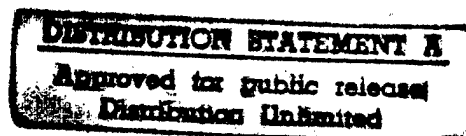

Logistics Management Institute

Promoting Extended
Product Responsibility
in the United States
A Nonregulatory Strategy

IR704R1

December 1997

Raheem M. Cash
Denise R. Dellovade
Daniel P. Jackson



DTIC QUALITY INSPECTED 8

19980107 036

LMI

Promoting Extended Product Responsibility in the United States A Nonregulatory Strategy

IR704R1

December 1997

Raheem M. Cash
Denise R. Dellovade
Daniel P. Jackson

DTIC QUALITY INSPECTED 3

LOGISTICS MANAGEMENT INSTITUTE
2000 CORPORATE RIDGE
MCLEAN, VIRGINIA 22102-7805

Promoting Extended Product Responsibility
in the United States: A Nonregulatory Strategy

IR704R1/DECEMBER 1997

Executive Summary

Extended product responsibility (EPR) is a rapidly emerging concept encompassing a set of practices implemented by manufacturers that promote responsible use of resources and minimization of solid waste generation, disposal costs, and contributions to diminishing landfill space. "Product takeback," the most prominent category of EPR, is being aggressively implemented by European and Asian nations in order to combat their solid waste problems. Nations such as Germany, the Netherlands, Austria, Italy, Taiwan, and Japan are requiring manufacturers to take back televisions, computers, radios, telephones, dishwashers, and other items from consumers. Consequently, manufacturers are actively developing programs to meet the requirements and are developing design protocols (often referred to as "Design for Environment" or DfE) that make products more amenable to recycling, refurbishing, and remanufacturing.

Although a limited number of U.S. electronics manufacturers operate product takeback programs, and some are developing environmentally friendly design protocols, the United States lacks a national commitment to EPR practices. Much of the discussion in the United States has centered on the notion that the government cannot and should not adopt the regulation-based strategy being employed in Europe and Asia. This focus on what the government *cannot* do has stifled the growth of EPR in the United States.

We identify the policies and practices the federal government *can* do to

- ◆ *encourage* the adoption of product takeback and DfE via the development of a national EPR strategy, and
- ◆ *facilitate* industry development and operation of EPR programs via direct government participation.

We will identify electronic industry EPR efforts and the core requirements needed for their success, initiatives of other nations, and the electronic property acquisition/procurement and disposal system of the federal government.

Preceding Page Blank

The recommendations identify specific actions that the U.S. federal government can take to spur the growth of EPR practices in the United States. The recommendations address two segments of the federal community: officials responsible for national environmental policy development and officials responsible for direct management of federal equipment (i.e., the government consumers). It is expected that the implementation of these recommendations within the public sector will ease efforts to make EPR a common practice in all manufacturing sectors.

Each of the recommendations are crafted to meet the six core EPR program requirements identified by electronic manufacturers:

- ◆ Economical and efficient transport and collection systems
- ◆ Consistent, predictable product flow
- ◆ Environmentally compatible product design
- ◆ Accurate product information
- ◆ Consumer awareness/education
- ◆ Partnerships.

We recommend the following initiatives and policy developments:

- ◆ Amend Executive Order 12999, *Educational Technology: Ensuring Opportunity for All Children in the Next Century*, to incorporate product takeback.
- ◆ Purchase equipment from suppliers that implement EPR and DfE practices.
- ◆ Expand the scope of EPA's DfE program.
- ◆ Increase procurement through leasing.

In many ways, the federal government's property acquisition/procurement and disposal system is well positioned to meet many of the requirements for successful EPR for electronic products. The key is making certain selective changes to enable full accommodation and integration of EPR within the government and further its growth in the private sector. In order to achieve this, some fundamental changes are necessary in the government's overall electronic equipment purchasing and disposal strategies and in specific practices. Specifically, the government should

- ◆ establish more regional partnerships with electronics recyclers;
- ◆ shorten the disposal process and establish takeback programs;

- ◆ conduct value assessments for all excessed items;
- ◆ implement a new equipment tracking system;
- ◆ provide EPR training for all property management, procurement, and contracting officials;
- ◆ benchmark federal electronic management practices; and
- ◆ finalize Environmentally Preferable Purchasing guidance and include discussion of EPR and DfE.

Decisions and practices of federal agencies as a large consumer can have a significant impact on the decisions and practices of manufacturers. Through its purchasing and disposal policies, the government can induce electronics manufacturers to initiate takeback programs and/or implement DfE practices. This is a market-driven approach to developing EPR programs. It is hoped that the above steps will enable the United States to take the lead in an emerging arena by adopting the unique approach we suggest.

Contents

Chapter 1. Introduction.....	1-1
PURPOSE AND CONTENT.....	1-2
METHODOLOGY	1-2
ELECTRONIC PRODUCT LIFE CYCLE AND EPR	1-3
ASSERTING GOVERNMENT INFLUENCE.....	1-4
Chapter 2. EPR Program Requirements in the U.S. Electronics Industry	2-1
INTRODUCTION.....	2-1
CORE REQUIREMENTS FOR SUCCESS	2-2
Economical and Efficient Transport and Collection Mechanisms.....	2-2
Consistent, Predictable Product Flow	2-2
Environmentally Compatible Product Design	2-3
Accurate Product Information.....	2-3
Consumer Awareness/Education	2-4
Partnerships	2-4
Chapter 3. International EPR Policy Initiatives	3-1
GERMANY	3-1
THE NETHERLANDS.....	3-2
OTHER NATIONS	3-3
IMPACTS OF NATIONAL POLICIES: LESSONS LEARNED	3-3
Chapter 4. U.S. Government Property Management.....	4-1
FEDERAL PROCUREMENT	4-1
ENVIRONMENTAL CONSIDERATIONS IN FEDERAL PROCUREMENT	4-3
DISPOSAL	4-3
GOVERNMENT EPR ACTIVITIES	4-5
IMPACTS OF GOVERNMENT PRACTICES AND EPR DEVELOPMENT	4-6
IMPACTS OF THE FEDERAL PURCHASING PROCESS	4-6

Preceding Page Blank

IMPACTS OF THE FEDERAL PROPERTY DISPOSAL PROCESS	4-7
RELATIONSHIP OF EXECUTIVE ORDER 12999 TO EPR DEVELOPMENT	4-8
Chapter 5. Recommendations	5-1
RECOMMENDED POLICIES AND INITIATIVES	5-1
Amend Executive Order 12999 to Incorporate Product Takeback	5-1
Purchase Equipment from Suppliers That Implement EPR and DfE Practices	5-2
Expand the Scope of EPA's DfE Program.....	5-3
Increase Procurement Through Leasing.....	5-4
RECOMMENDED EQUIPMENT MANAGEMENT PRACTICES	5-5
Establish More Regional Partnerships with Electronics Recyclers	5-5
Shorten the Disposal Process and Establish Takeback Programs.....	5-6
Conduct Value Assessments for All Excessed Items.....	5-6
Implement a New Equipment Tracking System	5-7
Provide EPR Training for All Property Management, Procurement, and Contracting Officials.....	5-7
Benchmark Federal Electronic Management Practices.....	5-8
Finalize Environmentally Preferable Purchasing Guidance and Include Discussion of EPR and DfE.....	5-8
Conclusion	5-8
Appendix A. Electronic Manufacturer EPR Programs	
Appendix B. Design for Environment	
Appendix C. State Government EPR Efforts	
Appendix D. References	
Appendix E. Abbreviations	

FIGURES

Figure 1-1. Electronic Product Life Cycle	1-4
Figure 4-1. Federal Property Acquisition and Disposal Process.....	4-2

Chapter 1

Introduction

Extended product responsibility (EPR) is a rapidly emerging concept encompassing a set of practices to be implemented by manufacturers. The overarching concept is that manufacturers, whose products often contribute to environmental degradation either during use or upon disposal, should take greater responsibility for the impacts of their products even *after* they are sold. This means extending a manufacturer's responsibility to the environment beyond its usual boundary of process emissions and waste effluents. The primary goals are to ensure the responsible use of resources and the minimization of solid waste generation. A primary driver is the diminishing landfill space faced by many nations.

Manufacturers may take this responsibility in numerous ways, directly or indirectly. "Product takeback," currently the most prominent form of EPR, is a direct approach whereby the product is returned to the manufacturer at the end of its useful life. The manufacturer is then responsible for its ultimate, and environmentally sound disposal. Product takeback is being aggressively implemented by European and Asian nations in order to combat their solid waste problems. Nations such as Germany, the Netherlands, Austria, Italy, Taiwan, and Japan are requiring manufacturers to take back televisions, computers, radios, telephones, dishwashers, and other items from consumers. Consequently, manufacturers are actively developing programs to meet the requirements and are developing design protocols (often referred to as "Design for Environment" or DfE) that make products more amenable to recycling, refurbishing, and remanufacturing.

This report focuses on EPR policies and practices (particularly product takeback and DfE) within the electronic products manufacturing sector. Electronic products are currently the primary focus of most takeback initiatives. The number of electronic products on the market has increased significantly since the late 1970s. Consequently, there has been a marked increase in the volume of these items that, having reached the end of their useful life, are now being thrown away or stored for later disposal by millions of households and businesses.

Because the contents of many electronic products are hazardous or toxic, the increase in the electronic waste stream inherently means an increase of hazardous and toxic materials finding their way to landfills and incinerators. These materials eventually find their way into the air, waterways, and soil creating significant environmental and health risks. In addition to being more toxic, electronic wastes are also more costly to handle than other solid wastes. A Carnegie Mellon University study estimates that current disposal rates for PCs are \$100 to \$200 per ton,

and the nationwide cost of disposal by 2005 could reach \$1 billion.¹ These estimates do not include hazardous waste disposal costs or future liability costs. [1]

PURPOSE AND CONTENT

The purpose of this report is to identify the policy and practices the federal government can implement to

- ◆ *encourage* the adoption of product takeback and DfE via the development of a national EPR strategy, and
- ◆ *facilitate* industry development and operation of EPR programs via direct government participation.

We will identify electronic industry EPR efforts and the core requirements needed for their success, initiatives of other nations, and the electronic property management processes used by the federal government.

The United States lacks a national commitment to EPR practices. Much of the discussion in the United States has centered on the notion that the government cannot and should not adopt the regulation-based strategy being employed in Europe and Asia. This focus on what the government *cannot* do has stifled the growth of EPR in the United States. This report outlines the key role the government can play in promoting EPR by using a nonregulatory approach.

This report is presented in five chapters and five appendixes. Chapter 2 discusses the core success requirements for industry takeback programs. Chapter 3 presents an overview of some takeback and DfE efforts in other nations. Chapter 4 analyzes the federal government's current management practices for electronic equipment and how these practices enhance or impede potential EPR growth. Chapter 5 presents a set of recommendations designed for both federal policy-makers and federal property managers. Appendix A describes the sample EPR programs of three electronics manufacturers. Appendix B is a description of DfE. Appendix C describes the EPR efforts of two state governments. Appendixes D and E are lists of references and abbreviations, respectively.

METHODOLOGY

The following questions served as the foundation for all analyses conducted for the report:

- ◆ How are electronic products currently managed (e.g., purchase, transfer, and disposal) by the federal government?

¹ This figure assumes that 150 million computers will be landfilled each year. An update to the Carnegie Mellon study reported that only 55 million computers would be landfilled.

- ◆ Which government property management policies potentially encourage/discourage product takeback and DfE within the electronics sector?
- ◆ What criteria must be met for industry takeback and DfE programs to succeed?
- ◆ What are the obstacles faced by a company or government wishing to start and/or continue such programs?

To answer the first two questions, we examined federal regulations and interviewed agency officials to determine how the government functions as an electronics consumer. The focus of this effort was to determine how the government's electronic product procurement and disposal practices mesh with the needs of manufacturers, recyclers, and others who take back used electronic products. We have limited our scope to include takeback programs for electronic equipment especially computers (e.g., CPUs, monitors, and printers), and telecommunications equipment (e.g., telephones and fax machines).

Answers to the last two questions provided critical information from interviews with computer manufacturers, electronic product recyclers, and from current literature on EPR issues. Strategies cannot be developed for the government to encourage private-sector takeback activities without understanding private-sector needs.

ELECTRONIC PRODUCT LIFE CYCLE AND EPR

Developing solutions for the electronic product disposal problem requires an understanding of the products' life cycle, that is, how these products end up in the waste stream.

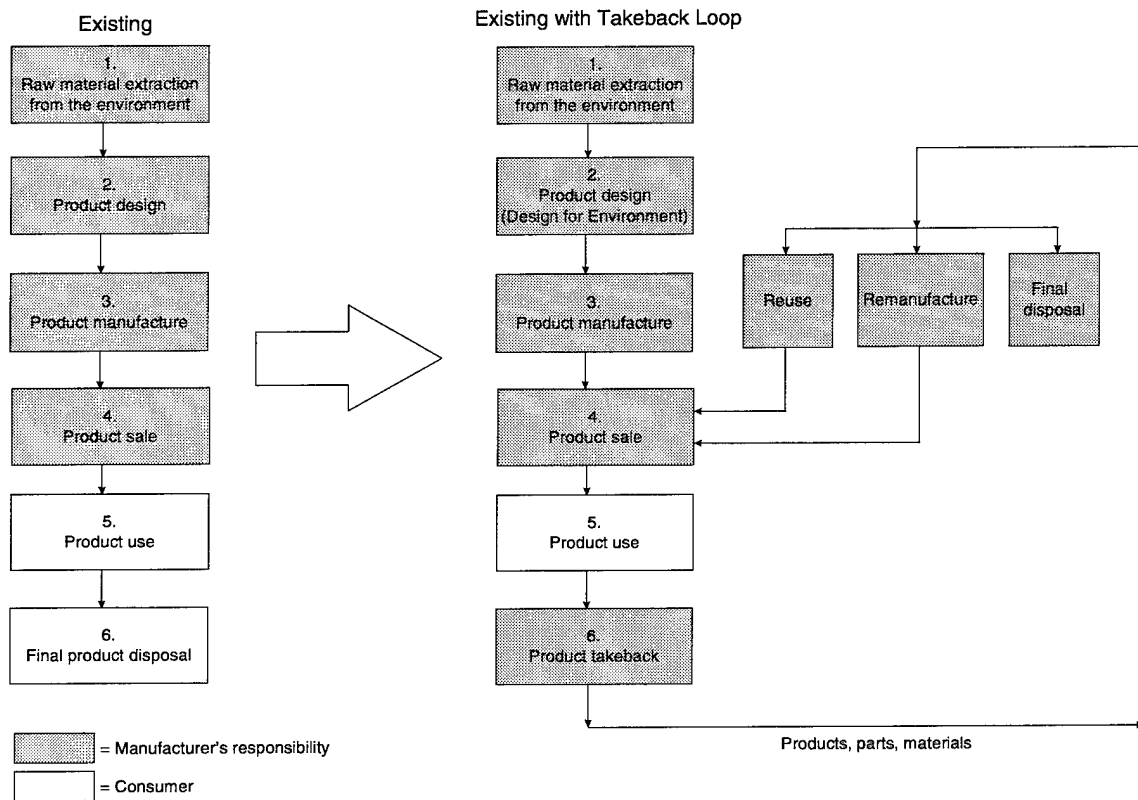
In its simplest form, a typical product life cycle follows the steps below:

1. Raw material extraction
2. Product design
3. Product manufacture
4. Product sale
5. Product use (by consumer)
6. Product disposal (by consumer).

Currently, the manufacturer of a product relinquishes virtually all responsibility for the product after step 4 of the life cycle (product sale). Under EPR, the manufacturer's responsibility is extended beyond step 6 (product disposal); at this

point under a product takeback program the manufacturer acquires responsibility for final disposal. As shown in Figure 1-1, the three most common options available are reuse, remanufacture, and direct disposal.

Figure 1-1. Electronic Product Life Cycle



ASSERTING GOVERNMENT INFLUENCE

Decisions and practices of federal agencies as a large consumer in steps 5 and 6 of the electronic product life cycle can have a significant impact on the decisions and practices of manufacturers in steps 2 and 3 of the product life cycle (see Figure 1-1). Through its purchasing and disposal policies, the government can induce electronics manufacturers to initiate takeback programs and/or implement design for environment practices. This is a market-driven approach to developing EPR programs. Like other consumers, the government can affect business behavior by the choices it makes in the marketplace. With approximately \$5 billion spent annually on computers, etc., the government has substantially greater leverage to affect change in the private electronic manufacturing sector.

Chapter 2

EPR Program Requirements in the U.S. Electronics Industry

INTRODUCTION

In general, large U.S. electronics manufacturers are multinational corporations that have operations in Europe as well as the United States. Consequently, manufacturers that do not have takeback programs or engage in other EPR activities in the United States tend to have these programs in Europe; this is due to the requirements of the countries where they do business. This is not the sole motivation however.

Officials in some companies recognize the impacts of electronic wastes and also the potential value (in terms of additional revenue and cost avoidance) that electronic waste can have for the manufacturer. The primary complaint from the manufacturers centers on how the European governments have forced the industry to develop programs in a haphazard manner without first considering a simple question: What does an electronic manufacturer need for its takeback program to work?

While the regulatory approach often is criticized as being heavy-handed, there is one tangible benefit: it guarantees that manufacturers will take the necessary steps to actually implement some type of EPR program. Manufacturers essentially are forced to use their ingenuity to develop a working program. The lessons learned from the experiences of companies in Europe should enable the U.S. government to develop strategies that avoid or mitigate some of the problems encountered.

Some manufacturers operate small EPR programs in the United States and more sophisticated ones overseas. By examining EPR programs, both domestic and foreign, we were able to identify the core requirements for a manufacturer to operate a successful takeback program. Detailed program summaries are in Appendix A. Core program requirements are discussed next.

CORE REQUIREMENTS FOR SUCCESS

Our research into the EPR programs of various manufacturers, states, and foreign countries revealed several key factors that not only determine the relative success of such programs but also influence the willingness of a state, nation, or firm to develop and/or expand an EPR program. In these subsections, we summarize each of the identified requirements.

EPR Program Core Requirements

- Economical and efficient transport and collection systems
- Consistent, predictable product flow
- Environmentally compatible product design
- Accurate product information
- Consumer awareness/education
- Partnerships

Economical and Efficient Transport and Collection Mechanisms

The key to a successful takeback program is an economical and efficient collection and transport system. The cost for transport and collection is significant and no one is willing to bear all of the costs. Most manufacturers lack an existing infrastructure for product collection and transport. Those with takeback programs contract with outside haulers to do the job. Most manufacturers see municipal collection of electronics as a potential solution. Due to the lack of a centralized infrastructure, the few takeback programs in the United States require individual consumers to takeback items.

Consistent, Predictable Product Flow

Consistency and predictability are essential elements to most industrial operations, especially when it comes to product flow. Manufacturers with existing takeback programs expressed a desire to retrieve a greater number of their products. This is because most of the manufacturers have found some valuable use for the returned products and/or their components. However, they have not experienced a deluge of products flowing back to them; so, the real issue is still how to produce the volume with which manufacturers wish to work. Low volume not only lessens the potential for asset recovery, it increases the unit costs for collection and transport. In the United States, the issue of flow is not as critical for manufacturers simply because fewer of them have takeback programs that are integral to their operations. High consumer participation and the higher flow that accompanies it is, however, a major criterion for U.S. manufacturers who expressed a desire to expand their programs.

Computer recyclers and refurbishers, especially nonprofits, are very eager to increase the flow of used electronic equipment to their facilities for distribution to various organizations such as prisons and needy schools.

Environmentally Compatible Product Design

A product designed with the environment in mind is much easier to incorporate into a takeback program. A returned product is easier to manage if it is recyclable or reusable, composed of uniform materials, and easy to disassemble. Most manufacturers readily admit that receiving items that meet these criteria depends upon their producing items that meet these criteria. This is why firms in Europe have increased their efforts to incorporate DfE concepts and procedures into their manufacturing processes. While these efforts are to some extent mirrored in the United States, European-based firms tend to be further along because they have a strong incentive (i.e., regulations that essentially force them to take back their products). Though the United States may not wish to impose similar regulations, no EPR initiative will succeed over time without DfE.

The importance of DfE in the EPR network cannot be overemphasized. Many of the options available for recovered electronics become difficult if not impossible when items are not easy to disassemble, contain mixed content materials, or contain toxic materials. An increase in DfE products increases the likelihood that manufacturers will implement takeback programs.

A larger problem is how to handle older products. In general, the greater the age, the less likely the product was designed with recycling or other environmental aspects in mind. A Carnegie Mellon study estimates that as much as three quarters of old and used computer equipment is still in storage. [1] This is likely to be true for other electronic items such as VCRs. The consequence of this is obvious, the majority of the electronics returned by consumers within the next several years will be older, non-DfE-designed products that will limit the opportunities for recycling, reuse, and remanufacturing.

Accurate Product Information

Accurate product information allows manufacturers to determine what products they will be getting, how many, when, or in what condition. The need for this is especially acute for firms that use specific returned components for specific recycling or reuse processes. Not knowing what you will receive means not knowing what you can provide to your customers.

To alleviate this problem, communication needs to be established between suppliers (consumers) and the takeback program operator. This is virtually impossible when dealing with residential consumers unless there is a third party serving as a funnel point. Bulk consumers (e.g., businesses, school systems, and

government entities) have a greater ability to track their inventories and provide disposal information to manufacturers and recyclers.

Another critical piece of information concerns the material makeup of a particular product. Anyone collecting electronic equipment for EPR purposes needs to know exactly what types of plastic resins are used in the product, what toxic materials are contained, etc., in order to decide precisely what can be done with the product and its components.

Consumer Awareness/Education

Consumer awareness of the potential value of old electronic equipment and knowledge of EPR disposal options is important from the perspective of industry and government. Consumer awareness directly affects product flow, which is a key factor in transportation costs. From a government's perspective, consumer awareness is another means to influence the desired behavior changes within industry.

Partnerships

Partnerships are a key component to creating successful takeback programs. This is likely to be the case for some time. Almost 71 percent of the German manufacturers surveyed by the Marketing Institute at the University of Münster have found partners, especially recycling firms, to whom they have delegated tasks such as the return of used products, return logistics, dismantling, recycling processes, or opening up markets for secondary raw materials. Nine percent have set up joint ventures with recycling firms. Fourteen percent delegate product recycling to outsiders. Only 15 percent of the companies carry out the tasks independently. State programs utilize partnerships between the government and private or nonprofit recyclers. In all, three types of partnerships dominate: government-recycler, government-manufacturer, and manufacturer-recycler. [4]

Chapter 3

International EPR Policy Initiatives

Several European nations have drafted comprehensive product takeback legislation for appliances (white goods), packaging materials, and consumer electronics.¹ Most nations have taken or are planning to institute a mandatory compliance approach, which essentially requires manufacturer's to establish a system for product takeback. The Netherlands however gave the electronics industry an opportunity to develop its own takeback program with no government mandates. In either case, many electronics manufacturers operating in Europe already have begun to either establish programs or take the steps necessary to create one.

GERMANY

The legislation proposed in Germany, the *Elektronikschrottverordnung*, was put forth by the German Ministry for the Environment to deal with the estimated 800,000 tons of electronic waste produced annually in Germany. The proposed law is far-reaching and strict, affecting manufacturers and retailers, including mail-order houses. It targets a broad range of equipment for takeback and recycling. It would apply to any company (1) that manufactures or puts its brand name on electronic equipment in Germany or (2) that commercially introduces electronic equipment into the German market. "Electronic equipment" as defined by the proposal, includes office equipment, such as personal computers and fax machines, televisions with screens larger than 30 cm, calculators, medical equipment, and other items. [5]

As currently drafted, the law requires the following actions:

- ◆ Products must be manufactured from "environmentally compatible" and recyclable materials.
- ◆ Products must be designed and manufactured for easy disassembly and repair.

¹ "Consumer electronics" refers to computers, audio/visual equipment, telecommunications equipment, and other electronic items commonly used in a residential or office setting.

-
- ◆ Used equipment collection centers must be easily accessible to the end user (the consumer returning the product).
 - ◆ Parts deemed nonrecyclable must be disposed of safely.

Electronics industry trade groups have had an active voice in the process of drafting the *Elektronikschrottverordnung*. The German Ministry for the Environment and several working groups—such as VDMA/FG Bit (the German Business Machines and Information Technology Manufacturers Association) and ZVEI (the Central Association of the German Electric Industry)—are developing the details on criteria for safe disposal, recyclability, and environmentally compatible materials. They are also planning a large-scale recycling system and developing methods for enforcing the law.

Seventy-one percent of German manufacturers have already set up product take-back systems in response to the pending legislation. One problem has been that most of the items collected during current efforts were designed and produced without considering recyclability. A survey conducted by the Marketing Institute at the University of Münster found the following: [4]

- ◆ The majority of firms do not offer free takeback.
- ◆ The amount of scrap returned was usually a mere 5 to 10 percent.
- ◆ Higher return rates tended to be found for items that were rented or leased.

THE NETHERLANDS

Over the past few years in The Netherlands, a “covenant” has been used frequently as an instrument of policy. A covenant is a written agreement between the government and others (e.g., local authorities, industry, and nongovernmental organizations) aimed at developing, implementing, and achieving policy objectives in The Netherlands. Although covenants with industry explicitly state that the agreement is governed by civil law, compliance is voluntary. During 1994 through 1995, the Dutch government formed a covenant with the electronics industry whereby manufacturers and their associations were to develop a mechanism to take back their respective products. [6]

Because this voluntary approach was not successful, in late 1996 the government produced a draft decree requiring producers and importers of electronics and other items to take back their products free of charge. Industry would, however, be able to levy a surcharge on the price of new products to fund takeback programs. The draft also includes a ban on the landfilling and incineration of the products collected. Suppliers, retailers, and local authorities would share responsibility. This is unusual as most other nations place the burden solely upon the manufacturers. Under the proposed system, retailers would take back old equipment when new

items are sold, communities would manage a collection system, and manufacturers would oversee equipment processing. Major Dutch industry associations have reviewed the draft decree. At least one, VIFKA, has major concerns. One fear is that retailers will remove valuable portions of products prior to returning them to the manufacturer. There is also industry concern over the impacts of the proposed surcharges on Dutch product sales. However, despite these concerns, industry representatives are still very much involved in discussions with the government. [7, 8]

OTHER NATIONS

Sweden, Switzerland, and other nations have proposed plans similar to The Netherlands. The Danes, however, are proposing to take a slightly different approach to product takeback. The environmental agency Miljøstyrelsen recently issued a proposal that would make municipalities responsible for the collection and disposal of electronic equipment. Funding would come from waste-removal fees. Manufacturers will be allowed to take back their own products as long as their recovery plans are in compliance with the government's environmental requirements. The products covered include audio/visual equipment, information technology equipment, and laboratory equipment. [9]

Taiwan is the primary Asian leader in terms of product takeback policy initiatives. Taiwan has mandated that manufacturers of computers, TVs, refrigerators, air conditioners, and washing machines take responsibility for their products during the end-of-life stage. Retailers, manufacturers, importers, and recyclers have been brought together to manage and operate the takeback program. Financial support will be provided by the nations' recycling funds, which in turn are funded by taxes on producers that are tied to sales and imports. Municipalities will be responsible for collection and separation of materials. Japan is considering a similar program. [10, 11]

IMPACTS OF NATIONAL POLICIES: LESSONS LEARNED

The existing efforts to develop national EPR and product takeback policies are primarily legislatively driven albeit with some industry influence. The Netherlands is one of the few nations to provide the electronics industry with an opportunity to develop its own takeback system. For the most part, the policies being proposed and/or implemented have simply forced manufacturers to develop takeback programs and DfE initiatives. Governments have done little to ensure that the six core requirements identified in Chapter 2 are met.

The physical size of the United States along with its large yet relatively spread out population magnifies the problems faced by manufacturers overseas. Consequently, simply mandating takeback without any guidance or assistance could prove disastrous.

A look at efforts overseas also illustrates the fact that, thus far, no government has examined its contribution to the electronic waste problem as a consumer. While there are some environmentally preferable purchasing initiatives under review, especially in Canada, none of them have established a link with EPR concepts such as product takeback and DfE. Furthermore, the governments have not begun to analyze their current disposal practices for electronic equipment. We believe the United States' best chance for successfully adopting EPR concepts nationwide lies in unmasking and utilizing the link between government and EPR.

Chapter 4

U.S. Government Property Management

As a major consumer of electronic products, the government can have a great influence on the development of EPR. The government's consumer role resides in its property acquisition/procurement and disposal systems.¹ This chapter provides a general description of both systems and their relation to electronic products and the federal government.

FEDERAL PROCUREMENT

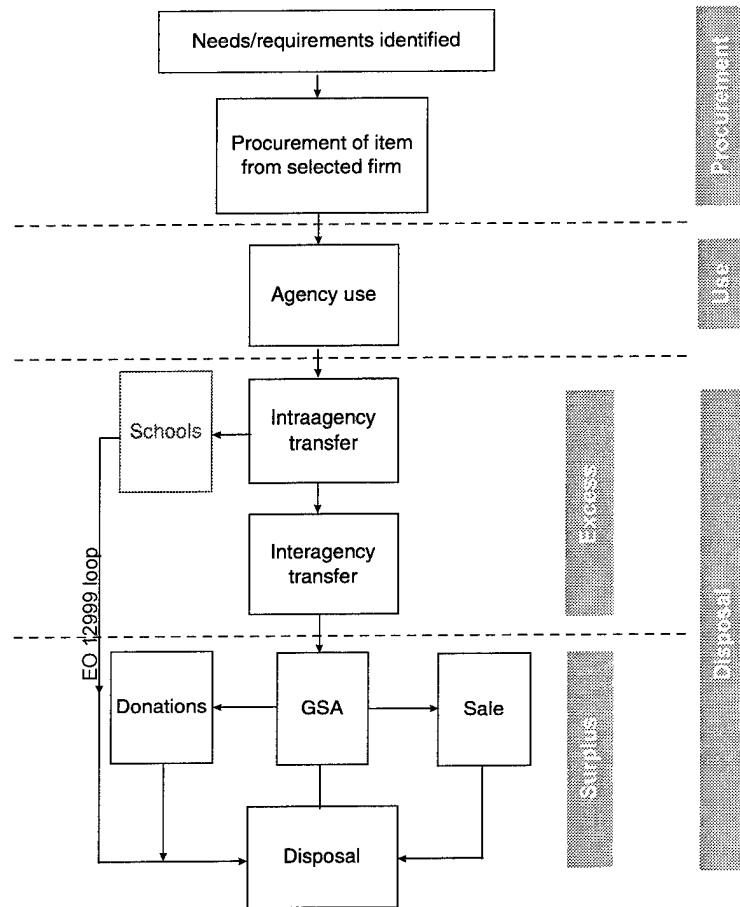
Federal procurement is vast enough to make the government the largest single consumer in the nation. During FY96, for example, the government purchased \$5 billion worth of automatic data processing equipment. [12] To manage this large activity, the Federal Property Management Act of 1949 (FPMA) established the primary property regulations governing all federal purchasing and made the General Services Administration (GSA) and the Office of Management and Budget's (OMB's) Office of Federal Procurement Policy (OFPP) responsible for their implementation. The OFPP is responsible for providing overall procurement policy direction and leadership for federal agencies. OFPP issues policy letters that are incorporated into the Federal Acquisition Regulation (FAR), which establishes the criteria to use for federal procurement. The FAR is issued and maintained by the Department of Defense (DoD), National Aeronautics and Space Administration, and GSA.

Firms desiring contracts with the government must demonstrate their ability to meet performance, cost, and other requirements stated by GSA and by individual agencies that have authority to set additional information technology (IT) criteria specific to their needs. An examination of existing contract awards reveals that the government obtains its IT equipment from major manufacturers that are major retail market suppliers as well. These contracts are valuable to these manufacturers because of the large purchasing volume of the government.

Figure 4-1 illustrates the flow of property from government procurement and use to disposal of "excess" and "surplus." [12, 13, 14, 15]

¹ Note that this does not refer to real property.

Figure 4-1. Federal Property Acquisition and Disposal Process



Note: Executive Order (EO) 12999, *Educational Technology: Ensuring Opportunity for All Children in the Next Century*.

ENVIRONMENTAL CONSIDERATIONS IN FEDERAL PROCUREMENT

By law, the federal government is obligated to consider the environmental impacts of its purchasing decisions. Under FAR Section 23.704, federal agencies are compelled to “implement cost-effective contracting preference programs favoring the acquisition of environmentally preferable and energy-efficient products and services.” The regulation lists several environmental objectives that must be considered during procurement, including the following:

- ◆ “Obtaining products and services considered to be environmentally preferable (based on Environmental Protection Agency [EPA]-issued guidance) and energy efficient
- ◆ Eliminating or reducing the generation of hazardous waste and the need for special material processing (including special handling, storage, treatment, and disposal)
- ◆ Promoting the use of nonhazardous and recovered materials
- ◆ Realizing life-cycle cost savings
- ◆ Promoting cost-effective waste reduction when creating plans, drawings, specifications, standards, and other product descriptions authorizing material substitutions, extensions of shelf life, and process improvements.”

Section 15.605(b)(1)(iv) of the FAR stipulates that in addition to price, past performance and quality, “environmental objectives, such as promoting waste reduction, source reduction, energy efficiency,....shall also be considered in every source selection, when appropriate.”

It is clear that EPR and product takeback meet most if not all of the above objectives; however, these are not specified as options. Consequently, they will only be emphasized if the federal requisitioner is privy to the EPR and product takeback concepts.

DISPOSAL

The property disposal process is divided into two major parts. Within the government, property is not simply disposed of, it is excessed and subsequently surplused. Excessed items are those that no longer meet the needs of a particular federal agency. Surplused equipment no longer meets the needs of any federal entity. When property is no longer needed by civilian agencies, they are declared excess and transferred to GSA’s Federal Supply Service (FSS) for government-wide screening. Under its utilization program, the FSS makes excess property

generated by all agencies available for possible transfer to other federal agencies for their direct use or for use by their contractors or project grantees.

Surplus equipment is handled under the FSS's donation and sales programs. The donation program enables eligible nonfederal organizations—through the state agencies for surplus property (SASPs)—to obtain surplus property. Surplus property is available to nonfederal public agencies and private nonprofit organizations and institutions, such as educational and health activities and programs for the elderly and the homeless. The sales program affords individuals and businesses opportunities to buy items the federal government no longer needs. Property is primarily sold to the public by competitive offerings: sealed bid, auction, or spot bid. Once equipment is sold or donated, the federal government is freed of all ownership and responsibility for the product, including its ultimate disposal.

The ultimate goals of the excess and surplus procedures are to extend the useful life of equipment purchased by the government and thereby avoid costs associated with new purchases. Under the FPMA, agencies must actively seek out suitable excessed equipment prior to requesting new items. Agencies are required to maintain records of items excessed and surplus, but there is no centralized tracking system. Thus we were unable to obtain specific data concerning the numbers of individual computers, telephones, etc., excessed/surplus or how many items ended up being sold or donated.

GSA is only responsible for the management of civilian agency property. Within DoD, the Defense Logistics Agency (DLA) and Defense Reutilization and Marketing Office (DRMO) manage much of the procurement and disposal of defense equipment. The process is quite similar to that for civilian agencies. Equipment from installations and bases are first offered for redistribution to other military facilities. If there are no takers, suitable items are donated to schools and other nonprofit organizations while others are stored at DRMO facilities for future sales. DoD's policy is to recover and sell all precious scrap metals (e.g., gold and platinum) unless a cost evaluation assessment is made that shows that the market value for the assembled item is higher than the value of the metal. [16]

The disposal of electronic equipment for both civilian and military agencies is governed by two additional sets of rules, the Stevenson-Wydler Technology Innovation Act of 1980 (Stevenson Act) and Executive Order (EO) 12999, *Educational Technology: Ensuring Opportunity for All Children in the Next Century*. The Stevenson Act compels federal agencies to actively seek other users for their excess/surplus laboratory and scientific equipment, much of which is electronic. EO 12999, signed into law by President Clinton in April 1996, is a far-reaching law with major impacts on how the government handles computer equipment. It directs agencies, civilian and defense, to provide excessed computers and computer-related equipment directly to needy schools. The primary goal is to simplify the process whereby needy schools can obtain computer technology. Under the rules described earlier, school officials would have to go

through GSA warehouses and SASPs to obtain equipment. The EO makes schools the top priority for excess *and* surplus computer equipment, thus creating a major detour from the usual disposal process and GSA management (see Figure 4-1). All computers not finding their way to a school eventually find their way to GSA. Agencies are supposed to inform GSA of all items donated to schools under the EO. Yet as of this writing, GSA has not received such information from any federal agency.

GOVERNMENT EPR ACTIVITIES

The General Services Administration operates one government-industry electronic takeback program for federal offices in the National Capital region (Washington, DC). Electronic equipment, regardless of the manufacturer, age, or condition, that is not successfully sold or donated is provided to Digital Equipment Corporation (Digital) under a unique contract agreement with GSA. Under that year-old contract, Digital picks up the items from GSA warehouses. The company then decides whether to sell, reuse, recycle, or dispose of the equipment. The government receives 15 percent of the proceeds of any equipment sales Digital makes. Last year, GSA estimated that it earned \$50,000 from the Digital contract and saved a substantial amount of money by avoiding costs of managing wastes themselves. By implementing a takeback program where the contractor handles the hazardous waste aspects of the program, the government saves money on cost avoidance that the agencies would otherwise have to pay for hazardous waste treatment and disposal.

Technically speaking, the Digital-GSA program is not an EPR program in its purest sense (the original product manufacturers are not taking extended responsibility for them), but it does meet some EPR objectives. The Washington, DC, program is not replicated in other regions of the country, and according to GSA, there are no concrete plans to do so. No individual agency offices we contacted had any similar arrangements with an electronics manufacturer or recycler.

Within DoD, individual DRMOs participate in takeback programs for some items such as car parts, sulfuric acid, batteries, compressed natural gas cylinders, and grease/lube material, but not electronic equipment. Surplus computers not given away under EO 12999 are donated, sold intact, or sold as scrap.

Although EPR is not yet an integral component of the government's property management procedures, there are clearly opportunities to inject the concept at various points; the GSA-Digital arrangement is an indication of this. [3]

IMPACTS OF GOVERNMENT PRACTICES AND EPR DEVELOPMENT

At the beginning of this report, we assert that the most powerful influence the federal government can have on the growth of EPR in the United States is through its role as a major consumer in the marketplace. The key difference between the government as consumer and the average citizen as consumer is that the government, through its relatively centralized policymaking process, has the ability to make decisions that can single-handedly affect millions of products and thousands of companies in the marketplace. No other individual consumer has this much purchasing power.

Now that we have identified the core requirements for a successful EPR program, it remains to be seen whether the government, as a consumer, can establish an environment that meets these requirements. Next, we analyze the government's consumer behavior with reference to its tendency to promote or hinder the attainment of the six core requirements discussed earlier.

IMPACTS OF THE FEDERAL PURCHASING PROCESS

Federal supplier contracts for IT are often designed to last for 3 or more years during which agencies purchase items in bulk. Agencies also tend to purchase individual products from the same manufacturer. From our industry research, it is clear that a steady stream of products with known characteristics is preferred by existing takeback program operators. The federal purchasing structure is well positioned to meet this requirement and is also well suited to accommodate product takeback partnerships between the government and manufacturers and/or recyclers.

The FAR compels the federal government to be an environmentally conscious consumer. Through discussions with GSA officials and federal property managers at various agencies, we learned that this environmental consciousness has not been fully realized. Despite the existence of an environmentally oriented policy, the environment is still not a high priority in the procurement realm. Government procurement policy prescribes that purchases be made on a competitive basis for both products and services rendered. The successful firm must be able to provide the government with what it needs and wants at a good price and quality. The integration of these requirements with the array of environmental criteria has not yet occurred.

The environmentally preferable purchasing policy delineated in FAR Section 23.704 is the key to establishing product takeback and other EPR actions as a common requirement for electronic procurement; hence, spurring the growth

of viable takeback programs within industry. The primary hindrance is that the government is not the most environmentally aware consumer.

IMPACTS OF THE FEDERAL PROPERTY DISPOSAL PROCESS

The disposal process is where we find most of the potential hindrances and opportunities to government promotion and facilitation of EPR. As described earlier the government's property disposal system actually consists of a series of steps prior to the final disposal of an item. This final disposal usually represents a transfer of the product to a nongovernment entity. In many ways, the government's disposal process is a perfect example of EPR. The useful life of a given product is lengthened by extending the government's responsibility for the product through internal transfers of equipment. This is the crux of the excess process. Unfortunately, this is a potential hindrance to the development of takeback programs. While a product's useful life is extended for the government, the potential value to a manufacturer or recycler diminishes with time, thus eliminating any incentive to take back the item. This represents a big loss to the government as well.

A 1994 General Accounting Office report found that DLA typically only receives 2 percent of the original acquisition costs when selling its electronic products due to the extended years of storing excess property. Often, the property had not been needed by the military services for 5 years or more, yet DLA continued to incur the costs for storing the property. [17]

The negative impacts of the long time line from government purchase to disposal will depend greatly upon the intended use of the product. Those waiting for donations from the government are likely to be offered severely out-of-date products, which may not meet their needs. A single computer could take 5 or more years to find its way to the surplus stage and even then it would not be immediately available to manufacturers or recyclers. In addition, the time frame will vary for *every single piece of equipment*, complicating matters further.

The excess process can only be characterized as fragmented and disorganized. Items can be transferred among agencies in piecemeal or bulk fashion. GSA is not always privy to the exchanges. Tracking is virtually impossible. Agencies tend not to keep accurate records of what and how many items are transferred to whom. Agencies receiving excessed items are supposed to report them to GSA as they would any other procurement, yet this too is not consistently done.

The dearth of accurate information and the lack of a centralized mechanism to manage equipment information presents a serious problem. The government must develop the ability to tell a potential takeback market exactly what it owns, how much it owns, and where the items can be found. Again, this is more of an issue

for manufacturers who intend to reuse parts of an item or have some other use for them that requires a certain flow level and supply predictability. Little impact would be felt by recipients that simply recycle components or make use of the heavy metals contained in electronic equipment. Yet even those organizations need to accurately predict how much material they will receive in a given time frame. Reliable information and predictability are both crucial for personnel, budgeting, and capital investment decisions. The current excess process makes the government a weak candidate for a full takeback participant.

When electronic equipment finally reaches the surplus stage, it still is not available for the takeback market. GSA is responsible for selling and donating surplus equipment. Of course, a manufacturer or recycler could purchase the equipment at this stage, but again, we are faced with the problem of reliable supply and logistics. GSA surplus warehouses and SASPs are located all over the country; each stores a variety of equipment in addition to electronics. None of these places maintains a precise inventory. Under these circumstances, transportation efficiencies are impossible due to disparate locations. Again, the lack of information regarding the equipment held by each warehouse severely hampers the prospects for a takeback system.

A potentially beneficial feature of the property disposal process is that agencies have the option of not using GSA at all to handle their surplus items. Therefore, they have the option of establishing takeback arrangements with individual firms on their own. An agency could use a centralized process or allow its individual offices to develop partnerships. Of course, even a single agency would have to improve its inventory-tracking and management procedures, but this may be far easier than asking the entire federal government to do so on a centralized basis.

RELATIONSHIP OF EXECUTIVE ORDER 12999 TO EPR DEVELOPMENT

After only 1 year, federal agencies have been very successful with providing computer equipment to needy schools around the nation. Thousands of pieces have been donated; consequently, needy students are able to gain access to new technologies and all their wonders. The life cycles of many computers are extended. As stated earlier, agencies are free to locate needy schools and establish donation arrangements without going through the usual excess/surplus process. It is possible that any takeback arrangement would be in direct competition with the Administration's technology-to-schools initiatives. However, EO 12999 actually presents another problem that could be ameliorated with the implementation of EPR.

When one looks closely at how the technology-to-schools process works, it becomes painfully obvious that the federal government is not only passing on its computers to schools (i.e., county governments), it is also passing along the

onerous responsibility of disposing of those computers. No one within the government really knows what the schools do or will do with their electronic equipment when it is no longer needed; few seem to care either. It is possible that these computers are ending up in landfills without any recycling of components. School disposal of formerly government-owned equipment is a potential target for government participation in EPR.

Chapter 5

Recommendations

The recommendations contained in this chapter identify specific actions that the government can take to spur the growth of EPR practices in the United States. The recommendations address two segments of the federal community, the first being those responsible for the development of national environmental policies and initiatives and the second being those responsible for direct management of federal equipment.

Each of the recommendations is crafted to meet the six core EPR program requirements identified by electronic manufacturers:

- ◆ Economical and efficient transport and collection systems
- ◆ Consistent, predictable product flow
- ◆ Environmentally compatible product design
- ◆ Accurate product information
- ◆ Consumer awareness/education
- ◆ Partnerships.

Recommended Policies and Initiatives
● Amend Executive Order 12999 to incorporate product takeback. ● Purchase equipment from suppliers that implement EPR and DfE practices. ● Expand the scope of EPA's DfE program. ● Increase procurement through leasing.

RECOMMENDED POLICIES AND INITIATIVES

Amend Executive Order 12999 to Incorporate Product Takeback

Executive Order 12999, while achieving a worthy goal, perversely results in the government dumping its disposal responsibilities on to the shoulders of needy schools. Failing to help the schools dispose of donated computers not only sets a bad example, but an incredible opportunity for EPR is missed as well. In order to encourage electronic takeback programs, the President should amend the EO 12999 to require that donating agencies, with assistance from GSA, establish school-recycler/manufacturer takeback partnerships. Identifying partners and

developing collection/transport mechanisms will be the most difficult duties. Ideally, partners would be organizations or firms from the local area or state. Taking on this responsibility achieves several goals. First, it enables the government to ensure that its equipment is disposed of in an environmentally sound manner through an extension of its product responsibility. Second, it plants the seeds for nationwide takeback programs by establishing centralized, focused programs in various regions. As a result, the government and firms will gain takeback expertise. School-based programs are also a great way to educate young people about the environment and the merits of reuse and recycling. In fact, educating students about EPR is a key step in the government's efforts to create consumer-based takeback programs; children have been found to have great influence over their parents' behavior when it comes to the environment.

School-based programs will create a valuable market for the computer recycling/refurbishing industry. Electronics manufacturers opting to participate would also benefit from such partnerships, not only from the equipment value but from a positive environmental image and potential brand loyalty of students, teachers, and school systems.

Purchase Equipment from Suppliers That Implement EPR and DfE Practices

Future IT equipment should be purchased from manufacturers that can clearly demonstrate a firm commitment to integrating EPR techniques/programs into their processes. Selection of companies committed to EPR is best accomplished through establishing applicable contract award criteria. To achieve this and to meet the requirements of FAR Sections 15.605(b)(1)(iv) and 23.704 (see Chapter 4), we recommend that the following evaluation criteria be used in large procurements wherever possible:

- ◆ Company operates a product takeback program or has arranged for product recycling or remanufacturing.
- ◆ Company has or is developing a DfE program
- ◆ Company's products are composed of uniform materials
- ◆ Company's products are easy to disassemble
- ◆ Company has minimized use of toxic materials in its products.

As a large consumer, the government has the ability to influence the market in order to satisfy its needs and in particular its environmental objectives. It must do so, however, in a way that harnesses the creativity of the commercial marketplace and is consistent with customary business practices. Given the large amount of federal purchases, electronics manufacturers would have a great incentive to begin

producing more environmentally friendly products. This recommendation is consistent with recent acquisition reform efforts because it does not require the government to buy products with features unique to the federal sector, and it also would not require manufacturers to implement practices inconsistent with existing industry practices. As we discussed in Chapter 2, most major electronics manufacturers have begun to implement EPR in Europe, and many have found DfE to be worth implementing at all locations. The goal is to provide an incentive to expand all of these practices in the United States.

Environmentally conscious federal procurement, focused on EPR, is the most powerful step the government can take to encourage the electronics industry to enhance their EPR efforts. Under this proposal, electronics manufacturers are being asked to conform to a consumer's, in this case the government's, changing tastes—something the industry has demonstrated a great ability to do in the past.

Promoting the acquisition of DfE-based electronic products has a critical side effect—it results in the increase of easy-to-recycle, disassemble, and remanufacture products. Thus, if manufacturers fail to implement takeback programs, recyclers and refurbishers can fill the void. Once DfE is an established industry practice, the heavy dependence on manufacturers to take back products diminishes. This seems like a potential disincentive for manufacturers to develop DfE simply because they would not want to lose their product's residual value and intellectual property attained through reverse engineering to another entity for recycling. However, a manufacturer not implementing DfE and/or other EPR practices also would not be supplying the federal government. The choices are clear from the industry perspective; it is better to implement EPR concepts in product development than not to, and it is also better to take back those products yourself rather than allow others to reap the benefits from doing so.

As manufacturers increase their implementation of EPR practices to meet government desires, the products manufactured under these practices will also find their way to the retail consumer. Separate design and production procedures for identical products would be inefficient and costly. Over time, the retail market will have enough products that are suitable for future consumer takeback programs, which is the next step in EPR's evolution.

As critical as this recommendation is, the proposal must provide manufacturers with enough time to develop the desired EPR programs. Additionally, the government must develop a clear set of criteria indicating what constitutes an acceptable DfE or takeback program. Our next recommendation speaks to this issue.

Expand the Scope of EPA's DfE Program

EPA's DfE program focuses on encouraging manufacturers to adopt DfE practices. Technical research and information is provided through a cooperative

network of manufacturers, trade associations, academic institutions, and public interest groups. In essence, it is an information exchange program. To provide a more direct incentive to industry, we recommended that EPA add a "green design" component to its DfE program. This program would fit under the umbrella of EPA's other voluntary programs such as Green Lights and Energy Star. The goals of this subprogram would be to provide a marketing incentive for manufacturers to implement DfE; aid in the identification of best DfE practices; and, most importantly, enhance the public's awareness of DfE, product takeback, and other EPR activities. Under this program, the following key questions would be answered: What qualifies as an EPR program? What constitutes a DfE program? What elements must a takeback program possess? Once these questions are addressed, manufacturers can voluntarily join the program by agreeing to meet the criteria set forth. In return, firms would be able to promote the fact that their products satisfy EPA green design protocols, and EPA would promote the company to the public as well. Ultimately, continued membership could be an evaluation factor for supplying products to the federal government. This program is not intended to be restricted to electronic products; the list of products is likely to expand over time.

The task of establishing the relevant criteria is expected to be the most arduous. An effective method would be to use the current networks established under the DfE program to form a partnership between industry, EPA, and GSA representatives. This will help to ensure that economic, technical, logistics, and environmental considerations are considered early and throughout the process. Inclusion of the electronics industry also ensures that realistic criteria are developed.

Increase Procurement Through Leasing

The government, like many organizations, often needs to upgrade its computer and telecommunications equipment about every 4 to 5 years. Given this fact, the benefits of *owning* these items should be questioned. Government agencies do, however, retain their equipment longer than average, sometimes for 6 to 10 years, prior to excessing or surplusizing them. Even so, the costs of the excess and surplus processes—in terms of time, personnel, transport, and storage—is high. Products can easily cost the government more to dispose of than to purchase, thus defeating the stated purpose of the excess process (i.e., to cut costs by purchasing fewer new items). GSA should explore the option of allowing agencies to lease most of their electronic equipment to avoid these costs.

Establishing leasing arrangements with computer and/or telephone manufacturers for an agreed length of time not only avoids excess/surplus costs, it also places the disposal responsibility upon the shoulders of the manufacturer. Indeed, leasing is a disguised form of takeback. Under a leasing agreement, the manufacturer knows that it will get its product back. Consequently, they have every incentive to figure out what to do with them. Their solutions may include refurbishing, reuse, or

recycling, which in turn would prompt the company to incorporate DfE into its processes. The exact cost savings and impacts of leasing on the entire federal property procurement system requires further investigation, but it is clear that leasing is an effective means for extending manufacturer's responsibility.

Federal acquisition regulations allow agencies to use leasing on an ad hoc basis. GSA and OMB should establish concrete leasing baseline mandates for federal purchasing of electronic equipment.

RECOMMENDED EQUIPMENT MANAGEMENT PRACTICES

In many ways, the federal government's property management system is well positioned to meet the requirements for successful EPR for electronic products. The key is making certain selective changes to enable full accommodation and integration of EPR within the government and further its growth in the private sector. In order to achieve this, some fundamental changes are necessary in the government's overall electronic equipment purchasing and disposal strategies and in specific practices.

Recommended Equipment Management Practices

- Establish more regional partnerships with electronics recyclers.
- Shorten the disposal process and establish takeback programs.
- Conduct value assessments for all excessed items.
- Implement a new equipment tracking system.
- Provide EPR training for all property management, procurement, and contracting officials.
- Benchmark federal electronic management practices.
- Finalize Environmentally Preferable Purchasing guidance and include discussion of EPR and DfE.

Establish More Regional Partnerships with Electronics Recyclers

The success of the Digital-GSA takeback/recycling program in the National Capital region indicates that similar programs should be attempted elsewhere. A partner company must be able and willing to collect virtually all government electronic equipment as Digital does.

We found that the majority of federal electronic equipment finds its way to landfills. Only computer-related equipment, through EO 12999, is strongly targeted for reuse and recycling. Other electronics, such as telecommunications

equipment, are not needed by as many nonprofit organizations and do not sell as well at government auctions. This state of affairs reinforces the need to find partners willing to take almost anything off the government's hands. Continuing the regional approach is the preferred strategy. Essentially 10 major federal regions exist with agency offices often concentrated in the same city.¹ These cities have well-established transportation infrastructures. Transportation efficiencies and the centralized location of agencies provides an ideal environment for takeback programs.

Regional federal agencies should coordinate their partnering efforts with manufacturers. A coordinated effort within federal regions will enable the government to more effectively manage excess/surplus takeback programs and potentially realize greater returns. Regional partnerships could facilitate partnership development among schools and manufacturers/recyclers because many of the schools eligible for donations under EO 12999 are located in urban areas.

Shorten the Disposal Process and Establish Takeback Programs

Pursuant to federal policies, ultimate equipment disposal can take 10 years or more. The cost of the prolonged disposal process is not justifiable. For all excessed or surplus electronic items that are not earmarked for schools under EO 12999, we recommend that GSA seek takeback arrangements with electronics manufacturers and recyclers/refurbishers.

Specifically, we suggest electronic product takeback programs begin immediately after the excess stage, thereby bypassing the surplus stage. It is also suggested that the excess process be drastically shortened in some instances. This may seem to contradict the government's efforts to make the most out of its purchases. However, it is clear from our research and other studies that the sales and donations of surplus electronics are very low. Most items are simply obsolete by the time they become available. Furthermore, state agencies, which were once major purchasers of surplus federal equipment, no longer have a need for as many federal hand-me-downs. The best chance the government has of disposing of such items in an environmentally sound manner is through product takeback arrangements. The government would earn more from the sale of its products if it did not wait for them to become obsolete.

Conduct Value Assessments for All Excessed Items

It is known that many surplus electronic items never find new owners primarily due to their age and condition. The government should develop the capability to forecast a product's performance in the excess and surplus markets. If an item is

¹ Boston, New York, Philadelphia, Washington, DC, Atlanta, Dallas, Chicago, Denver, San Francisco, and Seattle.

determined to have little or no chance of being needed by other federal entities or being sold to the public, it should be sent through a takeback or recycling program immediately. Past experience should serve as a guide; for instance, it should be known whether new owners are ever found for 4-year-old PCs. The goal is twofold: (1) save taxpayer dollars by avoiding the transportation and warehousing costs incurred for undesirable equipment and (2) help maintain sufficient product volume for takeback and recycling programs. Clearly, no part of this recommendation can be achieved without better organization and information management of the federal property management process as a whole.

Implement a New Equipment Tracking System

Earlier, we illustrated how the federal property management system begins in a highly centralized fashion for procurement and then devolves into a less-structured disposal process. As such, purchases are well documented but disposals are not. For example, an official at GSA confessed that he does not have sufficient information to tell a needy school how many computers he has to offer them much less what type they are. An effective equipment tracking system will enable GSA to know what products it has to offer, their quantities, and their conditions. Eliminating this challenge through an information management system will ensure the success of EPR and EO 12999.

A new database network should be established to enable property managers to input and obtain information regarding the purchase date of an item, the model, the condition, and the intended disposal method. The database should enable users to conduct queries in order to quickly communicate inventory information to GSA, needy schools, and other agencies.

Information and communication are keys to better management decisions. In the case of EPR, the information impacts the decisions of manufacturers, recyclers, transporters, and the government itself.

Provide EPR Training for All Property Management, Procurement, and Contracting Officials

Integrating EPR considerations into the government's procurement process requires integration of these considerations within the psyche of procurement/contracting officials. All such officials should be required to complete a training course, as part of the agency acquisition management professional development program, and be supplied with a guidance manual that explains the various environmental aspects one should look for when establishing procurement criteria. Training sessions and manuals should first cover electronics, paper products, and furniture, then be expanded as other products are studied. Such training will improve the government's overall compliance with affirmative procurement

guidelines. A formal press release should be held, and industry conferences should be used as a method of deploying the new policy initiative.

Benchmark Federal Electronic Management Practices

We have recommended substantial improvements to the government's current property management system. Prior to implementation, it would be useful for the government as a whole and individual agencies to know how private organizations manage their electronic products. This is best achieved by using benchmarking efforts that focus on particular organizations known to have "best-in-class" systems. Knowledge obtained from such a study would save the government time and expense by adapting the practices of organizations that have already completed the "trial-and-error" phase. Government agencies can bypass this phase and focus on implementing the better solutions.

Finalize Environmentally Preferable Purchasing Guidance and Include Discussion of EPR and DfE

In 1995 the Environmental Protection Agency issued a proposed guidance for Environmentally Preferable Purchasing (EPP) within the federal government. Although several pilot studies were initiated based on the guidance, EPA decided not to finalize the document. In order for EPP and EPR concepts to permeate the federal acquisition process, a final, comprehensive guidance should be available to all government personnel involved in procurement. This need is compounded by the fact that recent reform efforts designed to streamline and simplify the federal acquisition process and reduce the bureaucracy has resulted in the diversion of purchasing authority away from procurement personnel and toward all government employees.

One of the recommendations in the guidance should include the designation of a single advocate of EPP within every agency. An important function of this official would be to coordinate workshops and training programs for procurement staff and to share knowledge, experience, and lessons with their counterparts in other agencies.

Conclusion

Through our research, we identified a variety of steps the federal government can take to spark EPR practices within the electronics industry, especially product takeback programs and DfE protocols. It is hoped that taking these steps will enable the United States to lead in an emerging arena by adopting the unique approach suggested. The overall intent is to use the government's large role as an electronics consumer to produce sufficient momentum enabling the expansion of product takeback programs to the private consumer level and expand EPR practices to other industry sectors.

Appendix A

Electronics Manufacturer EPR Programs

COMPAQ COMPUTER CORPORATION

Compaq has undertaken a range of EPR-related activities, including takeback programs, DfE, and packaging reduction. Compaq has started to design its products with the expectation that the products will be returned within 10 years. Considering the rapid rate of computer industry growth, Compaq does not think reusing technology or hardware will be feasible. Currently, they rely on third-party recyclers to manage the takeback products that they are receiving now, and they will continue to do so.

Compaq's takeback experience has been mixed at best. In Switzerland and Germany, it operates a combined takeback and recycling service for its computers in response to consumer requests. Customers pay approximately \$25 to \$30 for the service. During the 4 years of operation, Compaq has reported low customer response. In Germany and Switzerland combined, only 60 computer systems are returned each year. As a whole, Compaq's European operations take back many more PCs than their U.S. operations because the infrastructure for returning electronic equipment is more advanced. In both the United States and Europe, Compaq uses third-party recyclers (e.g., Digital Equipment Corporation) to manage returned computers at little to no additional cost. According to Compaq officials, the equipment that they receive is obsolete, and they have no use for most of the parts. Compaq has seen little consumer demand for takeback programs, which may be due to a lack of awareness by most consumers.

In the DfE arena, Compaq designs computer parts that can be remolded such as plastics, metals and precious metals, and glass monitors. The intent is to enable maximum use of the raw materials after the end of the computer's life that will ensure future reuse. Compaq intends to recycle its own materials; thus, the company can be sure that the materials meet specifications. [2, 3]

DIGITAL EQUIPMENT CORPORATION

The GSA contract with Digital is one of the first takeback types of programs in the government. As discussed, Digital takes back almost all electronic office equipment regardless of the manufacturer. Last year, roughly 12,500 tons of computer equipment was collected. (Each computer system weighs between 25 and 50 pounds.)

Within Digital, the division responsible for electronic equipment takeback operates as an independent business entity. It collects used equipment from many sources for sale, recycling, or disposal. Digital has three classifications of recyclables: valuable as is, contain valuable components, or require disposal. Depending on the content of a batch of equipment that they pick up, the overall value of the products will vary. In some cases, Digital would bill the company with whom they have a contract if, after all transactions have been made, there is a net loss. In the case of GSA's contract, they do not pay if there is a loss, as stipulated by GSA.

Digital hopes to expand its program and has been working with other U.S. government agencies to discuss opportunities for new contracts. For example, the Department of Energy (DoE) has considered entering into a national plan for consolidating electronic waste management. Until then, Digital works with individual DoE facilities. Digital is also negotiating with the Defense Logistics Agency.

The benefits of participating in Digital's program include the avoidance of costs associated with waste handling. Digital explains they have recycling market resources and knowledge that facilitates equipment recycling. In addition, Digital benefits from economies of scale when arranging transportation, pickup, and marketing due to its large size.

Digital's focus is on corporate and government clients because residential takeback programs are not cost-effective since there is no centralized consolidation process for screening and collecting electronic equipment. Digital is not interested in the residential market since no procedures exist for consolidating waste for collection, something which is generally agreed to be necessary for program success. Centralized consolidation and screening is necessary for a cost-effective residential program. Overseas, Digital complies with EPR regulations on a nation-by-nation basis. No overall strategy has been contemplated. [3]

DELL COMPUTER CORPORATION

Dell recently announced a DfE effort that involves the conversion of one of its PC lines to a recyclable chassis that is expected to reduce waste when they are discarded by consumers. The new chassis is also designed to simplify upgrades and maintenance. The impact of this decision should be great because Dell sells 80 percent of its desktop computers to businesses with the remaining portions going to government and educational institutions. These are bulk buyers who also tend to upgrade at a faster rate than the average consumer.

Dell partners with several resale and recycling companies to offer a takeback program for its corporate customers. Through this service, Dell takes responsibility to ensure that unwanted products are properly disposed through resale, use of spare parts, or recycling/disposal. [3]

Appendix B

Design for Environment

Design for Environment (DfE) is the practice of incorporating environmental concerns into the design stage of a product's life cycle. Specifically, a manufacturer considers the environmental impacts the product will have during usage and after disposal. Once these impacts are known, an attempt is made to design the product in a manner that reduces or eliminates the impact. Sometimes, the design changes themselves do not mitigate the environmental impact but instead allow the product to be more easily handled in a manner that does reduce impacts. This is usually achieved through design changes that allow for easier dismantling; increased uniformity of materials to simplify recycling; or the use of modular construction, which can be readily upgraded.

Most electronic products contain an array of different types of plastics in addition to glass and metals. Paper, textiles, and wood also can be found in many electronic items. Designing products in a manner that reduces the number of plastic types is a major need and challenge for takeback programs and other EPR initiatives.

Recycling and repairing requires that a product be dismantled. Unfortunately, most electronic products are designed in a way that makes dismantling impossible without inflicting unwanted damage.

Designing upgradable products enables product components to be upgraded while the major part of the item continues to be used. When one looks at a typical consumer electronic product, it becomes clear that the real heart of the product lies within the product's shell. Thus, there is usually little need to discard the shell simply to upgrade the heart.

Appendix C

State Government EPR Efforts

MINNESOTA OFFICE OF ENVIRONMENTAL ASSISTANCE

Statistics from the Minnesota Office of Environmental Assistance (MNOEA) show that more electronic appliances are used and discarded in the Twin Cities Metropolitan Area than in all of Minnesota due to higher population and household incomes. Several other cities in the Metropolitan Area accept electronic appliances during special collection events. Charitable organizations, such as Goodwill Industries, represent one of the largest management channels for discarded electronic appliances in Minnesota. However, repair efforts have diminished in recent years, mainly because of the lack of parts for older machines and greater difficulty in fixing appliances that are not designed for easy repair. As of August 1995, several cooperative projects among businesses, local governments, and consumers were under discussion, with plans for implementation in the near term. The hope is that the programs will provide cost-effective alternatives to traditional solid waste management practices for problem materials.

In 1992, Hennepin County initiated efforts to collect waste electronic appliances (WEAs) separately from municipal solid waste (MSW) and ship them to a non-profit job-training organization in Minneapolis where they were disassembled so that components with recyclable or hazardous materials could be managed appropriately. The program was set up whereby consumer electronic products were accepted from households as part of the county's household hazardous waste program. Staff estimated that 200 tons of waste electronic appliances were collected in 1995.

Current statewide recovery efforts focus primarily on large businesses for two reasons. First, large businesses generate waste electronic appliances in substantial quantities and in consistent form. Second, large businesses face high costs for disposing of waste electronic appliances as hazardous waste, which motivates them to find and even pay for alternative management methods. Recovery of waste electronic appliances from households and small businesses would occur under different economic conditions.

Because WEAs from households and small businesses are more widely dispersed, additional costs may be incurred for collection and aggregation. The market value of the recoverable materials of household products is insufficient to offset the costs. For example, the cost for managing a medium-size television ranges from \$20.00 to \$35.00, while a stereo that weighs 8 pounds costs between \$0.40 and \$2.00, given the present management infrastructure.

The Office of Environmental Assistance report found that every private electronics reclamation firm surveyed could absorb more electronic appliances and components, thus presenting an opportunity for increased recovery. [18] However, the report identified four primary barriers that must be addressed for the increased recovery opportunity to be realized.

First, Minnesota policies primarily focus on businesses that generate WEAs, not on households. This may be an effective strategy for locating large individual sources of material, but it does not address this significant and growing source of hazardous and toxic materials that enter the municipal solid waste stream. In summary, there seems to be a lack of consistent policy for managing waste electronic appliances.

Second, disassembly (i.e., the removal of high-value and high-toxicity components) is a critical stage in the repair, recycling, or disposal of electronic appliances. Most of the available management options require disassembly, the cost of which may be a major barrier to improved waste management of electronic appliances. In summary, there are disassembly difficulties with regard to time, variety, and cost.

Third, business and household consumers lack information about the appliances they purchase. This affects end-of-life management in two ways: consumers are unaware of the hazardous and toxic materials contained in the appliances they purchase, and a lack of information may lead consumers to regard their broken or out-of-date appliances as “junk” when in fact they can be recovered for reuse or recycling. In summary, lack of information may prevent consumers from making more informed choices about the full costs associated with different products.

Fourth, every sector of society benefits from the use of electronic appliances. However, these shared benefits are not matched by a system that ensures that the responsibilities and costs of manufacturing and using these appliances are also shared equally. [18]

UNION COUNTY, NEW JERSEY DEMANUFACTURING PROGRAM

The annual generation rate of MSW in New Jersey is estimated to be 15 million tons per year. Of this volume, consumer electronics constitute roughly 1 percent or 150,000 tons per year. Electronics are a major source of lead, cadmium, and other heavy metals in New Jersey’s incineration ash. Therefore, the presence of electronics in the MSW stream necessitates extensive and expensive pollution-abatement technologies and result in significant ash disposal costs because the ash may be characterized as hazardous.

In coordination with the Environmental Protection Agency, the New Jersey Department of Environmental Protection provided a grant to Union County to develop and implement an electronic waste collection and processing program. The grant stipulated that the county was to survey and evaluate all items collected and develop a system for retail and repair store tracking of electronic appliances in coordination with original equipment manufacturers (e.g., Panasonic and Sharp). Finally, the county was to evaluate environmental operations at their resource-recovery facility before and during the grant period (i.e., results of air emissions and incinerator testing).

The county identified four goals in implementing this program:

- ◆ Sort separate electronic wastes from the MSW such as bottles, cans, etc.
- ◆ Track reductions in heavy metal concentrations in air emissions and incinerator ash.
- ◆ Show avoided or reduced disposal costs at the municipal and county levels.
- ◆ Develop partnership with a demanufacturer or recycler that would agree to operate locally and employ local individuals (i.e., to provide economic development to the area).

Based on their prominence in households and small businesses and the presence of toxic materials in their components, electronic items targeted for the program included televisions (≤ 22 inches), VCRs/cameras, microwave ovens, audio/stereo equipment, terminals/monitors, copiers, computer printers, fax machines, telephone/telecom equipment, keyboards/mice, and computer peripherals (e.g., CPUs).

From October 1996 through March 1997, the program processed about 18 tons of electronic waste. The county had expected to handle 200 tons within the first 2 months. The flow is expected to increase as other municipalities join the program. Six municipalities participated in the county program. Items were collected via curbside pick-up and drop-off depots. In addition, the Union County Utilities Authority hosted periodic drop-off days at prespecified locations. Once the materials were collected, they were sorted and redirected to one of three destinations: refurbishment, reuse, or recycle. The recycler charges a per-unit fee based on the recyclability and reuse value of the equipment. A major challenge has been handling the diverse stream of electronic equipment from households and small businesses. This particular challenge was so daunting that Digital Equipment Corporation, which recycles electronics from GSA in Washington, DC, decided not to be a partner with Union County because the items recovered were thought to be too varied and unpredictable. [19]

Appendix D

References

- [1] Scott H. Matthews, *Disposition and End-of-Life Options for Personal Computers*, Carnegie Mellon University, 1991.
- [2] Patricia Dillon, *Extended Product Responsibility in the Electronics Industry*, The Gordon Institute, Tufts University, October 15, 1996.
- [3] Telephone conversation with John Zannos, Digital Equipment Corporation.
- [4] Heribert Meffert and Manfred Kirchgeorg, *Strategies for the Implementation of Closed Loop Value Chains: An Empirical Study of German Manufacturers*, Marketing Institute, University of Munster, 1997.
- [5] German Embassy, Washington, DC.
- [6] Basmeijer, Ministry of Housing, Spatial Planning and the Environment Directorate-General of the Environment, *The Covenant as an Instrument of Environmental Policy in the Netherlands*.
- [7] Cutter Information Corporation, "Dutch Propose Electronics Takeback Plan," *Business and the Environment*, Vol. VII, No.12, December 1996.
- [8] Cutter Information Corporation, "Dutch IT Industry Criticizes Draft Takeback Legislation," *Product Stewardship Advisor*, Vol. I, No. 1, May 1997.
- [9] Cutter Information Corporation, "Changes Likely in Swiss Takeback Law," *Product Stewardship Advisor*, Vol. 1, No. 2, July 1997.
- [10] Cutter Information Corporation, "Is Mandated Product Takeback Coming to a Country Near You?," *Product Stewardship Advisor*, Vol. 1, No. 1, May 1997.
- [11] Cutter Information Corporation, "Taiwan Mandates Product Takeback...," *Product Stewardship Advisor*, Vol. 1, No. 2, July 1997.
- [12] Albert Gore, *Creating a Government That Works Better and Costs Less: Reinventing Federal Procurement*, National Performance Review, September 1993.
- [13] Telephone conversation with Martha Caswell, Director, Personal Property Management and Policy Division, General Services Administration.

-
- [14] Telephone conversation with Michael Brooks, General Services Administration.
 - [15] Telephone conversation with Benjamin Morris, General Services Administration, Springfield, VA.
 - [16] Telephone conversation with Angie Disher, Manager, Recycling Division, DRMS—Battle Creek, MI.
 - [17] General Accounting Office, *Commercial Practices: DoD Could Reduce Electronics Inventories by Using Private Sector Techniques*, June 1994.
 - [18] Telephone conversation with Bob Meier, Minnesota Office of Environmental Assistance.
 - [19] Telephone conversation with Steve Stanaback, Union County Utilities Authority.

Appendix E

Abbreviations

CPU	central processing unit
DfE	Design for Environment
DLA	Defense Logistics Agency
DoD	Department of Defense
DoE	Department of Energy
DRMO	Defense Reutilization and Marketing Office
EO	Executive order
EPA	Environmental Protection Agency
EPP	Environmentally Preferable Purchasing
EPR	extended product responsibility
FAR	Federal Acquisition Regulation
FPMA	Federal Property Management Act of 1949
FSS	Federal Supply Service
GSA	General Services Administration
IT	information technology
MSW	municipal solid waste
OFPP	Office of Federal Procurement Policy
OMB	Office of Management and Budget
PC	personal computer
SASP	state agencies for surplus property
VDMA/FG Bit	German Business Machines and Information Technology Manufacturers Association
WEA	waste electronic appliances
ZVEI	Central Association of the German Electric Industry

REPORT DOCUMENTATION PAGE

Form Approved
OPM No.0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources gathering, and maintaining the data needed, and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

1. AGENCY USE ONLY (Leave Blank)		2. REPORT DATE Dec 97	3. REPORT TYPE AND DATES COVERED Final
4. TITLE AND SUBTITLE Promoting Extended Product Responsibility in the United States: A Nonregulatory Strategy			5. FUNDING NUMBERS C DASW01-95-C-0019 PE 0902198D
6. AUTHOR(S) Raheem M. Cash Denise R. Dellovade Daniel P. Jackson			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Logistics Management Institute 2000 Corporate Ridge McLean, VA 22102-7805			8. PERFORMING ORGANIZATION REPORT NUMBER LMI- IR704R1
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Logistics Management Institute 2000 Corporate Ridge McLean, VA 22102-7805			10. SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION/AVAILABILITY STATEMENT A: Approved for public release; distribution unlimited			12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words) Extended product responsibility (EPR) is a rapidly emerging concept encompassing a set of practices that promote responsible use of resources and minimize solid waste generation, disposal costs, and contributions to diminishing landfill space. Product takeback, the most prominent category of EPR, is being aggressively implemented by European and Asian nations. Consequently, U.S. manufacturers are actively developing programs to meet the requirements and are developing design protocols (often referred to as Design for Environment or DfE) that make products more amenable to recycling, refurbishing, etc. The United States lacks a national commitment to EPR practices. This report identifies and analyzes the policies and practices the federal government can implement to encourage the adoption of product takeback and DfE via the development of a national EPR strategy and to facilitate industry development and operation of EPR programs via direct government participation. Recommendations are presented for policymakers and property managers.			
14. SUBJECT TERMS recycling, takeback, take back, electronics, environmental esign, Design for Environment, life-cycle analysis, remanufacturing, demanufacturing, waste electircal and electronic equipment, DfE, WEA, product stewardship federal procurement, international environmental policy, solid waste			15. NUMBER OF PAGES 52
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL