



# The toxic legacy of e-Waste

Fatimah Mahmood

**E**lectronic waste (e-Waste) can be defined as “any electrical appliance that has reached its end of life”. The representative life cycle of such appliances goes through stages like, introduction, growth, maturity, and recycling or disposal. An appliance reaches the final stage either because it is at the end of its product life cycle, progresses of technology, and/or due to the shifting requirements of consumers. It is now progressively common to replace electronics within a short duration. As a result of which, the generation of e-Waste is rising rapidly.

e-Waste is physically and chemically distinctive from other types of wastes. It includes both precious metals as well as various hazardous which all require special handling and recycling techniques to minimize the environmental contamination, and potential harmful effects on human health.

Research and Markets report, reveals that in the recycling process of e-Waste, the materials such as copper, aluminum, gold, silver, glass, plastics and many others can be extracted. According to the US Environmental Protection Agency, “Experts estimate that recycling 1 million cell phones can recover about 24 kg of gold, 250 kg of silver, 9 kg of palladium, and more than 9,000 kg of copper.” These recycled materials are reused for the manufacturing of electronic and non-electronic products.

This process of creating secondary raw materials results in huge energy savings. As recycling into secondary raw material uses 74 per cent less energy than the production of the primary products. It consequently allows the protection of valuable resources, divert usable materials from landfill and conserve

energy simultaneously. The global e-Waste management market is projected to reach \$5.04 billion by the year 2020, which is a massive figure, one that seems irresistible to developing economies.

Together with the monetary incentive for third world countries, the NIMBY (not in my back yard) attitude of developed countries, along with high labour costs, lack of facilities for recycling of e-Waste, and strict environmental regulations incline developed countries to export some of their e-Waste to poorer developing countries. The latter often treats and recycles the waste, however, at the expense of both human health and environment. For Pakistan this has become a mammoth task, by the invasion of e-Waste created domestically and that imported from developed countries. Iqbal et al., 2015 asserts that most of the e-Waste imported to Pakistan is still in the unidentified category, which is not classified by the country’s customs department.

The major recycling waste sites (highlighted by Iqbal et al., 2015 and other studies) in Pakistan are located in the port city of Karachi. Cities of Lahore, Peshawar, Gujranwala, Faisalabad, and Rawalpindi are also party to the recycling and disassembling of the e-Waste, but at a minor scale compared to that of Karachi. In Pakistan, the vast influx of e-Waste has formed an informal substance economy that feeds a population of 150,000 approximately. The country’s poor retrieve what they can from the waste of the ‘electronic revolution’. Some may not be aware of the dangers of what they are handling, others that do, have little choice, as it represents an important source of income.

Laborers involved in this work pay a hefty price for a few grams of treasure; four million people perish every year to causes linked to e-Waste, and evidently these

Continued on page 2

# e-Waste: the problem, the solution

Dr Wajid Nasim Jatoti & Rida Akram

**C**onsumer electronics have become an integral part of everyday life and are revolutionizing the way we convey, recover information, and enjoy entertainment. Between PCs, TVs, cell phones, electronic amusements, and even gadgets which measure metabolic rate, it is assessed that the normal individual possesses 24 electronic items.

We live in a society where more current is better, and for each new electronic device that enter in market, at least one ends up noticeably obsolete or achieves end-of-life. Therefore, electronic waste, which is also recognized as e-Waste, is a combination of used or unwanted electronic devices that have exceeded their shelf life or as any bit of electronic device which has achieved the finish of its helpful life, has turned into the quickest developing segment of the municipal solid waste (MSW) stream around the world. Internationally, more than 50 million tons of e-Waste were disposed in 2009 and this number is anticipated to increase to 72 in upcoming years.

## Hazardous components of e-Waste

Hazardous compounds are found at various places in electronic equipment. However, there are certain components and materials that more frequently contain these substances.

Capacitors containing polychlorinated biphenyls (PCBs), mercury-containing components such as switches or backlighting lamps, batteries, PC-boards of mobile phones and of other devices, asbestos waste, cathode ray tubes, freons and hydrocarbons, gas discharge lamps, external electrical cables, ceramic fibres, components containing radioac-

tive substances, electrolyte capacitors containing substances of concern, brominated flame retardants, dioxins, chlorinated, phenols and benzenes, polychlorinated naphthalenes (PCN), chlorinated paraffins, chlorinated benzenes, polycyclic aromatic hydrocarbons (PAH), chlorofluorocarbons (CFCs), triphenyl phosphate, phthalates, fluorinated compounds, liquid crystals display (LCD), toner dust photocopiers and laser printers and nanoparticles.

## Impact of products from e-Waste in human health

There are chances of accidents like cuts and burns during the dismantling, shredding, acid baths and incineration process, in addition, exposure to following chemicals have many long-term effects. Phthalates such as DEHP in this monomer form effects the

pression and behavioural changes, and reproductive disorders. Chlorobenzene, another toxic substance, causes acute/chronic diseases in mammals, like central nervous system, liver and thyroid. Increasing degree of chlorination such as tetrachlorobenzenes have negative effects on kidneys.

## Environmental impact

e-Waste constitutes over 5% of metropolitan waste around the world, and is the quickest developing class of waste. The natural effects are identified with the dangerous substances contained in e-Waste, and certain hazardous reusing practices. The poisonous substance of e-Waste is made out of an assortment of materials containing lethal substances that could deteriorate the soil and groundwater when discarded. These incorporate overwhelming metals, for example, mercury,



development of testis, butylbenzyl phthalate (BBP) and dibutyl phthalate (DBP) also hazardous to reproduction system and effects liver and kidneys.

Accumulation of polychlorinated biphenyls (PCBs) in fishes and other aquatic organism’s results in bioaccumulation which have negative impact on human’s health, may enter inter in skin through absorbance, inhalation or ingestion and cause various diseases like neurotoxicity, liver damage, tumors, immunosup-

lead, cadmium and chrome, fire inhibitors. To be sure, leaching from a site or distribution centre containing e-Waste can influence the compound nature of water, which at that point saturates the soil, at long last coming to the groundwater. Soil defilement can be considered if overwhelming metals are versatile and don’t develop in the soil, they will be exchanged to the groundwater and plants, and cause adulteration. In the event that the overwhelming metals are not versatile, they don’t

Continued on page 3



From page 1: The toxic legacy of e-Waste

workers have the lowest life expectancy in Pakistan. Typical e-Waste recyclers in the informal setting work with very few tools (blowtorches, hammers, acid baths), no personal protection equipment, that too amongst un-

children in their first 5 years of education, which according to a report by UN is one of the highest rates in the world.

In Pakistan's front, neglect of governmental and legislative organizations has led to circum-

stances in which no inventory, on the domestic generation of e-Waste nor the illegal import of second-hand equipment or e-Waste, exists. There is prominent presence of laws such as the PEPA Act of 1997, which counteract this perturbing matter. Section 11 of this Act 'prohibits discharge or emission of any hazardous chemical in the environment' and Section 13 'strictly prohibits the importation of any hazardous substance in the territory of Pakistan'. Pakistan is also a signatory of the Basel Convention (1994), that is essentially put together to monitor the trans-boundary movement of toxic wastes such as e-Waste. The succeeding Basel Ban Amendment (1995) restricts 'all type of hazardous waste from transboundary movement for any reason, including recycling'.

Despite the existence of Basel and other conventions that address such issues, the transmission of e-Waste remains relatively high. The accompanying export of e-Waste from developed to developing regions has been continuing for years, because of the unlawful character of such exports, there is still a dearth of information available on the transboundary movements and approximations of hidden flows are highly capricious. Furthermore, there is no evidence of a competent regulatory authority overseeing the occupational exposures and effluence caused by the processing of e-Waste. As with many other supervisory authorities in Pakistan, the practical uses of these laws seem inconsequential.



scrapers and public must be educated regarding the potential threat of e-Waste to health & environment, and importance of waste management protocols. Workforce involved in waste processing activities must be properly educated and trained with occupational health and safety. This could be done by information dissemination through print, electronic and

social media.

- There should be an introduction of end user certificates that provide information to the authorities, as to where the imported goods will be destined to; helping in regulating and pinpointing any unregistered industries that pose afore mentioned threats.
- e-Waste management can only be done sustainably if the concerned authorities effectively regulate the standards and legalities related to it. This can be undertaken through enforcement of binding laws and conventions.
- Additionally, it calls upon firms and consumers alike to consider and take responsibility for the consequences of the actions they un/intentionally take. There has been a high rate of drop out of school owing to poverty, abuse and employment opportunities at young ages; this needs to end. Protection of workers and the environment affected by the e-Waste is vital.
- Introduce extended producer responsibility or product take-back; an environmental protection strategy that makes the manufacturer of the product take responsibility for the entire life cycle of the product and especially for the recycling and final disposal of the product.
- Encourage longer lasting, recyclable and less toxic prod-

uct design. The aim should be "design to last", instead of "design to dump".

- Establish formal recycling facilities to deliver income generating opportunities for both small scale enterprises and individual workers. The financial, environmental and health benefits of formal e-Waste recycling are in stark contrast to informal facilities, which employ only a few people, generate less income, and may lead to many expenses such as indirect health costs. Therefore, if this business of recycling can be formalized, legalized, and equipped with technological advancements; Pakistan can potentially turn-around and benefit from this crisis.

Conclusively, this issue cannot be brushed under the carpet, as it is never trivial when human lives are un/knowingly at risk. The vital question to raise here is that; are the lives of people living in third world countries any less than those in the first, especially in the presence of other more environmentally friendly and safer methods of disposing off e-Waste? Finally, improved knowledge and mindfulness will prove critical in backing the government, community and stakeholders, to agree upon rigorous approaches for future endeavours. This will assist in managing and possibly taking advantage, of the e-Waste cumulating in Pakistan.

ventilated rooms filled with nauseating fumes, and working for more than 10 hours a day. These activities can release persistent toxic substances (PTSs) into environment ending up into food webs. Numerous PTSs are notorious as endocrine disrupters, carcinogens and health deteriorating agents leading to reproductive disorders, developmental deformities, in both humans and wildlife.

Wong et al., 2007 carried out a study in which they examined the levels of polycyclic aromatic hydrocarbon, polychlorinated biphenyls, flame retardants, and heavy metals in air, soil and sediment in surroundings of e-Waste recycling centres. The results showed exceptionally high concentrations. Moreover, it suggested that, they can bio-accumulate in humans and wildlife, once they enter the bloodstream. In addition, burning of computer parts can release a concoction of dioxins, which are very toxic. Similarly, Lead is also a very dangerous component as it can affect the mental ability of children. Chromium can enter the soil and water with ease. If it is inhaled or ingested, it can cause nasal ulcers, breathing impairment, asthma, and lung or stomach tumours, as it is a known carcinogen.

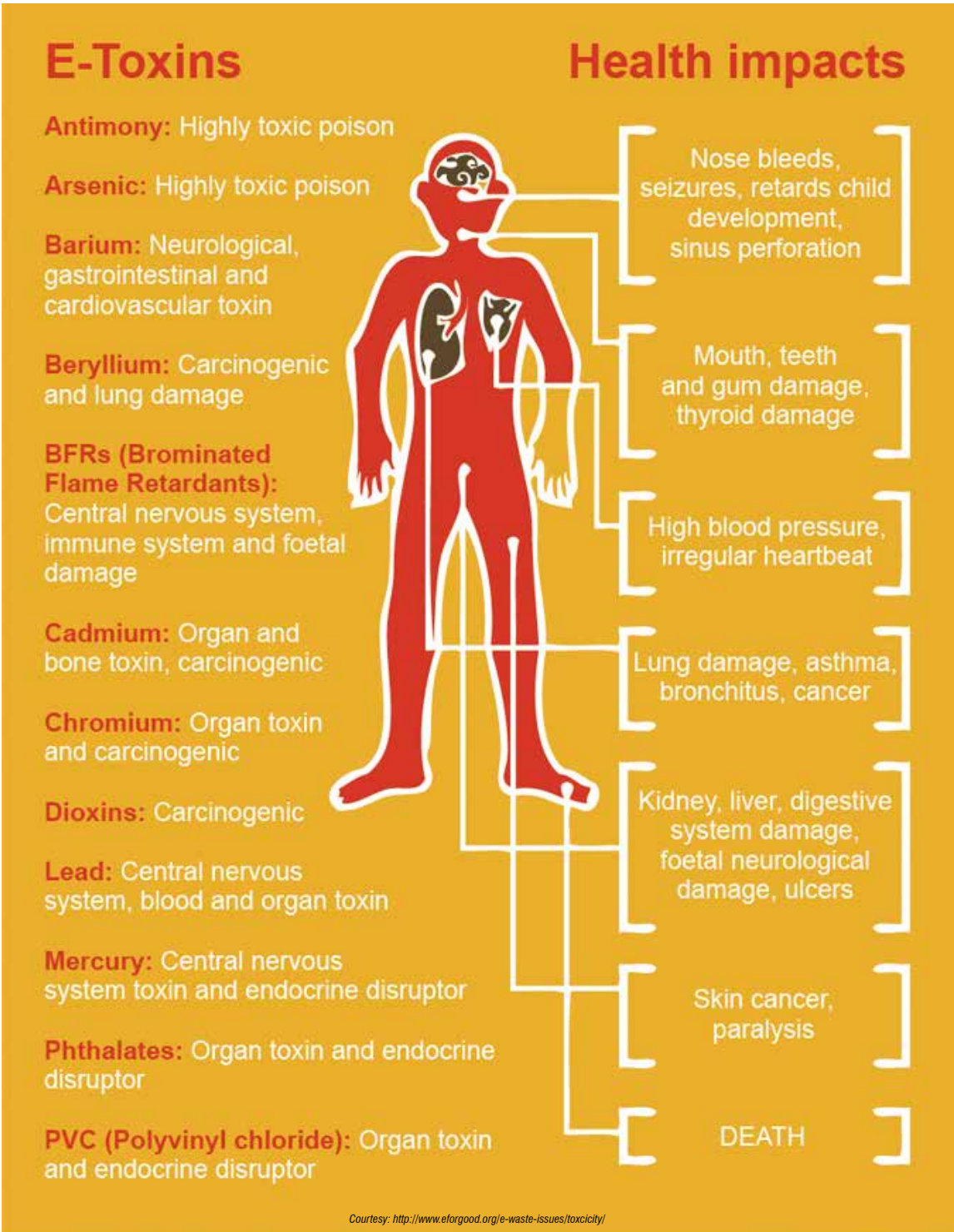
Robert Knoth, a photographer linked with Greenpeace, created a photo essay 'Scrap Life' about the area of Shershah and Lyari in Karachi. He found e-Waste burning adjacent the river in Lyari and many of the chemicals from the waste seeping into the river, turning it black. The Lyari river passes through the mangroves, eventually finding its way into the Arabian Sea. Studies show that the mangroves of the Indus Delta are exceedingly polluted with metals. This also poses a threat to the fish population in the coastal areas, and thus the fishery community. Knoth also established that many children, some as young as twelve, were seen working in the e-Waste industry. This can mainly be attributed to the 50% drop out rate of

stances in which no inventory, on the domestic generation of e-Waste nor the illegal import of second-hand equipment or e-Waste, exists. There is prominent presence of laws such as the PEPA Act of 1997, which counteract this perturbing matter. Section 11 of this Act 'prohibits discharge or emission of any hazardous chemical in the environment' and Section 13 'strictly prohibits the importation of any hazardous substance in the territory of Pakistan'. Pakistan is also a signatory of the Basel Convention (1994), that is essentially put together to monitor the trans-boundary movement of toxic wastes such as e-Waste. The succeeding Basel Ban Amendment (1995) restricts 'all type of hazardous waste from transboundary movement for any reason, including recycling'.

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Having said that, to every problem there needs to be a solution, which is genuinely safe and environmentally viable. The following are some of the solutions for the e-Waste problem in Pakistan:

- The leading solution to this crisis is to eliminate unsafe chemicals from the products and to protect the general public and workers from the







Tayyaba Javed

## e-Waste: a threat or an opportunity?

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# e-Waste: a threat or an opportunity?

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**P**resent technological needs such as the wish of people to be socially strong and stay connected around the globe can be satisfied by electronic product innovations. As some latest 3D products are continually developed and introduced into the marketplace, leading towards the trend that buyers replace standing electronic products that are either damaged or simply old-fashioned, resulting in the generation of bulk of discarded electrical goods that is increasing the worldwide waste stream leading environmental pollution. Sometimes, e-Waste is misunderstood if related to old computers or IT equipment, while, in the international literature the identical term Waste Electrical and Electronic Equipment (WEEE) is also used. e-Waste can be defined as:

### European Directive 2002/96/EC

Waste electrical and electronic equipment, including all components, subassemblies and consumables which are part of the product at the time of discarding". The Directive 75/442/EEC, Article I (a), defines as "waste" as "any substance or object which the holder discards or is required to discard in compliance with the national legislative provisions".

### Basel Action Network

e-Waste includes a wide and developing range of electronic appliances ranging from large household appliances, such as refrigerators, air-conditioners, cell

phones, stereo systems and consumable electronic items to computers discarded by their users

### OECD

Any household appliance consuming electricity and reaching its life cycle end"

### Existing Status

An estimated production of global e-Waste is as 20-50 million ton per year that is parallel to almost 1 to 3% of the estimated global urban waste production that is 1636 million ton. Electrical and electronic waste production has been increased worldwide. Between 2009 and 2014, the magnitude of discarded computers, telephones, televisions and other home appliances has been folded to about 42 million tons/year globally; comprising 16 million ton/year in Asia, 11.7 million ton/year in America, 11.6 million ton/year in Europe, 1.9 million ton/year in Africa. One of the major receivers of e-Waste and second-hand equipment along with China, India and Nigeria is Pakistan. Various of the source countries transmitting e-Waste to Pakistan include Australia, Japan, England, United States, European Union, Kuwait, Saudi Arabia, Singapore and UAE. There are certain national and international regulations like section 13 of The Pakistan Environmental Protection Act 1997, Government of Pakistan imposed 25% tax on computer monitors, National Environment Policy 2005 to discourage e-Waste flow from developed to developing countries, yet it still finds its way to Pakistan in the form of donations or second-hand equipment exports, the



problem lies in the fact that only 2% of the mass can be recovered. The rest is recycled by casual recyclers.

### e-Waste, major environmental concern

In modern years, the production rate of WEEE has intensely increased. On the other hand, electronic-waste (e-Waste) is an emerging issue in the developed and developing country, due to its negative consequences as environmental and human health hazards. These may be due to the inadequate recycling and disposal practices used. It can have serious outcomes for those in vicinity where e-Waste is being recycled or burnt owing to the occurrence of certain heavy metals like lead, cadmium, mercury, beryllium, BFR, polyvinyl chloride and phosphorus compounds.

### Challenges of e-Waste

Lack of public awareness regarding e-Wastes. Less attention from government and non-gov-

ernment environmental bodies.

Inadequate regulatory measures, strategies and implementation of law.

Lack of coordination among different Stakeholders and Ministries or Departments. Inefficient regulation system for import of refurbished computers.

Insufficient funding for the implementation of the provisions of the Basel Convention.

Proper inventories of Hazardous Waste including e-Waste are not available.

### Actions required to meet the challenges

Institutional Agenda for the implementation of Basel Convention needs to be strengthened instantly.

National Implementation Plan and strategies of the Convention need to be prepared and executed.

The current awareness regarding the presence and threats

of e-Waste are extremely low, partly because the e-Waste being generated is not as large as in developed countries. Serious actions are needed to address this problem. For this, following are some suggestions for e-Waste management include:

- Promoting the trend of reuse by donating old electronics, that will extend the shelf life of valuable goods and keeps them out of the waste management system for a while.
- Prefer to buy such electronic products that are made with less toxic constituents, use recycled content that are energy efficient, and designed for easy advancement or disassembly, use minimal packaging and offer take back options.
- Consumer awareness building campaigns should be planned by the Ministry and the other relevant Stakeholders on application of 3R technologies that will reduce the

## From page 1: e-Waste: the problem — the solution

represent an imminent danger to the living organisms, yet prompt as long lasting, irreversible and deteriorate the environment.

### Safe methods for disposal of e-Waste and managing authorities

Most safe strategy is reusing/recycling materials including metals and reusing them, which incorporates industry wide framework for the gathering of e-Waste. Actualizing appropriate principles to make following as obligatory wearing defensive covers and gloves and wellbeing glass when disassembling and maintain a strategic distance from simple techniques for extraction, for example, cremation which comes about unsafe exhaust, abstain from dumping and abstain from utilizing corrosive showers, and executing strict guidelines against

dumping e-squanders in landfills as it could filter out towards ground water or might be discharged after long time.

Make a move against unapproved unlawful e-Waste gatherers, support look into researchers in discovering contrasting options to risky chemicals and cancer-causing agents, restricting the electronic items with unsafe fixings, checking the transportation of e-Waste inside the state city confines and also ports and harbors. Additionally, executed the framework to make electronic fabricates to assume liability for their items. Thus, electronic makes are given incredible obligation to gathering the items after their utilization and reusing them. It is additionally vital to teach the general population on taking care of and transfer of e-squander through mindfulness programs.

### Awareness Campaign

In the structure, specialists might prepare environmental NGOs and people from line services and parastatals to secure essential comprehension of e-Waste administration and an inspiration to take part in exercises for enhancing the nature of the earth and create aptitudes for waste administration. This

preparation should be guided at helping implementers to expand their understanding, awareness and aptitudes in e-Waste handling. It is the obligation of these prepared individuals to teach into the masses solid sentiments principal to building up a worry for proper e-Waste management. The improvement of group construct awareness program in light of e-Waste ought to consid-

er the following aspects;

- The programme should help the participants to develop interest in improving the quality of their immediate environment and increase the awareness on environmental health.
- The programme should increase the awareness of and knowledge about e-Waste management, impart positive attitudes and motivate action about it.
- It should provide continuity and progression because behaviour modification is a long-term habit

It will be linked with community realities and cater for the community's e-Waste problems as best as it could.

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Hina Rasheed Baloch

### Not known phenomenon e-Waste

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Electronic waste or e-Waste portrays unwanted electrical or electronic devices. Expended electronics which are intended for reuse, resale, salvage, recycling, or disposal are also counted as e-Waste.

It is sort of bad news that this issue is not getting attention by policymakers, industry and consumers as well because people like you and me are still not certain about disposing of old computers, smartphones or any other electronic devices. Unavailability of convenient recycling options almost 75 percent of old electronics remains to be stored in lumber room.

These electronic devices, also identifies as e- waste or e-scraps, including items like old computer equipment, stereos, televisions and mobile phones. While recycling e-Waste only 10-15 percent of the gold is successfully obtained and rest is vanished. e-Waste holds sediments of precious metals and these sediments are 40-50 times richer than ores which are mined from the earth. On the other hand, these devices also contain a large amount of poisonous substances including lead, mer-

cury, chromium which needs to be recycled properly and proper processing needs to be ensure that these harmful materials are not released directly to the environment.

Embryonic approaches to recycling in countries have resulted in health risks to local people exposed to the release of toxins continues to an issue of concern. Rapid increase in the technology many people are replacing mobile phones and computers. Because of this, the generation of electronic waste, or e-Waste, is growing rapidly.

Developed countries in order to get rid of these un wanted materials sends a shipment every year to developing countries including Pakistan contains heaps of equipment for the purpose of disposing and recycling.

Many people in Karachi are involved in the e-Waste industry many of them are children. Lyari area in Karachi is known as hub of e-Waste industry which receives e-Waste from all over the Europe. e-Waste burning alongside the river and toxin materials are seeped into the river turning into black. Even a low level of exposure of children and pregnant woman to lead, mercury, cadmium and any other heavy material



will be reason the severe neurological damage. Children who pick up the stuff from e-Waste sites are the victims of deadly diseases.

Dr. Zaigham Abbas technical officer of Ministry of Climate Change, Government of Pakistan told the participatns at an earlier WEEE workshop in Osaka that Pakistan lacks proper systems to manage e-Waste at the national level and that very small amount of funding has been applied to research and development of suitable recycling technologies. He

stresses that government of Pakistan has not paid sufficient attention to this issue, government should have inventory record of e-Waste.

Presence of heavy metals, Persistent Organic Pollutant (POPs), and other hazardous substances in e-Waste is the main risk to human health and the environment.

Four billion Dollars loss is faced by Pakistan's economy every year because of environmental degradation. Nation has to face a lot of problem because

there is lack of seriousness from government. Sorrowfully, in our country decision are made until problem hits us on the face or once the damage is done. For the safe handling and disposal of e-Waste in Pakistan, there is a dire need to implement laws. Recycling businesses are facilitated by government. Pakistan could generate millions if such initiatives are taken, and more importantly it will create jobs for the thousands of people while achieving the core target of lowering the health and environmental risks.

