

# PNEAC Factsheet

## Facts About Paper

### Commercial Printing

The universe of paper is changing radically. Shifts in the ways we use and produce paper are being shaped by market forces, tightening access to forest resources, changes in consumer awareness and preferences, government restrictions and the proliferation of electronic and online technologies.

### WHAT PRICE PAPER?

For most printers, paper represents one of the largest input costs. But because paper prices can fluctuate suddenly and unpredictably, printers of all sizes can feel the strain of the paper industry's boom-bust cycles. The good news is that environmental considerations provide opportunities to improve efficiency and reduce costs. While printers often must defer to customers' specifications, they can play a major role in shaping those specifications. The key is staying abreast of the changes in the paper demand and manufacture, and learning how to help influence the changes. This fact sheet highlights some of the facts about paper related to the printing industry in Montana.

### Recycled Paper

Not that long ago, recycled paper was dismissed by many printers as "junk." And rightly so. Printers were having problems with quality, printability, availability and cost of recycled varieties. But today recycled and virgin stocks are almost indistinguishable. What has spurred the improvements in recycled paper?

Increasing public concern over depleted landfill space and use of natural resources in the 1980s stimulated demand for so-called ecologically friendly paper products. This fueled a big push for technological improvements, such as stronger fiber and improved pulp, thereby providing incentives for printers and suppliers to learn how to work with recycled paper. As experience grows and manufacturers continue to refine their processes quality will continue to improve.

According to a study by Franklin and Associates, paper represents roughly 40% of the total waste generated in the U.S. by weight. Of the more than 80 million tons of paper waste generated in 1994, about 29 million tons were recovered, yielding a recovery rate of about 35% (see Table 1). According to Rick Meis with Treecycle, however, this figure is somewhat misleading since much of what Franklin and Associates considers "recovered" was mill and post-mill waste that was never in the waste stream anyhow.

Table 1. Generation and Recovery of Materials in MSW: 1994. Percent Recovered for Recycling and Composting.

Material	Weight Generated	Weight Recovered	Recovery Rate
Paper/Paperboard	81.3	28.7	35.3%
Glass	13.3	3.1	23.4%
Metals	15.8	5.7	35.9%
Plastics	19.8	0.9	4.7%

Rubber/Leather	6.4	0.5	7.1%
Textiles	6.6	0.8	11.7%
Wood	14.6	1.4	9.8%
Food scraps	14.1	0.5	3.4%
Yard trimmings	30.6	7.0	22.9%
Misc. inorganics	3.1	Neg.	Neg.
<b>TOTAL</b>	<b>209.1</b>	<b>49.3</b>	<b>23.6%</b>

While recycling does keep paper from the landfills, it does not necessarily "save" trees. In a closed system, paper cannot be recycled indefinitely seven to ten times through is about the maximum before the fibers just break down so there will always be a need for some virgin wood pulp to be added to the recycled paper system. While much of the virgin matter is comprised of wood trimmings, "waste trees," scrap wood and saw dust from lumber mills, statistics show that over 60% of the roughly 17 billion cubic feet of timber harvested worldwide each year is used for paper and pulp (Dadd-Redalia, 1995).

## RECYCLED CONTENT STANDARDS

Paper labeling standards and waste content regulations have recently become a source of frustration for many buyers of recycled paper. Recycled papers may contain either or both "pre-consumer" and "post-consumer" material. Here is an overview of common terms associated with recycled paper:

- **Pre-consumer:** While there is no officially accepted definition, pre-consumer (often called post-industrial) material is material (mill broke, wood chips, other mill waste) that is usually generated by industrial manufacturing processes would otherwise have been landfilled.
- **Post-consumer material:** Waste paper (office paper, newspaper and other types) that has served its intended purpose and has been separated from solid waste to be recycled into new paper. The greater the percentage of post-consumer material in the paper, the less resource intensive it is because it is closer to true "closed-loop" recycling.
- **Post-mill:** Paper waste generated in converting and printing that is done by a facility other than the paper mill. This does not include mill waste or wood chips.
- **De-inked:** Waste paper that has had the ink, filler, and coating removed as a step in the production of recycled paper. This includes magazines and newspapers that were printed but never sold.

The federal government has established minimum-content standards for the paper it purchases. According to EPA guidelines, printing and writing paper purchased by the federal government is required to contain at least 50% total recycled fiber content, although this standard does not require a specific amount of post-consumer content. This standard, therefore, does nothing to divert paper waste from landfills.

Table 2. Changes in recycled paper content for fine paper used by the Federal government

	Total Recycled	Post-Consumer
<b>1994</b>	50%	0%
<b>1995</b>	50%	20%
<b>1999</b>	50%	30%

But an October 1993 Executive Order set a new standard for recycled papers, requiring specific amounts of post-consumer materials. In 1995, paper purchased by the government was required to contain at least 20% post-consumer material. By 1999, the post-consumer requirement increases to 30% (See Table 2). The standard allows the 50% overall recycled content to include any combination of:

- scrap trimmings, known as "broke"
- pulp substitutes, including end rolls and conversion scraps
- pre-consumer waste, such as unsold finished goods
- post-consumer wastes from municipal recycling operations

The federal government standards are gradually becoming the de facto industry standard, though its acceptance and use is by no means universal.

Another factor that affects the quantity of paper waste is its basis weight. Lower basis weight means less paper fiber is used. It may also be important to know if the post-consumer figure given is the percentage of fiber content, or of total weight. Most paper (especially coated paper) has filler materials in addition to fiber content, making its total weight much higher than its fiber weight. In this case, a comparison of recycled fiber to total fiber gives a more accurate picture.

## **LABELING RULES**

In 1992 the Federal Trade Commission issued guidelines for the use of environmental marketing claims directed at consumers so they can understand labeling and will not be deceived. Printers must label recycled products clearly and prominently, and indicate what portion of the product is comprised of recycled content. If a product is not 100% recycled, it must be labeled according to what percentage of recycled matter it contains. Printers are warned against using the term "recyclable" since the guidelines on that term vary from state to state, thereby making mislabeling easy.

## **Bleaching Issues**

The use of chlorine bleaching to produce both virgin and recycled paper is currently a hot topic of debate. For years, chlorine gas known as elemental chlorine has been used to bleach paper pulp and as an effective means of separating paper pulp from lignin (a glue-like substance that bonds wood fibers together). But during the 1980s, Europeans discovered that the industrial effluent from chlorine is linked directly to the creation of the organochlorine dioxins, a man-made carcinogen that passes easily up the food chain (see sidebar).

In 1994 the EPA issued a draft report concluding that dioxin can create adverse health effects, even at low levels. The findings have prompted the agency to begin developing air and water emission standards for the pulp and paper industry. While some chemical and paper industry associations feel the EPA is underestimating the compliance costs associated with the rules, some environmental groups fear that the rules don't go far enough and create few, if any, incentives to implement chlorine-free processes.

Alternatives do exist to elemental chlorine bleaching and have already been implemented widely in Europe, and to a lesser extent in the U.S.

## **ELEMENTALLY CHLORINE-FREE (ECF) PAPER**

ECF bleaching is one alternative process that may prevent pollution. This process utilizes chlorine dioxide or sodium hypochlorite instead of chlorine gas as a bleaching agent. Even though chlorine dioxide has "chlorine" in its name, its chemistry is very different from chlorine gas.

In the bleaching process using chlorine gas, chlorine tends to combine with lignin to create chlorinated organics that end up in mill waste water. In contrast, chlorine dioxide typically breaks apart the lignin, leaving behind organic compounds soluble in water and similar to naturally

### **Facts About Dioxin**

- Dioxins are a family of 75 different chlorinated

occurring substances. According to the Business for Social Responsibility Fund, ECF has the following benefits:

- **Reduced dioxin emissions.** By substituting chlorine dioxide at levels of 70% to 100%, mills can apparently reduce the level of chlorinated organics found in mill effluent by 80% to 90% and reduce dioxins to "non-detect" levels.
- **Superior bleaching.** Chlorine dioxide may be a better bleaching agent than elemental chlorine. ECF proponents say that it is 2.5 times as powerful an oxidizer as elemental chlorine, and that it preserves cellulose and attacks lignin more selectively.
- **Easy retrofit.** Mills using ECF have found it relatively easy to retrofit their bleaching generators without a large-scale capital investment. Additionally, there is little down time downtime for employee training, and new equipment.
- **Reduced water consumption.** ECF lines use about 5% to 15% less water.

Major drawbacks include:

- **Loss of market share.** The number of U.S. consumers who prefer totally chlorine-free (TCF) paper is expected to grow, and ECF mills could lose market share, particularly from overseas companies who already offer TCF paper.
- **Possible price shocks.** The main ingredient in chlorine dioxide is sodium chloride. Production of the chemical is currently at capacity, with no short-term capacity increases planned. In the event of a chlorine ban, other industries (such as municipal water systems that depend on chlorine) could turn to sodium chloride as a substitute. As a result, ECF manufacturers could face skyrocketing costs.
- **Later detection levels.** New testing techniques could make dioxins detectable at even lower levels, removing ECF's "non-detect" status.
- **Potential environmental violations.** Even if produced in "closed-loop" mills, ECF processes lead to chlorinated by-products, which would end up in mill sludge, concentrated bleach plant chemicals, and in emissions to the atmosphere, possibly violating EPA rules.
- **Lack of "closed-loop" recycling technologies.** The corrosive characteristics of chlorine require ECF producers and those using elemental chlorine to use large quantities of water, so "closed-loop" systems, where chemicals and water used in pulping and bleaching are recycled have been out of reach.

## TOTALLY CHLORINE-FREE (TCF)

- hydrocarbon compounds formed as by-products in chemical reactions involving chlorine and hydrocarbons, usually at high temperatures.
- The most harmful and widely studied compound is TCDDI usually just called dioxin.
- The pulp and paper industry is the third largest industrial buyer of elemental chlorine.
- Dioxin is one by-product from use of elemental chlorine gas in paper bleaching.
- Other sources of dioxin include municipal and hazardous waste incinerators, cement kilns, manufacture of certain herbicides and plastics, and several hydrocarbon chemicals.
- Dioxins tend to bioaccumulate, which means their concentrations in organisms increase successively up the food chain.
- Dioxin is a proven carcinogen (cancer causing chemical). However a 1991 study of dioxin found that its immunological, developmental, and neurological effects at very low levels may be more threatening to human health than its carcinogenicity. There is still much controversy over the accuracy or credibility of these data, and whether low levels of dioxins really pose a threat.
- The term "dioxin-free paper" is misleading. Paper does not contain dioxins, but they are produced as a by-product of the papermaking process and usually become part of the effluent wastewater of paper mills.
- Many North American paper companies are modifying their processes to reduce the formation of dioxins. One way is to switch from pure chlorine gas to chlorine dioxide, which generates less dioxin by-

## PAPERS

Adoption of TCF has been much more widespread in Europe than in the U.S. Currently 40% of European mills are operating TCF. The markets there are spurred by greater consumer awareness of chlorine issues and tighter regulations of chlorinated chemicals. While TCF only comprises about 1% of the current U.S. market, it is expected to increase to 10% by the year 2000.

Paper pulp produced from TCF is bleached with ozone, hydrogen peroxide, "peracids" or enzymes. TCF papers are available, but at a higher price, and a slightly lower quality than ECF papers, though advancements in technology are addressing these quality concerns. While the TCF processes require an initially large capital investment, the operating costs are much lower. Over time these factors, along with projected increases in demand, will help reduce and possibly eliminate the price gaps. It is important to note that TCF paper cannot be made without trees or some other virgin fiber in order to ensure absolute total chlorine-free paper. Currently there are only approximately four facilities in the U.S. that have switched to TCF processes.

Major benefits of operating TCF facilities include:

- **Reduced regulatory risk.** Should the EPA ban chlorine or tighten regulations even more than those included in its proposed rules, TCF producers would be ahead of the regulatory curve.
- **Ability to capture growing market demand.** The advocacy and educational efforts of environmental organizations fueled European concern about dioxins and led to a market demand for chlorine-free paper. Advocates could spur the creation of similar market demand in the U.S.
- **Reduced water consumption.** TCF pulp producers are currently better able to reduce water consumption, an important goal in light of possible Clean Water Act restrictions on water consumption and potential tax incentives to reduce water use. One TCF pulp mill in Canada operated effluent-free and consumes just a fraction of the water that a standard mill consumes.
- **Making innovations pay.** U.S. pulp equipment suppliers do not have any experience with TCF technology, so companies that convert to TCF processes may have to develop technologies in-house, which could provide competitive advantage for innovation.

The drawbacks in committing to TCF now include:

- **Non-post-consumer material.** In order to achieve totally chlorine-free paper, only pre-consumer fibers can be used, since there is no guarantee post-consumer fibers were unbleached. Therefore, TCF paper does not help close the loop of recycling.
- **Uncertain market growth.** While TCF is projected to gain market share, pulp mills may see the market grow more slowly than anticipated.
- **Uncertain financial costs.** There is little consensus on the capital investment and operational costs of TCF, so new capital investments may be riskier than ECF or chlorine bleaching processes.
- **Lack of operational experience in the U.S.** With little U.S. experience in conversion to TCF, mills may have to develop their own expertise and address unexpected problems.
- **Reduced fiber quality.** Extended delignification, during which pulp is "cooked" for longer periods to separate the lignin from the cellulose (a common practice with TCF) reduces the

product.

- Austria and Sweden substitute oxygen or other non-chlorine processes, or use only non-bleached (slightly brown) paper products. This is known as "total chlorine free" (TCF), and is defined as using no chlorine or chlorine dioxide.
- Reducing brightness requirements will make it easier for paper companies to eliminate chlorine compounds from their bleaching processes.

quality of the fibers, may increase the consumption of virgin fiber, and produces a lower-quality pulp.

## PROCESS CHLORINE-FREE (PCF) PAPER

Paper produced by TCF can not use post-consumer material, since there is no guarantee that residual chlorine won't be carried over. Process chlorine-free paper utilizes processes similar to TCF manufacture, but incorporates post-consumer material into the pulp. According to Rick Meis of Treecycle Paper in Bozeman, Montana, PCF is a better use of resources and poses no harm to end-users of the paper since it is the *process* of bleaching that creates environmental concerns, not the actual paper. Any residual chlorine in the paper would be negligible, according to Meis.

Major benefits of using PCF paper include:

- **Post-consumer material.** The PCF process has many of the same benefits as TCF processes, except that post-consumer recycled paper can be used.
- **Environmental emissions.** No dioxin or other chlorinated organics are generated or released to the environment in PCF processes
- **No lignin removal.** PCF is a logical process for bleaching recycled paper, since the lignins are already removed.

Drawbacks may include:

- **Cost.** The cost of running a PCF is currently very high. But this could change over time as consumers begin to demand cleaner paper-making technologies.
- **Fragile recycled paper supply.** Widespread adoption of PCF paper processes would necessitate much greater recovery rates of post-consumer material to ensure adequate supply of fiber.
- **Fiber strength.** The shorter fibers of PCF paper do not hold up as well as standard stocks in fast press runs, or tight registrations.

## How bright must it be?

Certain paper needs simply require very bright white paper. But increasingly, paper users are beginning to accept less-than-bright paper stocks as acceptable, and even preferable. As consumers become more aware of the issues associated with recycling and bleaching, they will demand more ecologically sensitive products. Forward-thinking printers will not only tap into this market, but will help to shape it.

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