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Environmental risks of wastes computer and electronic

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Abstract:
This article indicate basic problems with old computer hardware and other electronic smithereens, including environmental and health hazards from obsolete hardware and equipment that is typically discarded to the nearest landfill . The computers have changed and new computer models coming out every year, but what happen to your Computer smithereens when they get old? That obsolescence. Computer recycling and electronics recycling programs help keep waste out of our landfills but there is some toxic elements in computer and electronic hardware that make recycling a must for unused workstations.

Keywords: Computer hardware, E-waste, Environmental hazard, toxic elements

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I. Introduction

Nowadays need to Computer recycling and electronics recycling is very sensible for environment [3, 7]. Used computer hardware or monitors are a source of some useful elements like copper, tin, aluminum, Iron and so on but other harmful substances reside in old hardware that, improperly discarded, displays serious problems for environment and human health such as Mercury, Cadmium, beryllium, Lead and so on [3,4 and 6]. In addition to these known dangers, it's important to indicate that there are also more subtle elements in computer hardware that could be getting into our environment and even our bodies. Also some are concerned about plastics in consumer devices that can get into our bodies in traceable amounts that can build up over time. Issues like these add to the need for responsible use of old hardware and appliances [2]. E-waste is a popular, informal name for electronic products nearing the end of their "useful life." Computers hardware, Mobile phone, Televisions, Refrigerators, Copiers, and Fax machines are common electronic products. Many of these products can be reused, refurbished, or recycled. Unfortunately, electronic discards is one of the fastest growing segments of our nation's waste stream. With the passage of the Electronic Waste Recycling Act of 2003, certain portions of the electronic waste stream are defined and the systems to recover and recycle them will be administratively regulated beyond the universal waste rules that now apply to material handling [1].

In addition, some researchers estimate that nearly 75 percent of old electronics are in storage, in part because of the uncertainty of how to manage the materials. Combine this with increasing advances in technology and new products headed towards the market and it is no wonder that "e-waste" is a popular topic in the world. The United States Environmental Protection Agency (EPA) includes discarded CRT monitors in its category of "hazardous household waste". But considers CRTs set aside for testing to be commodities if they are not discarded, speculatively accumulated, or left unprotected from weather and other damage.

In the United States, an estimated 70% of heavy metals in landfills come from discarded electronics, [4] while electronic waste represents only 2% of America's trash in landfills. The EPA states that unwanted electronics totaled 2 million tons in 2005.

The collection of waste materials due to human and animal activities, usually solid and the unwanted or unusable and are discarded are applicable. This definition includes all the general resources, types of classification, composition and characteristics of wastes and three general categories of urban waste, industrial waste and hazardous waste division meet.

In Iran, waste or soil are buried or burned, and even sometimes are left in nature. All these roads are very dangerous for the environment and cause soil erosion, air pollution, ugly landscape as well as being bad for the environment are wildlife. Researchers have found that improper disposal of e-waste will affect the quality of ground water in the next 10-20 years. According to an estimate, the future generations will find it difficult to obtain clear water supply, due to the improper methods adopted for disposal of electronic waste.

Materials of computer hardware are shown in section II. Some Toxic elements in E-waste are defined briefly in section III. Electronic and computer hardware recycling in IRAN is perused in section IV. In section V, Some companies to recycle computer parts in the world is described and at last in section VI some conclusions and future directions of the research are given.

II. Materials of Computer Hardware

Composition of a Desktop Personal Computer

Based on a typical desktop computer that have 60 pounds weigh are shown in below.

Name	Percent of total weight of computer	Weight of Material in Computer	Recycling Efficiency	Use and Location of Material
Plastics	22.9907	13.8	20%	Includes organics, oxides other than silica
Lead	6.2988	3.8	5%	Metal joining, radiation shield/CRT, PWB
Aluminum	14.1723	8.5	80%	Structural, conductivity/housing, CRT, PWB, connectors
Germanium	0.0016	< 0.1	0%	Semiconductor/PWB
Gallium	0.0013	< 0.1	0%	Semiconductor/PWB
Iron	20.4712	12.3	80%	Structural, magnetivity/(steel) housing, CRT, PWB
Tin	1.0078	0.6	70%	Metal joining/PWB, CRT
Copper	6.9287	4.2	90%	Conductivity/CRT, PWB, connectors
Barium	0.0315	<0.1	0%	Vacuum tube/CRT
Nickel	0.8503	0.51	80%	Structural, magnetivity/(steel) housing, CRT, PWB
Zinc	2.2046	1.32	60%	Battery, phosphor emitter/PWB, CRT
Tantalum	0.0157	<0.1	0%	Capacitors/PWB, power supply
Indium	0.0016	<0.1	60%	Transistor, rectifiers/PWB
Vanadium	0.0002	<0.1	0%	Red phosphor emitter/CRT
Terbium	0	0	0%	Green phosphor activator, dopant/CRT, PWB
Beryllium	0.0157	<0.1	0%	Thermal conductivity/PWB, connectors
Gold	0.0016	<0.1	99%	Connectivity, conductivity/PWB, connectors
Europium	0.0002	<0.1	0%	Phosphor activator/PWB
Titanium	0.0157	<0.1	0%	Pigment, alloying agent/(aluminum) housing
Ruthenium	0.0016	<0.1	80%	Resistive circuit/PWB
Cobalt	0.0157	<0.1	85%	Structural, magnetivity/(steel) housing, CRT, PWB
Palladium	0.0003	<0.1	95%	Connectivity, conductivity/PWB, connectors
Manganese	0.0315	<0.1	0%	Structural, magnetivity/(steel) housing, CRT, PWB
Silver	0.0189	<0.1	98%	Conductivity/PWB, connectors
Antinomy	0.0094	<0.1	0%	Diodes/housing, PWB, CRT
Bismuth	0.0063	<0.1	0%	Wetting agent in thick film/PWB
Chromium	0.0063	<0.1	0%	Decorative, hardener/(steel) housing
Cadmium	0.0094	<0.1	0%	Battery, phosphor emitter/housing, PWB, CRT
Selenium	0.0016	0.00096	70%	Rectifiers/PWB
Niobium	0.0002	<0.1	0%	Welding allow/housing
Yttrium	0.0002	<0.1	0%	Red phosphor emitter/CRT
Rhodium	0	0	50%	Thick film conductor/PWB
Platinum	0	0	95%	Thick film conductor/PWB
Mercury	0.0022	< 0.1	0%	Batteries, switches/housing, PWB
Arsenic	0.0013	< 0.1	0%	Doping agents in transistors/PWB
Silica	24.8803	15	0%	Glass, solid state devices/CRT,PWB

In below some of toxic elements is shown in smithereens and devices electronic.

A. The metallic parts of obsolete computers are considered hazardous for the environment, as they contain poisonous chemicals.
B. Old models of televisions and computer monitors, which are very bulky, contain at least 5 pounds of a poisonous metal - lead.
C. According to a recent study, dumping of consumer electronics contributes to approximately 40 percent of the lead in landfills.
D. Lead is also found in the Cathode Ray Tubes (CRTs) of computer and television monitors. The metal causes damage to the nervous system.
E. Mercury, a hazardous metal used in the flat-panel display screens, is found to be a neurotoxin. The harmful metal is absorbed by the human body through contaminated drinking water. High levels of metallic mercury damages the nervous system and the developing fetus. It is hard to get rid of mercury, once it is released in the environment.
F. Circuit boards and batteries contain cadmium, which is known to be a carcinogen - directly involved in the promotion of various types of cancer.
G. Polyvinyl Chloride (PVC), a synthetic polymer used for the insulation of wires and cables of electronic equipments, gives rise to the emission of chlorinated dioxins and furans, when it is disposed.
H. Cadmium and mercury, found in the monitors of obsolete desktop PCs, leach into the ground water, thereby contaminating it.

I. Rechargeable nickel-cadmium batteries, found in laptop computers, are one of the major contributors of electronic waste. Cadmium is hazardous for the environment due to its chronic toxic property.

III. Some Toxic elements in E-waste

A. Lead

Lead can cause damage to the central and peripheral nervous systems, blood system and kidneys in humans. Effects on the endocrine system have also been observed and its serious negative effects on children's brain development have been well documented. Lead accumulates in the environment and has high acute and chronic toxic effects on plants, animals and microorganisms. Consumer electronics constitute 40% of lead found in landfills [8, 10].

B. Mercury

Mercury causes damage to the genitourinary system (tubular dysfunction), the central and peripheral nervous systems as well as the fetus. When inorganic mercury spreads out in the water, it is transformed into methylated mercury, which bioaccumulates in living organisms and concentrates through the food chain, particularly by fish [8, 14].

C. Beryllium

A bivalent element, beryllium is found naturally only combined with other elements in minerals. Notable gemstones which contain beryllium include beryl and chrysoberyl. The free element is a steel-grey, strong, lightweight brittle alkaline earth metal.

Although the use of beryllium compounds in fluorescent lighting tubes was discontinued in 1949, potential for exposure to beryllium exists in the nuclear and aerospace industries and in the refining of beryllium metal and melting of beryllium-containing alloys, the manufacturing of electronic devices, and the handling of other beryllium-containing material [9].

D. Cadmium

Compounds are classified as toxic with a possible risk of irreversible effects on human health. Cadmium and cadmium compounds accumulate in the human body, in particular in kidneys. Cadmium is absorbed through respiration but is also taken up with food. Due to the long half-life (30 years), cadmium can easily be accumulated in amounts that cause symptoms of poisoning. Cadmium shows a danger of cumulative effects in the environment due to its acute and chronic toxicity [8, 11]

E. Hexavalent Chromium

(Chromium VI) is the nasty agent made 'infamous' in the 2000 movie "Erin Brokovich". Chromium VI can easily pass through membranes of cells and is easily absorbed producing various toxic effects within the cells. It causes strong allergic reactions even in small concentrations. Asthmatic bronchitis is another allergic reaction linked to chromium VI. Chromium VI may also cause DNA damage.

In addition, Hexavalent chromium compounds are toxic for the environment. It is well documented that contaminated wastes can leach from landfills. Incineration results in the generation of fly ash from which chromium is leachable, and there is widespread agreement among scientists that wastes containing chromium should not be incinerated.

This same study estimated that the largest volume of plastics used in electronics manufacturing (at 26%) was polyvinyl chloride (PVC), which creates more environmental and health hazards than most other type of plastic. While many computer companies have recently reduced or phased out the use of PVC, there is still a huge volume of PVC contained in the computer scrap that continues to grow – potentially up to 250 million pounds per year.

The use of PVC in computers has been mainly used in cabling and computer housings.PVC is a difficult plastic to recycle and it contaminates other plastics in the recycling process [12, 14].

F. Brominated flame-retardants

Brominated flame-retardants are a class of brominates chemicals commonly used in electronic products as a means for reducing flammability. In computers, they are used mainly in four applications: in printed circuit boards, in components such as connectors, in plastic covers and in cables. They are also used in plastic covers of TV sets and in domestic kitchen appliances.

Various scientific observations indicate that Polybrominated Diphenylethers (PBDE) might act as endocrine disrupters. Research has revealed that levels of PBDEs in human breast milk are doubling every five years and this has prompted concern because of the effect of these chemicals in young animals.

The presence of polybrominated flame-retardants in plastic makes recycling dangerous and difficult. It has been shown that Polybrominated Diphenylethers (PBDEs) form the toxic polybrominated dibenzo furans (PBDF) and polybrominated dibenzo dioxins (PBDD) during the extruding process, which is part of the plastic recycling process. As a consequence, the German chemical industry stopped the production of these chemicals in 1986.

In addition, high concentrations of PBDEs have been found in the blood of workers in recycling plants. A recent Swedish study found that when computers, fax machines or other electronic equipment are recycled, dust containing toxic flame-retardants is spread in the air. Workers at dismantling facilities had 70 times the level of one form of flame retardant than are found in hospital cleaners. Because of their common presence in air, clerks working full-time at computer screens also had levels of flame-retardants in their blood – slightly higher than for cleaners. Humans may directly absorb PBDEs when they are emitted from electronic circuit boards and plastic computer and TV cabinets [8, 13 and 14].

IV. Electronic and computer hardware recycling in IRAN

According to one of the environmental experts in the organization of the environment, yet no program in the field of material recycling especially toxic substances in electronic components is any computer hardware. According to the expert, although toxic substances are exist in the computers, but it far more expensive than scrap those. Therefore still necessary predict in this area has not been adopted. The issue in the future for Iran will cause problem.

Electronic waste every day, and way of non- expert along with other waste disposal that any of the amount that can endanger the environment and human life with serious injuries. International law Waste Electrical and Electronic (WEE) this type of waste recycling rate of four kilograms per person is necessary. To cause the budget law, manufacturers are required to design this type of recycling waste to supply and retail services in making back to the customers. While the topic electronic waste recycling in the world for years as is done in a serious debate in our country still has not been seriously considered.

V. Some companies to recycle electronic parts in the world

Here are some companies that have computer recycling and electronics recycling programs that will give you money back on your next purchase. They'll help save the environment and save money.

Apple has an iPod recycling program. According to apple website you can drop off your old iPod and get a ten percent discount on the purchase of a new one.

Hewlett-Packard (HP) has a trade in program for computer recycling. You can go online, and get a free quote on an old computer, printer or fax. First, you type in exactly what product you want to recycle, then HP will tell you what your rebate will be. They also run specials for computer recycling and electronics recycling.

At **Sony**, they run various programs that give you rebates for computer recycling and electronics recycling.

Sprint has a buyback program in which recycling certain Sprint or Nextel phones can get you an account credit.

Toshiba also has a program in which you can trade in electronics for cash

Overall, these computer recycling and electronics recycling programs will help you be green, and will save some green, too [6].

VI. Conclusion

Expanding Computers few decades, despite the partial achievements, adverse effects on the human habitat and the environment entered more than all, to avoid people from nature has been led.
In developed countries, electronic waste processing usually first involves dismantling the equipment into various parts (metal frames, power supplies, circuit boards, plastics), often by hand. The advantages of this process are the human's ability to recognize and save working and repairable parts, including chips, transistors, RAM, etc. The disadvantage is that the labor is often cheapest in countries with the lowest health and safety standards.

Considering the rapid growth of technology and computer equipment and electronic parts in the world and the other hand, increasing electronic waste in the country electronic waste recycling need more to be felt. For environmental protection and pollution prevention of electronic waste recycling must be done.

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