Electronic Waste

Michigan 4-H Youth Conservation Council

The focus of the 2015 Michigan 4-H Youth Conservation Council is to raise awareness, revise current legislation, and propose new programs regarding electronic waste. To fulfill these goals, the council recommends updating and enforcing current legislation regarding the disposal of electronic waste. The council also advises the expansion of landfill bans to include covered electronic devices. Additionally, the council suggests setting and enforcing disposal and participation goals among manufacturers, and promoting the awareness of electronic waste recycling. These recommendations would serve to protect the environment, the people of Michigan, and the welfare of commercial industries.

Introduction

Samantha Ellison

It is the goal of the 2014/2015 Michigan 4-H Youth Conservation Council to present to the Senate Natural Resources, Environment and Great Lakes Committee, on the topic of electronic waste and its effects on Michigan. Our members will be covering topics varying from electronics waste's effects on living organisms and the environment, current regulations that are in place in Michigan, regulations that are being used in other states and countries, followed with the complied recommendations that have been brought about by the members of our council. We hope that our presentation will be informative as well as helpful in the creation of possible new bills related to electronic waste in Michigan. We believe that by re-evaluating and changing the current legislation that is in place regarding electronic waste, we will be able to ensure the future health and longevity of our states human and environmental health.

Background Information
Osten Eschedor

With technology advancing and world population increasing the demand for new and improved technology is increasing. Electronics are being thrown out as trash and the harmful chemicals that they contain are leaking into the environment. These outdated, usually broken, electronic garbage is called E-Waste. E-Waste includes cellular phones, televisions, and personal computers[1].

E-waste can be recycled. "The GSM Association, which represents phone makers and carriers using GSM says that 80 percent of a phone's material can be recycled". Most E-Waste contains valuable metals such as gold, platinum, silver, iron, glass, aluminum, and various plastics[2]. From every one-million cell phones that are recycled, 75-pounds of gold, 772-pounds of silver, 33-pounds of palladium, and 35,274-pounds of copper can be reclaimed[3].

However, not everything in E-Waste is easy to work with. There are many hazardous substances contained within that are essential for the electronics to function properly. These hazardous substances include mercury, lead, lithium, barium, beryllium, nickel, cadmium, and polyvinyl chloride. These substances should be disposed of properly instead of being dumped into a landfill[4].

These hazardous substances make it difficult to safely and inexpensively process electronics for recycling. E-Waste is being illegally disposed of in West Africa, especially in Ghana and Nigeria. Thinking that the E-Waste is a donation both adults and children salvage the dumps for useful parts to process and sell[5]. The processing methods that they use are very harmful not only to the environment, but to the individuals working with it such as exposure to toxic fumes from broiling, shredding, and burning[6]. Sometimes hackers find hard drives and are able to retrieve personal information from the original owner such as photos and credit card numbers, thus, making money at someone else's expense[5].

Other countries that are the final destination for overflowing amounts of E-Waste include Pakistan, Brazil, Philippines, India, and with the largest amount going to China[7]. Of the 20 - 50-million tons of E-Waste produced in the world each year, about 70% is dumped in China[6].

How E-Waste is Recycled
Dan Christensen

Recycling is considered to be beneficial to the environment as it keeps items such as plastic and metal out of landfills and nature. In some cases this is not always true. In the case of E-waste it depends on how the product is recycled whether or not it is more beneficial to the environment. In America some E-waste is recycled responsibly by American companies. But some E-waste is sent out of the country to China, India, and Africa where it is disposed of in a way that is potentially dangerous to people, animals, and the environment. In some extreme cases it would be better for an e-waste product to be put in a landfill than to be recycled.

In the great desire to help protect and improve our environment the desire of producers to have their products labeled as recyclable has caused consumers to believe that they are doing a great service to the environment. In the case of E-waste it is not just a matter of recycling the product as depending how the product is recycled it could be better to have simply thrown the product in the dumpster. The reason that this is sadly true is because of the methods used to recycle E-waste in places such as China are harmful to the environment. In China E-waste is recycled in places that use crude and unsafe methods of taking apart our old computers and TVs to get to and remove the metals, which they can sell, causing great harm in the process. These dangerous practices include:

- Bashing open cathode ray tubes with hammers, exposing the toxic phosphor dust inside.
- Cooking circuit boards in woks over open fires to melt the lead solder, breathing in toxic lead fumes.
- Burning wires in open piles to melt away the plastics (to get at the copper inside).
- Burning the plastic casings, creating dioxins and furans – some of the most poisonous fumes you can breathe.
- Throwing the unwanted (but very hazardous) leaded glass into former irrigation ditches
- Dumping pure acids and dissolved heavy metals directly into their rivers.[8]

Due to these practices it has become unsafe practices the quality of some rivers in China have deteriorated to the point where it is no longer possible drink, play, or even bathe in. Other companies such as All Green based in America recycle E-waste in a responsible manner. All Green is a collector and a recycler. This means that they will come to your business or home and pick up your old electronics. They also ensure that all of the material they collect is processed down to the basic commodities in North America. Most of the processing for the items they collect is conducted at their facilities in Southern California. Further processing is done at a partner facility in Northern California and the final refining process is done at a refiner in North America. Most items that they receive are manually dismantled as the first step to recovering all of the commodities. Items that cannot be dismantled in an efficient manner are put through a shredding process. Whole e-scrap or dismantled parts can be shredded down to pieces that are less than 2 inches in diameter. They are then separated through a series of devices all connected via conveyor belts in a process that is 95% automated. The products sold include iron, copper, aluminum, plastic, glass, precious metal mix, and shredded circuit boards. In shredding the circuit boards the information stored on them is destroyed which All Green provides clients with a data destruction guarantee.[9]

While consumers cannot control what a company does with their E-waste the consumer can control what company they use to recycle the E-waste.

E-Waste Statistics
Merannda Russell

Americans generate an astonishing 3.5 million tons of e-waste per year. Every two years the percentage will increase by thirty percent or more. In December 2013 it was predicted that

by the year 2017 there will be an outstanding rate of 65.4 million tons of e-waste in America for that year alone[10].

So, why does that really matter? Recycling or reusing conserves our natural resources tremendously. Without a dedicated approach to reducing the amount of natural resources we use, we will potentially use them up. Recycling for instance is breaking down something that is old or outdated and creating something new out of that material. Recycling would not only help preserve natural resources, it would clean-up the environment, as well as, reduce costs using a fraction of the energy needed to create a new item, and create more jobs. For instance, "Recycling aluminum uses saves 90% of energy needed to mine new aluminum."[11] Mining is costly, dangerous, and it uses up the immediately available resources. A ton of used cell phones (6000 phones) yields $15,000 in precious metals. According to the EPA, "Experts estimate that recycling 1 million cell phones can recover about 24 kg (50 lb) of gold, 250 kg (550 lb) of silver, 9 kg (20 lb) of palladium, and more than 9,000 kg (20,000 lb) of copper."[12] To recycle one million laptops would save the energy equivalent to the electricity used by 3,657 United States homes a year. To manufacture one computer and monitor, it takes 530 pounds of fossil fuels, 48 pounds of chemicals, and 1.5 tons of water. These resources are nonrenewable (not replaceable in a human lifetime). If humans don't learn how to recycle and conserve, we will continue to use up the natural resources, and there won't be any left for the future.

Knowing some of these statistics, it is hard to read data stating that an estimated 20-50 million metric tons of e-waste are disposed of worldwide each year. When electronics become obsolete they leave behind lead, cadmium, mercury and other hazardous wastes. Throwing these items into landfills is not the answer. Currently about 2% of landfill trash is estimated to be e-waste. However, this low percent balances out to a resounding 70% of the toxic waste[13]. If people across the globe took pride in recognizing the essential need to recycle or reduce electronic waste, our future would be looking a lot better. The recycling of 1 million cell phones can recover up to fifty pounds of gold, five hundred fifty pounds of silver, and twenty pounds of palladium. These are statistics that not many Americans know.

E-waste legislation in the United States seems to be currently delayed. Only 24 states passed or proposed laws on recycling electronics. With three hundred million computers and one billion cell phones being put into production each year, every state needs to take action by setting specific laws about how to discard all types of electronics.

Electronic waste and Landfills
Trip Dunham

About 85% of electronic devices are discarded in landfills. These devices can release toxic gases that pollute the air and ground. The toxins can get in to the ground water, than effecting humans and animals nearby. E-waste is still the fastest growing municipal waste stream in America. More than 4.6 million tons of e-waste end up in U.S landfills a year. Many European countries have ban e-waste from being disposed into landfills. In the U.S 29.8 kg per capita of e-waste was generated in 2012.

Many other states have passes laws preventing e-waste from going into their landfills. Burning the plastic can emit dioxin in to the air. States like California, Connecticut, Illinois, Indiana, Maine, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, North Carolina, and Oregon have banned many different electronic products from landfills. Many of these states have fines to the consumers that violate the ban. Some states make companies pay a fee for selling electronic products in there sates. In many states that have they ban they are forcing companies to take back products or consumers to recycle or donate the products.

In Michigan there is a landfill ban on many products like medical waste, yard waste, oil, tires, sewage, lead batteries, radioactive waste, and hazardous waste. Michigan has no landfill band against electronic waste. Michigan could easily add electronic waste to the list of products that it bans in landfills. Michigan also makes companies pay a fee for selling electronic products in the state. A Fine could be add to this law also to keep in more enforced.

Effects of Electronic Waste on Humans
Riley Burch

Many of the elements used in the construction of electronic equipment and devices are a threat to those living and working on or around electronic disposal sites. It is these health threats which bring forward the question of the recycling of old and or damaged electronic debris. Electronic waste has been found to contain Americium, a carcinogenic material; Mercury, which is known to have detrimental effects on the human nervous system; Sulfur, which can cause liver damage, kidney damage, heart damage, and eye and throat irritation; BFRs, which are known to cause impaired development of the nervous system, thyroid problems, and liver damage; and lead, which has been found to cause impaired cognitive function, behavioral disturbance, attention deficits, hyperactivity, conduct problems and lower IQ[14]. These materials also show evidence of genotoxic and cytotoxic effects on some chemicals, which are known to inhibit cell proliferation, elevate Reactive Oxygen Species levels, cause cell membrane lesion, and cause DNA single strand breaks. Among these effects, the most prevalent is the manipulation of DNA, with DNA breaks can increase the likelihood of cancer and DNA damages causing replication errors and mutations.[15]

Effects of E-waste toxins on Plants and the Soil
Nicholas Heilman

Excess heavy metal accumulation in soils is toxic to humans and other animals. Exposure to heavy metals is normally chronic (exposure over a longer period of time), due to food chain transfer. Acute (immediate) poisoning from heavy metals is rare through ingestion or dermal contact, but is possible. Chronic problems associated with long-term heavy metal exposures are: Lead – mental lapse; Cadmium – affects kidney, liver, and gastrointestinal tract; and Arsenic – skin poisoning, affects kidneys and central nervous system.[16] The most common problem causing cationic metals (metallic elements whose forms in soil are positively charged cations

e.g., Pb^{2+}) are mercury, cadmium, lead, nickel, copper, zinc, chromium, and manganese. The most common anionic compounds (elements whose forms in soil are combined with oxygen and are negatively charged e.g., MoO_4^{2-}) are arsenic, molybdenum, selenium, and boron.

Plants are very susceptible to the soluble metal cations that are produced when E-waste decomposes. Plants can take up heavy metals by their roots, or even via their stems and leaves, and accumulate them in their organs. Plants take up elements selectively. Accumulation and distribution of heavy metals in the plant depends on the plant species, element species, chemical and bioavailiability, redox, pH, cation exchange capacity, dissolved oxygen, temperature and secretion of roots. Effects of heavy metals on plants result in growth inhibition, structure damage, a decline of physiological and biochemical activities as well as of the function of plants. The effects and bioavailability of heavy metals depend on many factors, such as environmental conditions, pH, species of element, organic substances of the media and fertilization, plant species. [17]

Effects of E-Waste on Animals
Sam Ellison

Electronic waste is something that negatively affects many aspects of the environment, but most importantly the animals which inhabit it. Because of the lack of current legislation controlling electronic waste (E-waste), Michigan's wildlife could be negatively effective in a large number of ways. By working to control E-waste, we can ensure future success of Michigan's native creatures.

Electronic waste is something that can affect wildlife in multiple ways. The obvious effects are through either ingestion or entrapment with the objects when they are either disposed of at a landfill or littered on roadsides. This problem of entangle or entrapment has been relevant for a large amount of time. By working to regulate electronic waste, we would have the ability to cut down on the amount of waste that can turn hazardous to wildlife.

A more unseen form of pollution that results from improperly discarded electronic waste is the chemicals that are released from the different hazardous substances. Some of the most common hazardous chemicals/substances released include Mercury, lead, arsenic, and many other items that are harmful to the health and genetics of both all living creatures[18]. Listed below are some of the most commonly found compounds and their effects on animals:
Mercury - This substance is most commonly known to affect fish or wetland creatures. Waterfowl such as egrets and mallard have found to have a hard time properly reproducing in areas where there is a high dose of mercury. It has also been found that waterfowl eggs and newly hatched chicks could be killed off soon after hatching due to a large presence of mercury. It is debated and being studied on the effects of Mercury in fish, but the bioaccumulation of Mercury can occur for predators causing species such as eagles and hawks to have birth defects[19].
Lead - This product is well known as a potential killer because if it’s poisonous effects. The U.S. EPA reported that 2-8 of lead per kilogram of body weight per day over time can result in the

death of any animal. Lead poisoning is a slow death that results from the lead chemicals slowly reaching and shutting down the major organs, resulting in a coma and death. Lead is also another substance that can bio-accumulate in a predator species possibly causing the predator to get lead poisoning from the contaminated prey[20].

Arsenic – Much like the other compounds, Arsenic is known to be highly effective on aquatic species. With rainbow trout, the substance can build up in their bodies, causing them to become sick, stop eating/digesting food, eventually leading to death. In some toad species it has been observed that the vitality of the eggs ability to reach maturity was decreased by fifty percent in some cases. Birds have been known to be able to develop arsenic poisoning through ingestion, which causes weakness, burst blood vessels, and eventual death due to shock after prolonged exposure. Arsenic poisoning in a warm blooded animal is known to occur in two to three days after ingesting[21].

All of these substances plus dozens of others than can be found in the various forms of electronic waste, are something that can be detrimental to the overall health and population of animal species ranging from fish to birds and other wild animals which are so vital to Michigan's economy and overall environmental health. By better regulating electronic waste and the ways that is being handled, Michigan's wildlife will be able to continue thriving in the diverse habitats of Michigan woodlands.

Registration of Electronic Devices and Take-Back Program

Samantha Bellairs

When someone talks about e-waste or electronic waste people normally think about old computers, printers or cell phones that no longer work or are no longer used. However if they no longer work or are no longer used then what do you do with them? Some would say the answer is to send it to the landfill, but electronic devices contain deadly toxins that can leech out and pose risks to human and environmental health.

In Michigan we have a program called the electronic waste take back program; this program was established in 2008 as a way to promote the recycling of electronic waste. Under this program manufacturers and recyclers must register with the Michigan Department of environmental Quality (MDEQ). [22]

The forms for a manufacturer's and recyclers of electronics can be found online at the DEQ's website under the electronics take back program and are very similar. In the form for manufacturers they must provide brand names, contact information and the amount of tonnage that their take back program received. The manufacturers take back programs must be 'reasonably' available and convenient for the consumers and they must state how they made the information of their program available to the public.[23] A question comes to mind when the term 'reasonably' is used, what is reasonable for the manufacturers does not necessarily mean reasonable for the consumer.

Recyclers must comply with the recycling laws of the state of Michigan and in the registration form for electronic recyclers they must provide information like the manufacturers to including, their company names even assumed names, their contact information, and how much electronic waste in tons that they collected. Recyclers also have to report how much was collected and processed on site, how much material was collected then shipped off site, and they also have to include where that material went and the names of the facilities that it went to. Lastly recyclers have to report the total amount of Covered Electronic Devices or CED material that was collected and either incinerated or sent to landfills because of a lack of market for the materials.[24]

Upon registration which is due annually on October 30th manufacturers and recyclers pay a fee that goes back into the program. Besides paying for staffing these annual fee's also help with outreach and informational programs that inform residents, and also provide opportunities for them to recycle old and unwanted electronics.[25]

Current Legislation and Programs in Michigan
Christopher Chen

When it comes to Michigan legislation on electronic waste management, collection, and recycling, the Manufacturer Electronic Device Takeback Program in the larger context of the Michigan Electronic Takeback Law put into place in 1994 and amended in 2014 both dominate current legislation. In this portion of the paper, two major aspects of this program are discussed: the climate of statewide legislation regarding covered electronic device (CED) retailers and manufacturers, and the affect of statewide legislation on collectors and recyclers.

According to Part 173 of the Michigan Electronic Takeback Law, passed in 1994 and revised accordingly, a "manufacturer" is defined as the brand owner of a computer or television, who "imports", "manufactures", or "sells" more than 50 covered CED's.[26]The Michigan Manufacturer Electronic Device Takeback Program applies to manufacturers selling new computers and televisions to households and small businesses, with 10 people or fewer[27]. These manufacturers have to register with the Department of Environmental Quality (DEQ), and pay an annual, associated fee. The main effect of legislation like this is that it immediately gives Michigan businesses a disincentive, and the fact that it has to be "convenient of free to consumers" further results in this disincentive[27]. The manufacturers then have to label, and recycle all of the equipment that is collected through the program regardless of the time of purchase. A 60%, non-binding recycling goal is another aspect of this program, with a major drawback being that it is completely voluntary on the part of the manufacturer. Recommendations for the revision of this rule are included at the end of the paper, as well as additional changes in Michigan legislation. Another regulation that applies to Michigan Manufacturers of electronic waste includes maintaining a web site, or informing consumers how to recycle TVs and computers. The original purpose of this rule was likely to promote consumer awareness among the common public of these required programs. However, studies done by the Michigan DEQ report otherwise otherwise.

When it comes to the opportunity for electronic waste recycling, there is a strong inequality of recycling opportunity. Of the 302 locations reported by Michigan manufacturers, 90% of these report multiple times, and 75% of the locations are reported to be at the bottom 1/3 of the state[28]. This data shows that although Michigan statutes require the establishment of free and convenient programs, many manufacturers establish them almost exclusively in populated places, or places where their devices are most sold. Rural areas are a market that remain to be tapped by electronic recycling, and could be the subject of further legislative action in the future. The convenience of these programs is also questionable, and often is exploited in loopholes in the law by manufacturers. Because of the weaknesses in e-waste recycling law, as well as the "voluntary" program promoted by legislation, 57% of manufacturer programs are mail order only, 46% report that no materials are recycled, and 66% report that less that 10 pounds of waste material is recycled[28]. As a council of youth, mail order forms are very rarely used, or even made aware to us, and will continue to lose popularity in the coming generations. Thus, from a purely legislative standpoint, it is in the best interest of these programs to require manufacturers to switch to more modern types of recycling. These would include online, or bring-in recycling. When it comes to data reporting, manufacturers also have room for error. These groups have to submit annual information about their respective programs, including units collected, names of collection agencies, or recycling agencies involved[29]. Even with these laws in place, many manufacturers fail to properly report or keep records, resulting from discrepancies between records of manufacturers and recyclers. The main reason for these differences lies in the difference in economic incentives for reporting. Manufacturers have a neutral incentive when it comes to record-keeping--this means that their reporting makes no difference. However, recyclers of electronic waste have a strong incentive to over-report--each device "recycled" results in another unit going towards their 60% recycling goal. For this reason, widespread mis-reporting is rampant across Michigan as a result of this loophole. Furthermore, the DEQ has no mechanism to record a true number of recycled devices.

Retailers, too, play a large part in Michigan legislation regarding electronic waste. A "retailer", according to the Electronic Take Back Law, is defined as someone who "directly sells a computer or television to a consumer". This can be done in any or every way available to consumers, whether through stores, catalogs, mail orders, or online. Recently, in 2010, a retailer cannot sell devices not made by manufacturers registered with according to the rules above[26]. A likely reason for this change is the fact that the DEQ would very much prefer to enact Michigan legislation in every retailer state-wide. However, a downfall of the current legislation is that the retailer is not required to provide a Take Back program for customers. In its special place, directly to consumers, retailers are not required to promote electronic waste recycling. Michigan legislation has room for improvement in this regard.

Another vital component of all of the processes of electronic waste recycling in Michigan in the enacted legislation and its effect on recyclers and collectors. Much like manufacturers, recyclers of CED's must register with the DEQ by October 30th, annually, and pay a $2000 fee[27]. In doing so, these groups must also confirm that their recycling follows state and federal laws, including DEQ, local ordinances. These laws include removing, crushing, or "triple" wiping the hard drive of a computer or other CED, and recycling it in a safe way[28]. Another major part of electronic wastes recycling is the legislative mandate that these centers must annually report the

amount, in total weight usually tons, which they've recycled during the previous year. The reason for this is to hold records, much like the above regulation. A major improvement that the council recommends, from a legislative standpoint, is for recyclers to implement collaborative workgroups to discuss better running their sites and reporting information, as well as better enforcing a mechanism to cross-check the weight reported by these groups. There is currently no state or federal certification program for electronic waste recyclers[30]. This poses a unique problem for manufacturers and retailers, because there is no way for these parties to determine whether or not the recyclers they are transporting waste to are truly recycling sustainably.

In a superficial viewpoint, it can be difficult to determine the difference between a "collector" and a "recycler". The Michigan Electronic Take Back Law defines a "collector, as anyone who receives but does not process CED's[26]. Essentially, these parties are intermediates who do the promotional work of the retailers, manufacturers, or recyclers. In a way, they are much more valuable than the other groups, in that they are most connected to the community. Collectors who don't manufacture goods or recycle have no other requirements under the Electronic Takeback Law. As of 2002, the Michigan DEQ exempted community collection programs from solid waste regulations, in order to better incentivize these local programs. The Youth Conservation Council recommends promoting these programs and marketing them to the public in order to spread awareness for recycling opportunities in the future.

In conclusion, both the Electronic Take Back Law and the Manufacturer Electronic Device Take Back Program have stood as state-wide legislation in the past, but additional changes can improve this.

Current E-Waste Legislation and Programs in Non-Great Lakes States

Allison Melcher

So far 25 states have passed legislation mandating statewide e-waste recycling. Several more states are working on passing new laws or improving existing laws. Since 25 states have already passed legislation on e-waste, it is clearly an important and current issue. 65% of the population of the U.S. is now covered by a state e-waste recycling law.

All the states that have passed e-waste legislation, except California and Utah, use the Producer Responsibility approach, where the manufacturers must pay for recycling. In California, consumers pay a fee when purchasing the product, which goes to the state and is used to pay the collectors and recyclers. In Utah, producers are required to do public education to make consumers aware of the available recycling programs in the state, but are not actually required to do any recycling.

The products covered under various states recycling programs vary widely. In some states, there are products that can be recycled, but the manufacturers do not have an obligation to recycle them. Missouri has recycling programs for the smallest number of products, with only monitors, desktop computers, and laptops being recycled. New York has the most comprehensive recycling program with TVs, monitors, desktop computers, laptops, tablets, e-

readers, printers, fax machines, scanners, DVD players, computer mouses, converter boxes, receiver cables, cell phones, game consoles, MP3 players, and servers being recycled.

One way to measure effectiveness of a recycling program is pounds of material recycled per capita. In 2012, Vermont had the highest amount of pounds of material recycled per capita with 7.7 pounds. Wisconsin, Oregon, Minnesota, and Maine all recycled more than 6.5 pounds of material per capita in 2012. California, with its recycling model based on consumers paying a fee at the time of purchase, recycled only 5.54 pounds of material per capita in 2012. Since recycling is not required in Utah, there is no data for how many pounds of material were recycled. In Washington and Oregon, the high volumes collected are due to convenience requirements in the law: there must be a collection site in every county and in every city over 10,000 people. In Washington, 92% of residents now have a convenient collection site within 10 miles of their home. In Minnesota, the manufacturers have specific collection goals each year, which are based on how much they sold in the state the previous year. If they do not meet their goals, the manufacturers have to pay a fine.

Another factor in increasing recycling volume is to ban the dumping of e-waste in landfills. So far 17 states have banned at least some types of e-waste from being dumped in landfills. Some states imposed the landfill ban at the same time as the recycling program being started; others phased the landfill ban in later. Maine began its recycling program in January 2006 and the landfill ban took effect in July 2006. In the first 6 months, Maine collected 1,291,202 pounds. In the 6 months after the landfill ban took effect, Maine collected 2,869, 372 pounds[31].

I recommend that Michigan add convenience requirements and a landfill ban to its current recycling program.

E-Waste Programs in Other Countries

Megan Rylko

E-waste is a serious environmental issue. Each year in the United States alone, 50 million tons of e-waste is produced.[32] Out of that, only 20-15% is recycled safely and 75% of it ends up in landfills. [32] Right now, an e-waste program is in place in Michigan, but several improvements are necessary if e-waste is to be reduced, reused, and recycled properly. Right now, it is important to look at other countries and how they handle e-waste so Michigan can use their data to put in place new, successful regulations for the future. Specifically, Australia and Canada have great e-waste programs.

Australia has an excellent e-waste program. Australia implemented the world's first national e-waste program in 2012.[33] Australia's leading E-waste company, 1800ewaste, "collect and recycle hundreds of items of e-waste every week"[34] and recycles 95-98% of the collected E-waste. [34] The Hazardous Waste act of 1989 governs the disposal of all hazardous waste in Australia, which includes e-waste.[35] The main purpose of the act is to regulate the import and export of hazardous waste in Australia, and it requires a permit to be obtained to transport

hazardous waste into or out of the country.[36] Specifically for e-waste, Australia has the National Television and Computer Recycling Scheme, which requires companies that manufacture a certain number of electronics to join an approved co-regulatory arrangement.[37] These groups' jobs are to collect and recycle televisions and computers.[37] They may do this in several ways, for example partnering with a recycling company.[37] Some parts of Australia, including Sydney, even have a landfill ban in place for e-waste.[38] Australia's e-waste program is very effective.

Canada also has a spectacular e-waste program, specifically in Ontario. Ontario's Electronic Waste Recycling Program was initially launched on April 1, 2009, and was expanded in 2010.[39] The program collects, reuses, and recycles designated e-waste products, which include but are not limited to desktop computers, laptops, monitors, televisions, keyboards, mice, copiers, scanners, typewriters, telephones, cell phones, and cameras.[39] From 2010-2011, Ontario collected and recycled 34,585 tons of e-waste.[39] In Ontario, brand owners and first importers, also known as industry stewards, are required to fund the program under the Waste Diversion Act passed in 2002.[39] Ontario Electronic Stewardship, or OES, is the group responsible for collecting money to fund the program.[39] The funds are used in order to "cover collection, transportation and processing of electronic waste as well as research and consumer education programs to encourage greater electronic equipment recycling."[39] Ontario, Canada has a good e-waste program and sufficient funding.

Both Australia and Canada have excellent e-waste programs. They are able to successfully collect and dispose of e-waste properly through good programs and government acts. Australia and Canada are successfully limiting and, in some cases, preventing e-waste from ending up in landfills and damaging the environment. Australia and Canada's e-waste programs are great examples for future e-waste programs for Michigan.

Regulations in Other Great Lakes States and Recommendations for Set Goals
Randi Rice

In Wisconsin, there are multiple rules and regulations set in place to encourage the recycling of E-waste. Wisconsin has the manufacturers pay every year to recycle electronics in order to ensure that they will do their best to get the electronics recycled. The consumers can find places to recycle their electronic devices at every school in Wisconsin. The manufacturers are responsible for registering every year and funding a certain amount of electronic recycling. Wisconsin also has bans in place to prevent TVs, computers, and cell phones from entering landfills and incinerators[40].

In Indiana, there are multiple ways you can not only find the best place to go recycle your e-waste, but there is at least one place in each county. Indiana, much like Wisconsin, also has an E-Cycle program that holds the manufacturers of electronics responsible for the recycling of these electronics. Since Indiana has started their program, they have seen a significant increase in the amount of electronics recycled. Similar laws apply to the consumers and manufacturers as in Wisconsin, and there are also similar laws to prevent e-waste from entering Indiana's landfills[41].

Illinois provides a list of all sites that people can bring their e-waste to. They also have set goals for manufacturers. There is a state wide goal for the year as long as a list that provides the amount of electronics that each company is expected to collect. These numbers are based on the numbers collected from these companies the year before[42].

As a council we would like to recommend that Michigan adapts some of these laws. We believe that manufacturers in Michigan should be given set goals for the pounds of E-waste collected and that these manufacturers should be held responsible when they don't meet these goals.

Updating Current Laws
Kaitlyn Baljeu

The current laws that are set place in Michigan regarding electronic waste are out of date and need to be updated. Technology has advanced and new products are constantly being created to replace the old versions. As a result, landfills have been filling up with electronic devices that are not covered by Michigan law to be recycled. At the moment, one can only recycle covered computers, covered video display systems, and printers. That means if someone wants to recycle an old electronic device they can only select a few of their items from the limited list of recyclable items. The remaining dated electronics end up in landfills or wherever else people dump them, and it's not safe for the environment.

One of the main problems with these "covered electronic devices" is that they don't include cellphones or tablets. The law actually specifically states that they are not covered to be recycled[43]. This is a huge problem considering how many phones are produced each year. Taking a look at Apple specifically, the company sold 34 million iPhone 5's in just the first 100 days[44]. What happened to everyone's iPhone 4's? Many people probably sold theirs back to their carrier, but many of them were put in a drawer somewhere or they were simply thrown away. Tablets are another popular commodity in today's society. Many schools are now transferring over to tablets and computers to equip their students for schools. Every few years they buy new ones for the kids and where are all those old tablets going? Tablets and phones need to be included in Michigan's recycling program.

Electronic Waste Data
Samantha Ludlam

Michigan is one of only twenty-five states with some form of an electronic waste law[45]. Michigan's law is written into the Natural Resources and Environmental Protection Act of 1994 (NREPA). It enforces many things like electronic take back programs and the creation of an electronic waste advisory council. The manufacturer electronic take back programs have been in existence since April of 2010[46]. As of October 30th, 2014 there are over seventy-five

manufactures registered with the Michigan Department of Environmental Quality (MDEQ) for the electronic take back program, including companies such as Apple, Canon, Sony, and Toshiba[47]. However, there are several problems that are occurring within the manufacturer and recycling take back programs. One of the largest problems in this area is the amount of inaccurate information and numbers that do not add up between the registered recyclers and registered manufacturers with take back program in the state of Michigan. A lack of general data from this programs is also of concern.

One solution to these problems may be allowing consumer reporting to occur at the time of drop off or delivery to the manufacturers. If consumers took a few extra moments to record what they were taking back and how much of it, another database could be created. They could record where they were they are sending electronics, when they are sending them in, and why they are doing so. This database could then be used in comparison to the current ones to find where the real miscommunications are taking place. By having consumers fill out a form or answer simple questions like these, manufactures and consumers alike could find out through the consumers point of view which ways are the best to communicate, facilitate, and promote the electronic take back program. By increasing the communication between the consumer and manufactures an increase in the amount of electronic waste returned through this program may even become a possibility.

Landfill Bans
Brendan Rice

There are many states around us that have landfill bans. One of which is illinois. This state has made a list of things that is not allowed to be thrown away. Although this is a good list there can be loopholes. Their list is:

- Televisions
- Monitors
- Printers
- Computers (laptop, notebook, netbook, tablet, desktop)
- Electronic Keyboards
- Facsimile Machines
- Videocassette Recorders
- Portable Digital Music Players
- Digital Video Disc Players
- Video Game Consoles
- Small Scale Servers
- Scanners
- Electronic Mice
- Digital Converter Boxes
- Cable Receivers
- Satellite Receivers
- Digital Video Disc Recorders[48]

This list a great start but I think that we need to put something in effect with less loopholes like just restricting the throwing away of electronics. The definition of this is the branch of physics and technology concerned with the design of circuits using transistors and microchips, and with the behavior and movement of electrons in a semiconductor, conductor, vacuum, or gas. “Electronics is seen as a growth industry". I think that we need to pass a law saying that the landfills will be checked monthly for electronic waste and if electronic waste is found then the landfill will be fined X amount of dollars. From there we should make another law surrounding the fines the landfill owners can put on the specific people who violate this so that way it makes the landfill gain back a portion of the money they were fined for this person violating the rule. And then it will discourage the people from violating this again.

For the landfills side they could possibly do something like marking the trash cans and have a way of identifying where the trash they get comes from. That way if during the inspection if they found something the landfill could track that all the way back from who put it in there.[49] Illinois is not the only state taking a stand on this so are Wisconsin,Florida, and Minnesota.

Electronic-Waste Education
Cheyenne Hewlett

Electronic Waste or E-Waste is an up and coming problem in today society. This is how we can educate the public about this problem. With technology on an up rise there are more and more ways to communicate with the public.

Television news cast have happened since the creation of the TV. People have watched, listened, and relied on the news to bring them information about current events and changes in legislation. This is a great way to communicate with people. We can have a news cast about the laws on e-waste that may be created. 58% of people watch the news daily on TV, 34% of people listen to the news on the radio, and 44% of Americans say they got news through one or more internet or mobile digital source.[50] People say they spend on average 57 minutes a day watching news on the TV. Most people watch the morning and evening news cast[51], this is a great time to tell them about e-waste.

Commercials, some people like them and some people don't. This is another good way to get people aware of e-waste. When watching a commercial we tend to remember the creative ones, this is key to remember if commercials are created. Another thing that is helpful are websites. Websites can be accessed 24/7. They can hold a lot of crucial information regarding e-waste and all the legislation on this topic.

Public interaction is great way to communicate with people. When you have the opportunity to meet and great people of the community and teach them about e-waste and answer questions that they have you have a chance to make an impression. They think of you as a honest person they can trust. They then will tell others and know information on e-waste is being spread by word of mouth.

Another good way to educate people about e-waste is to place information on the electronic product or product packaging. We do this with pop cans, we have label on pop cans that say they are returnable. Including a detailed pamphlet with each new electronic product sold in the state of Michigan.

Electronic Waste is a problem and if legislation is passed TV, radio, and internet can be used along with labels at point of sale and public interaction.

Recommendations

The council would like the committee consider the following recommendations when reviewing the current laws and regulations that apply to electronic waste.

- Implement convenient, state-wide electronic recycling opportunities for residents
- Set recycling goals for manufactures
- Update methods for data collection in order to better monitor the performance of the electronic take-back program
- Consideration of a landfill ban for covered electronic devices

Conclusion

The Michigan 4-H Youth Conservation Council has come to the conclusion that electronic waste is an ever growing threat not only to the health of the environment, but the health of consumeristic society which has developed throughout the years. Through research and discussion, the council has found that the most effective strategy to deal with this threat is a combination of systems. These systems will allow for electronic waste to be recycled at the ease of the consumer with updated methods for data collection, while also aiding in the deprecation of waste being dealt with in a landfill setting. These regulations will impose a penalty for improper disposal of the waste, as well as penalizing landfills for violations concerning the regulations. This will allow for the further degradation of the environment to be limited, as well as for the health of those groups affected by electronic waste to be brought into concern. It is the council's belief that the impositions of this combined system will allow for a long term solution to the current issue.

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