass as aggregate material or even lower-end uses such as daily landfill cover, which in Oregon would be considered a type of disposal. Unless special care is taken in collection and handling, much of the glass becomes broken before it even gets to the sorting belt at processing facilities, and this broken glass is difficult to recover. The broken glass again can cause significant equipment damage both at the processor and at the paper mills unless the glass is removed early in the sorting process. To an increasing extent, processing facilities are dealing with this by purposefully breaking all of the glass at the beginning of the sort line so that the broken pieces will fall through the sorting screens and become separated from the paper. This broken glass ends up mixed with paper shreds, bottle caps, dirt, and all other small pieces of recycling and garbage that people put in their recycling bins. In most states, the glass is too contaminated to use for anything other than landfill cover, or if cleaned up to a degree, for aggregate uses such as the construction of road beds. California, through funds derived from their container redemption law, provides incentive payments of up to \$60 per ton for processing this glass to produce some color-separated glass that can be used in container manufacturing, but much of the glass is still lost and ends up in landfilled residue. In Oregon, such processing of dirty glass would not be feasible without such outside funding, as the price paid for separated glass by the local glass plant is too low to pay for the additional cost of processing the glass.

Some programs have taken special efforts to collect and handle their single-stream recycling in such a way as to minimize glass breakage. Doing so requires minimizing compaction of the recyclables in the collection truck, dumping the truck onto a softer surface than concrete so that less of the glass will break on dumping, and moving the glass directly to sorting to minimize the huge amount of breakage that usually happens when piles of recyclables are pushed around on the processor's floor. If this sort of care is taken, a fair amount of the glass (as high as 50%) can be hand-sorted from the other recyclables early in the process. Again, California's quality incentive payments of \$60 per ton for sorted glass helps make this sorting more economically feasible in California than it is in the rest of the country. A prototype machine has been built and tested in California that is intended to roll the whole glass bottles away from the other recyclables early in the process so that the glass can be sorted separately. Tests have shown some positive results, but other "round" heavy items including phone books and some plastic items also roll off with the glass bottles and need to be separated. A final report is due on this pilot process by this summer. As of yet though, no single stream processor of recyclable materials has indicated that they are intending to install this process, even in California where the quality incentive payments might make the process more economically feasible.

Markets and Market Prices for Glass in Oregon.

Currently, all of the high-end uses for glass require shipping the glass to Portland or else directly shipping the glass to California or possibly Seattle. All prices listed below are dollars per ton for glass delivered to the facility in Portland.

Owens Illinois operates a glass manufacturing plant in Portland that for the past few years has specialized on making brown bottles. They currently pay \$22 per ton for clear glass, \$15 per ton for green glass, and \$30.50 per ton for brown glass, with an extra 4 cents per ton per mile paid as a freight allowance. They can use small amounts of the clear and green glass in their plant, but any excess they ship to other Owens-Illinois plants in other states. They can use all the brown glass they can obtain. They do not accept color-mixed glass. The glass must be free of ceramics and other problem materials, and Owens will reject loads that have these contaminants present. Owens-Illinois is the largest recycler of Oregon glass, receiving a great majority of the bottle bill glass generated here and also most of the color-separated glass generated by curbside and other collection programs.

Strategic Materials operates a receiving depot only in Portland. Although they can pay for clean color-separated glass, most of the glass they receive is color mixed, and they currently charge \$18 per ton to receive that glass if relatively clean (and more if the glass is contaminated). They do not process glass in Portland, but instead ship it all to their processing facilities in California. They have discussed the possibility of building a glass processing plant somewhere in the Northwest, but have not yet moved ahead with any firm plans.

Cameron Family is building a new glass manufacturing facility in Kalama, Washington that will make mainly wine bottles. This will be the first new glass bottle manufacturing plant built in the United States in many years. The plant is scheduled to open in late 2008. They will be using some recycled glass as feedstock, but at this time DEQ does not have information on how much glass they will be using or how they intend to obtain that glass.

The other major markets for curbside glass are for use as aggregate, often for constructing temporary roads within landfills or for other landfill uses such as the drainage material that surrounds leachate collection systems. Much of the curbside glass from the Portland Metro area, Marion County, and Lane County and a few other places comes to Portland to either Owens Illinois or Strategic Materials, but for most of the rest of the state, including Benton and Linn Counties, the glass ends up being used as aggregate as described above. To an increasing degree, curbside glass from the Portland Metro area has also been going to these low-grade markets. Tables 1 and 2 show the tonnage and percentage of glass from bottle bill versus curbside and other glass that gets recycled into glass products versus used as drainage material or aggregate. These tables are based on 2005 data, when a little over 10,000 tons of collected glass ended up being used for drainage or aggregate. This figure climbed sharply by 2006, with over 17,000 tons of collected glass being used for low-grade applications. Almost all of this increase in low-grade use came from curbside and other collection programs rather than the bottle bill, and the amount of curbside glass being recycled as glass declined a corresponding amount.

Table 1: Markets for Oregon Bottle Bill and Other Glass: 2005 (Tons)

Market	Bottle Bill Glass	Curbside/Other	Total
Bottles or Fiberglass	55,556	28,651	84,207
Aggregate/Landfill Drainage	631	9,832	10,463
Total	56,187	38,483	94,670

Table 2: Markets for Oregon Bottle Bill and Other Glass: 2005 (percent by use)

Market	Bottle Bill Glass	Curbside/Other	Total
Bottles or Fiberglass	98.9%	74.5%	88.9%
Aggregate/Landfill Drainage	1.1%	25.5%	11.1%
Total	100.0%	100.0%	100.0%

Other Glass Losses

The numbers presented in tables 1 and 2 do not include glass that is collected through curbside and other commingled collection programs but that ends up being disposed as residue or that becomes entrained in the paper and sent off to paper markets where it causes substantial damage of the paper pulping and cleaning equipment. DEQ does not have much data that can be used for estimating this loss, but probably on the order of 2,000 to 3,000 tons of glass end up being disposed as residue, including 450 to 600 tons of glass that ends up as residue going to the paper mills. Since Oregon programs are not supposed to include glass in their commingled collection programs, this glass should not have been present in the commingled recyclables, but ended up there anyway.

Acknowledgments

The Oregon Department of Environmental Quality (DEQ) would like to thank George Henebury, Garry Kenny, Paul Faherty (Strategic Materials), Steve Apotheker (Metro), Jeff Murray (Far West Fibers), Tim Dewey-Mattia (Napa Recycling), Justin Stockdale (Santa Fe Solid Waste Management Agency), Doug Koplow (Earth Track. Inc.), Tim Brownell (Eureka Recycling), Ann Dorfman (City of Concord, Massachusetts), Gary Liss, Tom Mabie (Glass Packaging Institute) and Richard Gertmann (Environmental Planning Consultants) for information and guidance used in preparing this report. Comments and questions on this report should be directed to Peter Spendelow of DEQ at 503-229-5253 or by email to spendelow.peter (at) deq.state.or.us.