E-waste Awareness and Practices Among Wisconsin Businesses and Institutions

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ABSTRACT

The purpose of this study was to determine current Wisconsin business and institutional electronic waste awareness levels and disposal practices. E-waste is a serious global issue as many electronics currently dumped in landfills contain toxic materials and are hazardous to human health and the environment. The State of Wisconsin has taken steps to reduce the amount of unwanted or obsolete electronics being sent to landfills; some businesses, however, continue sending their e-waste to landfills. The existence of various barriers combined with the lack of awareness regarding electronic waste issues prevents some Wisconsin businesses/institutions from properly disposing of obsolete or unwanted electronics. State-wide e-waste practices were assessed through a combination of an online survey and targeted benchmarking research, as well as through site visits and interviews with key e-waste recycling stakeholders. This research identified certain types of businesses that may be less inclined to follow e-waste regulations because of various barriers. Small firms within the service, retail, manufacturing, construction, and non-profit industries, located in the Southeast, Southwest, and East Central regions of Wisconsin, lack awareness and understanding of e-waste issues and regulations. In conclusion, more awareness of e-waste and better understanding of Wisconsin regulations are needed. This could be done more effectively by segmenting businesses and institutions into categories such as the size, location, and industry. The University of Wisconsin System Solid Waste Research Program provided funds for this study.

INTRODUCTION

The world’s fastest growing source of toxic waste comes from computers, cell phones, and other electronics frequently referred to as “e-waste” (Basel Action Network, 2010). As the number of electronics being purchased each year increases so does the amount of electronic waste. “There are upwards of 300 million computers and one billion cell phones produced every year. All of these electronics become obsolete or unwanted, often within 2-3 years of purchase” (BAN, 2010). The Wisconsin legislature enacted an e-waste recycling law on January 1, 2010, in an attempt to decrease the amount of e-waste being disposed of improperly (2009 Wisconsin Act 50). The new law included the following components: computers, desktop printers, video display devices such as televisions, and e-readers. The E-Cycle Wisconsin program, started as a result of this new law, requires certain electronics manufacturers to take financial responsibility for their products; creates a network of manufacturers, recyclers, and collectors; and bans most electronics from landfill disposal and incineration after September 1, 2010 (E-Cycle Wisconsin, 2010). The landfill and incineration bans apply to everyone in the state including households. This legislation brought attention to e-waste issues and helped increase public awareness on the importance of e-waste recycling.

Businesses and institutions are subject to the State of Wisconsin’s universal waste rules. Many electronics contain enough toxic materials that they would be deemed hazardous waste if they were to be disposed in a landfill or incinerator. However, if these items are recycled or reused, the hazardous waste regulation requirements are reduced (Managing Unwanted Electronics and Components Parts, WI, 2009). Even though the Wisconsin Department of Natural Resources (WDNR) encourages businesses and institutions to recycle e-waste, recycling is not always the disposal method used. Enforcement and oversight can be difficult, so some businesses and institutions continue to illegally dispose of e-waste in Wisconsin landfills. Others send their e-waste outside of Wisconsin (knowingly or unknowingly) to be crudely recycled and dumped in third world countries (Granatstein, 2009; WI Hazardous Waste Regulatory Program, 2009). Data listing the number of electronics recycled or disposed of as hazardous waste by Wisconsin businesses and institutions was not uncovered during extensive searches by the investigators of this project; the
only available data pertains to statistics on household e-waste. Improper e-waste disposal poses serious risks to the environment and human health. In an effort to divert e-waste from our landfills and to promote sustainable methods of dealing with e-waste, organizations have pointed out the economic value of electronic components. The income potential of capturing precious metals, some heavy metals, and other materials has led to the development of a new industry. Responsible electronic recyclers are becoming more common, making it easier to find a way to dispose of e-waste properly. By encouraging electronic recycling, we can reduce toxic pollution, stop exportation of e-waste, and prevent further degradation of the environment.

Wisconsin business and institutional e-waste disposal practices were evaluated through an online survey and targeted benchmarking research, as well as site visits and interviews with key e-waste recycling stakeholders. This study identified barriers that prevent businesses and institutions from properly handling e-waste, as well as the ways that firm’s do responsibly dispose of their e-waste have overcome these barriers.

MATERIALS AND METHODS

This project was divided into three main sections; a literature review, a survey of businesses and institutions, and site visits to three Wisconsin electronic recyclers and collectors. The first section was the review of existing research on business e-waste disposal. The literature review was conducted by using research databases, such as Lexus-Nexus and EBSCO Host, available through Polk Library at the University of Wisconsin-Oshkosh. This background information was important in gaining an understanding of current Wisconsin regulations and in developing the survey.

The second section of the research process involved surveying Wisconsin businesses and institutions. The surveys were distributed electronically using an online service called Qualtrics. This helped to increase the availability of the survey rather than distributing the survey by mail, and potentially increased the response rate. The purpose of the survey was to learn about the current awareness and practices of business and institution e-waste disposal.

The survey was distributed using contact information for Northeast Wisconsin businesses and institutions provided by Dr. Steven Dunn at the University of Wisconsin-Oshkosh and through multiple e-mail lists of non-profit organizations including that of New North, Associated Recyclers of Wisconsin (AROW), and the Wisconsin Sustainable Business Council. The distribution method may have skewed the results because businesses and institutions that do not pay attention to e-waste, or do not have specific people tasked with managing recycling and/or e-waste, may have been less inclined to take the survey.

Responses were received from businesses and institutions located in 51 of the 72 counties in Wisconsin. The majority of responses came from six counties: Winnebago, Waukesha, Milwaukee, Outagamie, Brown, and Dane. Responses were grouped by region using the Public Land Survey System (PLSS) Township indexes published by the Wisconsin Department of Natural Resources (WDNR, 2006). The regions were slightly altered so that each county was only represented once. The geographic grouping of the counties for the purposes of this project can be seen in Figure 1. During the two months the survey was available, 157 responses were received and 130 of those responses were complete enough to be included in the analysis. The survey did not receive enough responses to be considered a representative sample. However, it does provide enough information to give some insight into practices and, especially, awareness about e-waste because of the breadth of responses across region, industry, and company size, and the wide distribution of the survey.

Respondents were asked a total of 21 questions, which focused on the following topics: demographic information, awareness and
knowledge of e-waste regulations, current practices regarding e-waste, and identifying barriers that prevent proper disposal of electronic material. Question types included multiple choice-one answer, open-ended, scaled ratings, and multiple choice-multiple answer.

The third section of the project included site visits and interviews with three electronic recyclers and collectors from around Wisconsin. The companies that participated were:

- RecycleThatStuff.com in Appleton, Wisconsin
- Universal Recycling Technologies (URT) in Janesville, Wisconsin
- Cascade Asset Management in Madison, Wisconsin

These recyclers were chosen from the WDNR online registry of e-waste processors (WDNR, 2010). These three businesses were the companies that responded out of five site visit requests. The purpose of the site visits was to gain an understanding of the e-waste industry in Wisconsin and to understand the perspective of e-waste recyclers and collectors.

RESULTS

Survey Results
Survey results were analyzed by looking at the overall responses for each question and then comparing demographic information, such as industry, number of employees, and geographic location, to the responses received. Due to the diversity among the demographics of businesses and institutions, such as, size, location, and industry, the comparisons were done using percentages. The following is a summary of the survey results.

Overall Awareness/Knowledge
Respondents were asked to report whether or not they were familiar with the term e-waste with the following question on the survey (see appendix A):

- How would you rate your personal knowledge of e-waste?

Respondents were then asked to report on their level of awareness regarding e-waste issues with the following question:

- How would you rate your personal awareness of the significance of e-waste issues?

Overall, 86% of respondents reported being familiar with the term e-waste and 14% reported either never hearing of or not being able to define the term. When asked to report their level of personal awareness of e-waste issues, 84% of respondents said that they were aware of related issues, and 16% of respondents reported not being familiar with e-waste issues.

Awareness/Knowledge by Number of Employees (or size of firm)
When the responses to the awareness and knowledge questions were broken down according to the number of people employed by the firm, the results showed smaller firms (those with less than 250 employees) are the least familiar with the term e-waste (Figure 2).

Mid-size firms (251-1499 employees) and large firms with 1500 or more employees had the highest level of knowledge of the term e-waste (Figure 2). Results for questions regarding the level of awareness of e-waste issues were similar between medium and large firms (figure 3). This
pattern could be due to the availability of resources within a company.

Large and medium sized firms may have the financial means to have a dedicated position or an entire department charged with the responsibility of dealing with e-waste and similar issues. Small firms may lack the resources needed requiring employees of these firms to juggle multiple responsibilities from various parts of the business.

Awareness/Knowledge by Industry
The results from the awareness and knowledge questions were then broken down by industry. The industries used for the analysis include: construction, healthcare, insurance, manufacturing, retail, sanitation, service, non-profit, and government (industries that had less than five responses were not counted as part of this comparison). All respondents from the insurance, retail, sanitation, and government industries reported having at least some knowledge of the term e-waste. The service industry was the least familiar with the term: only 8% of respondents from the service industry reported being completely familiar with e-waste and 31% reporting that they had at least some knowledge of the term and 62% reported no idea or complete unfamiliarity with the term e-waste.

Service was followed by construction which had 29% of respondents report complete familiarity and 14% being somewhat familiar leaving 57% having no idea or being unsure (figure 4). Non-profit and manufacturing sectors were somewhere in the middle with 92% manufacturing and 80% non-profit being familiar with e-waste.

This disparity in awareness across industries may be due to the importance of privacy and data
protection for the firms within certain industry and their clients. For example, privacy and data protection may not be as important for service industries compared to healthcare. Variation may also exist between industries because of differences in the rate and volume at which electronics are used. All of the respondents in the insurance, healthcare, sanitation, and government industries reported being completely aware of e-waste issues. Only 43% of respondents from the construction sector reported having a solid level of awareness followed by service at 54% (figure 5). Non-profit, retail, and manufacturing sectors were in the middle with 92% manufacturing, 80% retail, and 80% non-profit being able to define the term e-waste.

**Awareness/Knowledge by Region**

Geographically, respondents were the most familiar with both the term e-waste and with e-waste issues in the Northwest and West Central Wisconsin. Southwest, Southeast, and East Central Wisconsin regions had much lower levels of knowledge and awareness as seen in figures 7 and 8. The reason as to why certain areas have more awareness than others is puzzling. Figure 6 is a map of Wisconsin with indicators of the approximate locations of registered e-waste collectors and recyclers from the private industry. The Northwest and West Central areas have fewer options and greater distance between recycling facilities unlike the Southeast, Southwest, and East Central regions.
Overall Understanding of WI Regulations
Respondents were asked about their level of understanding regarding Wisconsin business and residential e-waste regulations. The questions on the survey were as follows:

- How would you rate your knowledge of Wisconsin business e-waste regulations?
- How would you rate your knowledge of Wisconsin residential e-waste regulations?

Overall, 67% of respondents reported that they either completely understood business regulations or were at least somewhat familiar. The other 33% reported that they either did not understand the regulations, or had no idea that business e-waste regulations exist. The responses about residential e-waste regulations were similarly surprising. Overall, 61% of respondents reported they completely or at least somewhat understand residential e-waste regulations, and 39% of respondents said they either do not understand residential e-waste regulations or were not aware that regulations exist. This is markedly lower than awareness of e-waste issues which gives reason to believe that people who are familiar with e-waste issues are not necessarily familiar with the implications for business.

Understanding of Regulations by Number of Employees (or size of firm)
When the responses to the regulation questions were categorized according to the number of people employed by the firm, the results show that small firms have the most trouble with understanding e-waste regulations, (figure 8) with 18% of them being completely unaware that regulations exist and only 18% having complete understanding of Wisconsin business e-waste regulations. Results show large firms have the greatest understanding of Wisconsin e-waste regulations with all the firms responding to the survey having at least some awareness of business regulations. With that said, at least a few firms of each size reported having difficulty with interpreting the regulations. This is possibly due to the difficult language used in the regulation and the gray area that exists when attempting to classify certain materials as hazardous waste.

Larger firms are more likely to have people dedicated to translating the legal language into company policy. Smaller firms have fewer resources and may not be able to devote employee time to research such matters.

Understanding of Regulations by Industry
When the responses to the regulation questions were categorized according to the industry of the firm, only one industry, which was sanitation, had over 50% of respondents report they completely understood Wisconsin business e-waste regulations (figure 9). However, less than 10% of service, non-profit, insurance, and retail reported having complete understanding of business regulations. Sanitation may include firms that handle electronic waste so it makes sense those firms have a better understanding of the regulations. Electronic processors in Wisconsin have to meet certain requirements and be registered with the WDNR to legally operate in the state. The other industries such as insurance, non-profit, service, and retail may have a large proportion of small firms compared to other industries and therefore may have fewer resources to deal with such regulations.

Understanding of Regulations by Region
When the responses to the regulation questions were categorized by location of the firm, the Northwest and West Central regions of Wisconsin reported having the highest level of understanding of business regulations which were 100% and 80% of respondents respectively.
The Southeast region had 16% and the Northeast region had 13% of respondent’s report that they were completely unaware that business e-waste regulations exist (figure 10).

The lack of understanding and awareness of Wisconsin business e-waste regulations is most prevalent with small firms in the service, non-profit, insurance, retail, and manufacturing industries that are located in the Southwest, Southeast, and East Central regions of Wisconsin.

Obstacles

Respondents were asked to select all that apply from a list of potential obstacles including: cost, security, awareness, convenience, limited choices, or transportation. The most significant obstacle to proper e-waste disposal of concern was cost, which was chosen by 56% of respondents. Data security was the next most selected obstacle at 44% of respondents. The third most significant obstacle reported was awareness. The least important obstacles in this question were limited choices and transportation. Reducing the cost of operation is a top priority for private sector businesses that are keeping an eye on profits and for public institutions that have to manage decreasing budgets. The fact that cost was reported to be a top obstacle seems rational. During a site visit interview to the e-waste collector Recyclethatstuff.com, company president Lora Boeger was asked her opinion on what barriers she observes to proper e-waste recycling. Her answer was, “the financial aspect is the only thing that I would consider to be a significant barrier” (Boeger, 2011). Interestingly, data security was the second most frequently chosen obstacle by respondents.

This could be attributed to the need of businesses to reduce liability related to consumer privacy concerns. Some industries, such as health care, are required by federal and state laws to document the disposal of electronic data pertaining to patients. Other, larger firms are interested in protecting proprietary information. This was evident during the site visit to Cascade Asset Management. Neil Peters-Michaud, Chief Executive Officer of Cascade Asset Management, went through the intensive inventory system used to track electronics received from Fortune 500 companies and health care industry clients. Peters-Michaud explained that his company tracks all the material processed through his facility. “Cascade has a very thorough inventory system that tracks each item from the moment it is brought to the facility through destruction. This enables companies to protect their liability” (Peters-Michaud, 2011).

Awareness and convenience were also commonly reported obstacles companies face when it comes to proper e-waste disposal. During a site visit to URT in Janesville, Wisconsin, company representative, Toral Jha gave her perception of barriers to proper e-waste disposal. She said, “Education regarding the environmental hazards associated with improper disposal and access to proper disposal options” are the most significant
obstacles for businesses and institutions (Jha, 2011).

CONCLUSION/DISCUSSION

The combination of qualitative and quantitative information collected in the research project generated a baseline understanding of the e-waste awareness and practices among Wisconsin businesses and institutions. The most significant findings are:

- Understanding of e-waste regulations lags behind awareness of e-waste issues
- Awareness of e-waste varies by industry, location, and size of the firm
- Understanding of e-waste regulations varies by industry, location, and size of firm

Understanding of e-waste regulations among Wisconsin business and institutions is less than the awareness of e-waste issues among these entities. Although a large percentage of organizations surveyed were at least somewhat aware of e-waste issues and regulations, more work needs to be done to reach organizations that are not. Awareness of e-waste and understanding of e-waste regulations varies by industry, location, and size of firm. Small firms within the service, retail, manufacturing, construction, and non-profit industries, and firms located in the Southeast, Southwest, and East Central regions of Wisconsin, have the lowest level of awareness and understanding of e-waste issues and regulations. Firms that do not have electronic information liability concerns may be less inclined to follow the existing regulations in Wisconsin regarding e-waste disposal practices.

In conclusion, more awareness of e-waste and better understanding of Wisconsin regulations is needed. The world’s fastest growing source of toxic waste comes from computers, cell phones, and other electronics. Although new residential legislation regarding electronic waste has been passed, even more electronics can be diverted from landfills and properly recycled by enforcing business regulations and providing effective informational material to firms across Wisconsin.

A new, more effective approach to informing Wisconsin businesses and institutions of e-waste issues and regulations is needed. Businesses and institutions should be divided into target sectors according to the size, industry, and location of the firm. The WDNR should create materials designed specifically for these sectors. Examples would be developing materials that help small businesses understand the regulations and lists affordable places to recycle e-waste. This awareness campaign could be tied to more research on obstacles to proper e-waste disposal.

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While conducting the research for this project the following individuals assisted me:

- Jill Haygood, Recycling Administrator, Outagamie County Landfill
- Paul Linzmeyer, Chair of NEW North Sustainability Committee
- Dr. Steven Dunn, University of Wisconsin Oshkosh
- Marcy J McGrath, E-Cycle Wisconsin Compliance Specialist, WDNR
- Eileen Norby, Solid Waste Research Program Manager, University of Wisconsin System Admin.
- Linda Freed, Director of the Office of Grants and Faculty Development, UW-Oshkosh
- Dr. Michael Jasinski, UW-Oshkosh
- Allen Doering and Devin Franklin

I would like to thank my mentor and research advisor Dr. James Feldman for his guidance and kind words of motivation throughout the course of this study. I would also like to thank the following organizations: Outagamie County Landfill, URT, Cascade Asset Management, Recyclethatstuff.com, New North, Associated Recyclers of Wisconsin, Wired Wisconsin, and the Wisconsin Department of Natural Resources E-cycle Programs.
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Appendix A – Sample Survey

1.) Please select the Wisconsin county that your business is located in.

<table>
<thead>
<tr>
<th>County</th>
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<td>Douglas</td>
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<td>Ozaukee</td>
<td>Taylor</td>
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<td>Ashland</td>
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<td>Pierce</td>
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<td>Langlade</td>
<td>Polk</td>
<td>Vilas</td>
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<td>Fond du Lac</td>
<td>Lincoln</td>
<td>Portage</td>
<td>Walworth</td>
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<td>Kenosha</td>
<td>Outagamie</td>
<td>Sheboygan</td>
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</tbody>
</table>

2.) Please select the average number of employees your company currently employs in Wisconsin:

- 1-50
- 101-250
- 251-500
- 500-999
- 1000-1499
- 1500+

3.) Please choose the option that best describes your company's industry:

<table>
<thead>
<tr>
<th>Industry</th>
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<th>Industry</th>
<th>Industry</th>
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<td>Mining</td>
<td>Sanitation</td>
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<tr>
<td>Forestry</td>
<td>Manufacturing</td>
<td>Service</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.) Please input your company's average yearly net sales (answering this question is optional):

5.) How would you rate your personal knowledge of e-waste?

- I have no idea what e-waste is
- I have heard of the term e-waste but do not know what it is
- I know of the term e-waste but I am unsure of what items fit into that category
- I know of the term e-waste but do not know how it applies to my company
- I know what e-waste is, how items are categorized as such, and that it does apply to certain electronics used by my company

6.) How would you rate your personal awareness of the significance of e-waste issues?

- I am completely unaware of e-waste issues
- I have heard of e-waste but am unaware of the related issues
- I am somewhat aware of e-waste issues
- I am aware of e-waste issues but did not realize the level of importance
- I am completely aware of the issues and the level of importance
7.) How would you rate your knowledge of Wisconsin business e-waste regulations?

I am completely unaware that regulations exist
I have some knowledge of WI regulations regarding e-waste
I know regulations exist but I have difficulty interpreting the law
I know of e-waste regulations and I somewhat understand the law
I know of e-waste regulations and I completely understand the law

8.) How would you rate your knowledge of Wisconsin residential e-waste regulations?

I am completely unaware that regulations exist in WI
I have some knowledge of WI regulations regarding e-waste
I know regulations exist but I have difficulty interpreting the law
I know of WI residential e-waste regulations and I somewhat understand the law
I know of WI residential e-waste regulations and I completely understand the law

9.) What are your company’s current disposal practices for electronic waste? (choose all that apply)

Recycle with a reputable electronics recycler
Recycle with an electronics recycler (reputation unknown)
Send electronics to be reused
Dispose electronics as hazardous waste
Dispose of electronics in trash to be sent to the landfill
Donate electronics to non-profit groups
Stores unwanted/obsolete items
Other

10.) Does your company pay to recycle e-waste?

Definitely yes
It depends on the item
Our company does not recycle e-waste
We recycle e-waste but do not pay for the service

11.) If your firm does recycle e-waste, which recycling firm and/or collector do you use?

12.) If your company does not recycle e-waste please explain why:

13.) How often does your company replace desktop computers?

As needed
Every 1-2 years
Every 3-4 years
Other

14.) Rate the following factors that influence or would influence your company’s e-waste policy in the order of importance. (1 being most important; 6 being the least important)

Data Security (1)
Cost (2)
Ease of donation (3)
Limited choices for responsible recyclers (4)
Convenience (5)
Other (6)

15.) What do you see as obstacles to proper e-waste recycling for your business? (choose all that apply)

Cost
Security
Awareness
Convenience
Other
16.) Does your company take the end-of-life requirements into consideration when making purchasing decisions?  
Yes  No  

17.) Does your company offer recycling options for employee household e-waste?  
Yes, we offer a regular drop off area on site  
Yes, we hold e-waste recycling drives at least once a year  
No, but we offer information on where they can take their e-waste  
No, we do not offer these services  

18.) Please choose the items below that your company regularly disposes of or recycles:  

- Computer flat screen monitors  
- Computer CRT monitors (cathode ray tube)  
- Keyboards  
- Computer mice and other small accessories  
- Scanners  
- Desktop printers  
- Large office printers  
- Fax machines  
- CPUs (central processing unit)  
- Laptops  
- Terminals  
- Mainframes  
- Net books/tablet PCs  
- Televisions  
- DVD players  
- Cell phones  
- POS systems (point of sale)  
- Projectors  
- Other  

19.) How many desktop and/or laptop computers are currently in use within your company?  

- 0-25  
- 26-100  
- 101-200  
- 201-300  
- More than 300  
- Unknown  

20.) How many company owned cell phones are currently in use?  

- 0-25  
- 26-100  
- 101-200  
- 201-300  
- More than 300  
- Unknown  

21.) Which of the following would be the best way for you and/or your business to learn more about e-waste?  

- Mail  
- Internet  
- E-mail  
- Newsletter  
- Newspaper  
- Other  

22.) Comments/Suggestions: