Three Case Studies: An Introduction

Watch closely and you'll see signs of a shift in corporate thinking

by Ellen Shapiro

Pollution prevention sounds good in theory, but does it make practical sense for the business community? Earlier articles in this issue of the *Journal* look at some of the organizational and financial obstacles that companies face when they decide to adopt pollution prevention as a strategy. This article considers the consequences of following through on that decision. To show some of the possible outcomes, we present the stories of three companies that have found a way to use pollution prevention to their advantage: Xerox Corp., a worldwide supplier of office equipment, with facilities located in Webster, New York; the Borden Chemical Co. plant in Fremont, California, which manufactures industrial adhesives and resins; and the Hyde Manufacturing Co., a small, family-owned tools manufacturer located in Massachusetts.

The steps being taken by these and a growing number of other firms represent what could be the beginning of a widespread shift in corporate thinking. Rather than merely complying with end-of-the-pipe environmental regulations, these firms take steps to reduce pollution at its source, thereby preventing future problems as well as cutting costs. Some are even finding ways to use their environmental investments to directly enhance the generation of profits.

(Shapiro is a policy analyst in the Economics, Exposure, and Technology Division of EPA's Office of Pollution Prevention, Pesticides, and Toxic Substances.)

These forward-looking companies appear to share certain characteristics that differentiate them from firms that are solely compliance oriented. For example, environmental staff are much more involved with other company functions and vice versa. The environmental staff at compliance-oriented firms, by contrast, focus narrowly on managing waste streams and in providing liaison with regulators.

Firms committed to pollution prevention seem to have better vertical integration, too. Senior managers have a direct interest in the design and progress of environmental projects since they affect the company's product line. At least a few companies are being pleasantly surprised to discover that, as environmental performance becomes everyone's business, overall morale improves.

Morever, companies with a pollution prevention orientation frequently adopt a broad program in which they become involved with their local communities, their suppliers, and their customers on environmental issues. Attention is paid to both upstream and downstream activities, including purchasing policies and end-customer concerns to provide safer supplies and products. Product stewardship—whereby the manufacturer actively helps the consumer use and dispose of its products in an environmentally sound manner—becomes a service offered by the company.

Environmental performance, in effect, becomes one of the company's products, and environmental success is likely to be found in increased sales and customer satisfaction. □

Asset Recycling at Xerox

by Jack Azar

Since Xerox Corporation does business worldwide, it makes sense for company managers to be alert to developments that may affect the international marketplace. One such recent development is the demonstrated concern in many countries about the proliferation of solid waste in the face of diminishing landfill space.

In some countries, legislation is in the works that could significantly affect marketplace demands. In Germany, legislation has been proposed that would require manufacturers and distributors to take back and recycle or dispose of used electronic equipment. The European Community is considering similar legislation. In Canada, too, interest in such legislation has been expressed. And in Japan, a 1991 regulation issued by the Ministry of International Trade and Industry promotes not only the use of recycled materials in certain durable items but also the recyclability of those items themselves.

At Xerox, we saw these signs of concern as indications of a future when the worldwide movement toward recycling would expand to include all kinds of products, including business equipment. We decided to act accordingly. Thus, in 1990, we began developing a corporate environmental strategy that encompasses equipment and parts recycling. The cornerstone of

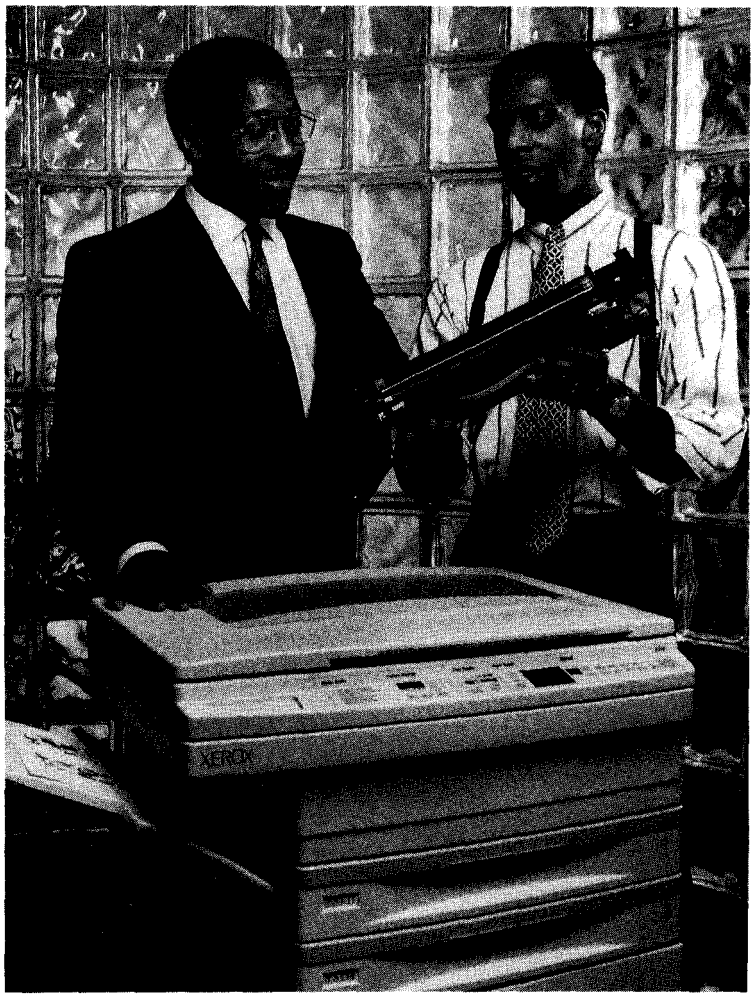
(Azar is Manager for Environmental Design and Resource Conservation at Xerox Corporation. James C. MacKenzie, Corporate Director of Environmental Health and Safety, and Richard S. Morabito, Vice President of Asset Recycle Management, both of Xerox, also contributed to this article.)

this strategy is our *Asset Recycle Management* program. As the name implies, it entails treating all products and components owned by the company—whether out on rental or on our premises—as physical "assets." This initiative marked a new departure for the company's Environment, Health, and Safety organization, which had previously focused almost entirely on proper handling of hazardous materials.

Historically, we had been taking our machines back from rental and remanufacturing them for re-use since the late 1960s. So how is the Asset Recycle Management program different from past practice? The key difference lies in our design-for-environment approach, which begins at the product concept stage. This is a radical departure from the past, when our machines were not *designed* from concept with the remanufacturing process and the recapture of parts and materials in mind. As a result, before Xerox adopted a design-for-environment approach, many used machines were returned in such condition that they were not salvageable for remanufacturing purposes; many ultimately found their way into landfills, contributing to the solid waste problem and depriving us of considerable salvage value.

The company's Asset Recycle Management program is based on a practical hierarchy of objectives:

- Distributing returned equipment for reuse by new customers, so long as it is in optimal working order
- Restoring equipment, through remanufacturing, to its original state
- Converting the equipment or major assemblies from the equipment into another product—for example, using in a printer the electromechanical elements of a copier
- Dismantling equipment to salvage parts for use either on the new product assembly line or as spare parts for field repairs
- If parts are not salvageable, recycling their source materials either at Xerox or externally through suppliers or recyclers. The latter may combine recycled source materials with virgin material into a blend that is used in Xerox parts.



Executives at Xerox Corporation discuss the company's latest returnable copy cartridge, used in the Xerox 5314 Convenience Copier. Spent cartridges are returned to Xerox and remanufactured, avoiding solid waste and saving production costs.

Xerox photo.

As a prerequisite for success, implementing a design-for-environment strategy meant getting our design and manufacturing engineers to bring an entirely new perspective to their work. It is difficult to overstate the significance of such a change. To accomplish this, we sought and obtained the support of senior Xerox management in making environmental considerations a formal product requirement.

With the support of senior management, an Environmental Leadership Steering Committee, drawn from the major organizations in the company, monitored activities and provided direction to the individuals involved in the design-for-environment program.

A separate task force addressed critical matters related to asset recovery and recycling. Over five months, the task force identified significant opportunities to optimize the use of equipment and parts, even for existing products. Thanks to the success of the task force, the company formed an Asset Recycle Management organization, thereby institutionalizing the process.

Early on, we recognized that company engineers needed design guidelines to enhance remanufacturing and materials recycling. The Asset Recycle Management organization developed these guidelines, and they are continually upgraded. They include guidance on materials selection and engineering techniques to facilitate disassembly for remanufacturing purposes.

Specifically, the guidelines reflect the following design criteria: extended product and component life—i.e., use of more robust materials and design to make asset recovery practical; selection of materials that are relatively easy to recycle at the end of product life;

simplification of materials to facilitate recycling; easy disassembly as well as easy assembly; remanufacturing convertibility, meaning that a basic product configuration is convertible to a different use—e.g., a copier to an electronic printer; and use of common parts to enable future re-use in different models and configurations.

Traditionally, product concepts incorporate the targeted customers' performance, configuration, feature, and price requirements. To this list we added environmental requirements. As when gathering conventional market data, we solicit customer feedback on environmental requirements through surveys, a customer hotline, and market research that includes focus groups and customer advisory councils.

All these data are factored into an initial design concept that embraces materials and manufacturing approaches. Again, by taking environmental considerations into account at this initial point, we avoid a great many problems and roadblocks that we would encounter if we waited for a later design phase to introduce them.

The Asset Recycle Program at Xerox is not concerned solely with equipment and parts; it also focuses on the business process associated with product delivery worldwide.

Unlike our previous business process, the new product-delivery process incorporates design for recycling right from the early concept phase, on a parallel track with new product design and manufacture. The remanufacturing process for returned equipment is planned in detail at the same time. Our goal is to have the remanufacturing process available when new products are launched, so that recycling of field-test equipment and manufacturing prototypes can begin within the next several months.

In the past, machine remanufacturing took place in separate refurbishing centers. Now it is integrated into new product assembly lines: This helps assure high quality and performance comparable to new products.

Our first environmental design to reach the market was a customer-replaceable copy cartridge, which has many of the characteristics of a complete xerographic copier. Designed for use in our smaller convenience copiers, the copy cartridge contains the main xerographic elements critical to the copying process—photoreceptor, electrical charging devices, and a cleaning mechanism.

Copy cartridges designed for older convenience copiers posed a special challenge. They had not been designed for recycling. In fact, their plastic housings were assembled by ultrasonic welding. We had to break them open to get at the components within, thereby destroying the plastic housings. While we were usually able to reclaim the photoreceptor-transport assemblies, all we could do with the housings was grind them down for reuse as injection-molding raw material.

When Xerox began developing a new 5300 series of convenience copiers, we worked with the product-delivery team to design a new cartridge that is assembled with a few fasteners. It is totally remanufacturable, a process that costs far less than building one with all new parts, and more than 90 percent of the material is recoverable. Like all our remanufactured or recycled-content products, it also meets all product quality specifications and carries the same warranty as newly manufactured cartridges.

To date, the Asset Recycling Program at Xerox has been a big success from the standpoint of both environmental and business considerations. On the business side, we saved a total of $50 million the first year in logistics, inventory, and the cost of raw materials. We expect these savings to increase greatly as design-for-environment Xerox products enter the market.

In addition, only a minimal amount of material has been scrapped compared with previous years. However, we have a considerable way to go to reach our goal of zero materials to landfill.

There are still external barriers to overcome. Some commercial customers still reject recycled-content products as "used," and so do several government jurisdictions in the United States and abroad. We hope that the environmental imperative will lead them to accept recycled or recycled-content equipment that meets their performance requirements. □

Plastics: A Special Problem

At Xerox, we want to develop new products that, at the end of product life, will contribute virtually nothing to landfills. Ideally, we want to recycle all materials that aren't reusable as components.

Plastics are a problem in this regard not only because not all plastics are easily recyclable, but also because they are frequently difficult to identify in the form of finished products. Moreover, there are very few recyclers of engineering thermoplastics.

Xerox plans to participate in both the supply and demand phases of plastics recycling. Our goal is to use 100 percent recyclable thermoplastic resins in our products. By 1995 we hope to use 25 percent of post-consumer recycled materials in our machine and supply products, and we aim to reach 50 percent by 2000.

Xerox is working with plastics manufacturers to test and qualify recycled-content materials and to develop specifications for recycled materials that meet the needs of business equipment. We have instituted an international marking system for plastic identification to simplify the processes of material separation and recycling at the end of product life.

In the process of this collaboration, we are reducing the number of thermoplastic resins that we will use in our machines from well over 500 to fewer than 50. We estimate that a very small number, fewer than 10, may satisfy 80 percent of applications.