# E-waste Management in Kuwait.


## Abstract:

Electronic Waste (E-waste) or waste electrical and electronic equipment (WEEE) is one of the fastest growing types of waste. In the State of Kuwait, E-waste is mixed with other types of waste in poorly designed municipal landfills. Currently, Kuwait Environment Public Authority (K-EPA) does not have any requirements for segregation or reduction of E-waste from households.

A survey has been conducted to evaluate the awareness level of people toward E-waste and find out E-waste current disposal mechanism by households. Around 980 people participated in the survey which was conducted from August 2008 to October 2008. Based on the results of the survey, in addition to literate review of E-waste management system of other countries, a number of recommendations were suggested to improve the E-waste management system in Kuwait.


## Introduction

One of special mark of our time is the availability of countless number of electronic products. Our growing dependence on these electronic products has given rise to a new environmental challenge: electronics waste (EPA, 2001). E-waste is defined as any electrical equipment or appliances that are past their useful lives. (Sinha et al., 2005). Another definition for E-waste is the result when consumer, business, and household devices are disposed or sent for recycling (Iles, 2004). Examples of E-waste are Televisions and Monitors, Computers, Audio/Stereo Equipment, VCRs DVD Players, Video Cameras, Telephones, Fax and Copying Machines, Cellular Phones, Wireless Devices, and Video Game Consoles (EPA, 2001). The European Council of the European Union has categories WEEE into ten categories as shown in Table 1 (European Council, 2003).

Table 1. Categories of E-waste as per the European Council of European Union

| Serial | E-waste Categories | Example |
|---|---|---|
| 1 | Large household appliances | Refrigerators |
| 2 | Small household appliances | Coffee machines |
| 3 | IT and telecommunications equipment | Computers |
| 4 | Consumer equipment | Radio and television sets |
| 5 | Lighting equipment | Fluorescent lamps |
| 6 | Electrical and electronic tools with the exception of large | Drills and saws |
| 7 | Toys, leisure and sports equipment | Video games |
| 8 | Medical devices (with the exception of all implanted radiotherapy equipment) | Dialysis |
| 9 | Monitoring and control instruments | Smoke detectors |
| 10 | Automatic dispersers | for hot drinks or monies |

The most common types of E-waste are cathode ray tubes (CRTs) and PCs (Nnorom, 2008). What distinguish E-waste from normal solid waste is the high material complexity and toxicity. Most types of E-waste contain a combination of low and high value of hazardous materials like Pb, Hg and plastics (Realff, 2004). For example, Pb is considered a major element in the glass of CRTs, which is a part of monitors (Macauley et al., 2003). Another component in many E-wastes is printed wire boards (PWBs) which contain lead (pb) and brominated flame retardants (BFRs) (Niu & Li, 2007). These hazardous materials in the obsolete electronics can be released to the environment during disposal which can cause an adverse impact to human and environment.

Another difficulty facing the management of E-waste is the growing technology. As the technology is growing very fast, the life span of consumer electronic products is getting shorter (Nnorom, 2008; Kang & Schoenung, 2005). The United Nations Environmental Programs (UNEP) estimated the amount of E-waste generated worldwide to be between 20-50 million tones, which can have severe risks to human health and environment (UNEP, 2005). Studies showed that E-waste represent about 4% of municipal waste in the European Union (EU) (Ylä-Mella, 2004). Similar study in the United State indicated that E-waste constitutes about 2 - 5% of the U.S. total municipal solid waste (Silicon Valley Toxics Coalition, 2004).

Methods for Enhancing E-waste Recycling

Recycling rate for E-waste is low worldwide. The two reasons for that are: the consumers have few recycling options and they have to pay substantial end of life fees (GAO, 2005). For example, in the State of Washington the consumer is charged between $10 and $27 per unit for proper handling of E-waste (GAO, 2005). As the traditional “pay your disposal fees at disposal site” is not effective to encourage people to recycle their E-waste, there are two main policies proposed for improving recycling of E-waste: extended producer responsibility (EPR) and advanced recycling fees (ARFs) (Nixon & Saphores, 2007). EPR is used in European Union (European Council, 2003) while ARF is used in the State of California. The advantages and disadvantages of each policy are shown in Table 2.

Table 2: The advantages and disadvantages for EPR and ARF.

| **Policies to Improve Recycling** | **EPR** | **ARF** |
|---|---|---|
| Advantages | The manufacturers will try to make their products environmental friendly as they are responsible for taking back, recycling, and final disposal of their products (Lindhqvist, 2000). The manufacturers can delegate their responsibilities to a third party. | Increase recovery rate as consumer does not have to pay at the time of disposal (Nixon & Saphores, 2007) |

| | | |
|---|---|---|
| | It will increase the use of non toxic materials and processes | Provide funds for developing recycling plants)( Nixon & Saphores, 2007) |
| | It will increase the recycling rate of E-waste as the consumer does not have to pay for disposal | Aware the consumers about the environmental impacts of what they are buying)( Nixon & Saphores, 2007) |
| Disadvantages | Difficulties will be faced with imported products. | Initial cost and administration are high |
| | | Since the consumer is paying for recycling, the manufacturer will not be stimulated to make their products environmental friendly ( Nixon & Saphores, 2007) |
| | | The manufacturers are not involved in the ARF financing model. |

In Kuwait most of the products are imported. For that EPR will be hard to implement, even though not impossible. The fees can be collected from the importer of the products instead of the manufacturers, but this will not result in improving the design of the products as the manufacturers will be out of the picture. On the other hand ARF system will be better in Kuwait as it will provide funding for recycling without depending on manufacturers on importers. ARF will require initial investment to build recycling facilities and make E-waste collection programs. These recycling programs can be run by NGOs or by private companies.

Achievement and difficulties in E-waste recycling in Worldwide

As E-waste contains many valuable metals, recovery of these metals can reduce the need for new raw material for the industries. One study on e-waste recycling found that many base metals can be recovered to over 90%, while precious metals can be recovered to an extent of 97% - 98% (Huisman, 2003). There are many technologies that can be used for treating of E-waste. One of these technologies is the Vertical hammer mill technology, which is a mechanical treatment that uses crushing of waste, density separation by air blowers, iron separation by magnets, and manual separation (Eichert et al, 2008).

Finding a technology for recycling of E-waste is not the only concern for the recycling of E-waste as there are other issues. United States Government Accountability Office (2005) summarized the problem with e-waste recycling as the following:

1. Recycling of e-waste is labor intensive as equipments must be separated into its component parts.
2. It is requires multimillion dollar machinery to process recycle scrap (e.g. metal and plastic) and change it into a sellable commodities.
3. Recyclers incur additional expenses when handling and disposing of toxic components (such as batteries) and toxic substances (such as lead), which are commonly found in used electronics.

For that reasons some countries are not able to recycle their E-waste and instead it is being shipped to other countries. United States Government Accountability Office (2005) recognized that USA E-waste, like computers and TVs, are being shipped overseas for recycling and reusing with no guarantee that it will be properly handled. While other studies by BAN & SVTC (2002) estimate that 50% - 80% of the E-waste collected in the US is being illegally transported to China, India, and Pakistan for recycling and disposal. The major reasons for shipping E-waste to developing countries are:

1. The high cost of labor in the developed countries compared with developing countries. It is estimated that the labor cost in the developing countries might be as low as $1.5 per day (BAN & SVTC, 2002).
2. The environmental laws in the developed countries are more stringent and enforced compared with the developing countries (BAN & SVTC, 2002).

Recycling of E-waste in areas with no enforcement of the environmental law has resulted in polluting these recycling areas. One study showed that PCBs and other organic compounds were found high in the soils and plants around E-waste recycling area (Liu et al., 2008). The same study indicates that the current recycling method for E-waste is by basic methods like manual treatment and open incineration (Liu et al., 2008). Another study states that several parts of India, China, Indonesia, and the Philippines may be exposed to toxic risks because of the way they process E-waste (Iles, 2004).

Environment Regulations in Kuwait.

The Kuwait Environmental Public Authority (K-EPA) was established in 1996 to be the environmental regulatory body in Kuwait. K-EPA issues their regulation in 2001 and was enforced a year later. These regulations did not define E-waste, and there is no requirement for purchasing, recycling or disposing of electronic products such as TVs, Computers, mobile phones, or any home applicants. Even industrial companies are not required to do any recycling of their E-waste. As a result E-waste is being disposed in municipal landfills.

The State of Kuwait is one of the countries that signed Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. In this convention most types of E-waste are considered hazardous waste as it contains Pb and Hg. Basel convention prohibit to disposal of hazardous waste to other countries, except under specific circumstances It should be clear that sending the hazardous waste generated in Kuwait to other countries is not acceptable; instead it should be recycled and disposed inside the State of Kuwait.

Municipal Landfills in Kuwait.

Currently all the municipal waste is disposed off in improperly designed landfills (Alhumoud, & Al-Mumin, 2006). The municipal waste is currently disposed at three active landfills in Kuwait. These landfills are unlined with no system to manage gases or leachate. Also, there is no control over the incoming solid waste to these landfills.

Moreover, the Kuwaiti Government pays contractors for collection and transportation of all household waste to landfill sites (Koushki & others, 2004). As a result, these municipal landfills are accepting all kind of municipal waste including E-waste which contains heavy metals, oils, and other harmful chemicals. Also, disposing E-waste in municipal landfills considered as a massive loss of materials and generates a large area of polluted landfills.

E-waste Management in Kuwait

Currently there is no management system for e-waste in Kuwait; there is no government program for separating, recycling, or recovery of E-waste materials. There is no specialized facilities in Kuwait for recycling of E-waste.

There are few small scale initiatives to manage E-waste from companies as one company is collecting batteries from the public and properly disposing these batteries. Another initiative by a phone company to collect used phones then recycles, or properly disposes of these phones.

A survey was conducted to determine the people awareness toward the hazard of E-waste and the current disposal method for computers and cell phones as a two example which were mentioned in the survey.

## Methodology

A questionnaire was developed in Arabic and English and distributed by hand and by e-mail to citizens and residents in Kuwait to evaluate their awareness level. The survey was conducted in the period from August 2008 to October 2008. Males and females were randomly selected from different citizenships, age groups, and different education levels.

In addition to statistical questions, the survey covered questions related to people awareness towards the hazard of E-waste material like fluorescent light bulbs and batteries. Also the survey contains questions about the current disposal methods for old computers and mobile phones.

## Results and Discussion

In the beginning of the survey, the questionnaire was e-mailed to participants in order to reduce paper waste but participation level was less than 1%. This indicated that the public is lacking interest toward participation in environmental issues or they are not interested in electronic surveys. Further, the rest of the participants were provided with hard copies of the questionnaire in order to improve participation level, which reached 980 participants.

The survey covered 86 areas in the six governorate of Kuwait. The statistics of the surveyed population is shown in Table 3.

Table 3: Statistics of Surveyed population

| | | | | | |
|---|---|---|---|---|---|
| **Gender** | Male (53%) | | Female (47%) | | |
| **Citizen** | Kuwaiti (79%) | | Non-Kuwaiti (21%) | | |
| **Age Group** | Less than 18 (2%) | 18-30 (43%) | 31-45(39%) | 46-60 (15%) | More than 61 (2%) |
| **Education level** | High School or less (16%) | 2 Years College (25%) | University (53%) | Graduate School (6%) | |

When people were asked whether they know that batteries and printer cartridges were considered hazardous waste, 43% reply that they did not know as shown it Figure 1. As almost half the surveyed population were not aware of the hazard content of these E-waste examples, awareness of these people can reduce the amount of electronic equipments they are using and change their method of disposal.

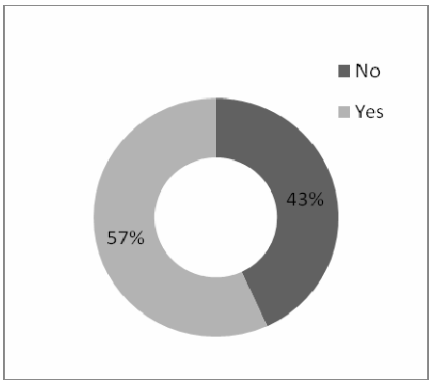


Figure 1: The Percent of People aware that batteries and printer cartridges are considered hazardous waste and should not be thrown in the normal garbage.

The surveyed population was also inquired about their disposal method for fluorescent light bulbs, as these bulbs contain mercury (Canadian Council of Ministers of the Environment, 2001). The results are shown in Figure 2. It can be concluded that 95% of the mercury inside these bulbs will end up in the municipal landfills. This result was expected as there is no collection system or recycling system for Fluorescent light bulbs for the public. National Cleaning Company (NCC) which operates the only industrial landfill in Kuwait has established a unit to properly dispose of Fluorescent light bulbs generated from industries. The disposal mechanism is crushing the tubes and then properly disposed of the crushed material without any recovery of material (NCC, accessed 2009). The benefit of this method is to stop the generation of mercury fumes or leachate of mercury to the ground water.

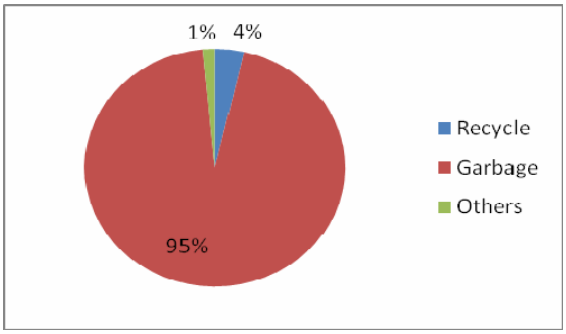

Figure 2: The current disposal method for fused/damaged fluorescent light bulb.

Another question was the disposal method for old mobile phones. The results are shown in Table 3. Almost half of the mobile phones are being reused either by selling these phones or by giving it to somebody. Storing, which represent the disposal method of 41% of the surveyed population, is not a good option when it comes to E-waste. The value of electronic products get reduces very fast as a result of introducing more advance products. Stored mobile phones will not be used efficiently since it will not have the features of the new phones and the demand on buying these old mobile phones will be very little. Only 2% of these mobile phones are sent to one company that voluntarily collect old mobile phones and then recycle or properly dispose of these phones. Establishing a facility to recycle mobile phones in Kuwait can reduce the amount of mobile phones ending up in the landfills.

The last question was about the disposal method for old computers. The results which are shown in Table 4 are similar to the results of disposing mobile phones. Storing computers is also not a good option as every year new computers have double the speed and the storage capacity.

Table 4: Disposal method for mobile phone and computers.

| Type of E-waste | Sell | Send to specialized company for recycling | Garbage | Store | Give to others | Do not have | Others |
|---|---|---|---|---|---|---|---|
| Mobile phones | 39% | 2% | 6% | 41% | 10% | 1% | 1% |
| Computers | 44% | 3% | 6% | 29% | 14% | 3% | 1% |

## Conclusion and Recommendation

Managing E-waste in Kuwait will require the following steps:

1. Increase the awareness level in Kuwait toward hazard waste and it harm. Large scale awareness campaigns should be conducted to cover all level of people.

2. K-EPA should modify their regulation and include regulation that will ensure proper collection and treatment of electronic equipments for residential and

industrial E-waste. ARF regulation can be useful to increase the recycling rate in the State of Kuwait

3. Proper collection system for E-waste should be established
4. Recycling facilities for E-waste should be established.
5. Monitoring system should be implemented to ensure that the waste collected in Kuwait will not be improperly disposed inside or outside of Kuwait.

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