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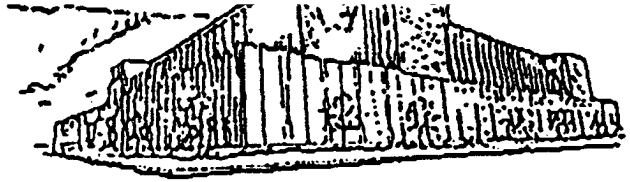
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**BARRIERS TO SOLID WASTE REDUCTION**  
**IN SMALL BUSINESSES:**  
**THREE CASE STUDIES**

by

Amy Shaw

B.S. Miami University, 1991

presented in partial fulfillment of the requirements

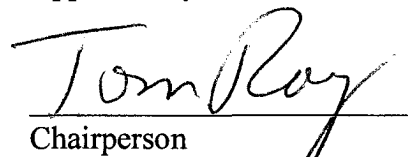
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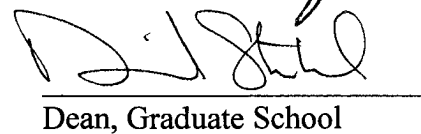
Master of Science

The University of Montana

1996

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## CHAPTER ONE

### INTRODUCTION

"Pollution Prevention Pays," "Waste Reduction Makes Cents," and "Wastewi\$e" are phrases representative of a recent trend in environmental management. They are slogans coined over the past ten years by industries and government to promote the idea that waste reduction<sup>1</sup> yields economic benefits for business and industry. This concept has increasingly appeared in industry trade journals, United States Environmental Protection Agency (U.S. EPA) publications, and a collection of books published in the early 1990s on eco-management. These slogans appear to have been embraced by businesses, the regulatory community and, to some extent, environmental organizations.

The early 1990s saw an array of books published on the subject of "greening business." These books, bearing titles

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<sup>1</sup> For the purpose of this paper, the term "waste reduction" encompasses both source reduction (decreasing the initial production of waste materials at their point of origin) and recycling (the systematic collection, sorting, and returning of waste materials to commerce for use or exchange).

such as Greening Business: Profiting the Corporation and the Environment (Shrivastava 1996) and Going Green: How To Communicate Your Company's Environmental Commitment (Harrison 1993), are written to teach business managers how to turn "environmental problems" into "competitive opportunities" using pollution prevention and waste reduction (Denton 1994, 11). Similar articles have appeared in business periodicals and trade publications, including Purchasing (Oct 20, 1994), Public Relations Journal (April 1991), and Office Systems (March 1991).

The regulatory community has embraced the concept that economics can motivate business to become environmentally friendly. In 1994, Cathy Zoi, then Deputy Director and Chief of Staff for the President's Council on Environmental Quality, said that one of the Clinton Administration's four general principles in environmental policy is forming "...partnerships that will protect the environment more efficiently and at less cost ... to encourage innovation and harness the technical ingenuity that exists in dynamic companies and environmental organizations" (Orti and Edelman 1995, 9). This represents a shift away from command and control environmental regulations to an incentive-based



approach.

The United States Environmental Protection Agency is also promoting this new approach. A U.S. EPA publication states: "As industries begin to understand the economic as well as the environmental benefits of pollution prevention, they will champion prevention on their own" (U.S. EPA 1993, 28). The U.S. EPA's campaign to promote waste reduction in business is entitled "Wastewise," suggesting that reducing waste yields fiscal rewards.

Several national environmental groups have formed alliances with industry to promote waste reduction. Douglas Hall, director of communications for the Nature Conservancy, contends that

"Smart companies know that environmental concerns will continue to affect their work (and customer base) far into the future. Smart nonprofits need to put more trust in the longevity of their issues by demanding quality and diversity in their relationships with corporations ... Just as we continue to need advocacy groups to push agendas of both industry and the environment, we increasingly need groups who can act strategically as catalysts for a truer greening of business" (Bennett et al 1993, 136).

Kathryn Fuller, president of the World Wildlife Fund concurs that "...while still not abandoning their vital role as environmental advocates, groups like the World Wildlife

Fund are exploring ways to work with corporations to make sure that business ventures respond to environmental concerns" (Bennett et al 1993, 136).

The most publicized example of this cooperation between an environmental organization and a large company is the partnership between the Environmental Defense Fund and the McDonald's Corporation. The two organizations jointly commissioned a study examining McDonald's waste stream and, subsequently, developed a plan to reduce the amount of waste generated and disposed at its 8,500 restaurants (Sullivan 1992, 4). Prior to this joint effort, the McDonald's Corporation had received negative publicity concerning its solid waste management practices, particularly the extensive use of polystyrene packaging (Sullivan 1992, 5). The waste reduction plan was initiated in April 1991 and, by 1993, McDonald's was diverting 80 percent of its total waste stream through recycling, reuse, source reduction and composting (Shrivastava 1996, 191).

Business, governments, and many environmental groups are promoting waste reduction in businesses by pointing out the potential bottom-line benefits. The multitude of books, articles and government publications on this subject cite

the experiences of a handful of multinational corporations including 3M, Proctor & Gamble, Dupont and Dow Chemical as examples of the impressive economic benefits resulting from waste reduction activities. What these testimonials do not demonstrate is whether smaller companies can also experience these economic benefits.

#### **SMALL COMPANIES AND WASTE REDUCTION**

Very little comparative data is available on the solid waste generation of small companies, perhaps because the practice of tracking solid waste statistics is relatively new. The majority of information compiled to date has been categorized by industry type rather than size. It is, therefore, difficult to determine what percentage of the nation's solid waste stream is generated by small businesses. However, the relative number of small businesses in the United States suggests that they contribute a significant portion of the industrial solid waste stream.

For example, Cincinnati, Ohio has a broad industrial base and is home to a number of large corporations including Proctor & Gamble and divisions of General Electric and Ford Motor Company. These companies, however, are vastly

outnumbered by smaller industries. In the Greater Cincinnati area, 98% of industries have fewer than 500 employees (1996 Harris Industrial Selectory). This ratio of small to large businesses is reflective of similar proportions found across the United States. In the United States, 99.7% of businesses are "small businesses<sup>2</sup>" (United States Small Business Administration 1994, 34). The individual contributions of these small companies to the waste stream may be minor compared to a company the size of Proctor & Gamble or General Electric. However, considering the relative number of companies with under 500 employees, reducing the waste stream of small businesses is essential to significantly reducing the area's overall solid waste stream.

Small companies' contribution to the waste stream is clear; their ability to benefit financially from waste reduction, however, is less certain. Small companies differ from large companies in more ways than just the number of

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<sup>2</sup>There is not a clear definition of what is meant by "small company" in the literature. The United States Small Business Administration uses employment data as a basis for categorization, with companies having fewer than 100 or 500 employees defined as small depending on the context. It has been argued that this definition should be more flexible and take into context the type of business being categorized (United States Small Business Administration 1991, 19). For the purpose of this paper, a small company will be defined by having fewer than 500 employees.

employees. These differences often derive from a limited access to resources such as capital, time, managerial talent and information.

In general, small companies dominate industries that are low in capital and are labor intensive (Solomon 1986, 31). They have less access to technology and computerization than larger firms and allocate less time for training (Holliday 1995, 11-15). The structure of small companies also makes them different than larger firms. Small companies generally have fewer management layers and are more flexible than their larger counterparts (Solomon 1986, 21). Smaller companies are often closer to the marketplace than larger firms and must be prepared to react to changes (Solomon 1986, 43). This adaptability may be behind the innovative nature of small firms. A study by the United States Small Business Administration found that small firms produce twice as many innovations per employee as large firms (United States Small Business Administration 1994, 15).

These characteristics of small companies may affect their ability to experience economic benefits from waste reduction. For example, studies of the hazardous waste

management practices of small business found that they "typically have fewer financial resources to invest in staff devoted to nonproductive functions such as waste management" (Deyle 1989, 5). Because solid waste is not regulated to the same extent as hazardous waste, there is even less incentive to invest in solid waste reduction. Also, small companies individually generate smaller volumes of waste material. Since locating recycling markets for small quantities of a material is more difficult and the market price is generally lower, small companies may find recycling to be uneconomical. A survey performed by the Gallup Organization of U.S. businesses found that 75 percent of companies with at least 250 employees have recycling policies versus 62 percent of smaller companies (Solid Waste Report 1995, 142). If small companies are limited in their ability to implement waste reduction cost-effectively, encouraging small businesses to reduce waste by promoting economic benefits may be ineffectual or inappropriate.

To further identify issues that affect the feasibility of waste reduction in small companies, three case studies are presented. The case studies involve three companies located in the Greater Cincinnati area with fewer than 500

employees. Each of the companies' waste management practices were analyzed, their waste streams quantified, and waste reduction opportunities identified and evaluated for cost-effectiveness. The results of the waste assessments are not intended to be representative of all small companies. However, these three case studies aid in identifying obstacles and opportunities facing small companies considering waste reduction programs.

Chapter two of this study will review the potential benefits of business waste reduction to the environment, the public sector, and to the businesses themselves. Chapter three reports the results of each of the case studies and discusses similarities and differences in these results. Chapter four concludes this study with a discussion of the opportunities for the public and private sector to aid small businesses in the common goal of waste reduction.

## CHAPTER TWO

### BENEFITS OF WASTE REDUCTION

Economist Milton Friedman argues that a company's primary responsibility is to earn a profit. By doing so, Friedman suggests, the company satisfies its social obligations (Judd, Greenwood, Becker 1988, 182). Following this logic, allocating resources for environmental improvements or anything other than profitable investments is inappropriate.

Many environmentalists, in contrast, want businesses to move toward a more sustainable mode of operation and devote more attention to the long term interests of the communities in which they operate. Barry Commoner wrote, "to create an ecologically sound, sustainable economy will require sweeping changes in the major systems of production" (Cohen and O'Connor 1990, xvii).

These divergent philosophies put businesses and environmentalists on opposite sides in battles over wetlands, endangered species preservation, and other



environmental issues. But, to some extent, waste reduction has become a common ground between government, environmentalists, and industry.

#### **BENEFITS TO THE ENVIRONMENT**

From an environmental standpoint, business waste reduction represents a step toward sustainability and has the potential to significantly benefit the environment. In 1992, 13 billion tons of solid waste was generated in the United States. Of that, 7.6 billion tons was nonhazardous industrial waste, 5.2 billion tons was special wastes (wastes from mining, oil and gas production, electric utilities, and cement kilns), and about 200 million tons was municipal solid waste (United States General Accounting Office 1995, 8). Municipal solid waste includes waste from residences, commercial generators, and industrial non-process waste such as shipping materials and office paper. On a national average, 35 to 45 percent of the municipal solid waste generated is from commercial or industrial sources (Kreith 1994, 2.2). Taking into account this portion of the municipal waste stream and special wastes, business and industry contribute 99% of the solid waste

generated in the United States.

Much of the material that is disposed in the United States has the potential to be reclaimed or reused. "Each year the United States landfills enough municipal waste to produce two million automobiles, enough wood to build a million homes, enough paper to produce all of our newspapers, one-half million house trailers worth of aluminum, and enough energy to drive thirty 1000-MW power plants" (Kreith 1994, 2.2). Reusing or reclaiming these materials can avoid environmental pollution associated with disposal and, at the same time, preserve nonrenewable resources.

For example, a study by the U.S. Forest Service found that if the United States recycled 39 percent of waste paper by the year 2040, 175 million fewer trees would be cut in the year 2010 and the demand for old growth timber would decrease (Kreith 1994, 7.2). Reclaiming metals would reduce the environmental impacts and waste associated with mining. Mining operations generate over a billion tons of mineral processing waste every year in the United States. Runoff from these operations adversely affects over 180,000 acres of lakes and reservoirs and 12,000 miles of rivers and

streams. The extraction and processing of lead ores results in 33 tons of solid waste for every ton of lead extracted (Kreith 1994, 7.2).

Business waste reduction has the potential to decrease the environmental impacts of raw material extraction, processing, and disposal. For every forest that is not logged, every mine that is not opened, and every ton of waste that is avoided, environmental damage is averted. Many environmental organizations, including the Environmental Defense Fund, have recognized this potential and have formed partnerships with large corporations to reduce waste. However, 99% of companies in the United States are small businesses. Reducing waste in these companies is essential to realizing the environmental benefits of waste reduction.

#### **BENEFITS TO LOCAL AND STATE GOVERNMENTS**

The public sector also has a stake in business waste reduction. Local and state governments are turning to waste reduction as they struggle to meet solid waste recycling and reduction goals and as public opposition to new landfills and incinerators intensifies (Kreith 1994, 7.2).

Spurred by a perception of diminishing landfill space

and an escalation in disposal prices in the late 1980s, states began focusing attention on solid waste management issues. In recent years, state legislatures have passed more laws dealing with solid waste management than with any other topic on their legislative agenda (Kreith 1994, 1.1). The most common type of legislation has been the establishment of waste reduction goals. Forty-one states have established goals for reducing waste disposal from between 15 percent to 70 percent by the year 2000 (United States General Accounting Office 1995, 19). Several states that established aggressive reduction goals are finding them difficult to reach and have pushed back their deadlines. Maine's deadline for 50 percent diversion of waste was changed from 1994 to 1998 while the District of Columbia's goal for 45 percent waste reduction was delayed from 1995 to the year 2000. Other states are changing the rules on what can be credited toward the goals. In 1994, California amended its goal for the diversion of 50 percent of its waste by the year 2000 to allow a 10 percent credit for biomass fuel recovery (Steuteville 1995 (May), 31). "Most states with goals of 40 or 50 percent have a long way to go, even those that have made substantial progress in recycling"

(Steuteville 1995 (May), 32).

While residential recycling has played an important part in waste reduction efforts to date, studies show that the residential recycling rate may have peaked. While continuing to rise, the rate of growth of the number of people served by curbside residential recycling programs in 1994 increased by less than half of what it had in the previous four years (Steuteville 1995 (April), 54). To reach a national diversion average of 25 to 35 percent, curbside collection will need to double by the year 2000 (Keep America Beautiful 1994, iii). To continue moving forward to meet the goals, the focus of waste reduction efforts must expand beyond residential recycling, and the public sector must encourage businesses to reduce waste.

While the waste reduction goals are established at the state level, day-to-day waste management is generally left to local governments. Local governments have the responsibility of developing and implementing programs to meet the state goals and must often face the politically unpopular job of ensuring local disposal capacity. Local officials seeking to site or expand disposal facilities are seeing more intense local opposition. The "not in my

backyard" sentiment has added years to the time it takes to obtain a site and construct a disposal facility (United States General Accounting Office 1995, 23). Officials must address the concerns of residents, environmentalists, and local business leaders about property values, quality of life, risks to human health and the environment, and increased taxes. Waste reduction presents a way for local governments to delay or avoid altogether the need to site or expand disposal facilities.

#### **BENEFITS TO BUSINESS**

For businesses, the potential benefits of waste reduction fall into three categories: avoided costs, market opportunities, and improved employee morale.

##### **Avoided Costs**

The most direct and measurable way businesses can benefit from waste reduction is by lowering the cost of waste management. Waste management costs can include labor, waste hauling charges, and tipping fees. Some labor is generally required to collect and process waste at the company. Hauling charges are the cost to transport the waste to a disposal facility, and tipping fees are the

amount charged per ton to dispose of waste at a waste management facility (United States General Accounting Office 1995, 49). Waste management costs vary by region. In New York state, the disposal, including hauling and tipping fees, of one ton of waste is approximately \$140, in Pennsylvania \$108, and in Ohio \$72 (United States General Accounting Office 1995, 49). The differences are a result of the proximity to a disposal facility, the type of facility available (incinerator or landfill) and the tipping fee charged by the facility.

Most industries pay for waste disposal based on the number of times their containers are emptied or the volume of waste disposed. By reducing the volume of the waste stream, companies can lower the cost of waste disposal. In addition, if the waste material is diverted for recycling, the company may be able to earn revenue from the sale of the recyclables, depending on recycling markets and the quality and quantity of material.

The Honda of America plant in Marysville, Ohio is an example of a company which has significantly lowered its waste management costs through waste reduction. By recycling corrugated cardboard, polystyrene, aluminum, wood,

and plastic, the plant diverts 60 percent of the 1,545 cubic yards of waste it generates daily and saves \$700 per day in landfill fees. Including the avoided disposal costs and the revenue earned from the recyclables, the plant saves \$1.75 million annually through recycling (Ohio Department of Natural Resources 1991, 17).

The Proctor and Gamble plant in Lima, Ohio has also realized a significant savings through recycling. In 1989, the Proctor and Gamble facility earned \$34,000 on the sale of waste corrugated cardboard and plastic while saving \$35,000 in disposal costs (Ohio Department of Natural Resources 1991, 44).

Waste management costs are not the only avoided costs associated with waste reduction. Whereas waste disposal was once thought of as a utility or a sign of high productivity, it is now recognized as a sign of inefficient production (Bennett, Freierman, and George 1993, 160). Waste reduction is closely tied to improving efficiency of production. As efficiency increases, less raw materials enter the waste stream as off-specification products and other by-products.

Companies implementing waste reduction strategies reduce the amount of wasted raw materials and lower their



disposal costs. While these are well-documented and tangible benefits of waste reduction, they are not the only benefits.

### **Market Opportunities**

There is mounting evidence that presenting a "green" image to the public can be good for business. A number of polls suggest that the public's concern for the environment affects their behavior as consumers. Recent polls by Newsweek, the New York Times, and U.S.A. Today show that more than 80 percent of Americans are concerned about environmental problems (Denton 1994, 34). A 1990 Gallup poll revealed that 52 percent of the respondents reported to have stopped buying particular products because of a poor environmental image of the manufacturing company (Denton 1994, 34). A 1994 survey of American adults by Cambridge Reports/Research International revealed that 39 percent of Americans said they "very frequently" buy a product because the label or advertising says it is environmentally safe or biodegradable. Additionally, 31 percent said they "very frequently" avoid purchasing products made by a company that pollutes the environment (Cambridge 1994, 2).

Roper Starch's Green Gauge Study is a series of polls used to measure the environmental commitment of Americans. Based on responses to questions about their activities, respondents are placed into one of three categories. The most committed category, "True-Blue Greens," consists of those respondents who have made substantial changes in their consumer behavior and personal habits as a result of their concern for the environment. The percentage of Americans in this group increased from 11 percent in 1990 to 14 percent in 1993 (Stisser 1994, 26). The next group, "Greenback Greens," vote pro-environment and belong to environmental organizations but have not changed their purchasing habits. The number of Greenback Greens in America declined from 11 percent in 1990 to 6 percent in 1993, presumably as Greenback Greens moved to the next stage of commitment (Stisser 1994, 26). The percentage of "Sprouts," those who are just beginning to accept the environmental message, increased from 26 percent in 1990 to 35 percent in 1993 (Stisser 1994, 26).

The Green Gauge Study and the other polls show what some businesses are beginning to realize, that the American public is becoming more concerned about the environment and

that concern is affecting what they buy. One company which has capitalized on this is the McDonald's Corporation. In the 1980s McDonald's had a negative environmental image because of its extensive use of polystyrene packaging. In 1990 McDonald's Corporation developed a partnership with the Environmental Defense Fund and became a leading proponent of recycling and consumer education (Sullivan 1992, 4). As a result, in 1991 and 1993, the McDonald's Corporation ranked number one in Roper polls of environmental reputation among consumers (Stisser 1994, 28).

Another example of the power of consumer attitudes was the "dolphin-safe" tuna controversy. To protest the more than 100,000 dolphins killed annually in tuna fishermen's nets, the Earth Island Institute called for a boycott of the major tuna-processing companies. In response to the boycott and fear of consumer backlash, the three major distributors of canned tuna, Heinz, Van Camp and Unicord, pledged to "stop the purchase, processing, or sale of tuna caught at the expense of dolphins" (Sullivan 1992, 37).

At the same time that consumers are using their buying power to express their environmental concerns, information on the companies' environmental records is becoming more

available to the public. Several organizations provide information and a ranking of companies' environmental responsibility (Sullivan 1992, 39). The Council on Economic Priorities publishes Shopping for a Better World, which rates companies' performance on a number of social issues including environmental responsibility. This and other books such as The Green Consumer, How to Make the World a Better Place, and The Green Lifestyle Handbook, advise consumers how to use their buying power to express their environmental concerns (Sullivan 1992, 39).

Companies marketing their products overseas are also affected by the public's "greening" attitude. In a 1989 survey of 2,500 European business representatives, 20 percent of the respondents reported that the most important attribute they look for in a supplier is "care for the quality of the environment." Environmental concerns ranked higher than "value for money" (Denton 1994, 4). According to Tsukas Sakai, Senior Managing Director of JGC Corporation, "In the future, access to international markets will depend on who has the most environmentally sound technologies" (Bennett, Freierman, George 1993, 151). In the 1970s and 1980s, Japanese companies focused on improving

the efficiency of their manufacturing processes so that they now use half the materials and energy used by U.S. companies to make one unit of GNP (Bennett, Freierman, and George 1993, 151).

In addition to green consumerism, "green investing" is on the rise. Green investing is a subcategory of ethical investing. Ethical investing dates back to the late 1920s when many religious institutions avoided investing in alcohol, tobacco, and gambling activities. Green investors choose investments based on the environmental record of companies. Within the past three years, at least six new mutual funds have been formed around green investing (Sullivan 1992, 43). The Social Investment Forum represents 375 investment advisors and eight mutual funds that impose environmental screening on the companies in which they invest. The total assets of investment funds dedicated to sound environmental and social practices have risen from \$40 billion in 1984 to \$450 billion in 1990 (Denton 1994, 49).

If the old adage "the customer is always right" holds true, businesses will need to green up their image to maintain their customer base. The benefits of greening a company image are contingent upon the company's ability to

communicate this image to its customer base.

### **Employee Morale**

Employee morale is important because morale affects productivity and staff turnover and because employees, officially or unofficially, represent the company in the community. "The employee view, expressed openly, affects how the firm is accepted in the community and the marketplace" (Harrison 1993, 50).

Waste reduction presents an opportunity to involve employees in improving the workplace. A company can improve employee morale by involving employees in waste reduction activities. Because waste reduction frequently changes the daily habits of individuals at the company, implementing a successful waste reduction program generally requires some involvement from all levels of staff.

Companies with successful waste reduction programs, almost without exception, have used a team approach to develop and implement those programs (Denton 1994, 64). At a Dow subsidiary in Port Washington, Wisconsin an employee task force identified and implemented a waste reduction program. The company trained employees in data collection,

analysis, and goal setting. Departments held weekly meetings during which operators, quality assurance personnel and management could share information and ideas on waste reduction (Denton 1994, 63). 3M involves employees through "waste minimization teams" in every operating division. The teams' purpose is to identify opportunities for reduction and develop plans to achieve them (Denton 1994, 69). It was a team of employees at Monsanto's Georgia pharmaceutical plant which developed the industry's only known alternative to cleaning process equipment with chemical solvents. The water-based cleaning procedure cut toxic air emissions by 90 percent and liquid hazardous waste 70 percent, while saving a total of \$500,000 in 1992 (Denton 1994, 156).

The team approach gives employees a sense of ownership in the waste reduction program and encourages innovative suggestions. Being involved in waste reduction activities gives employees the opportunity to improve their work environment. At the same time, employee morale may improve as the company becomes more environmentally responsible. Polls show that over 80 percent of Americans are concerned about the environment (Denton 1994, 34). Assuming individuals take this environmental ethic to work, a large

percentage of American workers have strong feelings about environmental problems. An employee's feeling of job satisfaction is "...enhanced with the awareness that one's work is being done with minimal expense to the environment, personal health, and the opportunities of future generations" (Callenbach et al 1993, 14).

## **CONCLUSION**

Reducing the solid waste generated by businesses holds potential benefits for the environment by making more efficient use of natural resources and avoiding disposal. Local governments must rely on business waste reduction to meet their waste reduction goals and to maintain adequate disposal capacity without siting or expanding disposal facilities. The examples presented in this chapter demonstrate that waste reduction can reduce costs for business and that many corporations are taking advantage of this profit opportunity. However, reaping the rewards from waste reduction requires investment of both time and resources. For example, avoiding waste management costs by reducing the volume of the waste stream requires investigation into alternatives to disposal and may require



a capital investment in production process changes. A company can only benefit from a "green image" if that image is conveyed to its customers. This demands a change in marketing strategies. Building employee waste reduction teams means that employees will spend time away from production-related activities. Chapter three investigates how these investment requirements affect small firms' abilities to benefit from waste reduction.

## CHAPTER THREE

### GETTING DOWN TO BUSINESS

The preceding chapter reviewed the potential benefits of waste reduction to businesses. As discussed previously, there are characteristics of small companies, beyond number of employees, that make them different from large companies. These differences may affect the way small companies approach waste management and their ability to benefit from waste reduction.

Three case studies follow which further identify the issues that affect the feasibility of waste reduction in small businesses. Three companies, with fewer than 500 employees, were provided technical assistance in developing and implementing waste reduction programs. Comprehensive assessments of the companies' waste streams were conducted. This included identifying opportunities for source reduction, locating markets for recyclable material, and performing cost analyses of waste reduction programs.

In addition, the assessments recorded subjective issues

which may affect a company's ability to implement waste reduction. For example, a company's motivation to reduce waste and the overall attitude of the company toward waste reduction may prove to be equally or more important to the success of a waste reduction program than objective factors.

The case studies are not intended to be representative of all small companies. Nor are they meant to definitively demonstrate that all small companies are capable of waste reduction. Instead, the case studies identify the obstacles and opportunities small businesses face when considering waste reduction.

The selection process for the case study companies began in November of 1994, when the offer for a free waste assessment and technical assistance was distributed by facsimile to approximately 1,500 industries in Hamilton County, Ohio. The distribution list was compiled from the 1995 Harris Industrial Selectory and contained only Hamilton County companies with fewer than 500 employees. Thirty-four companies responded to the facsimile. Twelve of these companies expressed interest in participating in the waste assessment program. The other companies requested general information about recycling or were interested in finding a

recycling market for a specific material type. Of the pool of twelve companies, three were eliminated because they had less than 10 employees. While these companies certainly fall into the small business category, they were not appropriate as case studies for this paper. From the nine remaining companies, three were chosen based on their eagerness to participate and their diverse solid waste streams. These three companies were Fechheimer Brothers Company, Rotex Incorporated, and Casco Products. A change in management at Rotex Incorporated caused a delay in the waste assessment process. An alternate company, Xomox Corporation was chosen from the pool to replace Rotex.

The first company, Fechheimer Brothers, manufactures specialty uniforms and has 150 workers. Xomox Corporation employs 320 and manufactures metal valves. The third company, Casco Products, has 155 employees and performs custom upholstery and sewing.

Since the companies requested assistance and agreed to participate in the waste assessments, it can be assumed that the companies' management have some desire to lower the volume of its waste stream. In fact, all of the companies have implemented some level of waste reduction but are

having difficulty reaching the level of reduction they seek. Part of the assessment will be to determine what is impeding their progress.

This chapter contains summaries of the waste assessment reports for each of the three companies. The complete assessment reports are attached as Appendices A, B and C. Following the summaries is a section identifying trends and discussing the significance of the findings.

#### **FECHHEIMER BROTHERS COMPANY**

Fechheimer Brothers is a manufacturer of specialty uniforms supplying post offices, police and fire departments, and school bands. Fechheimer was founded in 1942 and has 150 employees, including 50 office employees and 100 plant employees. Fechheimer Brothers is located in the City of Blue Ash, an affluent suburb of Cincinnati, Ohio.

Fechheimer generates an estimated 4,192 cubic yards of solid waste annually. Office paper and corrugated cardboard comprise one third of Fechheimer's waste stream and are currently being recycled by the company. The remaining two-thirds of the waste stream, consisting primarily of textile

scrap, paper and plastic, is sent to a landfill. Businesses in Cincinnati generally pay approximately \$5,700 to dispose of 3,000 cubic yards of solid waste. However, Fechheimer Brothers pays only a quarter of this cost because the City of Blue Ash subsidizes a portion of the solid waste hauling and disposal fees for its industrial and commercial generators. For Fechheimer Brothers, the City of Blue Ash pays to haul Fechheimer's six cubic yard dumpster and eight cubic yard dumpster three times per week. Fechheimer is billed by the waste hauling company for any additional hauls of the containers which, for the past year, has averaged one haul of each container per week.

Bud Myers, purchasing agent for Fechheimer, was the contact for this waste assessment. Mr. Myers chose to participate in the assessment to identify ways to reduce the number of additional hauls per week and thus reduce the cost to Fechheimer. Although Mr. Myers was encouraged to involve employees in the assessment, he chose not to form a waste reduction team. Mr. Myers requested that plant employees not be questioned during the assessment. He was resistant to involve plant employees because they are members of the garment workers' union and are paid based on the number of

pieces they produce. Also, Mr. Myers said that he did not believe the plant workers could offer valuable input in the waste assessment.

In 1994, Fechheimer Brothers implemented an office paper recycling program. Fechheimer recycles approximately 12,000 pounds of paper per year and in 1995 earned approximately \$600 from the sale of the waste paper. Mr. Myers estimated that 60 percent of the office employees participate in office paper recycling activities. Recommendations were made to increase this participation through employee education and incentives. It was also recommended that Fechheimer implement source reduction activities to reduce the volume of paper waste generated and lower purchasing costs. Such activities include double-sided copying, routing reports rather than making numerous copies, and using electronic communications.

Fechheimer Brothers' corrugated cardboard recycling program also saves the company money by diverting waste from the landfill. Unlike office paper, the recycler does not pay Fechheimer for corrugated cardboard. Fechheimer pays \$51.33 for the rental of an 8 cubic yard container for cardboard storage. Fechheimer Brothers would pay \$255 per

month to landfill 8 cubic yards of waste. Thus, Fechheimer saves around \$200 each month by recycling the corrugated cardboard.

The majority of waste disposed at Fechheimer Brothers is generated at the table where fabric is cut. The waste from this area must be reduced to lower Fechheimer's disposal costs. The cutting table waste consists of kraft paper, white paper, plastic, and synthetic textile scrap. The white paper, kraft paper and plastic are layered across the table to aid in cutting the textiles. Once the garment pieces are cut and removed, the scrap paper and textiles is stripped from the table and packed into rolling containers. The evening cleaning staff bag this mix of materials and place the bags in the dumpster. The cutting table waste must be sorted by material type before it can be recycled. A trial sort revealed that segregating the material types is time and labor intensive.

Locating recycling markets for the materials, particularly the textiles, is necessary to justify an investment in sorting. Textile scrap makes up the largest volume and weight of the material discarded. An exhaustive search revealed that a market does not exist for the types



and volumes of textile scrap generated by Fechheimer. Due to the lack of a viable market for synthetic textiles and the low value of the other materials generated, it was found that recycling the cutting table waste is not cost-effective. Reducing the waste stream at the source, however, can be cost-effective for Fechheimer. Through a change in the production process, Fechheimer can eliminate the use of white paper on the cutting table, thus saving in purchasing and disposal costs (see Appendix A, page 71). At this time, Fechheimer is continuing to evaluate this option.

For Fechheimer Brothers Company, increasing the amount of waste diverted from the waste stream by additional recycling is not cost-effective due to the lack of a market for synthetic textiles. Without this market, the labor cost to separate the materials can not be economically justified. Fechheimer Brothers can cost-effectively implement source reduction measures by increasing office paper diversion through employee awareness programs.

#### **XOMOX CORPORATION**

Xomox Corporation manufactures metal valves for industrial and municipal uses. The valves are used in

highly corrosive environments such as chemical processing industries and water treatment facilities. Xomox is located in Blue Ash, Ohio and employs 220 production personnel and 100 office personnel.

Pete Popovics, Environmental Coordinator at Xomox, was the contact for the waste assessment. He noted that Xomox Corporation has recently undergone a culture change and there is pressure from Xomox's parent company, Emerson Electric Company, to improve environmental quality and customer service. As a result, in 1995 Xomox implemented the Loss Prevention Program which created teams of employees to improve safety, hygiene, security, ergonomics, and environmental activities of the facility. Six members of Xomox Corporation's recycling team participated in the waste assessment.

Xomox is just beginning to analyze and improve its solid waste management practices. Currently, the majority of the solid waste generated at Xomox, approximately 730 tons, is landfilled. The City of Blue Ash pays all of Xomox's waste hauling and disposal costs. Xomox pays \$95 per month for the lease of a compactor and a 40 cubic yard dumpster.

The largest component of Xomox's waste stream is wood pallets. Xomox ships its product on non-standard sized pallets (38" x 38"), therefore few incoming pallets are reused by Xomox. Approximately 40 to 50 pallets are discarded by Xomox every day. Xomox uses non-standard pallets to make the most efficient use of its storage space. The storage shelves at Xomox are 10 feet wide. By using the 38" x 38" pallets, Xomox can fit three pallets on each shelf. Xomox's subsidiaries and distribution centers have the same type of shelving units. According to members of the Xomox recycling team, converting the shelving units would be expensive and is not an option at this time.

A primary goal of the assessment was to identify a way to reduce the number of pallets discarded by Xomox. Source reduction options were considered first. Xomox was encouraged to request that suppliers ship products to Xomox on 38" x 38" pallets which can be reused by Xomox. The Shipping and Receiving representative on the recycling team has begun to contact the larger of Xomox's 700 suppliers. Xomox is also willing to purchase reusable plastic crates for shipments to its subsidiaries. These crates can be custom made to work with the shelving units. While the cost

of these crates is high compared to wood pallets, their longer life and reusability makes them a good investment. Because it was not possible to eliminate the use of all wood pallets, a pallet recycler was contacted. The recycler agreed to pick up Xomox's used wood pallets at no charge.

One of the goals of Xomox's recycling team is to eliminate the use of polystyrene chips as packaging in shipping. Xomox uses 33,800 cubic feet of these chips each year to protect the finished valves. The chips are made from lightweight post-industrial recycled polystyrene. Thirty of Xomox's customers have expressed dissatisfaction with receiving shipments packaged with polystyrene. Alternative packaging options were investigated, including starch based products, chipped corrugated cardboard, and chipped pallets. Xomox has attempted to use shredded paper as loose-fill packaging but has found that it does not provide adequate cushioning for the heavy valves. During the investigation into packaging alternatives, Xomox's plant manager decided the company should make another attempt at using shredded office paper as packaging material.

The analysis revealed that it is more cost-effective to use office paper for packaging than to recycle it. The

value of Xomox's office paper on the recycling market will not offset the cost of purchasing packaging material. By using shredded paper, Xomox will avoid spending \$14,000 per year on polystyrene chips. Also, the paper packaging will be easier for Xomox's customers to recycle. Xomox established a packaging team to conduct a more detailed analysis of all packaging, incoming and outgoing, at the facility.

Xomox Corporation incurs minimal expenses from solid waste disposal. The company's willingness to participate in the waste assessment and its interest in reducing the waste stream was a product of the corporate commitment to environmental improvement. Xomox's team approach to environmental issues benefits the recycling effort by bringing in various perspectives and sharing the workload.

#### **CASCO PRODUCTS**

Casco Products is a manufacturer of sewn and upholstered products located in Cincinnati, Ohio. Casco Products has 155 employees, with 125 in the production area and 30 in the office. Casco manufactures hospital bed mattresses, medical stool seats, exercise pads and laptop

computer cases. In addition, Casco Products reupholsters furniture for individual customers.

Casco generates approximately 2080 cubic yards of solid waste annually. Unlike Xomox Corporation and Fechheimer Brothers, Casco pays the full cost of waste disposal, which amounts to \$587 per month or \$7,054 annually. Casco began recycling office paper, corrugated cardboard, and foam scrap in 1995. Through these recycling programs, Casco reduced disposal costs by \$293 per month or \$3,527 per year. In addition, in 1995 Casco Products earned a total of \$575 from the sale of recyclables. Don Budke, Manager of Industrial Relations for Casco Products, was the contact for this solid waste assessment. Mr. Budke was interested in finding ways to further reduce Casco's disposal costs.

Vinyl scrap is the largest volume material disposed by Casco Products. Reducing the amount of vinyl scrap discarded is the key to reducing disposal costs for Casco. Casco sorted the vinyl scrap for one month to estimate the amount generated annually. Casco discards approximately 500 pounds of vinyl scrap per week, or one ton per month.

The vinyl scrap generated by Casco Products consists of various types and grades. The largest volume scrap, a

polyvinyl laminate, is generated through the production of hospital bed mattresses. The polyvinyl laminate is reinforced with a grid of nylon or polyester threads. This contamination makes the vinyl less attractive to recyclers. An international organization, the Industrial Fabrics Association International, has been addressing the issue of polyvinyl laminate recycling. The Association reported that 60,000 tons of polyvinyl laminate end-roll scrap is being disposed of by vinyl manufacturers each year in North America. This tonnage does not include the waste generated from customers such as Casco Products. None of the members of this organization have found a market for the scrap.

An exhaustive search uncovered one possible outlet for Casco's scrap vinyl. A company in northern Ohio expressed interest in grinding the vinyl scrap from Casco Products, mixing it with other types of ground plastics and textiles, and forming it into a pad to line the trunks of cars. The market for this liner is not established so the value of the material is uncertain. Even if Casco is not paid for the vinyl scrap, diverting the vinyl will reduce the companies waste stream by at least 10 percent, or approximately \$700 annually.

Following vinyl, the next largest volume of the waste stream are clear low density polyethylene (LDPE) bags. Foam shipments arrive at Casco encased in these bags. Casco discards approximately 3,280 bags, or 2,473 pounds of plastic each month. At this time, no recycling outlet has been found for these bags. Local plastic recyclers indicated that the value of LDPE is low and it is not cost-effective for them to transport and recycle the low volume of plastic generated by Casco Products.

Casco has implemented a successful and cost-effective paper and foam recycling program. The potential for additional recycling at Casco Products hinges on the success of locating a market for the vinyl scrap. The relatively small volumes generated by Casco and the low market value of vinyl make finding a steady market difficult.

#### **FINDINGS AND COMPARISONS**

There are many factors which determine whether source reduction or recycling will be successful for a company. Some of these factors are within the company's control while others are not. Below are four factors identified in the case studies and a description of their affects on the three



companies.

### **Management Support**

Waste reduction often involves changes in daily operations at a facility, making the involvement of management necessary. Involvement of top management also lends importance to waste reduction activities and encourages other managers and employees to participate. True management support goes beyond condoning waste reduction activities. Managers should demonstrate the importance of environmental quality by incorporating waste reduction into training, staff meetings, and annual reports and by encouraging employees to share waste reduction ideas.

Though a member of management was involved in each of the case studies, the level of participation and support varied. Xomox Corporation had the highest level of management participation. The environmental mission statement issued by Xomox's parent company, Emerson Electric, is one form of management support at Xomox. A copy of the statement is displayed in the lobby of the Xomox facility informing managers, employees and customers that environmental quality is a priority to the company.

Xomox is the only of the three companies to have a member of management devoted exclusively to environmental affairs. Pete Popovics, Xomox's environmental coordinator, has a background in environmental management and establishes the company's environmental priorities. On the other hand, at Fechheimer Brothers, solid waste management is handled by the purchasing agent, Bud Myers. Don Budke, manager of industrial relations is responsible for environmental issues at Casco Products. These individuals have different perspectives on waste reduction and approach it differently. Pete Popovics, with educational background and experience in environmental issues, was more aware about the environmental impacts of the facility and viewed waste reduction as an environmental improvement issue. Mr. Popovics was also more conscious of the long term benefits of waste reduction. At Fechheimer Brothers and Casco Products waste reduction is viewed more as a cost-reduction activity. Also, whereas waste management was a part of Pete Popovics job, it was an additional responsibility for Mr. Myers and Mr. Budke who had less time to devote to solid waste issues.

## **Employee Involvement**

While management support is necessary to get waste reduction programs initiated, employee involvement is critical to their continued success. As with management support, the three case study companies have varying degrees of employee participation in waste reduction activities.

Xomox Corporation has an active recycling team comprised of representatives from five areas of the plant and chaired by Mr. Popovics. The team meets twice a month to discuss recycling options at the facility. The team members bring enthusiasm, creative ideas, and knowledge of the facility's operations to the waste management discussions. The team played an integral part in the waste assessment by providing information about the facility and evaluating program options.

At Fechheimer Brothers there is minimal employee involvement in environmental issues. Office employees were not involved in the development of the office paper recycling program, nor were they provided training or incentives to participate. Mr. Myers was reluctant to involve production personnel in the waste assessment for two reasons. First, most of these workers are paid by the

number of pieces produced. Therefore, they have little incentive to take time away from their production related tasks to participate in waste reduction projects. Second, these employees are members of a trade union which makes it more complicated for Fechheimer to involve them in non-production related activities. Mr. Myers requested that plant workers not be asked questions during the assessment. It was his opinion that they would not contribute valuable information.

At Casco Products, employees are not involved in waste reduction activities in part because the company is experiencing a shortage of skilled laborers and cannot afford to take the staff away from production.

#### **Definition of Costs and Benefits**

Whether or not waste reduction is considered cost-effective depends largely on how costs and benefits are defined. The various benefits of waste reduction, avoided costs, market opportunities and employee morale, were discussed in Chapter two.

For the cost-analyses performed as part of the waste assessments, benefits were given a narrow definition,

including only avoided disposal and raw material costs, and revenue from recycling. Because the benefits of improved company image and employee morale are difficult to predict and even more difficult to put into monetary terms, they were omitted from the analyses. However, during the assessments it became clear that one of the companies was motivated to reduce its waste stream by these less tangible benefits of waste reduction.

At Fechheimer Brothers and Casco Products, the contacts made it clear that they were participating in the waste assessments only to reduce their waste management costs. However, because waste disposal is free to Xomox Corporation, the company had other motivations to reduce the volume of waste discarded.

One such motivation was the desire to improve Xomox's environmental image. Xomox wants to be seen by its customers and the community as a good corporate citizen. For example, when evaluating packaging options, the recycling team took into account the recyclability of the packaging for its customers.

Employee morale was also an important consideration to Xomox. The recycling team is interested in improving morale

at the facility by involving employees in recycling and using the revenue from recycling to fund employee appreciation programs.

### **Market Value of Materials**

Management support, employee education, and good intentions will not help a recycling program if there is no market for the materials. The process of recycling begins when the materials are collected by a recycler. The materials are then shipped to a processor which prepares them for use and sells them to an end user. This end user manufactures a new product using the recycled materials. A market must exist for this new product for the recycling process to work.

There are strong recycling markets for many materials, such as office paper. However, even well-established markets experience fluctuations that affect small companies in particular. These fluctuations not only affect the price paid for the material but also the quality and quantity of material accepted for recycling. For example, during the summer of 1995, the resale value of paper for recycling was very high. Local recyclers paid \$150 per ton for baled

corrugated cardboard and \$100 per ton for mixed office paper. By the end of 1995, the market value of these materials had dropped to \$25 and \$50 per ton, respectively (Recycling Times Market Page, May 16, 1995 and December 12, 1995). When paper markets are strong, all grades of paper are more valuable and it becomes economical for recyclers to collect lower grades. During these times there is competition for paper and the recyclers seek out material from small generators. As the market drops, it is no longer lucrative for the recycler to collect from small quantity generators.

Whether or not a market can be found for a material depends largely on the volume of material available. The cost per ton to ship and process the material lowers as the volume increases. Larger volumes of recyclables can be economically shipped greater distances to markets. For small companies, the low volumes generated makes it more difficult to recycle materials. The low density polyethylene (LDPE) bags generated by Casco Products are an example of this problem. Recyclers need a minimum of a tractor trailer full of LDPE to make collection profitable. Similarly, at Casco Products the volume of non-contaminated

vinyl is too low to interest recyclers.

#### **CONCLUSION**

Out of the 1,500 Hamilton County companies notified about the free waste reduction assistance, only around 2 percent responded with interest. It is difficult to pinpoint the cause for the low response rate. The means of disseminating the information could be one factor. The faxes, addressed to "recycling manager" since contact names were not available, may never have reached the individuals responsible for solid waste management at the facilities. Perhaps some companies were reluctant to involve a representative from a government agency for fear of regulatory intervention. Either of these factors could have affected the response rate. However, it must also be assumed that many company representatives either do not have an interest in waste reduction or feel that they do not need assistance.

The three companies which participated in the assessments had each taken some steps toward waste reduction. Xomox was at the beginning stage having recently formed a recycling team, Fechheimer Brothers had an office



paper and corrugated cardboard recycling program, and Casco Products had moved beyond paper recycling to divert certain production wastes. The case studies demonstrate that certain characteristics of small companies, including limited time to devote to environmental issues and lack of in-house expertise may pose barriers to waste reduction.

Another, unexpected, barrier was identified in the Fechheimer Brothers and Xomox assessments. Both of these companies are located in the City of Blue Ash, which subsidizes waste hauling and disposal for its industrial and commercial generators. Because these companies pay only a small portion of their waste management costs, they have little economic incentive to reduce waste. The City of Blue Ash implemented this policy in the 1970s to attract companies to the area. Blue Ash rapidly developed in the 1980s and is now an affluent community with a large industrial and commercial base. The Service Director for Blue Ash said that the City does not want to terminate the waste management subsidy because the companies in the area are accustomed to and expect this service. Companies which have always operated in Blue Ash do not realize the true cost of waste management. Bud Myers at Fechheimer Brothers

was unaware that Blue Ash is one of two of the 48 communities in Hamilton County which provide waste hauling and disposal subsidies and was surprised by the cost of waste disposal to companies in the other communities.

The Blue Ash subsidy acts as a deterrent for companies to recycle. Therefore, many companies in Blue Ash are discarding materials that have value as recyclables. The City then pays for disposal of materials that might otherwise be recycled. Blue Ash has not performed an analysis to determine if the tax revenue from the businesses pays for the waste management costs. Chapter four further discusses public sector involvement in business waste management.

## CHAPTER FOUR

### BEYOND THE BARRIERS

Chapter one discussed the trend to encourage companies to "green-up" their operations by convincing them of the bottom line benefits. Trade journals, environmental literature and government publications, in particular, carry testimonials of companies which have saved considerable amounts of money through waste reduction. Among the companies appearing frequently as success stories are 3M Corporation, McDonalds Corporation and Dow Chemical, multi-national corporations with substantial resources. As seen in the case studies, small companies experience barriers to reaping comparable financial rewards from waste reduction. Therefore, marketing waste reduction to small companies using these testimonials may be misleading.

For governments to market the profitability of waste reduction may be inconsistent as well as misleading, as public policies often act as disincentives to waste reduction. While, as discussed in Chapter two, it is in the

best interest of governments to stimulate waste reduction in business and while governments appear to be embracing the idea of partnerships with businesses, in actuality they often support policies which discourage waste reduction and make it less cost-effective. The City of Blue Ash's waste management subsidies is the example encountered in the case studies, however, these underlying policies are present at all levels of government.

In the case studies, it was found that companies readily pay every month for waste disposal. Recycling programs, in contrast, are expected to, at a minimum, pay for themselves. This attitude is also found in the public sector as local and state governments are more willing to spend money on waste disposal than waste reduction. A 1989 study by the Northeast-Midwest Institute found that 18 states in the region planned to spend 10 times more to incinerate waste than to recycle it over a 5-year period (Kreith 1994, 7.6).

In every state, bonding authorities, which issue tax-exempt bonds to finance new construction for local governments, make money available for capital intensive projects like landfills and incinerators. These funds are

less accessible for recycling and composting facilities because of the scale of the projects and the nature of the costs associated with these facilities (Kreith 1994, 7.6). Whereas municipalities invest in waste disposal, recycling programs are expected to generate revenues to cover collection and processing costs.

Many municipalities enter into "put-or-pay" arrangements with regional disposal facilities. These arrangements require municipalities to pay for specified amounts of waste for incineration or landfilling regardless of whether or not the waste is actually generated. The operators of the facilities pressure municipalities to enter into put-or-pay agreements to guarantee a consistent influx of waste and revenues. Some states also provide indirect subsidies for incinerators. For example, electric utility companies in Illinois receive tax credits for purchasing power generated by municipal solid waste incinerators (Kreith 1994, 7.6).

The federal government also has policies which discourage recycling. The United States Forest Service policies give virgin timber an advantage over recycled pulp. The Forest Service builds roads into national forests which

lumber companies can use to cut timber priced by the Forest Service below market rate. Thus, due to federal government subsidies, recycled paper pulp and virgin pulp do not compete on a "level playing field."

This preferential treatment for waste disposal must be reversed if waste reduction is to become a viable waste management method. Advertising the benefits of waste reduction will be in vain if waste reduction is not, at a minimum, given equal access to public funds as waste disposal. Before promoting waste reduction to businesses, all levels of government need to examine their own policies to see if they are creating disincentives to reducing waste.

Eliminating barriers imposed by the public sector will help to make waste reduction an economically competitive waste management option. However, small businesses may need assistance beyond this. The public sector and environmental organizations can aid small businesses by focusing their efforts at overcome the barriers discussed in this paper: lack of information and resources, lack of capital to invest, and difficulty in marketing small volumes of recyclables. As discussed in Chapter two, it is in their best interest to do so. Businesses contribute 99 percent of

the solid waste generated in the United States. Over 99 percent of the businesses in the United States are "small businesses." In order for states to reach their waste reduction goals and avoid the need to site new disposal facilities, small businesses must be helped to reduce waste. For environmental organizations, investing in small business waste reduction means more efficient use of natural resources and a minimization of the environmental damage that comes with extracting those resources. The following are examples the way the public and non-profit sectors can assist small businesses in overcoming the barriers identified in this study.

### **Marketing Materials**

As shown in the Casco Products and Fechheimer Brothers case studies, a major problem for small companies is locating stable markets for recyclable materials. Local governments, chambers of commerce and economic development agencies can stimulate markets for materials by offering grants or low-interest loans to encourage the development of new recycling processes or the use of recycled feedstock in production. Market development projects have been

undertaken in many communities across the country.

In Thousand Oaks, California, a non-profit project helps new environmental-oriented businesses get a start. The Thousand Oaks Environmental Business Cluster provides inexpensive space, furnishings, and management services to businesses in emerging environmental technologies. The business incubator can support up to twenty-five companies and has provided assistance to recycled materials manufacturers and other environmental product and service providers (Watts 1996, 185).

In North Carolina, the goals of the Recycling and Reuse Business Assistance Center are two-fold: to strengthen and expand the markets for recyclable materials, and to create jobs within the recycling industry to improve the state's economy. The Center provides training to economic development professionals on recycling markets and educates recycling professionals about economic development. According to the director of North Carolina's Office of Waste Reduction, the Center "...signals a new era that will merge environmental and economic concerns in North Carolina and work towards supporting recycling efforts by creating markets and eliminating market development barriers"



(Ewadinger 1994, 11).

Volume is often the primary problem in marketing recyclables generated by small companies. These companies can work together and solve their marketing problems by forming cooperative marketing arrangements. In a cooperative marketing program, companies generating similar materials either physically consolidate the materials or contract jointly with a recycler. Public or private organizations can help connect companies for cooperative marketing programs.

Materials exchanges are another way to help businesses work together to reduce solid waste. A materials exchange is a service which links a generator of a waste material with a business which can reuse or recycle that material. Often this is accomplished through a catalog containing listings of materials available and materials wanted by companies in the region. This enables companies to by-pass the recycler and the processor, making it more economical to recycle small volumes. Materials exchanges also benefit the company receiving the material by providing low-cost recycled feedstock.

Over fifty materials exchange programs are operating in North America. These exchanges vary by size and activity level. A few of the exchanges take a more proactive approach and seek out companies that might generate or have use for particular waste materials (U.S. EPA 1994 (Sept.), 7). The Iowa Waste Reduction Center stations representatives throughout the state to solicit participants for the materials exchange program, perform waste assessments and provide free technical assistance to businesses. Through these activities, each representative diverts between 6,000 and 10,000 tons of solid waste each year (Nicelanders 1996).

Drop-off programs can assist businesses which generate very small quantities of commonly recycled materials. The Solid Waste Authority of Palm Beach County, Florida operates a small quantity generator drop-off program. The Authority operates forty-five drop-off centers located throughout the county which accept commonly recycled materials, including office paper, corrugated cardboard, aluminum cans, glass, plastic, newspaper and magazines from businesses. The program is paid for through disposal fees collected at the landfill (Zimms 1996, 55).

**Funding**

Allocating start-up funding for waste reduction activities can be a problem for small companies. The State of Maine offers a revolving loan fund to aid businesses which are starting a program intended to substantially reduce or eliminate their solid or hazardous waste or reuse post-consumer materials. The loans are provided at a low interest rate to qualified applicants. Also, Maine law provides companies an investment tax credit equal to 20 to 30 percent of the cost of machinery and equipment purchased and used exclusively to reduce solid waste or increase recycling (Blocher 1995).

**Company Image**

Local governments and non-profits can also help small businesses reap the less tangible benefits of waste reduction such as improved company image. Small businesses may require assistance in publicizing their waste reduction successes to their customers and the community.

King County, Washington's Green Works program gives recognition to companies for the time and effort spent on waste reduction. King County businesses can join Green

Works by demonstrating that they have implemented specified levels of source reduction and recycling. Green Works members benefit from a publicity campaign, with their successes publicized in local newspapers, business publications, consumer media and through special promotions. Each participating company receives a window decal and certificate of achievement to notify community members and customers of its dedication to environmental quality. Members are also given permission to use the Green Works logo to market their products (Green Works 1993).

Other communities, such as Pinellas County, Florida, present awards to businesses for their waste reduction efforts. The Pinellas County awards are given to support creative approaches to waste reduction and acknowledge businesses for taking a leadership role in reducing solid waste. Because the awards are given to businesses in categories based on employee numbers, small businesses do not compete with larger companies for recognition. Award recipients are acknowledged in the local press (Stone and Wertel 1996, 147).

### **Information Barriers**

Whereas large companies often have environmental professionals on staff, small businesses generally lack in-house environmental expertise. Organizations can assist small companies by providing technical assistance and access to information.

Kentucky Partners State Waste Reduction Center provides free waste reduction assistance to businesses. The Center trains retired engineers and chemists in waste reduction. The staff provides on-site assistance to industries, as well as, seminars and workshops on waste reduction (Kentucky Partners 1995).

Often, the most useful waste reduction information is that which is shared between businesses. Opening communication channels between companies and facilitating the sharing of information can benefit small businesses. This can be accomplished through neighborhood business groups or roundtable workshops.

WasteCap programs are another type of business-helping-business initiative. WastCaps are a group of businesses who, with the help of the public sector, have joined together to form a technical resource for the entire

business community. Business representatives volunteer as WasteCap assessors and are provided waste reduction training. When a business in the community requests WasteCap's assistance, a team of these assessors are chosen and sent out to the company where they provide technical assistance and information. According to Robert Ruddock, senior vice president at the Associated Industries of Massachusetts, "This program embodies the 1990s approach to environmental improvement, offering tangible solutions that simultaneously help the bottom line and the environment" (Hess and Bishopbric 1995, 29). About 75 waste assessors are active in Massachusetts' WasteCap program. WasteCap programs are also operating in Vermont, Maine, New Hampshire, Nebraska and Wisconsin (Hess and Bishopbric 1995, 31).

A similar program in Michigan is increasing the pool of waste reduction experts in the state. The Waste Assessor Training program provides waste reduction training to business representatives, recycling coordinators, graduate students, and interested community members. Participants go through a ten week training course which is held, in part, at local businesses. The host businesses receive a free

waste assessment, while the assessors get hands-on experience. The assessors are asked to share their expertise with other businesses in the community. Since the program began in 1994, 100 assessors have been trained (Semer 1996, 176).

## **CONCLUSION**

Waste reduction has the potential to benefit businesses by lowering waste management costs, improving company image and employee morale, and accruing revenue from the sale of recyclables. Many companies across the country have experienced these benefits firsthand. The most acknowledged waste reduction accomplishments have taken place at a few large corporations. Their laudable success stories have served as testimonials in the effort to increase waste reduction in businesses.

As seen in the case studies, small companies can also cost-effectively reduce their solid waste stream. However, there are characteristics of small companies which may hinder their waste reduction efforts. These impediments include lack of information and technical resources, lack of capital to invest in waste reduction, and difficulty in

accessing recycling markets for small volumes. These barriers are joined by indirect barriers imposed by government policies which give preference to waste disposal and virgin materials. Local governments, environmental organizations, chambers of commerce, and economic development organizations can assist small businesses in overcoming the structural obstacles to waste reduction. However, the full potential benefits of waste reduction will not be realized until changes are made in public policies which discriminate against waste reduction.



**APPENDIX A**  
**FECHHEIMER BROTHERS CORPORATION**

The following report details the results of a solid waste management assessment performed for Fechheimer Brothers Company facility in Blue Ash, Ohio beginning in June of 1995.

**COMPANY BACKGROUND**

Fechheimer Brothers Company (Fechheimer) is a manufacturer of specialty uniforms, supplying post offices, police and fire departments and school bands. Fechheimer Brothers was founded in 1942 and currently employs 150, with 50 office employees and 100 plant employees. The facility is 90,000 square feet in area and is located in an industrial park in the City of Blue Ash, Ohio.

The Fechheimer facility in Ohio primarily manufactures the jackets of the uniforms. High volume items such as pants and shirts are made at the four other Fechheimer-owned facilities located in Pennsylvania, Maryland, Kentucky, and New York. The shirts and pants are shipped from these facilities to Blue Ash to be paired with the jackets and shipped to the customer. Fechheimer Brothers supplies organizations and also sells directly to individuals. Fechheimer operates a second specialty shop in San Antonio, Texas. All cutting for the Texas plant is performed at the Blue Ash facility. The pieces are shipped to Texas for assembly. The Ohio facility ships the pieces to the Texas facility in reusable plastic containers. Fechheimer Brothers also operates 50 retail stores located across the United States.

The contact for the waste assessment was Mr. Bud Myers, Purchasing Agent for Fechheimer Brothers. Mr. Myers has

been employed at Fechheimer for 45 years and is planning to retire in December 1996.

#### **MANUFACTURING PROCESS**

The majority of Fechheimer's supplies (fabric, perforated kraft paper, and white plotter paper) are shipped to the company on 6 foot long rolls. Fechheimer's manufacturing process is centered around a Gerber cutting table. This machine consists of a 120 foot by 6 foot table equipped with a vacuum unit to hold the fabric in place while it is being cut. The table is first lined with a sheet of perforated kraft paper. The kraft paper allows the fabric to be moved down the table easily, while the perforations permit the vacuum system to hold the fabric in place. The fabric is then placed on top of the kraft paper. The number of layers of fabric varies depending on the number of each piece needed. The white paper is run through a plotter which outlines the patterns to be cut and is then placed on top of the fabric. The final layer is a sheet of 1-mil High Density Polyethylene (HDPE). The vacuum holds the HDPE film in place, thus securing the fabric. A computer guided blade moves over the length of the table cutting out each piece. Two employees stand at the end of the table and remove the pieces. The scrap kraft paper, fabric, plotter paper, and HDPE film are thrown, commingled, into large bins. The material in these bins is bagged at the end of the day by cleaning staff and placed in the dumpster.

The cut pieces are sorted and sent to sewing stations where they are assembled. The assembled garments are then sent to an embroidering area for final preparations. A minimal amount of scrap fabric and thread is deposited on the floor of the sewing and embroidering areas and is swept up at the end of the day by the cleaning crew. The finished jackets are stored on hangers until they are paired with pants or shirt. The orders are then shipped to customers in corrugated cardboard boxes packed with polystyrene peanuts.

When Mr. Myers started working at Fechheimer in 1950, the company employed 75 people to cut the pieces for the garments. The Gerber machine has replaced all but one

employee, who performs re-cuts if necessary.

### **SOLID WASTE MANAGEMENT**

Fechheimer Brothers generates approximately 4,192 cubic yards of solid waste annually. Approximately 1,280 cubic yards of office paper and corrugated cardboard is recycled each year. The remaining 2,912 cubic yards of waste consisting of textiles, paper, plastic, glass, beverage cans, and food is bagged and placed in a 6 cubic yard and an 8 cubic yard dumpster\*. The dumpsters are hauled by Rumpke Waste Inc. four times per week.

The cost for hauling and disposal of 2,900 cubic yards of solid waste per year would normally cost a Cincinnati company approximately \$480 per month. However, Fechheimer Brothers pays only 25% of the total cost for disposal of solid waste. The City of Blue Ash subsidizes waste hauling and disposal for most commercial and industrial generators in the City. For Fechheimer Brothers, the City of Blue Ash pays the cost to haul one 6 cubic yard and one 8 cubic yard container three times per week, or 2,184 cubic yards of waste per year. Fechheimer Brothers is billed by Rumpke Waste, Inc. for any additional hauls of the container. In 1994, Fechheimer Brothers paid for an average of one additional haul per week at a total yearly cost of \$1,438.

Mr. Myers chose to participate in this waste assessment to identify ways to reduce the number of additional hauls per week and reduce the cost to Fechheimer. Reducing waste disposal costs can be a strong incentive for companies to implement waste reduction programs; however, because Fechheimer Brothers does not pay the full cost of its waste disposal, it is difficult to demonstrate potential economic benefits from waste reduction.

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\*In the past, small pieces of fabric and paper fell out of the dumpsters as they were emptied and littered the grounds. To alleviate the problem, all solid waste is bagged before it is placed in the dumpster. According to purchasing records, the garbage bags cost Fechheimer approximately \$2,000 per year.

It is important to note that the five year contract between the City of Blue Ash and Rumpke Waste, Inc. for waste disposal expires in February of 1996. Discussions with Mike Milampe, Service Director for the City of Blue Ash, revealed that the City has not decided whether the contract will be renewed. The City spends \$1.5 million annually on solid waste disposal. Eighty percent of this budget is spent on solid waste services for commercial and industrial generators. Blue Ash is a rapidly developing area and the City's waste hauling budget has been growing proportionately. Budget constraints have forced the City to limit free services to businesses operating in Blue Ash as of 1994. Companies which have moved to Blue Ash after this date are not receiving free waste hauling. Regardless of whether the contract is renewed or re-bid, it was Mr. Milampe's opinion that existing businesses would continue receiving subsidized waste disposal.

Based on observations when touring the facility and interviews with Mr. Myers and the cleaning staff, the majority by volume of solid waste generated at Fechheimer is from the following areas:

- Offices (office paper)
- Receiving (corrugated cardboard)
- Cutting table (plastic, paper, textiles)

Smaller quantities of solid waste are also generated at the sewing and embroidering areas of the plant and in the employee break areas and restrooms. However, the focus of the assessment was on the three above-mentioned areas.

#### **Office Waste**

Fechheimer generates a variety of office paper waste, including green-bar and white computer paper, white ledger, and colored ledger. There is an ongoing recycling program for all office paper at Fechheimer. Each employee has a desk-side recycling bin which they are responsible for emptying into centrally located containers. There are three central collection containers for computer paper, white ledger, and mixed office paper. According to receipts from

the recycling service provider, Fechheimer Brothers is recycling approximately 1,000 pounds of paper per month. The revenue earned from the recycling of the paper averaged \$50 per month from January to June of 1995.

Inspection of the central containers revealed evidence that employees are not sorting the paper correctly, i.e. computer paper was mixed with white ledger. Recyclable paper is only as valuable as the lowest grade in the mix so proper sorting is important. Mr. Myers concurred that contamination is a problem and estimated that around 60% of office personnel participate in the recycling program.

The office paper recycling program is well organized. Desk-side containers make it convenient for employees to separate material. The boxes to consolidate the paper are easily accessible and clearly marked. Fechheimer Brothers has contracted with a reputable recycling company that is paying competitive prices for the paper. However, there have been no efforts at Fechheimer Brothers to educate employees about the recycling program or motivate them to participate.

**Recommendations:**

1. To increase participation and decrease contamination in the office paper recycling program, employees at Fechheimer need to be educated about the program and given incentives to participate. To educate the employees, Fechheimer should hold a training session for office staff. The training could be given to department supervisors who could then train their staff or could be in the form of a staff meeting. The training program should inform employees about how much office waste is generated and recycled at Fechheimer and stress the importance of recycling for environmental and economic reasons. This meeting should also explain what materials can and cannot be recycled in Fechheimer's program and how the different types of paper should be separated. On-going education should continue after the initial training session. Lists of what is acceptable and unacceptable for recycling should be posted by each employee's desk-side bin and in central locations. Employees should be

periodically updated on the success of the recycling program.

To motivate employees to participate in the recycling program, Fechheimer could create an employee fund with a portion of the profits from recycling. This fund could be used for an office Christmas party or other special events. Fechheimer could hold a contest for recycling with the goal of breaking a recycling record of the company. These types of awareness and incentive programs can increase the success of a recycling program and boost employee morale.

Fechheimer was offered assistance in developing and implementing an employee awareness program. Mr. Myers seemed interested in the assistance but has not accepted the offer at this time.

2. In order to conduct employee awareness programs and evaluate the success of the recycling program, Fechheimer Brothers must keep accurate records on the amount of paper recycled and the revenue accrued. Currently, the receipts from the recycling company report only monthly revenues. However, Fechheimer is being paid per pound of paper recycled, so data on tons recycled is available from the recycler. Fechheimer should request that this information be included on its monthly receipts. Tracking this data is essential to monitoring the progress of the recycling program, identifying problems, and ensuring that the price paid by the recycler is competitive.
3. The market for recyclable paper is generally at its highest during shortages of paper fiber. When this occurs, companies like Fechheimer make the greatest profit on the paper they recycle. However, during fiber shortages, the price of paper products also rises. So while companies are making more money on recycling paper, they are also spending more on buying paper products. The most effective way to reduce costs in the long run is to reduce the amount of paper used and discarded. Fechheimer Brothers should institute office-wide waste reduction policies.

Examples of waste reduction techniques for office paper include double-sided copying and reusing one-sided paper for internal memos, draft copies, and memo pads. Office paper should not be recycled until both sides are used. Fechheimer should also make a practice of routing materials or using a centralized bulletin board rather than making numerous copies. Electronic communications and records storage also reduce paper waste. Employees should be educated on waste reduction during recycling training. By implementing these recommendations, Fechheimer Brothers can reduce the amount of paper purchased and discarded.

### **Receiving Area Waste**

Corrugated cardboard is the primary waste generated in the receiving department. The rolls of kraft paper, white paper, HDPE film, and textiles are shipped to Fechheimer on high density corrugated cardboard tubes, or "cores". The cores are compacted and bound with a solvent-based adhesive and, therefore, cannot be recycled locally. Fechheimer's supplier, Better Methods, was contacted about the possibility of using plastic cores which could be returned to the supplier for reuse. The contact at the Better Methods stated that they only use corrugated cardboard cores. Fechheimer has been a customer of Better Methods for several years and could attempt to use its purchasing power to persuade the supplier to change this practice. Fechheimer discards all its corrugated cardboard cores.

The remainder of Fechheimer's supplies are shipped in corrugated cardboard boxes. Currently, the waste corrugated cardboard is collected by the evening cleaning crew, flattened, and placed in an 8 cubic yard recycling container. The hauling service for the cardboard recycling container was increased to two times per week in April, 1995 and then to three times per week in May of 1995. Rumpke Waste, Inc. picks up the cardboard for free but charges \$51.33 per month for the container rental. It would cost \$255 per month to dispose of the 96 cubic yards of corrugated cardboard. By recycling the cardboard, Fechheimer is saving \$203 per month.

**Recommendations:**

1. When this assessment began in June 1995, the corrugated cardboard market was unusually strong. Processors were paying up to \$150 per ton for baled corrugated cardboard and many local recyclers were paying businesses for loose (un-baled) corrugated cardboard. Subsequently, the market has declined dramatically, with processors now paying only \$45 per ton for baled corrugated cardboard and charging to pick up loose corrugated cardboard.

Baled corrugated cardboard consistently brings a higher price than loose material. For this reason, Fechheimer should consider the purchase of a baler. Fechheimer has adequate space for the baler in the area where the loose corrugated is now stored. The following is a cost analysis of the purchase of a standard size, mid-price baler.

<b>CURRENT EXPENSES</b>		
Rental of container	\$51.33/month x 12	\$616
Labor (estimated)	3 hrs/week x \$5/hr	\$780
<b>TOTAL COST PER YEAR</b>		<b>\$1,396</b>



<b>EXPENSES WITH BALER</b>		
Purchase of baler*	\$7,200 at 10% for 3 yrs	\$2,788
Bailing wire	2 bundles at \$70	\$140
Labor**	1 hr/week at \$5/hr	\$260
<b>TOTAL COST PER YEAR</b>		<b>\$3,188</b>
Income from cardboard	27.3 tons x \$45/ton	\$1,228
<b>TOTAL COST LESS INCOME</b>		<b>\$1,960</b>

\* This price includes a three year warrantee, therefore, maintenance costs are not included in the table.

\*\* Labor costs are anticipated to decrease with the purchase of a baler because the boxes will not need to be flattened. One hour is the estimated time required to bale 24 cubic yards per week.

While the estimated costs of purchasing a baler slightly exceed the potential savings or revenue at this time, if the market price for baled corrugated cardboard increases to \$66 per ton the purchase would be justified.

2. In addition to shipments from suppliers, Fechheimer receives shipments from other company-owned facilities. According to Mr. Myers, the majority of these shipments are from the facilities in Maryland and Kentucky. To reduce corrugated cardboard waste, Fechheimer should consider substituting reusable containers for all shipments between Fechheimer facilities. Reusable plastic containers are already used for shipments from the Ohio facility to the Texas facility and have proven to be cost-effective according to Mr. Myers. This practice should be expanded to include the Maryland and

Kentucky facilities. This will reduce the cardboard for disposal and the number of new corrugated boxes that must be purchased.

#### **CUTTING TABLE WASTE**

As discussed earlier in this report, the waste generated at the cutting table consists of textiles (wool, polyester, and poly-wool blends), kraft paper, white plotter paper, and 1 mil high density polyethylene (HDPE) film. Both Mr. Myers and the cleaning crew staff estimated that waste from this area comprises 85% of the waste landfilled by Fechheimer Brothers. Thus, approximately 2,475 cubic yards of waste is generated at the cutting table. Three methodologies were used to more accurately quantify the amount of each waste material type generated in this area.

#### **Method A.**

Jeff Gloss, Plant Foreman at Fechheimer Brothers, reported that an average of 12 tables of material are cut per day. Since one sheet of each of the kraft paper, plotter paper, and HDPE film are layered over the area of the table each time it is used and the area of the table is 80 square yards, it is estimated that 960 square yards of each material is used per day. All of the kraft paper, plotter paper, and HDPE film used at Fechheimer Brothers ends up in the facility's solid waste stream. One square yard of each material type was weighed and extrapolated to determine the weight per table full. Assuming a 250 day work year, it was calculated that 13 tons of kraft paper, 2 tons of white marking paper, and 5 tons of HDPE film are generated per year. The amount of textile waste generated could not be calculated in this manner due to variability in the number of layers of textiles per table and in the weight of the fabric.

**Method B.**

Any recycling option for the material from the cutting table would require sorting the waste by material type. A limited waste sort was performed to assist in quantifying the amount of material that could be recovered for recycling and determine the time required to segregate the material types. Four hours were spent sorting the waste from the cutting table. Approximately half of the material was sorted into 18 equally full 30 gallon containers which were then weighed. Based on these weights and the visual estimate that half of the material was sorted it was calculated that approximately 5.2 tons of HDPE film waste, 12 tons of kraft paper waste 4.5 tons of plotter paper waste, and 45 tons of textile waste are discarded annually. Because a large portion of the plotter paper is removed from the cutting area along with the finished pieces, the tons of plotter paper estimated in this method may be low.

The sort also revealed that the materials from the cutting table are more difficult to separate than expected. The long pieces of fabric were entangled with the other materials and small pieces of plastic, paper, and textiles made it very difficult to completely segregate the materials. While most recycling markets allow a certain amount of contamination, it may pose a problem for recycling at Fechheimer.

Any processing of recyclables (sorting, baling, etc.) would be performed by the contracted evening cleaning crew. Although sorting the material as it comes off the table would be simpler, Fechheimer employees are paid by the piece and would not be asked to perform any work that would slow down the production process. Fechheimer employees are also members of the garment workers union. Mr. Myers was resistant to involving the plant employees in any type of recycling or waste reduction program. He would not allow them to participate in any way in this waste assessment and did not believe that their input would be valuable.

**Method C.**

Purchasing records indicate that in 1994 Fechheimer Brothers bought 132 rolls of plotter paper, 96 rolls of kraft paper, and 38 rolls of HDPE film. The distributor of the materials was contacted and reported that the weight of the plotter paper is 89 pounds per roll, the kraft paper weighs 100 pounds per roll, and the HDPE film weighs 120 pounds per roll. Because all of the kraft paper, plotter paper, and HDPE film which is purchased is eventually discarded by Fechheimer, it is estimated that in 1994, Fechheimer disposed of 5.9 tons of plotter paper, 4.8 tons of kraft paper, and 2.8 tons of HDPE film.

There are obvious inconsistencies in the data derived using the three methods. The weakness of Method B is that it was based upon a visual estimation that 50% of all the materials had been sorted. However, this method did identify the difficulties in sorting the material. The data derived through Method C was based on purchasing records and is, therefore, more reliable. The weight of the textile waste could not be estimated using Method C because the amount of fabric waste from each table varies as does the weight of the fabric. For all calculations that follow, it will be assumed that Fechheimer disposes of 4.8 tons of kraft paper, 2.8 tons of HDPE film, 5.9 tons of plotter paper (Method C) and 45 tons of textiles (Method B).

Once the quantities of the materials were estimated, an investigation of the recycling markets for the materials was conducted. Local and regional recyclers were contacted to determine if a market exists for each material type, what the value is, and if there are minimum volume requirements or processing specifications. The following is the result of this investigation:

**Plotter paper**

It was determined that the plotter paper can be sold as white ledger, which is priced at \$360 per ton if baled. If 70% of the plotter paper were recycled, the potential

revenue would be approximately \$1,487 per year\*\*.

### **Kraft paper**

The small amount of kraft paper waste generated by Fechheimer can be mixed with baled corrugated cardboard without lowering the value of the corrugated. The value of the mix would be \$45 per ton. Assuming 70% of the kraft paper is recovered, the annual revenue from the sale of the kraft paper will equal around \$150.

### **HDPE film**

The local recycling market value of the HDPE film is \$300 per ton if baled. The processor offering this price requires semi-truck load shipments. Semi-truck loads hold 20 tons of material. It would take Fechheimer seven years to accumulate this amount of HDPE film. Another recycler will pick up the material, unbaled, for \$120 per ton. The recycler will pick up the material three to four times per year. Fechheimer has adequate storage space for this volume of material. The annual revenue from the sale of the HDPE film scrap would be \$244, assuming a 70% recovery.

### **Textile scrap**

Recycling the textile scrap is the key to success for the recycling program because of the large volume of textiles discarded. There is a strong market for cotton textiles in Canada and Asia but not for synthetic fabrics. Fourteen textile recyclers were contacted and samples were sent to seven companies in Ohio, Kentucky, Michigan, and Ontario, Canada. None of these companies responded that they were interested in the textiles from Fechheimer Brothers.

The following is a cost analysis of recycling the cutting

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\*\*To be conservative in estimating potential revenue, it is assumed that only 70% of material would be diverted from the waste stream. With employee education, this percent should be higher.

table waste based on the market conditions described above:

Labor cost to sort***	4 hrs/day x \$5/hr	\$5,000/year
Value of HDPE, kraft, and plotter paper		\$1,881/year
Savings in disposal costs****		\$719/year
<b>Cost Less Savings</b>		<b>\$2,600/year</b>

**Recommendations:**

1. Without a market for textile scrap and with the low volumes of the other materials, it is not cost-effective for Fechheimer to fund the labor hours required to sort the material from the cutting table. As market demand for material changes over time, Fechheimer should monitor the textile recycling market. If, in the future, revenue can be earned for the textile scrap or if disposal costs rise, sorting the material for recycling may become economically advantageous for Fechheimer.
2. Fechheimer Brothers purchases virgin kraft paper, bleached white plotter paper, and natural HDPE film. All of this material is used to aid in cutting the fabric and is then discarded. Waste reduction ideas include buying kraft paper with larger perforations, thereby throwing away less paper. Purchasing a plastic film which can also be used as the plotter paper. Several samples of plastic film which could be printed on were presented to Mr. Myers, however, none could be run through the plotter machine. There are numerous

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\*\*\*This is additional staff time above the two hours it currently takes to bag the material.

\*\*\*\*Assuming that additional hauls would be reduced to two hauls per month.

polymers of varying density and opacity which could be considered. It is recommended that Fechheimer discuss additional options with its supplier. Fechheimer should also consult their supplier about buying a lower grade, possibly recycled-content, plotter and kraft paper.

## **SECOND QUALITY GARMENTS**

In addition to the above mentioned waste, Fechheimer Brothers annually generates 10,000 to 15,000 garments which, for a variety of reasons, cannot be sold as first quality. Many of these seconds are currently being sold at an outlet store located at the Blue Ash facility. This outlet store generates a revenue of \$100,000 per year. However, Mr. Myers would prefer to find a steady market for all the seconds and eliminate the outlet store.

### **Recommendations:**

1. While there is a high demand for garments in overseas markets, uniforms are not accepted. Textile recyclers and "rag dealers" were contacted locally, regionally, and internationally but no market could be found for the uniforms. Therefore, it is recommended that Fechheimer continue to operate the outlet store and donate the remainder of the uniforms (primarily band uniforms) to charitable organizations.
2. Fechheimer is encouraged to evaluate its quality control and seek methods to reduce the number of seconds produced. Improved quality control will lower disposal costs as well as raw material expenses.

## CONCLUSION

The corrugated cardboard and office paper recycling programs at Fechheimer Brothers are successfully diverting waste from the landfill and reducing costs for Fechheimer. Minor improvements could be made to these programs to make them more efficient or cost-effective. There are many waste reduction activities that could be conducted in the office and in the plant at Fechheimer. The success of these programs depends on employee involvement. Several times during the assessment, Mr. Myers implied that the union workers in the plant could not be counted on to participate in any waste reduction or recycling activities. However, while performing the waste sort, several employees in the plant expressed an interest in recycling at the facility.

Beyond the existing recycling programs, however, the low cost of solid waste disposal at Fechheimer makes it difficult to demonstrate economic benefits from additional recycling or waste reduction. The Blue Ash subsidy for solid waste disposal gives Fechheimer a disincentive to reduce the amount of waste discarded and causes the City of Blue Ash to continue to pay for the landfilling of waste that could be recycled. If this situation changes, Fechheimer should be prepared to make changes in their solid waste management practices.



**APPENDIX B**  
**XOMOX CORPORATION**

The following report details the results of a solid waste management assessment performed for Xomox Corporation beginning in November 1995.

**COMPANY BACKGROUND**

Xomox Corporation, a division of Emerson Electric Company, manufactures various types and sizes of valves for industrial and institutional uses. Xomox is located in Blue Ash, Ohio, an affluent suburb of Cincinnati. Two-hundred twenty plant workers and 100 office workers are employed at the 160,000 square foot facility.

According to Pete Popovics, Environmental Coordinator at Xomox and primary contact for this assessment, Xomox has undertaken a culture change which has put environmental quality and customer service at the forefront. This change stems in part from an environmental mission statement adopted by Emerson Electric Company. In 1994, Xomox Corporation implemented a Loss Prevention Program in support of this statement. This program created teams of employees to focus on improving safety, hygiene, security, ergonomics and environmental issues at Xomox. The recycling team, a committee of the Loss Prevention Program, began meeting in October of 1995. Members of the recycling team played important roles in this assessment by providing information and evaluating waste reduction options. The following are members of the recycling team at Xomox:

Pete Popovics, Environmental Coordinator  
John Gamel, Shipping and Receiving  
Ron Lovitt, Central Storage  
Ed Scheid, Product Engineering

### Rick Fasnacht, Maintenance

Xomox Corporation manufactures metal valves for industrial and commercial uses. The valves are intended for use in highly corrosive environments such as water treatment facilities, chemical processing plants, and petroleum refining industries. The body of the valves are molded at a Xomox subsidiary and shipped to Xomox for finishing. Xomox customizes the valves for their intended use, assembles additional parts, lines the insides of the valves with Teflon, and paints the valves to protect them from corrosion.

### **SOLID WASTE MANAGEMENT**

Xomox leases a two cubic yard compactor and a 40 cubic yard dumpster from Rumpke Waste Incorporated. Rumpke picks up the full dumpster two times per week. Rumpke reports that the average weight of the full dumpster is 7 to 8 tons. Using this figure, it is estimated that Xomox discards 728 tons of solid waste annually. The City of Blue Ash pays for all waste hauling and disposal costs for Xomox Corporation. Xomox pays \$95 per month for the lease of the container and compactor.

All solid waste other than metal scrap and a small percentage of office paper is placed in the compactor for disposal. The facility tour and discussions with the waste reduction team revealed that the majority of solid waste is generated in the following areas:

### **Shipping and Receiving**

Corrugated cardboard and wooden pallets comprise the majority of waste generated by shipping and receiving at Xomox Corporation. Pallets present a particular disposal problem for Xomox, resulting from the company's storage practices. Xomox stores all supplies and finished products on 10 foot wide storage shelves located throughout the facility. To make maximum use of storage space, Xomox uses pallets which are 38" x 38" in dimension. This allows Xomox

to place three pallets on each shelf, leaving three inches in between for easy movement. According to the recycling team, using a larger sized pallet would sacrifice valuable storage space.

The majority of pallets shipped to Xomox by suppliers are of standard size (40" x 48"). These pallets are not reused for transporting material within the Xomox facility or for shipping. Xomox discards approximately 40 to 50 pallets each day and purchases new 38" x 38" pallets for shipping. To get the maximum use out of the new pallets, the company uses them for transporting material in-house for a period of time before they are used for shipping. Xomox's subsidiaries and distribution centers have the same type of storage shelving and also use non-standard pallets. According to the recycling team, changing the storage shelves would be too great of an expense for Xomox and is not an option at this time.

Xomox ships the finished valves in corrugated cardboard boxes stacked on pallets. These boxes also contain a loose-fill packaging material to keep the valves from shifting. Xomox carefully packages the valves to avoid scratching the paint and making the valves susceptible to corrosion. The majority of Xomox's shipments are packaged with polystyrene chips. The company purchases 33,800 cubic feet of polystyrene chips each year at an annual cost of \$14,612. While the chips are economical and lightweight, 30 of Xomox's customers have expressed dissatisfaction with receiving shipments of products packaged with polystyrene. It is a goal of the recycling team to find an alternative packaging material.

The following are the loose-fill options examined as part of this assessment:

#### **Corrugated cardboard chips**

Xomox has attempted in the past to use chipped corrugated cardboard as packaging material. The chips can be purchased from local recyclers at a cost of \$.56 per cubic foot. However, if the recycling market value for corrugated

cardboard increases, this price will rise and the chips may become unavailable altogether. Xomox was not pleased with the performance of the chips for three reasons. First the cardboard stuck to damp paint on the valves. Second, Xomox pays for the freight based on the weight of the shipments. The weight of the corrugated cardboard made shipping more expensive. Finally, Mr. Popovics felt the corrugated cardboard chips were unattractive to customers.

### **Wood chips**

The possibility of grinding Xomox's pallets and using the wood chips as packaging material was also investigated. A sample of ground pallet wood was collected from a local pallet recycler who agreed to grind Xomox's pallets and supply the company with the chips. However, the size of the chips was proved to be too small and the recycling team was concerned that there would be too much sawdust in the material. As with the corrugated cardboard chips, the wood chips were also found to be very heavy and unattractive.

### **Biodegradable loose-fill**

With biodegradable loose-fill, weight and appearance were not drawbacks. Biodegradable loose-fill looks very similar to polystyrene but is made from a starch-base which dissolves quickly when exposed to water. However, the biodegradable loose-fill cost is approximately twice the cost of the polystyrene chips used by Xomox.

### **Spray-in-bag system**

Mr. Popovics requested that the spray-in-bag packing systems also be examined. These systems consist of equipment which mixes two chemical components to form a thick foam. An empty plastic bag is placed around the product in a corrugated cardboard box. A nozzle is then inserted into a valve in the bag. The two chemical components are mixed in an enclosed container and pumped through the nozzle. Foam fills the plastic bag which then conforms to the empty space

in the box. While the foam itself is considered non-hazardous, one of the components is a hazardous substance and is regulated by the Occupational Safety and Health Administration. Also, this material presents a disposal problem for Xomox's customers as it cannot be recycled or reused.

### **Shredded office paper**

The final type of loose-fill packaging material examined was shredded office paper. Xomox has previously attempted to use its shredded office paper to protect the valves during shipment. The company found that this material did not provide adequate padding for the heavy valves and was difficult to handle. However, during the investigation into other options, the plant manager at Xomox decided that the company should make another attempt at using Xomox's shredded office paper.

### **Recommendations:**

1. Throwing away incoming pallets and purchasing new is not a cost-effective or environmentally sound strategy. Three alternatives are:
  - a) Use returnable plastic crates or pallets for shipments between Xomox and its subsidiaries. The plastic crates have built up sides and lids which would also reduce the need for corrugated cardboard shipping boxes. The plastic pallets cost between \$25 and \$50 each, while the crates run between \$125 and \$235 per crate. New wood pallets generally cost around \$8 each. Due to the expense, plastic crates or pallets should only be sent to facilities who agree to return them to Xomox. Wood pallets used to ship material from Xomox to its six distribution centers or five subsidiaries are often returned. These pallets can be reused by Xomox, but many are in poor condition after being used only twice. Plastic crates and pallets are more durable than wood pallets and can be reused many more times.

- b) Work with vendors to receive supplies on 38"x 38" pallets which can be reused by Xomox. Members of the recycling team have been contacting vendors to discuss the feasibility of this option. Xomox receives shipments from over 700 vendors so this may be a slow process.
  - c) There are several local companies who pick up and "recycle" pallets. Generally, these companies refurbish pallets for sale or grind them into mulch. If the pallets are the standard 40" x 48" and in good condition, they will pick them up for free. Otherwise, the cost ranges from \$.50 to \$1.00 per pallet. A representative from a pallet recycling company examined the pallets discarded by Xomox and agreed to pick up the pallets free of charge. However, many of the pallets discarded by Xomox are covered with oil and may not be suitable for refurbishing. Mr. Popovics reported that the pallets come in contact with oil as they travel through the Xomox facility. It is recommended that Xomox attempt to keep the pallets clean and in good condition. If plastic reusable crates are purchased, this will eliminate the need to use wood pallets for transportation within the Xomox facility.
2. Since Xomox has experienced problems with using shredded paper, the company should conduct a three month trial to identify and work out the problems. During this trial period, Xomox should use shredded paper loose-fill for a small percentage of shipments. The company should solicit input from shipping and receiving staff. Also, Xomox should make customers aware of its environmental commitment and encourage them to include the shredded paper in their recycling programs.

## Office

Xomox generates several types of office paper which fall into three categories: computer paper, white ledger, and colored ledger. Based on discussions with personnel in charge of purchasing, computer paper and white ledger comprise the majority of the paper waste generated. The purchasing officer reviewed 1995 records and estimated that Xomox purchases 250 reams of copy paper every ten days, or 9,125 reams annually.

Xomox does not have a comprehensive office paper recycling program and the majority of paper waste is thrown away. Confidential paper waste is stored in secured bins and picked up by a local document destruction company. This company charges Xomox \$45 each week to shred and recycle this paper. Xomox realizes no profits from the recycling of this paper. The document destruction company reported that four to five 50 gallon containers of paper are shredded and recycled each week. In addition, in 1995, Xomox purged 63 tractor trailer loads of obsolete records and stored documents and paid approximately \$70,000 to have the records shredded and disposed.

An investigation was conducted of the office paper recycling options available to Xomox. Representatives from four local paper recycling companies toured the facility and examined Xomox's service needs. These companies were then asked to submit proposals on the recycling services they could provide. Mr. Popovics identified the following needs for Xomox:

- Simple system for pick-up of materials
- Reliable pick-up
- Single recycler for all materials (office paper, corrugated cardboard, scrap metals, and wooden pallets)
- Documentation of destruction for all confidential materials
- Good method of accounting
- Partnership with Xomox
- One point of contact
- Fair price for materials

Three recyclers submitted proposals for recycling service. Because storage space at the Xomox facility is limited, Mr. Popovics suggested placing a tractor trailer at an unused loading dock and storing all recyclable materials on that trailer. For two of the recyclers, the quantities of recyclables were too small to warrant placing a trailer at Xomox. The one company who agreed to try this option did not specify a price in the proposal. In a subsequent discussion, a representative of this recycling company stated that the sale of the recyclable material would not cover the cost of the trailer rental. Therefore, Xomox would have to pay for the recycling service. The two other recyclers proposed to pick-up corrugated cardboard and office paper and pay Xomox between \$95 and \$150 per ton for computer paper, \$30 to \$35 for file stock, and \$10 for loose (un-baled) corrugated cardboard. One of these recyclers offered a document of destruction for the sensitive material at no cost while the other will charge \$.05 per pound to shred the paper.

Based on these proposals, it is more cost-effective to use shredded paper as packaging than to recycle it. Xomox is paying approximately \$.43 per cubic foot for polystyrene chips. One cubic foot of shredded paper weighs approximately .48 pounds. The value of computer paper on the recycling market is currently around \$.06 per pound. Thus, one cubic foot of shredded computer paper is worth \$.03. The value of the paper does not off-set the cost of purchasing polystyrene packing material. It is more cost-effective to use the paper as packing.

Mr. Popovics was concerned that there will not be enough paper waste to fill Xomox's packaging needs. Xomox purchases 9,125 reams of paper each year. One ream of paper weighs 5 pounds. Thus, Xomox purchases 45,625 pounds of paper each year. Not all of this paper is disposed at Xomox. For the purposes of this estimation, it was assumed that 60% of the paper purchased by Xomox is discarded at the facility. Of this 60%, it was assumed that a conservative 70%, or 19,162 pounds, will be captured by the office recycling program. This 19,162 pounds of office paper will equal approximately 39,920 cubic feet of shredded paper. Xomox is currently purchasing 33,800 cubic feet of the



polystyrene chips. The amount of paper is a conservative estimate as it only includes office paper and does not count the drafting paper, NCR, and other types of paper used at Xomox. If Xomox employees participate in the office paper separation program, there will be an adequate amount of shredded paper to supply the shipping department.

**Recommendations:**

1. From an environmental standpoint, avoiding the generation of waste is preferable to recycling it. Source reduction can also reduce the amount of money spent on raw materials. The recycling team is encouraged to implement paper waste reduction activities. These activities include making double-sided copies, using the back side of used paper for drafts or interoffice correspondence, re-programming printers to avoid printing blank pages, eliminating unnecessary copies of reports, and investigating ways to reduce the paper needed for tracking products through computerization. The recycling team was very receptive to source reduction ideas. Mr. Popovics has spoken with an equipment representative about defaulting the printers and copiers to make double sided copies.
2. Regardless of whether the paper is recycled by a service provider or reused in-house, Xomox must implement a paper separation program. The use of shredded paper for packaging will not be successful unless office employees separate their paper from other wastes. Employees must be made aware of the program and encouraged to participate. The recycling team discussed ways to motivate employees to participate and boost employee morale and planned to use a portion of the funds generated from the recycling program to fund these activities. If the paper is used as packaging, Xomox will not receive payment for the paper but will save more than \$14,000 per year on packaging material. Xomox employees could be rewarded for their part in this savings by allocating a portion of this money for employee events and incentive programs.

## **Production**

Metal scrap and Teflon are the primary production wastes. Ferrous and non-ferrous metal scrap, including ductile iron, stainless steel and bronze, is placed in a 20 cubic yard chip hopper and sold to Moskowitz Brothers. Titanium turnings are placed in a separate drum and sold to Cohen Brothers. In 1995, Xomox recycled 117,280 pounds of stainless steel and 486,890 pounds of other metals. A small percentage of the metal, approximately 3,000 pounds per year, ends up in the solid waste stream as floor sweepings.

Teflon scrap is also generated in production. The Teflon is used to line the inside of the valves as an alternative to liquid lubricants. Most of the Teflon scrap is reused by Xomox, with very little ending up in the solid waste stream.

## **Recommendations:**

1. The metal recycling program at Xomox is successful at diverting metal from the waste stream and is very cost-effective. It is recommended to continue the metal recycling program as is.
2. Xomox should improve quality control to further minimize the amount of metal lost during production. Production employees should receive quality control and waste reduction training.

## **OTHER ISSUES**

The employee cafeteria is another area where solid waste is generated. Food and beverages are served on polystyrene plates and cups. One way to reduce the amount of polystyrene cups in the waste stream is to charge less for beverages purchased in reusable coffee cups or glasses. This can be tied in with an employee awareness program by giving each employee a reusable mug imprinted with Xomox's logo and a recycling message.

Employee education and involvement will be crucial to the success of any waste reduction or recycling program at

Xomox. At the meeting, the team discussed some ideas for encouraging employees to participate, including using the money made from recycling as a prize for drawings at the Christmas party or to pay for a catered lunch. Another idea for encouraging participation in a recycling program is to keep employees informed by periodically posting the results of the program both in terms of the tons of waste recycled and the environmental impacts. For example, for each ton of paper recycled 17 trees are saved.

Training sessions also will be necessary at the beginning of the program, especially for those whose daily activities will be affected. Janitors will need to be included in this training if they will be involved in any recycling activities. Xomox could designate the kick-off week as "Xomox Recycles Week" during which Xomox could hold training sessions and promote the program.

Measuring results will be critical both to encouraging employees to participate and to monitoring the success of the program. Xomox should track information in terms of the pounds recycled, dollars received from recycling, and any avoided costs (such as reduced usage of paper).

## **CONCLUSION**

There are many areas to cost-effectively reduce the amount of waste generated and disposed by Xomox Corporation. It is suggested that Xomox concentrate first on reusing or recycling office paper and corrugated cardboard, which are both a large part of the waste stream and have value as recyclables. However, while the revenue from the sale of recyclables is important, Xomox is encouraged not to overlook the value of source reduction.

Xomox has already made the first step to a successful waste reduction program by establishing a recycling team. Waste reduction programs that are models of success, such as those at 3M and Dow Chemical, all involve teams of employees in the efforts. Teams which involve members from different departments bring in a variety of perspectives and allow the work to be shared among several individuals. With a

corporate commitment and participation of the employees, Xomox has the essential elements to a successful waste reduction program.

**APPENDIX C**  
**CASCO PRODUCTS INCORPORATED**

The following report details the results of a solid waste management assessment performed for Casco Products Incorporated beginning in September 1995.

**COMPANY BACKGROUND**

Casco Products is a family-owned business operating in Cincinnati, Ohio since 1959. Casco employs 155 workers with 125 in the production area and 30 in the office. The company manufactures a wide variety of sewn and upholstered products including hospital bed mattresses, medical stool seats, exercise pads and laptop computer cases. In addition, Casco reupholsters individual pieces of furniture for non-commercial customers.

The contact for the assessment was Don Budke, Manager of Industrial Relations for Casco Products. Mr. Budke agreed to participate in this assessment with the goal of decreasing costs associated with solid waste management.

**MANUFACTURING PROCESS**

Casco Products' manufacturing process relies heavily on manual labor. Because Casco performs contract work, the process varies based on the orders received. The company's largest ongoing contract is with Hillrom Corporation, a hospital equipment supplier. Casco supplies Hillrom with vinyl-covered foam mattresses for hospital beds.

Casco Products' employees manually draw and cut patterns for each order produced. The employees create patterns by disassembling and tracing a sample of the product or by

using the specifications provided by the customer. A long sheet of vinyl or fabric is rolled out on a cutting table. The employees arrange the patterns on the sheet so that a minimum amount of material is wasted and cut the vinyl or fabric by hand.

While the fabric or vinyl covering is being produced, workers in another area of the plant build the foundation of the product. Just as with the outside covering, patterns are made for the internal components of the product. Casco's highest volume product, hospital bed mattresses, has a foam center. Other products, such as medical stool seats, also have a plywood base. All the pieces are then assembled and sewn.

The pattern-making, cutting, and sewing are performed by non-union skilled laborers. The January 1, 1996 issue of the Cincinnati Business Courier featured an article about labor shortages and mentioned Casco Products specifically. Casco Products is having difficulty finding enough skilled workers to meet its growing demand. The executive vice president at Casco was quoted as saying, "We're experiencing a tremendous number of price increases from our suppliers. And, on the other end, the customer wants the highest-quality product at the lowest price. That's very difficult to provide in a market where there's a shortage of skilled labor." Casco is trying to alleviate this problem by attracting workers from competing companies.

#### **SOLID WASTE MANAGEMENT**

Casco Products generates approximately 2080 cubic yards of solid waste annually. This waste is placed in two 4 cubic yard dumpsters which are hauled five times per week by Rumpke Waste Incorporated. The total cost for the rental and hauling of the containers is \$587 per month, or \$7,054 annually. Casco recently began recycling office paper, corrugated cardboard and foam scrap. Through these recycling programs, Casco was able to eliminate the use of a third dumpster and reduce disposal costs by approximately \$3,500 per year.

The following describes Casco Products' recycling efforts and investigates opportunities for additional waste reduction and recycling at the facility.

### **Office Waste**

Casco Products began recycling computer paper and white office paper in June of 1995. Each office employee is asked to segregate his or her paper waste into three categories: computer, white ledger and colored paper. The sorted paper is stored in large boxes located on the plant floor. In January of 1996, Casco Products hired Rumpke Recycling to recycle the computer paper and white ledger. Rumpke pays Casco \$60 per ton for the computer paper and \$30 per ton for the white ledger paper. Casco's previous recycling service provider, 3R Recycling, also picked up the colored paper at no charge. Rumpke Recycling will not accept colored paper for recycling.

When this report was compiled, Casco was still storing paper for the first pick-up by Rumpke Recycling, therefore, information on quantities was not available. However, a representative from 3R Recycling estimated that Casco Products recycles an average of 800 to 1,000 pounds of office paper per month. It can be assumed that this amount will decrease slightly since the colored paper now is being discarded. At current paper prices, if Casco Products recycles 600 pounds per month it will earn between \$108 and \$216 per year from the sale of the paper.

An examination of Casco's trash receptacles and dumpsters revealed a small amount of white and computer paper in the waste stream and some unacceptable paper in the recycling bins. When asked about employee education programs, Mr. Budke said that employees have been informed that they are required to separate office paper for recycling. However, there has been no employee involvement in the development of the recycling programs and management has not conducted a training or awareness program.

**Recommendations:**

1. To increase participation and decrease contamination in the office paper recycling program, employees at Casco Products should be educated about the program and given incentives to participate. To educate employees, Casco should hold a training session for office staff. The training program should inform employees about the amount of office waste generated and recycled at Casco Product and should stress the importance of recycling for both environmental and economic reasons. This meeting should also cover what materials can be recycled in Casco's program and how the paper should be separated. Ongoing education should continue after the initial training session. Lists of what is acceptable and unacceptable for recycling should be posted by each employee's desk side bin and in central locations. Employees should be periodically updated on the success of the recycling program.

To motivate employees to participate in the recycling program, Casco should create an employee fund with a portion of the recycling profits. This fund could be used for an office Christmas party or other special event or donated to a local charity. Casco could hold a contest for recycling with the goal to break a recycling record of the company. These types of awareness and incentive programs can increase the success of a recycling program and boost employee morale.

2. The market for recyclable paper generally is at its highest when there is a shortage of paper fiber. When this occurs, companies like Casco make the greatest profit on the paper they recycle. However, during fiber shortages, the price per ream of paper also rises. So while companies are making more money by recycling paper, they are also spending more on paper products. The most effective way to reduce costs in the long run is to reduce the amount of paper used and discarded. Casco Products should institute office-wide source reduction policies for paper.



Examples of source reduction techniques for office paper include double-sided copying and reusing one-sided paper for internal memos, draft copies and memo pads. Office paper should not be recycled until both sides are used. Casco also should make a practice of routing materials or using a centralized bulletin board rather than making numerous copies. Electronic communications and records storage also reduce paper waste.

### **Shipping and Receiving Waste**

When Casco Products receives supplies, it also receives a variety of shipping materials which it must recycle or discard. Casco's receiving waste consists of corrugated cardboard boxes, wood pallets, corrugated cardboard cores and clear plastic bags. Casco Products currently diverts pallets and corrugated cardboard from the waste stream.

The majority of incoming pallets are of standard size (40" x 48") and are reused by Casco Products. Only the pallets which are in poor condition, approximately 6 per week, are discarded. Six pallets take up an estimated 1/4 of a 4 cubic yard dumpster. Thus, Casco is paying around \$70 per month to dispose of the pallets.

Corrugated cardboard boxes are flattened and stored for recycling at the Casco facility. In May of 1995, processors were paying \$150 for a ton of baled corrugated cardboard (Recycling Times Market Page, May 16, 1995). Several new recycled-content paper mills went on line in 1995 resulting in an increased demand for recyclable paper. Local recyclers were aggressively seeking sources of OCC to fill this demand. The high value of OCC at the mill made it cost-effective for the recyclers to pick up small quantities of the material. By the end of 1995, this demand had leveled off and the price of old corrugated cardboard had dropped to \$25 per ton (Recycling Times Market Page, December 12, 1995). The recyclers could no longer cost-effectively recycle materials from small quantity generators. Casco Products is one of the smaller companies affected by this market fluctuation. When the market was

strong, a local recycler paid Casco for its old corrugated cardboard. As of September 1995, the recycler will no longer pick up the material from Casco. The corrugated cardboard is now hauled to a recycling center by a former Casco employee. Casco is neither paid nor charged for the recycling service. Approximately 10 cubic yards of corrugated are recycled each month at an estimated annual savings of \$400.

Textiles and vinyl are shipped to Casco on rolls with high density corrugated cardboard cores. These cores are made from corrugated cardboard which is compacted and bound with a solvent-based adhesive. The adhesive prevents the cores from being recycled with other corrugated cardboard, therefore Casco discards the used cores.

The receiving waste that represents the greatest volume of the waste stream is clear low-density polyethylene bags (LDPE). Casco's foam supplies arrive enclosed in these bags. The supplier of the foam was contacted to gather the information on volumes shipped to Casco Products. The supplier estimated that 3,280 of these bags, or an equivalent of 2,473 pounds of LDPE plastic are shipped to Casco Products each month. All of the bags are discarded at the Casco facility. The LDPE bags are of three densities and sizes: a 110" x 40" bag that is 1.25 millimeters thick, a 24" x 26" bag that is 1.75 millimeters thick and a 31" x 30" bag with a thickness of 1.20 millimeters. The plastic bags have paper labels adhered to them which will need to be removed before recycling. Currently, these bags are sliced open to remove the foam but can be opened at the end to permit reuse.

**Recommendations:**

1. Casco Products is fortunate to have found an individual willing to transport its old corrugated cardboard to a recycling facility at no cost to Casco. While Casco is not experiencing the revenues from the sale of the OCC as it did in 1995, the company is reducing its disposal costs by \$400 per year. Casco should continue using this recycling service. Casco should also try to

reuse corrugated cardboard boxes that are in good condition.

2. Five local industrial plastic recyclers were contacted regarding the LDPE bags. Because the value of recyclable low density polyethylene is very low, the recyclers will only accept the material if it is baled and in semi-truck load quantities. Casco does not own baling equipment and would pay approximately \$2,700 per year for three years to purchase a small vertical baler. At twenty pounds per cubic yard, the 2,473 pounds of LDPE equates to approximately 125 cubic yards. Reducing the waste stream by 125 cubic yards per year, would save Casco \$423 annually. Local plastic recyclers will pay \$.01 per pound for baled LDPE film. Casco would earn around \$25 each year from the sale of the bags. Because, the plastic would cost a minimum of \$2,700 per year to bale, and would result in only \$450 per year in savings and revenue, it is recommended that Casco not purchase a baler. Baling would also require labor time and would Casco would have to allocate storage space for 30 to 40 bales which are 60" x 30" x 40" each.

The supplier of the foam was contacted about taking back the bags for reuse but was not interested in back-hauling the bags. Because there is potential for reuse, it is recommended that Casco advertise the bags in the local materials exchange network. This free service links businesses that generate a waste product with other businesses that can reuse or recycle that product.

3. Casco Products reuses all but approximately six incoming pallets each week. Local pallet recyclers will not pick up the remaining pallets because of the low volume and condition of the pallets. Casco could haul the pallets to a nearby pallet recycling facility. The recycler was contacted and will accept them for free. By

recycling these pallets, Casco can save valuable dumpster space.

4. There is no recycling option for the densified corrugated cardboard cores. Casco should encourage the suppliers of the vinyl and fabric to ship on reusable plastic cores. Companies can often use their purchasing power to influence the environmental behavior of their suppliers.

### **Production Waste**

Since Casco's production process varies based on its orders, so does its production waste stream. Foam, fabric, vinyl and wood are always present in the waste stream although the volumes of each vary.

Casco uses polyurethane foam in a variety of its products. The foam waste consists of several hundred grades of foam including old foam from furniture reupholstering. Casco sells its scrap foam to a local recycler, Hathaway Carpet Services, for \$.10 per pound. Approximately 300 pounds of foam are recycled each month, for an annual revenue of \$360.

Casco discards a small volume of synthetic textile scrap. The textile waste is scrap left over from production and old fabric removed from reupholstered furniture. Mr. Budke reported that the amount of scrap from the reupholstering varies widely. During the assessment, there were no orders which required the use of textiles, therefore, an accurate amount of the textiles in the waste stream could not be calculated.

As with the foam, there are various types and grades of vinyl disposed by Casco Products. To determine the volume of vinyl in the waste stream, Casco segregated vinyl waste for one month. During this month, Casco generated 1,704 pounds of vinyl scrap. Mr. Budke estimated the vinyl used for hospital bed mattresses makes up 50 percent of scrap. This vinyl is a polyvinyl laminate reinforced with nylon or polyester threads. The supplier of the vinyl, Herculite Company in Pennsylvania was contacted. Herculite generates

8,000 pounds of the polyvinyl laminate scrap each week and is also seeking a recycling market. Herculite has sent samples to recyclers in the Lancaster and York, Pennsylvania area but has not found an outlet. The contact at Herculite revealed that there is an international organization, the Industrial Fabrics Association International, addressing issue of polyvinyl laminate recycling. The Association was contacted and reported that 60,000 tons polyvinyl laminate end-roll scrap is being disposed each year in the United States. None of the members of this organization have found a market for the scrap.

Samples of Casco's scrap vinyl were sent to a number of regional plastic recyclers. One sample was sent to ISORCA, a company founded by retired engineers from Owens Corning that investigates possible uses for industrial scrap. ISORCA recently received a patent on a chemical called Petraplas, which allows different grades of plastic to bond together. ISORCA is working with an extruding company in Kentucky and an auto-parts manufacturer in Detroit to develop a new type of acoustic liner for automobiles. This company expressed interest in grinding the vinyl scrap from Casco Products, mixing it with other types of ground plastics and textiles, and forming it into a pad to line the trunks of cars. A larger sample of the vinyl was sent to this company for a test grind. There was concern that the reinforcing threads would wrap around the blades and damage the grinder, but the test grind proved successful.

ISORCA has sent a sample of its product to an independent lab to be tested for its effectiveness in dampening vibration. If the product passes the test, ISORCA estimates that it will need 20 million pounds of vinyl the first year of production and 40 million pounds per year over the next 5 years. The ISORCA liner will be competing against the asphalt-based liner currently used in most automobiles. Asphalt is a very low value material so it can be assumed that the ISORCA liner will be in a similar price range. Taking this and the cost to transport and grind the material into account, it can be assumed that the generators of the vinyl waste will be paid a minimal amount for the scrap if they are paid at all. However, by recycling the vinyl Casco could reduce disposal by approximately 100 cubic yards per

year, or \$340 per year.

There is concern that, because Casco generates a small amount of vinyl compared to the needs of ISORCA, Casco might be left out of the venture altogether. Herculite was approached about back-hauling the scrap vinyl from its customers and transporting the consolidated scrap to the recycler. The contact at Herculite expressed an interest in this idea. No action can be taken until ISORCA receives approval on its product, develops a market, and begins production.

**Recommendations:**

1. Casco Products should monitor the progress of ISORCA's project. If ISORCA begins production, Casco should further discuss a back hauling arrangement with Herculite Company. This would eliminate the problem of small volumes.
2. A small, one-person operation was found who would pick up Casco's wood scraps at no charge. Casco will not receive payment for the scraps but it will reduce the amount of waste disposed. Since all of the wood is generated in one area of the plant and is to some extent already being separated from the other waste, recycling the wood will involve minimal time and labor.
3. Casco Products should continue to search for ways to reduce the amount of production waste generated. In many ways, waste reduction is synonymous with increasing efficiency. Production staff should be trained on waste reduction tactics. Staff should also be encouraged to suggest ways to reduce waste and save money for Casco. Employees who submit ideas which are implemented should be recognized and rewarded.

## CONCLUSION

Casco Products has already made significant steps to reduce its waste stream. By recycling office paper, corrugated cardboard, and foam, Casco has reduced its waste stream by one third, saved over \$3,000 per year in disposal costs and earned a total of \$575 in revenue. The primary waste stream that is left to divert is the vinyl scrap. However, the variety in the vinyl and the contamination with other synthetic fabrics makes it less desirable in an already weak recycling market.

If Casco is seeking to draw workers away from competitors, the company needs to promote itself as a good working environment. Involving employees in waste reduction and recycling may improve the work atmosphere at Casco. By implementing mechanisms for employee involvement and encouraging and rewarding creative input, Casco can boost employee morale and make the company a more attractive place to work.

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