

## **Barriers to Implementation of Electronic End of Life Product Programs in the U.S.**

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**Abstract** As our society makes the transition into the digital age, electronics manufacturers are constantly pushing newer and better electronic equipment onto the market to satisfy customer demands for newer technology. Yet when this new stream of products makes its way into homes, older electronic equipment will, as a consequence, be discarded. Currently, several manufacturers have begun to initiate product take-back programs in some regions of the US. Yet given the estimate of how much electronic waste may enter into the waste stream in the next few years, the present collection infrastructure seems highly inadequate. This paper looks at the current experimental and commercially available product take-back programs and tries to evaluate the trends and patterns that have kept these programs from developing into full-scale nation wide programs. Through a series of interviews with major manufacturers in US electronic waste issues, a general willingness to resolve electronic waste issues at hand can be established. However, many finer details such as wording of federal and local regulations, financial models of product take back programs have not been worked out for several reasons, one of which is the lack of precedence in electronic equipment waste issues. Another major concern is the lack of recycling infrastructure to process the potential electronic wastes in the US.

## Introduction

According to the National Security Council's (NSC) 1999 Electronic Product Recovery and Recycling report, approximately 315 million computers will have become obsolete in the US by 2004. In the same study, it was estimated that the U.S. recycled 14% of the computers that became obsolete in 1998, which means if the recycling trend continues through 2004, 86% or 270 million computers will either go to a landfill, be incinerated or get stored in consumers' attics (Fig.1) (NSC, 1999). The problem that arises from such a scenario is the fact that heavy metals, which are potentially harmful to the environment, are abundant in computer. For

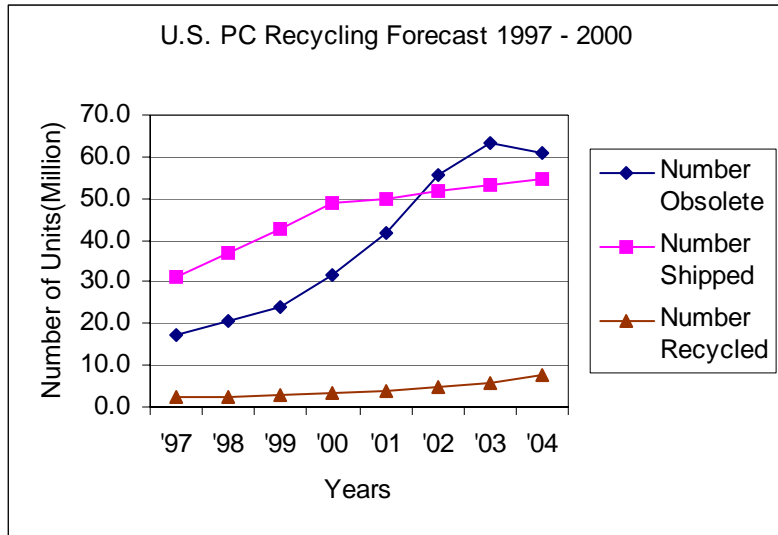


Figure 1 - Forecast of computer equipment flows through the year 2004. Source: National Security Council.

example, a typical desktop computer weighing 50lbs contains by mass 6.3% lead, 0.0022% mercury, 0.0094% cadmium, all of which are neurotoxins that may be released into the environment when being landfilled or incinerated (Aanstoos, 1998). In addition, heavy metals mentioned above are bioaccumulative in nature, therefore they will pose long lasting hazards to ecological systems.

Aside from health concerns, throwing electronic equipment into the waste streams can often be a very wasteful act. Large appliances such as TVs, refrigerators and computers can often have their life span extended via repairs and part replacement. Therefore, if these appliances were thrown away or put into storage, the consumers are effectively foregoing several years of services from these appliances. Even for electronic equipment that is dysfunctional beyond repair, its raw materials are highly recyclable after disassembly (Bullinger, et al, 1999).

Currently, the most readily available computer recycling services come from redistribution organizations, which collect obsolete computers and parts, then redistribute them to individuals, groups or recyclers. There are both for profit and non-profit redistributors. Recyclers generally have larger facilities that disassemble computer they receive into parts. Both types of

organizations, however, are limited by their resources and minimal profit. For example, non-profit resellers are often under-staffed, as is the case in Berkeley Neighborhood Computers (BNC), where stockpiles of donated computers are waiting to be processed before being given out to under-privileged children in Berkeley, CA (Mack, 2000). Larger for-profit organizations may have better resource and man power, but they would not have the marketing leverage to draw large customer bases like large manufacturers, thus can only gain minimal profit (NSC, 1999).

A more efficient method of handling electronic equipment waste disposal is Extended Producer Responsibility (EPR), in which manufacturers are involved in the processing of end of life products\*, such as product take-back programs (Bullinger et al, 1999). EPR would be a more efficient end of life solution because by processing their own brand of products, manufacturers can apply their knowledge of their own products to streamline the technical aspect of the end of life process. In addition, involving manufacturers at the end of life process will encourage manufacturers to reduce the complexity at the design and planning stages such that end of life processing becomes simpler and cheaper (Bullinger et al, 1999). Despite the benefits of EPR, only IBM and several other computer manufacturers have publicly advertised programs dealing with end of life product issues. Other federal and corporate efforts to enforce such a strategy have been largely absent in the US. The main reason for the absence of EPR efforts in the US is the regulations concerning hazardous materials in electronic equipment. Furthermore, manufacturers in the US have not created a sustainable financial model for EPR programs that would persuade them to commit their efforts in handling end of life products.

## **Methods**

A large part of the data collected for this paper comes from interviews conducted with electronics manufacturers. The list of manufacturers that I intended to interview include Apple, Compaq, Dell, Gateway, Hewlett Packard, IBM, Micron, Panasonic, Philips, Sharp, Sony, Sun Microsystems. I determined that picking the largest consumer electronic corporations is most appropriate because of their status as top tier electronics companies will make the findings in the paper more significant. Base on this criterion, this particular sample of manufacturers as chosen

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\* End of life products here means products that are incapable of performing tasks to fulfill its owner's satisfaction. The product itself may be functional.

because each has a significant share in the commercial electronics market (Electronics Business Magazine, 1999).

The opinions of the manufacturers are important in this issue because in many ways manufacturers will need to be leaders in the electronics waste movement. As manufacturers, they are the most knowledgeable about their products, thus they can provide useful information to recyclers on how to streamline the recycling processes. Manufacturers are also potentially the best marketing agents, who will prove important in educating the public in one of the most important elements in acquiring support for a new standard such as EPR. Large manufacturers are more likely to have the resources, financial and otherwise, to initiate the EPR programs.

Preliminary data was collected at the Electronics Recycling Infrastructure Working Group sponsored by US EPA Region 9 and The California Integrated Waste Management Board in Santa Clara University, April 23<sup>rd</sup>, 2001. Through informal interviews with members of government agencies, non-governmental organizations and manufacturer representatives at the working group, I was able to obtain most of the contact information I needed for later interviews.

The main method of data collection was personal semistructured interviews for several reasons. Mainly, semistructured interviews, which allow for freedom in the interviews yet maintain a structured format such that efficiency can be achieved (Bernard, 1988), are best suited for the targeted interviewees for this project, consisting of managers, directors of their respective department. Persons of higher positions would be most helpful in acquiring data for this project because I felt the information regarding electronic wastes would be recent, and therefore limited to employees of lower positions. In addition, the size of my sample population is small enough such that I feel I would be able to commit the time required for a semistructured interview to each of the interviewees. With the exception of Frank Marella's interview, all other interviews were conducted over the phone. Before the interviews, I wrote an interview guide, which contained a basic set of questions I addressed during the interviews. The questions in my interview guide are listed below in the order they were asked.

- 1. To what degree do you believe computer manufacturers should be financially and physically responsible for managing end of life products? In your opinion, what are some of the other alternatives to manufacturer responsibility? <delay>Financially and/or physically responsible encompasses all or some of the activities and costs of collection, recycling, reuse, transport and disposal of computer waste. (Positive comments skip to next question)*

- a. *What aspect of manufacturer responsibility do you see as unreasonable?*
2. *Does [company name] currently have any Extended Producer Responsibility(EPR) programs, which deal with End of Life products? If so, describe its functionality. <delay> End of life is here defined as computers that have been discarded by corporate or individual consumers because they are no longer functional, outdated, or not passed on to other people.*
3. *(Assume such program does exist) How accessible do you think the Extended Producer Responsibility program should be to customers who want to return End of Life products? <delay>Customers here refer to any end user that uses your product, which includes individuals, business, etc.*
4.
  - a. *If [company name] currently does not have any Extended Producer Responsibility program, has [company name] explored the options of starting such a program? What difficulties, both financially and technically, do you foresee, in implementing such a program? <delay>(How much change in the company's infrastructure will be needed to implement an Extended Producer Responsibility program? Changes in design/planning process?)*
  - b. *(If the company already has such a program) What were some of the difficulties that [company name] encountered when implementing an Extended Producer Responsibility program?*
5. *(Are you familiar with hazardous waste regulations concerning electronic wastes?) How have the hazardous waste regulations played a role in your decision to implement or not implement an End of Life program.*
  - a. *The proposed legislation(HSC 25251) in California plan to stop regulating the transport of CRT, how will that affect you decision on the implementation of an End of Life program?*

The <delay> marks were used to remind me as an interviewer to pause at those points and allow time for the interviewee to think about the answers to the question. If the interviewee had a hard time understanding the question, or when the interview got off track from the original question, then the information after the <delay> is presented to interviewee to steer the conversation back onto the main topic.

Though I had planned to interview 12 manufacturer representatives, only 6 interviews were actually conducted. The six interviews were conducted with (in alphabetical order): Chales Dolci, Sun Microsystems (hereafter Dolci); Frank Marella, Sharp Electronics Corporation (hereafter Marella); Daniel McDonnell, Tim Ohsand, IBM (hereafter McDonnell/Ohsand); John Minter, Dell Computers (hereafter Minter); Doug Smith, Sony (hereafter Smith); David

Thompson, Panasonic/Matsushita Electric Corporation of America (hereafter Thompson). The representative from Apple Computers refused an interview citing that Apple was not ready to give out information on the issues of electronic waste. Several other manufacturers such as Hewlett Packard, Phillips and Compaq did not respond to my request for an interview. In the case of Micron and Gateway, I simply could not obtain contact information for their managers of environmental issues through their telephone representatives or their website. For manufacturers other than Micron and Gateway, I speculate the reason for non-response was that they did not have as comprehensive a plan for handling end of life products as other manufacturers who granted my interview request. In the case of Micron and Gateway, I believe the reason for my unsuccessful attempt to reach the appropriate contact person is because of the lack of interest from consumers. Without consumer demand for product take-back programs, there seems to be no need, from a financial standpoint, to provide easy access to those programs on the company's homepage.

## **Results**

Table 1 shows a summary of the current status of EPR programs from 12 electronics manufacturers. In general, all the manufacturers being represented have expressed awareness of the significance of electronic waste, both as a burden to their current infrastructure and as a source of potential profit. Among the manufacturer representatives I interviewed, many felt the economics of product take-back programs does not hinder the development of such programs. This is especially true for take-back programs focusing on business users, also commonly known as asset recovery programs, which in actuality are profit generators. According to Minter and Smith, product take-back programs for business users at their respective companies (Dell and IBM) were developed long before that of home users due to higher demand. For example, one alternative to recycling end of life electronic equipment is to put obsolete equipment into storage. However, businesses generally have a large inventory of obsolete equipment, which requires high storage costs. The other alternative to product take-back programs is landfill, which is not a viable option either financially (considering the potential for fines) or environmentally (Aanstoos, 1998). The reduced cost of transportation in conjunction with business' willingness to pay has made asset recovery programs profitable.

<b>Name of Company</b>	<b>Types of Products*</b>	<b>Take Back Program?</b>	<b>Take-Back Program Description**</b>
Apple	Computer	No	Website encourages customers to donate computer to charity sources, but does not offer direct assistance to customers in the US.
Compaq/ Digital	Computer	unclear	No response. No direct mention of any take back program on website.
Dell	Computer	Yes	Had product take-back program since '96 for business users. Began a pilot program in fall '00 called TradeUp@DellExchanged to take back old computers for \$15 per item. Dell pays the shipping cost. Any brand of computers is accepted.
Gateway	Computer	Yes	No charge for trade in service. Maximum rebate of \$50 in Gateway store credit. Any brand of computers is accepted.
Hewlett Packard	Computer	Yes	Gathered info from website, which mentioned product take back programs, but doesn't give details on how to use it. Wasn't able to speak to a manager because customer representatives don't know whom I should talk to.
IBM	Computer	Yes	Had business asset recovery program since '92. In Nov. '00, began a take back program that charge customer \$29.99 to recycle any brand of computers. Shipping cost is included.
Micron	Computer	Yes	Info is from website. 4 types of recycling, which cost \$25 or \$75 depending on the type of processors in the systems. Cash rebate to customers is awarded for each system recycled. Customer must buy as many new Micron PCs as the number of old PCs they are recycling.
Panasonic/ Matsushita Electric Corp. of America	Consumer electronics	Yes	Co-sponsored pilot program with Sony in Minnesota to collect Panasonic branded electronic equipments. Will expand that program to Connecticut, and is working to expand similar programs to New Jersey and Florida where regulation is more relaxed.
Philips	Consumer Electronics	unclear	Website does not directly mention product take-back programs.
Sharp	Consumer Electronics	Yes	Will work with Sony and Panasonic to sponsor take-back programs in Connecticut and other states where regulation encourage take-back programs.
Sony	Consumer Electronics	Yes	Subsidize recyclers to recycle Sony branded products from take back program. Expect to extend program nation wide in the future.
Sun Microsystems	Computer	Yes	Take back program only available to consumers buying new Sun computer systems. Comes at no cost to consumers.

Table 1 - Description of take-back programs provided by selected manufacturers.

\* Although most consumer electronics manufacturers also produce computer-related products, their end of life efforts seem to focus mostly on its consumer electronic products.

\*\* More details on the websites mentioned here are given at the end of the reference section.

On the other hand, manufacturer representatives such as Minter, Thompson, and Marella, admit that product take-back programs geared toward home users have been slowed by their financial uncertainty. Home users, unlike businesses, have little obsolete equipment, which they can store away easily without having to worry about maintenance cost. The convenience of storage being an attractive alternative to recycling can reduce home users' interest in paying for

product take-back programs (Rose, 2000). In addition, the transportation cost for home user take-back programs will increase because the discarded equipment is, according to computer manufacturers' websites, sent one by one to the recycling facilities rather than in bulk (Gateway Computers, MicronPC, Dell, IBM, 2001). Minter also suggest that sporadic transfer of equipment forces manufacturers such as Dell to contract with the most reliable recyclers that can sustain operation even through sporadic shipments, in fear that smaller recyclers will go out of business without a continuous flow of resources. This concern further limits the number of recyclers available to Dell, which delayed the implementation of its pilot product take-back program as a result.

Smith believes the current pitfalls of the model for home user product take-back programs can be remedied. Smith suggested that if more manufacturers collaborate to expand the operation of take-back programs, these programs could eventually produce profit by attracting more home users to recycle and again benefit from economies of scale principles. This will then help to stimulate the recycler's market and reduce transportation overhead. For example, Thompson pointed out that Panasonic has worked with the state and local government of Minnesota, and Sony, since fall 1999 to develop an experimental electronic waste drop-off program. In that pilot program, consumers can drop off any obsolete Sony or Panasonic branded electronic equipment at one of eleven drop-off points in Minnesota.

Government regulation of hazardous waste is another common concern among manufacturers. All of the manufacturer representatives I interviewed expressed a willingness to work with local or federal governments to establish product take-back programs in the United States. Representatives from computer manufacturers such as Sun Microsystems, Dell and IBM expressed their goal to fully comply with hazardous waste regulations on both the state and federal levels. The representatives of computer manufacturers also emphasized the fact that their interaction with the regulations goes as far as contracting with recyclers who are in full compliance with the regulations in question. The recyclers in turn will carry out the necessary task of collecting, transporting, and processing discarded equipment.

The three other manufacturer representatives I interviewed, from Sharp, Sony and Panasonic, also established their willingness to work with local governments to explore the possibilities of product take-back programs. However, representatives from these companies pointed out during the interviews that they are currently only working with states where relevant hazardous waste



regulations will allow the handling of household electronic waste without government licenses. These states include New Jersey, Minnesota, Florida and Connecticut.

Lastly, when being asked the question “To what degree do you believe computer manufacturers should be financially responsible for managing end of life products?”, each of the six interviewees responded with “shared responsibility.” The general definition of the phrase, according to the interviewees, is sharing the responsibility of handling discarded electronic equipment among all stakeholders, which includes, but is not limited to, users, the government, manufacturers and retailers. Smith elaborated on the reasoning behind his answer by suggesting manufacturers should focus on “the things manufacturers have a strong influence on, [such as] design of the product, raw material of the product, usage of the product...” while other stakeholders also focus their efforts on what they are able to influence. For example, Smith pointed out that the collection infrastructure needed for discarded electronic equipment already exists in the form of local municipal waste infrastructure. He compared the U.S. situation with that of Japan, where recent legislation mandated that manufacturers establish a new recycling infrastructure to handle electronic wastes in Japan (Tojo, 1999). He suggested the newly built infrastructure in Japan is similar to the existing infrastructure in the U.S., thus it’s most efficient to use the existing infrastructure rather than looking to build a new one in the US.

## **Discussion**

As the results in the previous section have shown, many major electronic manufacturers in the US are clearly aware of issues surrounding electronic waste. Yet manufacturers such as Sharp and Panasonic are still in experimental stages of offering product take-back programs to the general public. Part of the reason for the delay in developing product take-back programs for home users is the lack of market demand for refurbished electronic equipment and electronics recycling services. Many consumers simply are not aware of options available to recycle their obsolete electronics equipment (Moyer et al, 1997). Incidentally, this is in part due to the limited supply of electronics recycling services available, which itself is a result of limited demand for such service, and the cycle continues. Also, many consumers tend to adopt the negative perception that used or recycled goods are inferior in quality (Moyer et al, 1997).

It is also worthy to note that, the positions of computer manufacturers and consumer electronic manufacturers differ considerably in implementing product take-back programs.

Three computer manufacturers have well established, commercially available product take-back programs while the consumer electronics manufacturers with whom I spoke to are still in the early stages of implementing product take-back programs (Table 1). This seem to derive mainly from the differences in the products handled primarily by the two types of manufacturers, namely computers vs. consumer electronics.

For computer manufacturers, the detail of their product take-back program differs from each other depending on the manufacturer, but there is a general trend toward providing home users a cash incentive for using the take-back service. The cash incentive would depend on the specification and condition of the system, and its usage would also often be restricted to in-store purchases. The take-back services provided by computer manufacturers are all operating on a case-by-case basis, where individual users ship their computer systems to the recycling facility. The cost of such programs is financed through the recycling process itself, either by remanufacturing the discarded systems via component upgrades, or by the sale of raw material from shredding the computer system. Though the process of disassembly and reselling raw material has proven to be financially inefficient by itself (EPA, 1999), the upgrading process can be financially rewarding. In a 1997 study, Geraldo Ferrer found that a two year old computer system, when upgraded to current specifications, can yield a profit of approximately 18.5% of the current market price of the upgraded system, where  $\text{profit}^* = \text{total revenue} - \text{cost of upgrade} - \text{value of old system}$ . Assuming the average price of the upgraded system is \$900, 18.5% of that is \$167. This profit, though a small one, allowed computer manufacturers to sustain take back programs that might otherwise seem costly. Furthermore, the operation of product take-back programs also gives manufacturers good environmental publicity, which has become a key element in profitability over the years (Stanzyzk, 1995). Since the operation of product take-back programs is not region specific, computer manufacturers have placed the responsibility onto its users to identify the relevant regulations in the local area. From a regulatory standpoint, such a model of product take-back program adopted by computer manufacturers has also simplified the interaction between government and manufacturers.

On the other hand, consumer electronics manufacturers have yet to discover a sustainable source of income from product take-back programs due to the nature of their products (Table 1).

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\* Note the profit defined here does not include cost of transportation, labor, fixed costs, etc. It only includes cost of upgrade and value of old computer system if it was not upgraded.

Consumer electronics rarely have interchangeable parts like those of computer systems, therefore an upgrade process under the current circumstances would be much too costly. In addition, just like computer systems, shredding consumer electronics and selling its raw elements is not financially sufficient to support the product take-back services (EPA, 1999). In lieu of these financial obstacles, Sony has actively pursued the option of sharing some of the responsibilities with other stakeholders such as local governments and the users themselves. A shared-responsibility model such as that proposed by Smith will reduce the cost for each stakeholder. In speaking to Sony's Doug Smith, I was given the strong impression that a product take-back program involving multiple manufacturers and multiple stakeholders would turn a profit. Based on Panasonic and Sharp's co-sponsorship with Sony in its upcoming product take-back program in Connecticut, it seems that Sony has gained some peer support for its shared-responsibility model. Yet despite the visible progress, a nation wide implementation of these product take-back programs will need to overcome another obstacle, namely the regulatory issues surrounding electronic hazardous wastes.

In 1995, the US EPA adopted a set of rules called the "Universal Waste Rule (UWR)" with the intention of reducing hazardous material in municipal waste stream while increasing the recycling rate. Under the UWR, hazardous wastes generated by households are not regulated as such by Resource Conservation and Recovery Act (RCRA). Since 1995, many states have also adopted UWR as a reference in dealing with hazardous materials such as batteries, printed circuit boards, and, more recently, Cathode Ray Tubes (EPA, 2001). It is through this UWR that manufacturers such as Sony have been able to implement its product take-back programs in certain states like Minnesota, Connecticut, etc. Unfortunately, states can also choose not to adopt the UWR, thus forcing any recycling program under their authority to purchase recycling licenses, which add significant financial burden on any product take-back program, to handle the hazardous waste. This is in fact the situation in California, where manufacturers are hesitant to start any type of product take-back program because Californian hazardous waste regulations presents a fixed cost too large for any take-back programs. Instead, manufacturers such as Sony chose to work with states like Minnesota, where wastes generated by households are not regulated as hazardous waste, and thus require no special license to process. California regulatory agencies such as DTSC (Department of Toxic Substances Control) and other

interested parties are now discussing the possibility of adopting new regulations, like those in eastern states, to exempt household generated waste from the hazardous waste category.

Though the electronic waste issues in the US are drawing more and more attention from various parties, some of the most important issues like profitability and regulations are still left to be addressed. But until manufacturers can address issues like customers' lack of awareness and cooperation with local government, end of life product programs in the US will continue to develop slowly compare to the rapid rise in number of obsolete electronic equipment. Also, it is evident from the results of this paper that computer manufacturers approach their EPR programs quite differently than consumer electronics manufacturers. Perhaps future research can focus on each group of manufacturers separately to find out what has or has not worked in their effort to implement EPR programs, and what the future holds for their respective end of life product policies. Computers and consumers electronics are products of different values, therefore end of life programs for these two types of different products should be different.

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### **References**

#### **Publications**

Aanstoos, V., M Torres, S.P. Nichols. Energy model of end-of-life computer disposition. IEEE Transactions on Components, Packaging and manufacturing Technology – Part C, V. 21, No. 4, October 1998.

Bernard, R. H. Research Methods in Anthropology. Walnut Creek: Altamira Press, 1988.

Bullinger, H; J Warschat; R Bopp. Elimination of end-of-life cost through a standardized simultaneous design methodology for SME supply chains. The 1999 7th IEEE International Symposium on Electronics and the Environment, Danvers, MA, USA, 05/11-05/13/99, pp. 225-231.

Electronics Business Magazine. The Electronic Business TOP 250 Electronics Companies Vital Statistics. Available: <http://www.eb-mag.com/eb-mag/issues/1999/9907/0799top3.asp>. November 30, 2000.

Environmental Protection Agency(EPA), Analysis of Five Community Consumer/Residential Collections of End-of-Life Electronic and Electrical Equipment. Washington, 1999.

Ferrer, G. The economics of personal computer remanufacturing. Resources, Conservation and Recycling 21(1997) 79 – 108.

Mayers, K. C. France. Meeting the “Producer Responsibility” Challenge: The management of waste electrical and electronic equipment in the UK. Greener Management International 25(1999) 51 – 66.

McDonald, S., R. Ball. Public participation in plastics recycling schemes. Resources, Conservation and Recycling, 22(1998) 123 – 141.

Moyer, L., S. Gupta. Environmental concerns and recycling/disassembly efforts in the electronics industry. Journal of Electronics Manufacturing 7(1997) 1 – 22.

National Safety Council(NSC). Electronics Product Recovery and Recycling Baseline Report. May, 1999

Rose, C. Design for environment: A method for formulating product end of life strategies. Dissertation. Stanford University, November 2000.

Stanczyk, T. The emerging role of annual environmental performance results. 1995 IEEE International Symposium on Electronics and the Environment, IEEE Piscataway NJ USA, Orlando, FL, USA. 1995

Tojo, N. Analysis of EPR policies and legislation through comparative study of selected EPR programmes for EEE. Dissertation. Lund University, September 1999.

### **Personal Communications**

Dolci, C. Director, Environment, Health & Safety, Sun Microsystems. April 2, 2001.

Mack, B. Director, Berkeley Neighborhood Computer(BNC). October 2000.

Marella, F. Project Engineer Environmental Compliance, Sharp Electronics Corporation. March 22, 2001.

McDonnell, D., Ohsand, T. IBM. April 13, 2001.

Minter, J. World Wide Environmental Affairs, Dell Computer. April 20, 2001.

Smith, D. Director of corporate environmental affairs, Sony Electronics Inc. April 3, 2001.

Thompson, David. General manager of Matsushita Electric Corporation of America Corporate Environmental Department, New York, NY. April 23, 2001.

**Internet References**

Apple Computers. [http://www.apple.com/about/environment/eol/electronic\\_equip/electr\\_equip.html](http://www.apple.com/about/environment/eol/electronic_equip/electr_equip.html) . 4/14/2001

Compaq/Digital. <http://www.compaq.com/corporate/ehss/reports.html>. 4/14/2001.

Gateway. <http://www.gateway.com/yourware/home/yw%5Fhm%5Frecycle.shtml>. 4/14/2001

Hewlett Packard. <http://www.hp.com/hpinfo/community/environment/recycle.htm>, 4/23/2001.

MicronPC. <http://www.micronpc.com/mservices/new/lifecycle.html>. 4/14/2001

Philips. [http://www.philips.com/environment/report/report/report2000\\_part2.pdf](http://www.philips.com/environment/report/report/report2000_part2.pdf). 4/14/2001.