

Assuming Responsibility for E-Waste Through Recycling: Emerging Issues with Product Stewardship Initiatives

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As the issue of e-waste has moved to the forefront of green initiatives, it is increasingly important for businesses, municipalities, environmentalists and manufacturers to understand the emerging responsibility for reducing the environmental impacts of products. In addition to reducing packaging, streamlining manufacturing processes and using recycled materials, this means providing end-users with a convenient and accessible way to dispose of their electronics in an environmentally sound manner. Many states have already enacted electronics product stewardship legislation of varying degrees, and several more states are poised to join this effort in 2009.

Key Words: rechargeable battery, recycling, sustainable, product stewardship, e-waste.

1. INDUSTRY-DRIVEN PROGRAM

1.1 Rechargeable Battery Recycling

The concept of product stewardship stems from environmental concerns of how to properly manage a potentially hazardous product at the end of its useful life. When used in relation to electronic waste or e-waste, how the terms “properly” and “manage” are defined depends upon the audiences involved. What should be recycled and who bears the financial responsibility are points for discussion as these and other issues involving e-waste are examined. The success of e-waste recycling programs depends upon safe handling of the components in electronics products, cost-effective recycling processes, and addressing legislation. As America’s consumption of electronics continues to increase, we must swiftly deal with the growing rise of e-waste in our communities.

Call2Recycle[®], a program of the Rechargeable Battery Recycling Corporation (RBRC), serves as an example of how a product stewardship program can evolve for the proper disposal of e-waste, in this case rechargeable batteries. Founded in 1994 as a non-profit organization by the rechargeable battery industry, the program provides a comprehensive, environmentally sound, free and easy recycling solution in the U.S. and Canada.

Initially dedicated to preventing Nickel Cadmium (Ni-Cd) batteries from entering the solid waste stream, the predominant power source in cordless electronic products at the time, RBRC’s mission expanded to include other rechargeable battery chemistries. In addition to Ni-Cd, today the program includes Nickel Metal Hydride (Ni-MH), Nickel Zinc (Ni-Zn), Lithium Ion (Li-ion), and Small Sealed Lead Acid (Pb) rechargeable batteries. Observing the trend of consumers upgrading personal electronics at an accelerated rate, the program also accepts

cell phones to ensure that the rechargeable batteries left inside are properly recycled.

The program is funded by licensing of RBRC's Battery Recycling Seals to the rechargeable power industry. Currently, more than 350 licensees place the Seal on their rechargeable batteries and/or battery-powered products. These fees allow consumers, retailers and communities to participate in the program at no charge. To date, the program has successfully recycled more than 50 million pounds of rechargeable batteries. [see Fig. 1]

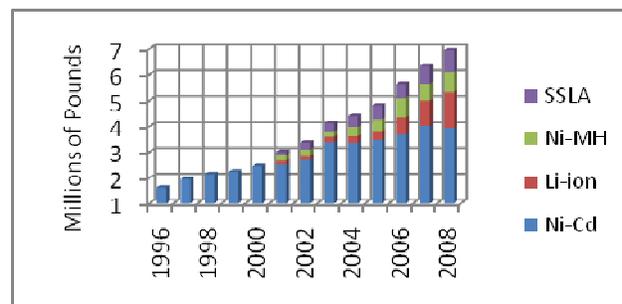


Figure 1. Total rechargeable batteries recycled.

1.2 Electronic Waste Legislation

As new electronics come to market, disposing of the products they replace will place higher demands on our swelling landfills. The notion of product stewardship was initially designated to manage hazardous chemicals found in paints and mercury-containing products. Over the past years, product stewardship has expanded to include consumer electronics. The European Union (EU) directive on electronic waste, Waste Electrical and Electronic Equipment - often known as “WEEE”, is perhaps the most prominent example where restrictions are imposed on the use of hazardous substances in electronic equipment. The objective is to increase reuse of recycled products and

seeks safer alternatives to using heavy metals in manufacturing. While ambitious, only one third of e-waste meets these requirements. It is reported that the remainder is entering into landfills and into sub-standard treatment sites in or outside of the EU^[1].

In North America, several Canadian provinces have implemented product stewardship legislation that ranges from cell phones and televisions to paints and medical waste. Stewardship Ontario, working with municipalities and retailers, created the Municipal Hazardous or Special Waste (MHSW) program to recover potentially hazardous wastes (including alkaline batteries). The program is funded by the manufacturing industry and helps Ontario residents locate free and convenient drop-off sites. In British Columbia, the Ministry of Environment recently added electronic products, including alkaline and rechargeable batteries, to a list of items that must be accounted for with product stewardship programs in accord the *Environmental Management Act*.

In the U.S. Congress enacted legislation in 1996 known as *The Mercury-Containing and Rechargeable Battery Management Act*. The Act references the most common types of household batteries: alkaline (primary) and rechargeable (secondary). Alkaline manufacturers are required to phase out the use of mercury in production while rechargeable battery manufacturers are required to label Ni-Cd batteries as recyclable and establish a free and easy consumer recycling program.

This act also streamlines state regulatory requirements for transporting Ni-Cd batteries and encourages voluntary industry programs to recycle them. In addition to the federal law, nine U.S. states (California, Connecticut, Florida, Iowa, Maine, Maryland, Minnesota, New Jersey, Vermont) also require the industry to implement state-approved rechargeable battery recycling programs. More recently, New York City created legislation requiring retailers to assume this responsibility. Compliance with these examples of North American e-waste legislation can be achieved using RBRC's program as a turnkey solution. Looking to the future, more e-waste legislations will appear on the domestic horizon.

1.3 Lifespan and Recycling Rate

It is estimated that millions of dry-cell batteries are sold each year in the U.S. According to a RBRC survey conducted by GfK NOP World, Americans use an average of six wireless products in their daily lives. The average cell phone user has a total of three or more cell phones in their possession. While more than forty-three percent replace their cell phones about every two years, roughly twenty percent replace them annually. In comparison, laptop computer are replaced every three years^[2] while desktop computers average a two- to four-year expected

lifespan. Within the next five years, more than 350 million computers will become obsolete^[3].

E-waste is growing at a faster rate than other municipal waste^[4]. Electronics containing heavy metals must be diverted from our landfills. Recent media scrutiny on the illegal export of e-waste to developing countries sheds further light on how the improper disposal of these hazardous materials will damage human and environmental health. The potential influx of e-waste and its impact on the environmental are enormous.

It is no surprise that the introduction of new legislation coincides with the rate of e-waste disposal. The U.S. Environmental Protection Agency (EPA) reported that mandatory recycling of electronics through e-waste legislation could account for "an increase of eighteen percent of the overall amount recycled between the years 2006 and 2007." Meanwhile, the global economic downturn forecasts a decline in production and sales of consumer electronic goods. As manufacturers prepare to downsize, their dedication to product responsibility at end-of-life potentially could be compromised. Now as our country enters a recession, the management of our hazardous waste will face challenges greater than financial commitment.

2. CHALLENGES FOR VIABILITY

2.1 Sustaining Through Reuse

Both the public and policymakers have expressed concerns over potentially harmful materials contained in certain products entering the environment. Proper disposal must mean more than simply diverting these items from landfills and incinerators. The ultimate motivation and measure of a recycling programs should be based on minimizing the impact of waste on the environment.

Before entering the high thermal process for individual metals recovery, rechargeable batteries must be sorted by chemistry types. The reclaimed nickel and iron are used to make stainless steel. Cobalt and lead are also extracted for reuse. The battery electrolyte is used in the facility's wastewater treatment plant. The cadmium is recovery in a specialized furnace, vaporized and condensed. The cadmium, at a minimum 99.95% purity rate, is used to make new Ni-Cd batteries. The cadmium disposal process is considered the Best Demonstrated Available Technology as determined by the EPA. The remaining non-hazardous byproducts create slag that is used as road base and construction aggregate. The waste-less process ensures the preservation of natural resources, eliminates long-term landfill liability, and is environmentally sound in that none of the waste byproducts leave North America. Other electronics require slightly different recovery processes to ensure careful extraction of choice materials.

For example, improperly disassembling old computer monitors and CPU units to recover copper, gold, and iron can release toxic dust. Careful planning is needed to determine effective materials recovery of electronics filled with various metals that require separate recycling processes and special handling. Many companies currently offer varying levels of e-waste recycling and are poised and ready to receive the amount of e-waste that Americans generate.

Many in the industry believe that alkaline batteries do not pose a risk to environmental or human health because of the exclusion of mercury. However, consumer expectation that all batteries should be managed as e-waste, though no cost-effective comprehensive recycling process currently exists, compels both policymakers and battery manufacturers to address the issue sooner than later. When recycling is an option over landfill or incinerator, support and funding for a recycling program is encouraged to maintain these programs.

2.2. Explicit vs. Implied Fees

In the example of the *Call2Recycle* program, operating fees obtained from the industry are essential for the feasibility of rechargeable batteries recycling since finances gleaned from the resale of reusable metals is itself not sufficient. While reclaimed metals are reused to make new products, the metals market has significantly weakened in recent years. The volatility of these markets is precisely why the resale of recovered materials should not be the driving force behind maintaining a program that diverts and reuses harmful heavy metals. Without funding through a sustainable metals market or the support of product stewardship it is less likely that cost-effective recycling programs can exist. If pondering between financial or ecological incentive, the motivation should always be the long term wellbeing of humans and the environment.

In some industries, recycling programs are sustained by charging a fee (or surcharge) for disposal, placing the financial responsibility upon the end user. Examples of fee-based recycling include bottle deposits, vehicle tires, and automotive batteries. Most recently, a proliferation of trade-in programs promise consumers cash for unwanted electronics including cell phones, laptop computers, mp3 players, GPS devices, digital cameras, camcorders, game consoles, video monitors, and printers. Online users calculate the value of their old electronic to determine if a rebate can be placed towards the purchase of a new product. Consumers mail in their product to receive a redeemable gift card equal to the calculated rebate. In cases that the product does not have a trade-in value, the retailer or manufacturer offers to recycle the electronic at no cost.

The potential increase of unwanted televisions sets unequipped to operate after the switch to digital broadcasting have undoubtedly prompted many manufacturers to engage in free take-back programs to keep up with consumer demand. While these programs heighten repeat traffic during the purchase of new products, the consumer should be assured that discarded products will be recycled for reusable byproducts and not simply diverted from the solid waste stream.

When disposal fees are reasonable (whether explicit or embedded), it is less likely to deter consumer participation in recycling. While a consumer may not balk at a five-cent deposit on a glass bottle, a fee for electronics may be far greater than a few pennies per item. With the cost of a laptop battery averaging eighty-dollars, will consumers be willing to pay an extra ten dollars at the time of purchase to guarantee that their used battery is recycled properly at end of life?

Given the unstable prices for resalable byproducts, additional funds are necessary to administer a recycling program. Such funds help pay for a public education campaign, transportation of e-waste, and maintain a viable and safe infrastructure for collection and recycling. Without financial support for product stewardship, ensuring proper recycling is not guaranteed.

2.3 Safety, Handling, & Transportation

While various forms of infrastructures exist for municipal waste collection of common recyclable items, the handling of e-waste presents a unique set of challenges. Unlike glass, paper, and plastic which are relatively standardized in size and content and do not contain toxic heavy metals, special handling is needed for e-waste. The multiple components found in e-waste involve different recovery processes than the common recyclable items.

Though glass and plastics must be sorted by color or type to prevent contamination during the recycling process, they pose no environmental concerns if left exposed to the elements. Used rechargeable batteries, on the other hand, are considered hazardous waste and therefore require special handling to ensure safety during storage and transport. Rechargeable batteries must have their terminals covered with nonconductive tape or be placed in individual plastic bags to minimize the potential risk of fire during storage or transport. From the doubled-walled collection box and supply of plastic bags to safety instructions imprinted on the box, safety training is enforced with program participants to protect personnel and property. Used rechargeable batteries are shipped by ground courier only per the U.S. Department of Transportation requirements for transporting hazardous materials in accordance with the Universal Waste Rule. The *Call2Recycle* program complies with requirements for safe transportation of all used rechargeable batteries.

2.4 Public Awareness

Studies have shown that the average consumer does not differentiate between primary (alkaline) and secondary (rechargeable) batteries. According to a survey conducted by Polaris Marketing Research on behalf of RBRC, when asked to select from a list of common cordless electronic products powered by rechargeable batteries, respondents indicated that they use an average of five to six products on a daily basis. But when asked in the following question how many rechargeable batteries were in their home the answers were much lower. Surprisingly, even though the previous question prompted them to consider the number of rechargeable battery-powered products they owned, respondents' indicated a lower awareness of what devices they use that are actually powered by a rechargeable battery.

This may be due to the fact that the consumer rarely interacts with the rechargeable battery during the product's life cycle. Cordless products are designed to allow users to plug the entire unit into a power supply to recharge so there is very little reason to be aware of the battery. Often, the consumer may upgrade or dispose of the entire unit before ever removing or replacing the battery. But the survey found that when a consumer does replace their rechargeable batteries, sixty-one percent are either throwing them away or "hoarding" them with the motivations for the latter ranging from planning to use as a backup to being unsure of how to dispose of it properly. While many are unaware of existing e-waste recycling programs, there is inherent awareness that these products should not be thrown into the trash. Furthermore, GFK Custom Research, another survey conducted for RBRC, revealed that more than ninety-three percent of Americans would be more likely to recycle their used rechargeable batteries and old cell phones if there was a convenient drop-off location at a store near them.

Standardizing e-waste collections that require manufacturers to provide a nationwide program at no cost would greatly increase consumer participation and increase recycling rates. Establishing an all battery recycling program would reduce confusion of what can be recycled.

It is not uncommon for product manufacturers to redesign products to meet consumers' needs and behavior. By committing product stewardship at the beginning of product development, manufacturers can further anticipate customers' desire to properly manage e-waste while also enhancing their own corporate responsibility.

3. EMERGING TRENDS

Even as engineers design greener electronic products, investigate alternative materials for production, and improve or reduce packaging, these innovations do not

eliminate the need to account for the proper disposal of the product at end-of-life. Sustainable and clean manufacturing can coexist with growth and profitability. From the beginning of the product's life to its useful end, manufacturers, marketers, businesses, municipalities, and consumers can all do their part to ensure a safer environment.

Just as our nation moves towards adopting sources of renewable energy, it must also address product stewardship and corporate responsibility as part of the environmental solution. Maintaining a standard of living while reducing environmental impact is possible. It is commonly accepted that recycling is good for the environment because it reduces the waste entering our landfills and prevents toxic chemicals from reaching people. It also preserves natural resources and reduces pollution. But the other side to recycling is that it's also good for the economy. It produces reusable materials, creates jobs in the recycling and reuse industries, requires less energy, and creates a new demand for more recycled products.

In the future, more e-waste legislation will appear across the U.S. and Canada and more manufacturers begin to enact voluntary product stewardship initiatives. RBRC can provide a voice in these discussions on improving recycling collection programs with its understanding of legislative compliance, environmental standards, and the experience from a over a decade of operating the *Call2Recycle* program. RBRC encourages all parties to become environmental stewards by making a commitment to reduce the environmental impacts of consumer electronic products.

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