

PREFERRED PACKAGING:
Accelerating Environmental Leadership in the
Overnight Shipping Industry



A Report by
The Alliance for Environmental Innovation
A Project of the Environmental Defense Fund and The Pew Charitable Trusts

The Alliance for Environmental Innovation

The Alliance for Environmental Innovation (the Alliance) is a joint initiative of the Environmental Defense Fund (EDF) and The Pew Charitable Trusts. The Alliance works cooperatively with private businesses to reduce waste and build environmental considerations into business decisions. By bringing the expertise and perspective of environmental scientists and economists together with the business skills of major corporations, the Alliance creates solutions that make environmental and business sense.

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This report was written by Elizabeth Sturcken. Ralph Earle and Richard Denison provided guidance and editorial review.

Acknowledgments

Funding for this report was provided by The Pew Charitable Trusts, the Environmental Protection Agency's WasteWi\$e Program and Office of Pollution Prevention, and the Emily Hall Tremaine Foundation.

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The Alliance for Environmental Innovation is the product of a unique partnership between two institutions that are committed to finding cost-effective, practical ways to help American businesses improve their environmental performance. It is a powerful partnership. By combining the experience and resources of one of the nation's largest environmental philanthropies with one of the country's most respected environmental organization, the Alliance has a unique ability to assist businesses to better integrate environmental concerns and criteria into their mainstream operations. Although government will always play an important role in helping to set and enforce environmental standards, it is increasingly apparent that additional efforts, beyond the regulatory system, are needed to encourage and assist businesses to reduce environmental impacts. The Alliance was established for this purpose and represents a potentially important tool for helping both the environmental and business communities achieve common goals in the years ahead.

- Joshua Reichert, Director, Environment Program, The Pew Charitable Trusts

The Alliance for Environmental Innovation, created in partnership with The Pew Charitable Trusts, works with business to create direct and measurable improvements in the environment and business practices. We live in an age that demands creativity in response to environmental problems. By forging direct, face-to-face relationships with individual businesses, the Alliance blazes a new path toward environmentally-sound, cost-effective, sustainable solutions. We seek to catalyze new ways for the business community to address environmental issues. Most important, this approach -- working towards win-win, leadership solutions -- is a powerful way to achieve important results.

- Fred Krupp, Executive Director, Environmental Defense Fund

TABLE OF CONTENTS

Introduction	1
What's the Problem?	1
Industry Overview	3
The Challenge.....	3
Environmental Priorities: Reduce, Reuse, Recycle.....	4
Economic Considerations	7
Comparing the Packages: Best Practices	8
Purchasing Recommendations.....	8
Report Methodology.....	9
Paperboard	9
Quick Hits	12
Corrugated Containerboard	12
Quick Hits	15
Plastic	15
Quick Hits	16
Company Comparison	17
Results of Analysis and Recommendations	18
Appendix A: Environmental Comparison of Similar Products.....	19
Appendix B: Environmental Benefits: Some Examples	23
Appendix C: Environmental Packaging Practices Survey	26

INTRODUCTION

This report focuses on one aspect of the environmental performance of the overnight shipping industry: its packaging practices. Boxes and envelopes provided by overnight shipping companies are everywhere -- in almost every American company's supply drawer, stacked high in delivery trucks, and in transport across the country and around the world. The number of company-provided overnight shipping boxes and envelopes used each year is staggering. Customers of overnight shipping companies use over *one billion* of these envelopes and boxes annually, including the boxes and envelopes provided by shippers for second-day or later deliveries.

Overnight shipping companies have implemented a number of changes to reduce the environmental impact of their business operations. Most notable for this report, there are several instances of leadership in packaging. For example, UPS recently began testing a two-way reusable shipping envelope, the industry's first venture into this highly promising area of environmental improvement. Other companies have pushed their packaging products to be more than just functionally adequate and cost effective; they are environmentally superior as well. The U.S. Postal Service uses a paperboard envelope that is 100% recycled with a minimum of 80% postconsumer fiber and has no impediments to recycling such as a plastic document window. Airborne Express's basic corrugated shipping box contains almost double the current average for recycled content, at 82% postconsumer fiber.

Even given the advances thus far, the packaging used by the overnight shipping industry represents an excellent opportunity for shipping companies to engage in meaningful environmental progress. The environmental profile of existing packaging can be improved in any number of ways: Boxes and envelopes can be made to be reused multiple times. Additionally, the amount of postconsumer recycled material can be increased and the use of bleached paper can be eliminated.¹ The fact is that many significant environmental improvements can be made with a minimum of effort, and often with substantial cost savings. Overnight shipping companies have an opportunity and a responsibility to demonstrate leadership by demanding and using environmentally superior packaging. Responding to this challenge would allow members of the shipping industry to serve as models in the growing movement toward environmentally preferable packaging.

WHAT'S THE PROBLEM?

The use of over one billion shipping envelopes and boxes per year has a significant impact on the environment. Not only do these envelopes and boxes create a large solid waste problem after they've been used, their production also creates significant pollution. Large quantities of paper and plastic are manufactured to be transformed into shipping packages. To begin with, paper and plastic packages consume raw materials, whether from virgin sources such as trees or petroleum, or from recovered sources. Energy, often fossil-fuel derived, is required to convert these raw materials into products. This manufacturing process produces emissions to both air and

water, generates solid waste and consumes water. Finally, the paper or plastic must be converted into its final form as a shipping package by cutting, folding, printing, and any other finishing that is necessary, such as gluing.

Solid Waste

Solid waste is the most visible manifestation of the environmental effects arising from our use of such a large number of shipping packages each year. Paper and paperboard (of which a majority of shipping packages are made) comprise the largest segment of municipal solid waste (MSW), making up almost 40% of total MSW in 1995.² The total U.S. consumption and discard of paper and paperboard has grown dramatically from 29.9 million tons in 1960 to 81.5 million tons in 1995. Most of the paper and paperboard packaging that is recovered is corrugated containerboard, which is the material used to make overnight shipping boxes. Though containerboard represents the single largest product category of MSW (28.8 million tons generated in 1995), it is also recovered at the highest rate -- 64.2% of all boxes generated in were recovered in 1995.³ In contrast, the recovery of other types of paperboard packaging, including overnight shipping envelopes, is negligible.⁴

Plastics, used to manufacture some overnight shipping envelopes, are a growing component of municipal solid waste. The recovery rate of plastic packaging is very low -- less than 10% in 1995, most of which was PET soft drink bottles, and HDPE milk and water bottles.⁵ The recovery rate of items such as plastic shipping envelopes, like paperboard, is negligible.⁶

Energy Use, Water Use & Environmental Releases

Many other environmental impacts, in addition to solid waste, arise from the production of shipping packaging. For example, the manufacture of 20,000 white bleached paperboard shipping envelopes from virgin fiber uses over 20,000 gallons of water and almost 40 million BTUs of energy and releases over 5,600 pounds of net greenhouse gases.⁷ The process of bleaching paper releases a variety of toxic substances including chloroform, dioxins and other chlorinated organic compounds. Other environmental impacts include air emissions of nitrogen oxides, particulates, sulfur oxides, hazardous air pollutants, and volatile organic compounds; and water releases of suspended solids and oxygen-depleting substances.⁸

Materials Composition of Packaging

Company-supplied packaging for overnight shipping falls into two basic categories -- boxes and envelopes. All of the boxes used by the industry are made out of corrugated containerboard that is fashioned into a variety of shapes and sizes. Corrugated containerboard consists of two parts -- linerboard and corrugating medium. To provide the strength needed for shipping, the layer of medium is sandwiched between two layers of linerboard.

Envelopes are made either of paperboard or plastic. Paperboard envelopes are designed to hold a limited number of documents, whereas plastic envelopes serve to ship various different-shaped items. All of the overnight shipping companies offer their customers a basic envelope

made from paperboard. Paperboard comes in three major grades: solid bleached sulfate (SBS), coated unbleached kraft (CUK) and clay-coated 100% recycled paperboard.

Finally, some envelopes supplied by the overnight shipping industry are made out of plastic -- either Tyvek[®], which is spun high density polyethylene, or a three-layer polyethylene film. Some plastic envelopes also have padding for added protection, in the form of a layer of plastic bubble wrap.

INDUSTRY OVERVIEW

The overnight shipping industry is made up of a relatively small number of large companies. Five companies have over 95% of the overnight shipping business in the United States, with total revenues exceeding \$93 billion in 1996. Three of the top five companies -- Federal Express (FedEx), Airborne Express and DHL -- focus predominantly on express shipping. The other two -- the U.S. Postal Service (USPS) and United Parcel Service (UPS) -- derive the bulk of their revenues from other delivery services (e.g. mail delivery, parcel post delivery).

TOTAL REVENUE & MARKET SHARE FOR THE OVERNIGHT SHIPPING INDUSTRY - 1995

Company	Packages (3-70 lbs.)	Letters & Envelopes (< 2 lbs.)	Total Revenues
United Parcel Service	42.5 %	12.8 %	\$22B
Federal Express	40.0 %	59.0 %	\$10.3B
Airborne Express	8.1 %	12.8 %	\$2.48B
DHL	3.1 %	2.6 %	\$3.8B
USPS (Express Mail)	2.6 %	9.0 %	\$56.6B
Others	3.7 %	3.8 %	

Sources: Wall Street Journal, September 17, 1996 and Dun & Bradstreet, Inc., 1996.

THE CHALLENGE

Why Should Companies Care? Because Their Customers Do

There is no question that Americans increasingly care about the environmental attributes of products they use, including packaging. A 1996 poll done by Environmental Research Associates examined attitudes about packaging and found that a large majority of Americans believe companies could be doing a better job of making their packaging “environmentally friendly.”⁹ Not only do people believe that more could be done, they are very aware of what business leaders have done to make packaging better environmentally: Seventy one percent

(71%) of the survey respondents could identify specific changes made for environmental reasons over the past few years.¹⁰ Changes that enhance recyclability and increases in recycled content were most often recalled. According to the survey, environmental attributes of packaging are a strong influence when customers purchase a product.¹¹

A recent in-depth study that analyzed environmental values in American culture found that “most Americans share a common set of environmental beliefs and values.”¹² This study found that the views of the general public regarding the environment closely parallel those of self-identified environmentalists.¹³ The study’s authors conclude that “the strong endorsement of environmental values by the diverse groups studied in our survey may well reflect a general willingness for the American public to make significant sacrifices for the sake of the environment.”¹⁴ Business should embrace the fact that a diverse public cares deeply about the environment. The decision to use environmentally superior packaging is increasingly becoming a core element of providing good service and being competitive. Indeed, it is yet another opportunity for businesses to identify themselves in the minds of their customers as leaders in their industry. With that leadership comes benefits not only for the environment and the company image, but also for a business’s bottom line.

Shipping Companies Have the Opportunity for Positive Change

Overnight shipping companies provide shipping envelopes and boxes to their customers free of charge. As a result, the companies have become major purchasers of shipping packaging. By virtue of this purchasing power, these companies have a special opportunity and ability to ensure that the products they purchase are environmentally superior while maintaining their functionality and competitive cost. Moreover, many of the changes that need to be made are readily achievable within a short time frame with minimal additional cost, or even lower cost than the present alternative.

ENVIRONMENTAL PRIORITIES: REDUCE, REUSE, RECYCLE

Current Packaging

Packaging is necessary for shipping documents and other materials safely from one location to another. It serves the function of securely keeping items in good condition while in transport. Most of the overnight shipping packaging supplied by the companies we surveyed is designed to be used only once and discarded. Once a typical overnight shipping container is opened, it is not made to be used again for shipping. Because there is little opportunity to reuse or recycle most materials used to make overnight packages, most people simply throw them away. Options for positive environmental leadership in this area abound.

A Hierarchy for Action

The classic environmental hierarchy of **reduce**, **reuse** and **recycle** is quite applicable to overnight shipping packaging. Simply put, packages should be designed to reduce their impact on

the environment as much as possible. The options of first resort to achieve this goal are source reduction and reuse. Our research and analysis indicates that a shift from single-use to multiple-use (i.e. reusable) packaging represents the single greatest opportunity to reduce the environmental impact of packaging. Beyond reuse, packaging should be made from materials the production and disposal of which entails the least possible impact on the environment. Three straightforward actions can achieve this goal. First, packages should have the highest postconsumer recycled material content possible, consistent with maintaining function and cost-effectiveness. Second, the virgin material content of all paper packages should be produced from unbleached paper. Finally, all packaging should be designed to be *easily* recycled, meaning that it should use single or readily separable materials for which a widely accessible collection and processing infrastructure is already established.

Reduce

The optimal environmental solution is source reduction, which means using fewer resources and fewer materials (or reducing the impacts associated with producing such materials) to perform a given function. Source reduction avoids the need to manage environmental problems after they have been created, by minimizing resource consumption, releases to the environment from the manufacturing process, and solid waste.

Reducing the amount of material used to make shipping boxes and envelopes -- called lightweighting -- is one important method of source reduction. Other important avenues of source reduction involve changing the methods of production or choice of materials. For example, changing from bleached to unbleached paper or paperboard eliminates the considerable energy consumption and pollution associated with the bleaching process.

Reuse

Reusable shipping packages provide large environmental benefits in the form of significant reductions in the amount of material needed to perform the function of packaging. The overnight shipping business offers clear opportunities for the introduction of reusable packages, including shipping between two or more offices of the same company and shipping between companies or individuals who routinely send items back and forth (e.g. documents that have to be signed and sent back to the sender).

The benefits of reusable packaging extend beyond the environment to include the potential for reduced costs in the long run and increased customer loyalty.¹⁵ It may be much more convenient for customers to reuse a shipping package they have received instead of having to maintain a larger stock of single-use packages (as well as manage and pay for the greater amount of solid waste they generate). Other factors being comparable, many customers will give their business to companies that demonstrate they care about the environment. These factors are among the many reasons for companies to offer a reusable alternative.

There are many logistical issues that need to be addressed when considering reusable shipping packaging. Among these are the fact that, depending on the design, the investment in multiple-use reusable packaging means larger *initial* costs. Studies suggest, however, that reusable systems result in substantial cost savings after even a few reuses.¹⁶ In addition, systems for tracking and ensuring reuse or return of empty multi-use packaging must be implemented, although this task is likely made less daunting given overnight shipping companies' package tracking systems.¹⁷

UPS has made the first step in creating and using reusable packaging through the recent introduction and test marketing of a two-use paperboard envelope. UPS has shown leadership in this area by beginning to move the paradigm of shipping packaging away from single-use toward multiple-use packages. The benefits to be reaped from this move are numerous, including environmental benefits (pollution prevention and source reduction) as well as business benefits (cost savings and increased market share.)

Recycle

A shift from virgin to postconsumer recycled material as inputs to the manufacturing process for packaging typically results in major reductions in environmental impact. In the case of paper, a recent study done by the Environmental Defense Fund and others comparing paper recycling programs and the manufacture of paper with recycled content to the production of virgin paper and its disposal in landfills or incinerators found the former to be the clear winner. For each of the five major paper grades of paper studied, the recycled materials-based system "significantly reduces releases of numerous air and water pollutants to the environment, reduces solid waste, and conserves energy and forest resources."¹⁸

Airborne Express has shown that they take the issue of recycling seriously, as evidenced by the corrugated box that they provide to customers. It is composed of significantly more postconsumer recycled content than any other company's box -- a full 82%. In addition, Airborne's box uses absolutely no bleached paper or coatings. The result is a box that meets all functional requirements while having excellent environmental characteristics.

Once a package has been used, it will either be reused, recycled, or, more likely, discarded. None of the five overnight shipping companies has taken effective steps to “close the loop” -- i.e. to facilitate the collection and recycling of the packaging that they supply to their customers. While shipping packages themselves are made largely of a single material, other design features -- most notably, the use of plastic document windows -- compromises the ability to recycle such packaging. In some cases, packages are made from materials for which there exists limited or no infrastructure to collect or process the materials for recycling. As a result of these factors, the practical recyclability of some shipping packaging, notably paperboard and plastic envelopes, is limited at best.

ECONOMIC CONSIDERATIONS

The cost savings associated with choosing environmentally-preferred packaging may be significant. Historically, the cost of recycled paper used in shipping packaging has been less than or competitive with the price of their virgin counterparts. For example, the price of recycled unbleached boxboard has consistently been lower than the price of bleached board since the early 1980's. Recycled board now costs about 30% less than bleached board.¹⁹ Generally, it has also been less costly to manufacture corrugated containerboard using recovered fiber rather than virgin fiber, with the cost savings in proportion to the amount of recovered fiber used.²⁰ Bleached paper, including bleached corrugated liners, usually cost more than their unbleached alternatives because of the additional processing that they require to manufacture.

Packaging changes that benefit the environment can also have a positive impact on market share. As described above, the environment is an issue that Americans care deeply about. Action in this area often reflects a corporate culture that values efficiency, waste minimization, and concern for the future. Companies that demonstrate and communicate environmental leadership will reap the attendant benefits in terms of positive public image. For example, the release of a two-use envelope by UPS is expected to deliver not only environmental benefits and cost savings, but also increased business.

Comparing the Packages: BEST PRACTICES

PURCHASING RECOMMENDATIONS

Organizations and businesses that purchase overnight shipping services can use the analysis and comparisons detailed below to help inform their decision as to which company to purchase services from. Environmentally-preferred packaging offers the opportunity to create both environmental and economic value. In the short run, there will be environmental benefits from choosing a company that has packaging with the best environmental profile in each category. In the long run, as shipping companies realize lower costs from reducing waste and choosing environmentally-superior materials, cost savings should also be passed on to shipping customers.

In addition to purchasing services from overnight shippers who provide environmentally-preferred packaging, shipping customers should consider expanding the dialogue with their shipper to include environmental considerations along with cost and service issues. We recommend that companies emphasize the importance of providing packaging that is the best it can be -- functionally, economically, and environmentally.

Packaging Highlights

Overnight shipping companies differ dramatically in the paperboard envelopes that they offer for customers' use. Some are clearly leading in this area while others could make simple, yet dramatic, improvements: UPS just recently announced a pilot of the industry's first two-use envelope, an important step toward multi-use reusable packaging. The U.S. Postal Service offers the best paperboard envelope currently in widespread use -- a 100% recycled, 80% postconsumer fiber envelope. In contrast, FedEx's signature package -- its paperboard envelope -- is far behind on every environmental aspect considered. It contains almost 100% virgin bleached fiber and has a plastic document window attached.

Corrugated boxes offered by shipping companies differ among competitors predominantly in how much postconsumer recycled fiber content they contain and whether they use a bleached outer liner. On both accounts, Airborne Express's box excels -- it has an impressive 82% postconsumer fiber content, and has no bleached paper or coatings. Others, despite exceeding the national standard for recycled content, have room for improvement by increasing postconsumer recycled fiber content and eliminating the use of bleached paper. No company yet offers a box that is designed to be reused.

Plastic shipping envelopes vary somewhat in the type of plastic used and in the amount of postconsumer recycled content that they contain. The envelopes used by FedEx and the U.S. Postal Service have 25% postconsumer material. While these numbers are substantially lower than the numbers for paperboard, they are markedly better than the plastic envelopes offered by Airborne and UPS, which contain even lower amounts of recycled material.

For a detailed analysis of how different companies' individual packages compare environmentally, please see Appendix A beginning on page 19. A company-by-company comparison can be found on page 18.

REPORT METHODOLOGY

As a basis for gathering information for this report, a survey was sent to each of the five major overnight shipping companies -- Airborne Express, DHL, FedEx, UPS, and the U.S. Postal Service. The survey asked general questions about the companies and their environmental policies and programs. In addition, specific questions were asked about the functional and environmental specifications for each of the packages supplied by each company. A copy of the basic survey is included as Appendix B.

We received completed surveys back from four of the five companies -- Airborne Express, FedEx, UPS and the U.S. Postal Service. DHL declined to participate. We regret that DHL decided not to provide information about the environmental attributes of their packaging products. In the absence of their response, we have obtained the best available information from other sources, including package labels.

Much of the analysis of paperboard and corrugated shipping packages was done based on data from The Paper Task Force, a project of the Environmental Defense Fund, Duke University, Johnson & Johnson, McDonald's, The Prudential Insurance Company and Time, Inc. These data were used in conjunction with the survey results and additional research to produce the information, conclusions and recommendations below.²¹

PAPERBOARD

Basic Overnight Envelopes: Comparing the Alternatives

Reuse

The great majority of shipping envelopes currently in use are designed to be used only once. One notable and very recent positive exception is a new two-use envelope offered by UPS. This envelope, currently being test-marketed in the United States, is very similar to UPS's current paperboard envelope. It is made of 100% recycled (75% postconsumer) paper and water-based inks. After being used once, a second flap can be pulled out to allow the envelope to be resealed. The original shipping documentation removes easily because of a special coating on the envelope, allowing the address label to be replaced.

This change -- making an envelope that can be used more than once -- represents a significant step toward multiple-use reusable packaging. It is the first time that any overnight shipping company has offered a package that was designed for more than one use. Its benefits are immediately apparent: The cost savings for UPS, if the envelope gets used twice, could be as

high as 50%.²² The amount of packaging material used is cut in half -- a compelling source reduction. In addition to cost savings and waste reduction, the company expects to reap other business benefits, such as attracting additional customers who will find it convenient to reuse the envelope. As one example, the envelope is being piloted by mortgage firms, whose customers routinely immediately return the documents they receive.

Recycled Content & Bleaching

All of the basic overnight letter envelopes are made from some type of paperboard. They are sealed using a peel-and-stick adhesive and are opened by pulling an embedded string strip. Four of the five carriers have envelopes made from 100% recycled, clay coated fiber. The U.S. Postal Service leads the way in this category with an envelope that contains, at a minimum, 80% postconsumer recycled content. Not far behind, UPS's single-use envelope has 73% postconsumer content. According to Airborne, its overnight envelope has 50-100% postconsumer recycled material. The postconsumer fiber content of DHL's envelope is unknown.

In marked contrast to all of its competitors, FedEx's envelope is made almost entirely of virgin, solid bleached sulfate (SBS) paperboard. It contains less than 8% recycled content, none of it postconsumer. One possible reason for this is cost; in most cases adding recycled content to SBS paperboard makes it more expensive.²³

In some cases, the basis weight of recycled paperboard is higher than that of SBS in a given application. But, even in such cases, the high recycled content is preferable over the modest reduction in the total amount of material used. FedEx's bleached, mostly virgin content SBS envelope is not at all or only slightly lighter than other carriers' high postconsumer recycled content envelopes. The recycled envelopes are at most 5% heavier than FedEx's bleached alternative. Available data indicate that, pound for pound, the environmental releases and energy associated with making recycled stock are so much less than those used to make SBS that recycled paperboard is environmentally preferable even if it is up to 20% heavier.²⁴

One obstacle that is frequently identified when considering switching from virgin SBS paperboard to 100% recycled paperboard is appearance, specifically brightness. But the addition of a clay coating to recycled board in which the fiber is unbleached results in a product that is only slightly less bright than clay-coated SBS.²⁵ When the full scope of negative environmental effects of choosing bleached virgin paper over recycled paper is considered, the advantages of recycled paper clearly outweigh the disadvantages.

There are also cost savings to be realized as a result of changing from virgin SBS to 100% recycled paperboard. The price of recycled unbleached boxboard has consistently been lower than the price of bleached board since the early 1980's. Recycled board now costs about 30% less than bleached board, indicating that there are significant cost savings to be gained from moving away from bleached virgin board to 100% recycled paperboard envelopes.²⁶ Shipping customers can benefit, too, when these cost savings are passed on in the form of lower shipping prices.

The argument for an industry standard that matches the U.S. Postal Service's lead on postconsumer recycled content is a strong one, both environmentally and financially. According to recent research, among all grades of paper the environmental benefit is greatest when recycled paperboard is used to replace SBS paperboard. Recycled paperboard is preferable across all major environmental parameters: air and water pollutants emitted, energy and water consumed, and solid waste produced.²⁷

Recyclability

Paperboard envelopes have a poor record when it comes to recycling. Not only is it hard to find recyclers that will accept any type of paperboard (especially in small quantities), all of the overnight shipping envelopes we examined have contaminants that can interfere with recycling or significantly reduce the value of any recovered material and hence the economic viability of recycling. For example, the peel-and-stick adhesive used for closure can complicate or interfere with the recycling process.

Another contaminant is the plastic "document window" that is found on many paperboard envelopes. Both FedEx and DHL have this plastic window already attached to their envelopes. The plastic shipping window is an option with both UPS's and Airborne's paperboard envelopes. Plastic windows are not used at all on the U.S. Postal Service's paperboard envelopes. The alternative to using a plastic window is to have the shipping documents adhere directly to the envelope through an adhesive backing. This, too, can impede the recycling process if the adhesive used is not water-based.

What Can Be Done

There are many steps that can be taken in the short-term to improve the environmental profile of paperboard envelopes. These include increasing the minimum postconsumer recycled content to at least 80% of the total fiber content, and eliminating entirely the use of bleached virgin paper in the manufacture of paperboard envelopes. In addition, to make the envelopes as easily recyclable as possible, plastic document windows should be eliminated and water-based adhesives should be used.

There are significant decreases in release of pollutants, as well as energy and water use, when 100% recycled paperboard is used rather than virgin bleached paperboard to make envelopes. For example, moving from an envelope like the one that FedEx currently uses (predominantly virgin SBS) to an envelope with the characteristics of the US Postal Service's envelope (100% recycled, 80% postconsumer fiber content) results in the following benefits for the environment:

- 39% fewer net “greenhouse gases” that contribute to global warming.
- A 75% reduction in hazardous air pollutants.
- Less than one-fifth as much water consumption.
- Half the energy use.

QUICK HITS

- #1 - Increase Minimum Postconsumer Recycled Content to 80%**
- #2 - Eliminate Bleaching of Virgin Paper in Paper Envelopes**
- #3 - Eliminate Plastic Windows on Paper Envelopes**
- #4 - Use Water-Based Adhesives**
- #5 - Expand the Use of Reusable Envelopes**

CORRUGATED CONTAINERBOARD

Shipping Boxes: Comparing the Alternatives

Reuse

While corrugated board is recycled at a high rate (see below), it would be preferable for boxes to be reused a number of times before they are recycled. Like virtually all overnight shipping envelopes, all shipping boxes are designed for only one use. Once the adhesive bond that seals the box is broken, it is not designed to be resealed again. Nor is there a means to replace the shipping documentation, even if the box were resealed by the user.

Recycled Content

Between 1990 and 1996, the average total recycled content used in all corrugated boxes produced in the U.S. increased from 26% to 46%. Most of the recovered fibers were from postconsumer materials.²⁸ Four of the five shipping companies we surveyed exceed this

benchmark with their corrugated boxes. Airborne leads the pack with boxes that contain 82% recycled content, all of which is postconsumer fiber. The U.S. Postal Service's Express Mail boxes have 71% total, and 48% postconsumer, recovered material. FedEx's and UPS's basic boxes have 61% recycled content, with 50% postconsumer content. FedEx has another, less frequently used, unbleached box -- its brown "Other Packaging" box -- which recently increased to 100% recycled, 75% postconsumer fiber content.

UPS has other corrugated boxes that are made with 43% and 53% recycled content (the Hard Pak and Tube respectively), all of it postconsumer material. DHL's Express Box is labeled as containing 40% recycled material, below the 46% national average for recycled content. The label on DHL's box does not specify the postconsumer content.

The functional performance of corrugated containerboard is much more a matter of individual mill technology than fiber type. Depending upon the mill that makes the containerboard, boxes made from as much as 100% recycled material can have the same compression strength performance as virgin corrugated boxes. Other mills may not be capable of producing boxes with recycled content without compromising compression strength.²⁹ Boxes are currently manufactured with 100% postconsumer fiber that meet the strength (e.g. edge crush test) specifications for overnight shipping boxes. Boxes made using 100% postconsumer content for the inner liners and medium (i.e. about two-thirds of the total box weight) routinely pass the required tests. However, strength considerations may limit the amount of recycled content in the outer liner. Because wood fibers tend to become shorter as they are recycled, there is some loss of strength in the resulting paper. New mill technology may deal with most of these issues by separating out more of the short fibers or by creating high-performance board, most often by a manufacturing process that arrays fibers perpendicular to one another. Another common option to deal with shorter recycled fibers is to retain some virgin kraft content in the outer liner in order to maintain the functional integrity of the shipping boxes.

Bleaching

Neither Airborne Express, DHL, nor the U.S. Postal Service use bleached paper in their basic shipping boxes. Indeed, the box used by Airborne is uncoated, increasing the ease with which it can be recycled. In contrast, FedEx and UPS use boxes in which the outer layer of linerboard is bleached white and coated. One of the boxes supplied by FedEx but used infrequently is unbleached and uncoated -- their brown "Other Packaging" box. There are enormous environmental benefits in moving away from a bleached virgin upper liner toward an unbleached recycled alternative. At the very least, a large environmental gain can be made in moving completely away from a bleached outer liner to an unbleached one, such as Airborne and DHL already have.

The marketing concerns regarding the brightness of shipping boxes are similar to those encountered with paperboard envelopes. The alternatives to using a bleached top layer are an unbleached upper liner with or without coating. Not using a coating produces a very natural looking brown box. On the other hand, clay coating can be used on the upper liner to achieve a white package that is almost as bright as a bleached one, similar to what is currently achieved with

100% recycled paperboard envelopes. Again, the advantages of the environmentally preferred alternative -- unbleached, coated paper -- significantly outweigh the disadvantages.

Source Reduction

There may be opportunities for source reduction in shipping boxes without compromising their functionality. The design of the box itself may afford some room for reducing the amount of fiber used in fabrication. For example UPS redesigned the flaps of its basic Express box, reducing the amount of material by 9%. In addition, UPS has achieved additional lightweighting of the box by reducing the total weight and fiber amounts. Likewise, Airborne has removed unnecessary flaps from boxes and changed the fluting size on its boxes. These changes save environmental resources *and* save money for the company.

Recyclability

As described above, corrugated cardboard is currently the most commonly recycled paper product, recovered at a rate of 70% in 1995.³⁰ In practical terms it is much more easily recyclable than paperboard or plastic envelopes. Commercial recovery of containerboard is especially well-established, although expansion into the residential sector is also slowly occurring.

What Can Be Done

There are some straightforward opportunities to improve the environmental profile of corrugated shipping boxes. These include increasing the postconsumer recycled content to 65% of the total fiber content and eliminating bleached paper in the outer liner. Finally, with no reusable boxes available in the marketplace, there is clearly potential to create a new market niche while at the same time substantially reducing environmental impacts.

When a comparison is made between a box with Airborne's environmental characteristics (82% postconsumer recycled fiber, the rest unbleached kraft fiber) versus one with FedEx or UPS's characteristics (50% postconsumer recycled fiber, 33% virgin bleached fiber, and 17% unbleached virgin kraft fiber), the environmental benefits are remarkable. There are notable reductions in solid waste, release of pollutants, and energy and water use, including:

- 40% less solid waste.
- A 64% reduction in water consumption.
- Over 50% fewer volatile organic compounds.

QUICK HITS

- ☑ #6 - Increase Postconsumer Recycled Content of Boxes to at Least 65%
- ☑ #7 - Eliminate Bleached Paper in Outer Liner of Boxes
- ☑ #8 - Explore Options for Creating Reusable Boxes

PLASTIC

Plastic Envelopes: Comparing the Alternatives

Reuse and Recycled Content

Plastic shipping envelopes, like their paperboard counterparts, are designed to be used only once. But, unlike paperboard, the plastic envelopes supplied by the overnight shipping industry are uniformly low in recycled content. The Tyvek[®] envelopes used by the United States Postal Service and FedEx contain 25% post consumer recycled high-density polyethylene (which, as they note on their label, is derived from recovered water and milk bottles). The Padded Pouch from Airborne Express contains only 10% recycled content, all of it postconsumer, while Airborne's other plastic envelope, the Express Pack, contains 10-20 % postconsumer recycled content. Finally, UPS's plastic envelopes have the least recycled content. The Next Day Poly Pak and the Pad Pak each contain up to 10% recycled material, none of it postconsumer. The company survey response that its envelopes contain "up to 10% recycled" material suggests that they may often have less or even no recycled content.

Source Reduction

Plastic envelopes have the advantage of being lighter than their paperboard counterparts, which saves on transportation costs, fuel use and vehicle emissions. In addition, plastic envelopes have some desirable functional characteristics relative to paper. They usually have higher burst and tear strengths than paper and are water resistant, although they provide less rigidity. Often, because of the strength characteristics of plastic, there are opportunities for source reduction by reducing the thickness, or gauge, of the plastic. Airborne Express has done that with the envelopes that their company provides to its customers, offering a lighter envelope that saves resources while maintaining functionality.

Recyclability

Like paperboard envelopes, plastic envelopes are in practice difficult or impossible to recycle, given the very limited recycling infrastructure currently in place for such materials. Manufacturers of both types of plastic envelopes used by overnight shipping companies have

indicated they will take their products back to be recycled, but these programs have an extremely limited reach. The reality is that few recyclers accept Tyvek® or layered film polyethylene envelopes, and if they do they often will only accept large quantities.

Some Tyvek® envelopes have the potential to cause problems within the recycling system. Tyvek® is made out of spun oleoresin, a form of high-density polyethylene. Given this type of fabrication, if the envelope is predominantly white, it has an appearance similar to white paper. This opens the possibility that they will become mixed in with office paper for recycling. When this happens, Tyvek® envelopes can damage recycled papermaking systems.³¹ Of the two overnight shipping companies that use Tyvek® envelopes -- FedEx and the U.S. Postal Service -- some of the envelopes used by FedEx are predominantly white.

What Can Be Done

Plastic envelopes have much room for improvement regarding the amount of recycled material, especially postconsumer content, that they utilize. In the short-term, the postconsumer recycled content should be increased to at least 30% of the total material content. Additionally, lightweighting opportunities may be available and should be thoroughly investigated.

QUICK HITS

- #9 - Increase Postconsumer Recycled Content of Plastic Envelopes to at Least 30%**
- #10 - Explore Source Reduction Opportunities, Especially Lightweighting**

COMPANY COMPARISON

All of the overnight shipping companies have room for improvement in their packaging. No one company excels in every category of packaging -- opportunities remain for all five major shipping firms, even though several have made efforts to excel environmentally, in packaging and in other areas of their business. Because DHL chose not to provide us with information, the environmental profile of their packaging is less certain and we are unaware of environmental initiatives they have undertaken. Partly due to this lack of information, DHL compares relatively poorly to its competitors. The table below summarizes the comparative positions of the companies, detailing areas where they have excelled and areas where change is needed.

The U.S. Postal Service has made a number of broad-based efforts to improve the environmental profile of its packaging. Thus, it compares favorably in all of the categories of packaging considered, especially the basic paperboard envelope. UPS is the leader in introducing a reusable shipping envelope and they compare favorably in most other categories, except for plastic envelopes. Airborne Express is the leader in corrugated boxes, with theirs having the highest postconsumer recycled content with no bleached paper or coatings. FedEx, on the other hand, trails behind; most notably because it is the only major overnight shipping company to use a paperboard envelope that is both bleached and contains no postconsumer recycled content.

RESULTS OF ANALYSIS & RECOMMENDATIONS

Company	<ul style="list-style-type: none"> ✓ = Shows Leadership in This Area ✗ = Opportunities for Improvement
USPS	<ul style="list-style-type: none"> ✓ Leader in currently-used basic paperboard envelope - high postconsumer recycled content, no plastic window, no bleached paper ✓ Relatively high postconsumer recycled content in plastic envelopes ✗ Increase postconsumer recycled content in corrugated boxes ✗ Increase postconsumer content in plastic envelopes
UPS	<ul style="list-style-type: none"> ✓ Leader in piloting the industry's first two-use envelope - high postconsumer recycled content, no plastic window, no bleached paper ✓ High postconsumer recycled content in paperboard packages ✗ Increase postconsumer content in basic corrugated box ✗ Increase recycled content in plastic envelopes ✗ Eliminate use of bleached paper in corrugated boxes
Airborne	<ul style="list-style-type: none"> ✓ Leader in basic corrugated box - high postconsumer recycled content, no bleached paper or coating on corrugated boxes ✗ Increase postconsumer recycled content in paperboard envelopes ✗ Increase postconsumer recycled content in plastic envelopes
FedEx	<ul style="list-style-type: none"> ✓ Relatively high postconsumer recycled content in plastic envelopes ✗ Shift from SBS to 100% recycled, unbleached paperboard envelopes ✗ Increase postconsumer content in corrugated boxes ✗ Eliminate plastic window in paperboard envelopes ✗ Eliminate use of bleached paper in corrugated boxes
DHL	<ul style="list-style-type: none"> ✓ No bleached paper used in corrugated boxes ✗ Increase postconsumer recycled content in corrugated boxes ✗ Eliminate plastic window on paperboard envelopes

APPENDIX A

Environmental Comparisons of Similar Products:

BASIC ENVELOPE

Company	Paper Grade	Recycled Content	Postconsumer Content - % of total	Bleached Paper & Coatings	Window	Recyclable?
USPS Express Mail	Clay Coated Newsback	100%	80% min.	Not bleached/Outer coating	No Plastic Window	Possible, but unlikely given current limited infrastructure
UPS Next Day Letter	Clay Coated Newsback	100%	73%	Not bleached/Outer coating	Plastic Window Optional	Possible, but unlikely given current limited infrastructure
Airborne Letter Express	Clay Coated Newsback	100%	50-100%	Not bleached/Outer coating	Plastic Window Optional	Possible, but unlikely given current limited infrastructure
DHL Express Document	Clay Coated Newsback	100%	Unknown	Not bleached/Outer coating	Plastic Window	If window is removed possible, but unlikely given current limited infrastructure
Fed Ex Overnight Letter	Solid Bleached Sulfate (SBS)	Less than 8%	None	Bleached/Outer coating	Plastic Window	If window is removed possible, but unlikely given current limited infrastructure



✓ = Best choice



= Reason for selection

PLASTIC ENVELOPE*

Company	Plastic Type	Recycled Content	Postconsumer Content	Recyclable?
Fed Ex Tyvek® Pak	High Density Polyethylene Tyvek®	25%	25%	Possible, but unlikely given current limited infrastructure
USPS Express Tyvek® Envelope	High Density Polyethylene Tyvek®	25%	25%	Possible, but unlikely given current limited infrastructure
Airborne Express Pack	Layered Polyethylene	10-20%	10-20%	Possible, but unlikely given current limited infrastructure
DHL Express Flyer	Unknown	Unknown	Unknown	Possible, but unlikely given current limited infrastructure
UPS Next Day Poly Pak	Layered Polyethylene	10% or less	None	Possible, but unlikely given current limited infrastructure

 = Best choice
  = Reason for selection

* The Alliance has not undertaken an in-depth study to compare the production processes of various plastic products. Thus, our analysis and selections are based on postconsumer recycled content alone.

BASIC BOX



Company	Paper Grade	Recycled Content	Postconsumer Content - % of total	Bleached Paper & Coatings	Recyclable?
Airborne Express Pack	Corrugated	82%	82%	Not bleached/ No coating	Yes
USPS Express Mail Box	Corrugated	71%	48%	Not bleached/ Outer coating	Yes
Fed Ex Overnight Box	Corrugated	61%	50%	Top layer of linerboard is bleached & coated	Yes
UPS Express Box	Corrugated	61%	50%	Top layer of linerboard is bleached & coated	Yes
DHL Express Box	Corrugated	40%	Unknown	Not bleached/ Outer coating	Yes

✓ = Best choice



= Reason for selection

SHIPPING TUBE

Company	Paper Grade	Recycled Content	Postconsumer Content - % of total	Bleached Paper & Coatings	Recyclable?
UPS Tube	Corrugated	53%	53%	Top layer of linerboard is bleached & coated	Yes
Fed Ex Tube	Corrugated	27%	13%	Top layer of linerboard is bleached & coated	Yes



✓ = Best choice  = Reason for selection

PADDED PLASTIC ENVELOPE

Company	Plastic Type	Recycled Content	Postconsumer Content	Recyclable?
Airborne Padded Pouch	Layered Polyethylene	10%	10%	Possible, but unlikely given current limited infrastructure
UPS Pad Pak	Layered Polyethylene	10% or less (outer layer)	None	Possible, but unlikely given current limited infrastructure

No ✓ = Neither is a best choice

APPENDIX B

Environmental Benefits: Some Examples

The potential environmental benefits of improving current shipping packages are significant. Analysis of the two most common forms of shipping packages, paperboard envelopes and corrugated boxes, reveals some remarkable benefits of choosing environmentally-preferable packaging over the current alternative. These are changes that can produce positive results both for the environment and for a company's bottom line.

The analyses presented below compare a current package with a recommended alternative. For each package, energy use, water use and environmental releases across the lifecycle of the package are considered.³² The paperboard envelope analysis compares the worst of the class, a totally virgin bleached envelope, to the best of the class, an 80% postconsumer recycled envelope. The second analysis, of corrugated boxes, compares a box that is superior in its category (82% postconsumer recycled content and no bleached upper liner) to the box that is used by two large shipping companies (50% postconsumer recycled content with a bleached upper liner). Both of these analyses demonstrate the tremendous environmental benefits to be gained by simply meeting current best practices.

Paperboard Envelopes

The table below compares 100,000 FedEx bleached virgin envelopes* to 100,000 of the U.S. Postal Service's 80% postconsumer recycled paperboard envelopes.

PAPERBOARD ENVELOPES

Environmental Releases ³³ (per 100,000 envelopes)	FedEx 100% virgin bleached paperboard	USPS 80% post consumer recycled paperboard	Difference	Percentage decrease between #1 and #2
Total Energy Usage (MMBTU)	199	103	95	48%
Air Emissions (lbs)				
Net Greenhouse Gases	28,209	17,172	11,037	39%
Nitrogen Oxides	93.3	66.4	27	29%
Particulates	59	36	23	39%
Sulfur Oxides	131	106	25	19%
Hazardous Air Pollutants	12	3.3	9	75%
Volatile Organic Compounds	28.7	11.8	17	59%
Water Emissions (lbs)				
Biochemical Oxygen Demand	31	13	18	58%
Chemical Oxygen Demand	408	52.3	356	87%
Suspended Solids	49	13.6	35	71%
Effluent Flow (gal)	103,346	19,888	83,452	81%
Solid Wastes (lbs)	11,075	4,425	6,650	60%

* The FedEx envelope contains less than 8% recycled content, none of which is postconsumer. The actual amount of preconsumer recycled content is unknown, and may be as low as zero. For this reason, this analysis is based upon 100% virgin SBS paperboard and therefore may slightly overstate the environmental benefits.

Corrugated Boxes

The table below compares the Airborne corrugated box to the UPS Express box or the FedEx box (the latter two have the same environmental profile.) The UPS or FedEx box contains 50% postconsumer recycled fiber, 33% virgin bleached fiber, and 17% unbleached virgin kraft fiber, while Airborne's box contains 82% postconsumer recycled fiber and the remainder unbleached kraft fiber.

CORRUGATED BOXES

Environmental Releases (per 100,000 boxes)	UPS or FedEx 50% post consumer recycled 33% virgin bleached 17% unbleached kraft	Airborne 82% post consumer recycled 18% unbleached kraft	Difference	Percentage decrease between #1 and #2
Total Energy Usage (MMBTU)	1,107	822	280	25%
Air Emissions (lbs)				
Net Greenhouse Gases	177,552	145,716	31,837	18%
Nitrogen Oxides	601	518	83	14%
Particulates	327	246	82	25%
Sulfur Oxides	935	877	58	6%
Hazardous Air Pollutants	62	32	31	49%
Volatile Organic Compounds	134	66	68	51%
Water Emissions (lbs)				
Biochemical Oxygen Demand	182	148	34	19%
Chemical Oxygen Demand	1,096	n/a	n/a	n/a
Suspended Solids	210	103	107	51%
Effluent Flow (gal)	385,028	136,955	248,073	64%
Solid Wastes (lbs)	54,172	32,283	21,889	40%

APPENDIX C

Environmental Packaging Practices Survey

1. Does your company have an environmental affairs division?
If so, may we have the name of a contact person and a phone number?
Name: _____ Number: _____

2. Does your company have an environmental staff or committee that considers strategies to reduce waste and environmental impact?
If so, may we have the name of a contact person and a phone number?
Name: _____ Number: _____

3. Could you provide us with copies of your company's annual report and any environmental reports?

4. Does your company have an environmental policy? If so, could you provide us with a copy of the policy?

5. Does your company have general environmental specifications for all packaging? If so, what are they?

6. Please describe the nature of your supply network for packaging materials (names of suppliers, location of packaging operations, etc.).

7. Do you offer recycling programs for your packaging materials? Do you have programs to collect or facilitate the collection of used packaging materials, either at your outlets or through other means? Please describe.

8. Please describe steps you have taken to:
a) Reduce the amount of material used in your packaging; _____

-
-
- b) Replace single-use with reusable materials; _____

- c) Increase the use of recycled materials in your packaging, including post-consumer recycled materials;____

- d) Enhance the ability of your packaging to be recycled after use; _____

- e) Otherwise use materials the production or disposal of which has reduced environmental impact; _____

- f) In any other way address environmental concerns associated with your packaging.

Specific Questions

1. Approximately how many new shipping boxes and envelopes are supplied to customers each year? ____

2. What kinds of containers are used to collect and transport overnight packages and letters?

Overnight Document Envelope

1. What are the functional requirements and/or specifications for the Overnight Document Envelope?
 (Please indicate actual numeric specifications where appropriate)
- Size _____
 - Strength/rigidity _____
 - Durability _____
 How long is the envelope designed to be used? _____
 - Reusability - Is the envelope designed to be reused? **Yes** or **No**
 If so, how many times? _____

- Protection against moisture_____
- Other product protection features_____
- Ability to be automatically sorted_____
- Visual_____
- Other (please specify)_____

What are the environmental attributes of the Overnight Document Envelope? Which of these are codified in specifications? Specifically:

- What is the paper grade of this envelope?_____
- What is the recycled content?_____
- How much of the recycled content is post-consumer?_____
- Is the paper bleached? **Yes** or **No**
- Is it coated or uncoated?_____
- What adhesive is used?_____
- What type of printing method is used? (e.g. lithography, flexography, etc.)_____
- What type of material is the clear window made from?_____
- Is the envelope recyclable? **Yes** or **No**
- What recycling programs do you have for this envelope?_____

Plastic Envelope

2. What are the functional requirements and/or specifications for the Plastic Envelope? (Please indicate actual numeric specifications where appropriate)

- Size_____
- Strength/rigidity_____
- Durability_____
- How long is the envelope designed to be used?_____
- Reusability - Is the envelope designed to be reused? **Yes** or **No**
If so, how many times?_____
- Protection against moisture_____
- Other product protection features_____
- Ability to be automatically sorted_____
- Visual_____
- Other (please specify)_____

What are the environmental attributes of the Plastic Envelope? Which of these are codified in specifications? Specifically:

- What type of material is it made from? _____
- What is the recycled content? _____
- How much of the recycled content is post-consumer? _____
- What is the outer white layer made of? _____
- What is the inner gray layer made of? _____
- What type of printing method is used? (e.g. lithography, flexography, etc.) _____
- What adhesive is used? _____
- What type of material is the clear window made from? _____
- Is the package recyclable? **Yes** or **No**
- What recycling programs do you have for this envelope? _____

Overnight Box

3. What are the functional requirements and/or specifications for the Overnight Box? (Please indicate actual numeric specifications where appropriate)

- Size _____
- Strength/rigidity _____
- Durability _____
How long is the box designed to be used? _____
- Reusability - Is the box designed to be reused? **Yes** or **No**
If so, how many times? _____
- Protection against moisture _____
- Other product protection features _____
- Ability to be automatically sorted _____
- Visual _____
- Other (please specify) _____

What are the environmental attributes of the Overnight Box? Which of these are codified in specifications? Specifically:

- What is the paper grade of this package? _____
- What is the recycled content? _____
- How much of the recycled content is post-consumer? _____
- Is the paper bleached? **Yes** or **No**
- Is it coated or uncoated? _____
- What type of printing method is used? (e.g. lithography, flexography, etc.) _____
- What type of material is the document window made from? _____
- Is the package recyclable? **Yes** or **No**

- What recycling programs do you have for this box? _____

Thank you for completing the survey!

ENDNOTES

¹ From The Paper Task Force, p. 71: "Postconsumer recycled content refers to 'products or other materials generated by a business or consumer that have served their intended end uses and that have been recovered or otherwise diverted from the solid waste stream for the purpose of recycling.' (Federal Register 49992, October 2, 1991). In other words, postconsumer materials are finished products that are collected from homes or places of work."

² Franklin Assoc. Ltd., *Characterization of Municipal Solid Waste in the United States: 1996 Update*, p. 36.

³ *Ibid.*, p. 68.

⁴ *Ibid.*, p. 31. Negligible in this case means less than 5,000 tons per year or 0.05%.

⁵ RW Beck, 1995. PET is polyethylene terephthalate and HDPE is high-density polyethylene.

⁶ Franklin Assoc. Ltd., *Characterization of Municipal Solid Waste in the United States: 1996 Update*, p. 41.

⁷ Analysis based on data from the Paper Task Force. Net greenhouse gases includes CO₂ emissions from combustion of fossil fuels and methane emissions from landfills. This figure does not include emissions of CO₂ from burning wood-derived materials, as this does not result in a net increase of greenhouse gases because the materials are derived from trees that absorbed an equivalent amount of CO₂ while growing (Paper Task Force, p. 80).

⁸ See Endnote 33 for a detailed description of environmental releases.

⁹ *Environmental Packaging*, Jan. 1997, Vol. 5 No. 8.

¹⁰ COPE: WAVE VIII National Consumer Survey, done by Environmental Research Associates, p. 4, Executive Summary.

¹¹ *Environmental Packaging*, Jan. 1997, Vol. 5 No. 8.

¹² *Environmental Values in American Culture*, p. 211.

¹³ *Ibid.*, p. 196.

¹⁴ *Ibid.*, p. 212.

¹⁵ A study of reusable shipping systems, *Delivering the Goods: Benefits of Reusable Shipping Containers*, by INFORM found cost savings in the areas of packaging, disposal, and product damage due to shipping and handling. p. 2.

¹⁶ *Ibid.*, p. 2. This study focused on a number of reusable shipping container systems. Many of its findings are directly applicable to the overnight shipping industry.

¹⁷ *Delivering the Goods: Benefits of Reusable Shipping Containers*, INFORM, 1994 p. 7.

¹⁸ Paper Task Force, p.66.

¹⁹ Resource Information Systems, Inc., July 1997. These numbers are based on actual transaction prices.

²⁰ Paper Task Force White Paper # 9, p. 16.

²¹ Paper Task Force Recommendations for Purchasing and Using Environmentally Preferable Paper, Final Report, 1995.

²² Apart from research and development costs, the envelope itself is very similar to the current envelope. The additional cost of producing the envelope derives from the extra flap and the coating on the documentation area, perhaps a 2 to 5% increase.

²³ Paper Task Force White Paper #9, p. 18.

²⁴ *Ibid.*, p. 100.

²⁵ Brightness for clay-coated SBS is anywhere from 80 to 86 GE brightness which is a percentage scale comparison against the 100% reflective ability of magnesium oxide. The brightness of recycled board, on the other hand, is in the high 70s. Paper Task Force White Paper # 6B, p. 15. In the same white paper, on page 17, the experience Eastman Kodak Co. and how it dealt with switching from virgin paperboard to recycled is detailed. The company required that its packaging reproduce precisely the correct hue of its trademark gold and red. Considering this critical to point-of-purchase sales and worrying that if its packaging looked recycled, it would imply that its film was of poor quality, the company worked to find a source of 100% recycled paperboard that would hold colors exactly.

²⁶ Resource Information Systems, Inc., July 1997. These numbers are based on actual transaction prices.

²⁷ Paper Task Force, p. 99.

²⁸ Paper Task Force White Paper # 6A and the American Forest and Paper Association.

²⁹ *Ibid.*, p. 16.

³⁰ *Recovered Paper Statistical Highlights 1996 Edition*, American Forest and Paper Association, p. 15.

³¹ Plastic envelopes can clog pumps and screens in deinking systems. Paper Task Force, p. 75.

³² Analysis based on data from the Paper Task Force.

³³ Environmental releases include the following:

- Total energy usage measures the energy demand of the process equipment to produce a ton of pulp or paper. The unit of measurement is millions of BTU's per ton of final product.
- Net greenhouse gases is a measurement of the releases of carbon dioxide (CO₂)
- Particulates are small particles that are dispersed into the atmosphere during combustion. The ash content of a fuel determines the particulate generation upon combustion.
- Hazardous air pollutants (HAPs) are a group of 189 substances identified in the 1990 Clean Air Act Amendments because of their toxicity.
- Volatile organic compounds (VOCs) are a class of organic gases, such as vapors from solvents. VOC emissions react with nitrogen oxides (NO_x) to form ground-level ozone, the major component of smog.
- Biochemical oxygen demand (BOD) measures the amount of oxygen that microorganisms consume to degrade the organic material in the effluent. Discharging effluent with high levels of BOD can result in the reduction of dissolved oxygen in the receiving waters, which can adversely affect aquatic life.
- Chemical oxygen demand (COD) measures the amount of oxidizable organic matter in the effluent. It measures the quantity of organic waste discharged from the bleach plant as well as any spills.
- Total Suspended Solids (TSS) measure the amount of debris such as wood fiber and dirt that is present in mill effluent. TSS can physically cover and smother stationery plants and animals.