Paper Industry Background

Paper manufacturing is a competitive, international industry. The United States, with its abundant forest resources and low-cost production facilities, plays a major role in this industry. There are over 500 paper and paperboard mills throughout the country, with facilities located in nearly every state. Products include newsprint, printing and writing papers, tissue, kraft and packaging paper, unbleached kraft paperboard, and semi-chemical medium.

There are nearly one hundred specialized grades of wastepaper and paperboard that fall into five major categories – old newspapers (ONP), old corrugated cardboard (OCC), high-grade deinking papers, pulp substitutes, and mixed papers. Recovery of wastepaper and paperboard in 2007 was 54.3 million tons -- a rate of 56 percent\(^1\) of all paper and paperboard supply for that year. The recovery rate has grown annually since 1970, and by 2012. The majority of recovered paper and paperboard is remanufactured into similar products. Exports and other domestic uses, such as cellulose insulation or animal bedding consume the remainder. Wastepaper accounts for 37 percent\(^1\) of the U.S. industry’s fiber needs.

Paper Manufacturing and Recycling

The first authentic papermaking was practiced in China as early as 100 AD, using a suspension of bamboo or mulberry fibers. The U.S. paper industry started near Philadelphia in 1690, and until 1860, paper was made exclusively from recycled fiber derived from cotton and linen rags and from wastepaper. As demand for paper and paperboard grew, techniques were developed to use wood fiber in papermaking.

Pulps derived from coniferous (softwood) and deciduous (hardwood) woods are the most commonly used plant fibers in U.S. papermaking. These fibers are composed of the carbohydrates cellulose and hemicellulose; lignin, a complex material that provides interfiber bonding; and extractives. The keys to papermaking, whether using virgin or wastepaper pulp, are that fibers must be conformable (capable of being matted into a uniform sheet) and capable of forming strong bonds at the points of contact. Proper conformability and bonding begin with the pulping process. There are three primary forms of pulping for virgin fiber: (1) mechanical pulping, where the fibers are liberated by the application of pure mechanical energy; (2) chemical pulping, which uses added chemicals to degrade and dissolve lignin and to leave cellulose; and (3) semi-chemical pulping, a combination of the first two forms.

Recoverd paper and paperboard require a different pulping process. The key to the recovered fiber pulping process is a continuous pulper, much like a blender in which the wastepaper is beaten into a pulp and rejects are removed. Most recovered pulps are then deinked, where ink and other extraneous materials are removed by mechanical disintegration and chemical treatment. Depending on the type of recovered fiber and its intended use, washing and/or flotation steps may follow to further clean the pulp. The resultant pulp is subjected to a number of processing steps, which vary depending on the pulping method used and the intended use. Virtually all pulp grades require screening, thickening, and storage operations. Cleaning is usually required only when appearance is important, such as fine printing paper production. Once processed, pulp from virgin or recovered sources enters the paper manufacture stage. It is taken through a series of processes that uniformly distribute the pulp into large sheets; dewater, dry
and roll it into large parent rolls. Parent rolls can be distributed to converter or be manufactured into finished goods on-site.

There are various reasons that mills are motivated to use wastepaper. In some cases, mills producing paper products (tissue, newsprint, printing paper) realize a net energy savings by using wastepaper. In other cases, mills use wastepaper if abundant supplies are available more cheaply than wood pulp. Certain mill technologies may require the use of wastepaper. However, perhaps the greatest reason that many mills converted to utilizing wastepaper in the late 1980’s and later, was the increased demand for recycled-content paper. This demand was fueled by government recycled-content mandates paper products as well as demands of other consumers for these products.

**Waste Paper and Paperboard Uses**

The total amount of wastepaper and paperboard used in product manufacture varies considerably depending on the type of final product. For some paper products, wastepaper is used in conjunction, and sometimes competes directly, with wood pulp. In other instances, the paper product is manufactured form 100 percent wastepaper. Table 1 shows amounts of wastepaper and paperboard used in the major product types, including exports, in 2007.

<table>
<thead>
<tr>
<th>Product Type</th>
<th>ONP</th>
<th>OCC</th>
<th>High Grades</th>
</tr>
</thead>
<tbody>
<tr>
<td>Containerboard</td>
<td>1</td>
<td>15,331</td>
<td>-</td>
</tr>
<tr>
<td>Recycled paperboard</td>
<td>1,051</td>
<td>3,926</td>
<td>2,200</td>
</tr>
<tr>
<td>Newsprint</td>
<td>2,955</td>
<td>-</td>
<td>250</td>
</tr>
<tr>
<td>Tissue</td>
<td>579</td>
<td>191</td>
<td>3,140</td>
</tr>
<tr>
<td>Printing &amp; writing papers</td>
<td>355</td>
<td>-</td>
<td>1,200</td>
</tr>
<tr>
<td>Others</td>
<td>1,039</td>
<td>294</td>
<td>1,000</td>
</tr>
<tr>
<td>Exports</td>
<td>2,787</td>
<td>5,418</td>
<td>8,480</td>
</tr>
</tbody>
</table>

**Old Newspaper**

The grade of wastepaper categorized as ONP includes used newspapers originating from households (with advertising slicks), over-issues, news blanks, and groundwood computer printout paper. In 2007, 73 percent of all newsprint paper produced was recovered. As Table 1 indicates, most ONP is recycled into newsprint. Other uses include building products like cellulose insulation; molded pulp products; animal bedding, and hydromulch.

**Old Corrugated Cardboard**

Corrugated and solid fiber containers, plant cuttings, and kraft paper and bags are all categorized as OCC. Approximately 78 percent of all OCC generated was recycled in 2007; a record-high rate. Most OCC originates from nonresidential sources. The majority of OCC is used in the manufacture of containerboard and recycled paperboard, such as the facing and inner fluting of cardboard boxes (see Table 1). Domestic use of OCC also depends heavily on export markets. Increased exports of OCC reduce the amount available for domestic consumers.

**High-Grade Deinking Papers/Pulp Substitutes**

High-grade deinking papers are generally defined as office type papers of high quality. Print-free grades are classified as pulp substitutes. The bulk of these high quality papers are recycled into tissue products and fine printing and writing products, as Table 1 indicates. Major suppliers of these grades of paper are commercial operations and institutions, such as government offices. Mills have either added or upgraded deinking facilities to accommodate growing supplies of these paper grades, and to meet growing government recycled content mandates for tissue and writing papers.
Mixed Papers
Mixed papers represent a catchall category for lower grade papers recycled from residential or commercial sources. These lower quality grades of paper are recycled into numerous products, with recycled paperboard leading the field. Recycling of these types of paper, particularly from residential sources, represents an area of potential that will meet the growing needs of domestic and export consumers of wastepaper.

Paper Recycling in Wisconsin
Paper recycling constitutes the greatest weight of a single material collected by Wisconsin community recycling programs. Nearly 250,000 tons of paper was collected in 2002 in these programs. A 2002 report by the Wisconsin DNR showed that 67 percent of all newspapers and 72 percent of OCC waste paper was collected for recycling. The recycling rate for other grades of paper was less than 50%. While Wisconsin has a strong recycling system, there is the opportunity for improvement in the area of mixed paper and office paper collections.

1 2007 Recovered Paper Annual Statistics; American Forest and Paper Association

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