E-WASTE: ARE WE READY?

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What is E-WASTE?

E-WASTE comprises of old electronic and electrical appliances ranging from personal computers to various household appliances such as TV’s, refrigerators, cell phones, switches, wires, batteries and fluorescent lamps.
WHAT IS E-WASTE?

Electronic waste
- DVD/VCR players, CD Players, radio, Hi-Fi sets, etc: 15%
- Computers, telephones, fax, printers, etc: 15%
- Televisions: 10%
- Monitors: 10%

Electric waste
- Refrigerators: 20%
- Washing machines, dryers, air-conditioners, vacuum cleaners, coffee machines, toasters, irons, etc.: 30%

Known and Suspected Routes of e-waste Dumping

There is currently no system for tracking legal or illegal (under international law) shipments of electronic waste, and therefore, there is no quantifiable data on volumes or even all of the true destinations. Some electronic waste is shipped as "working equipment" only to end up as waste upon arrival. This map indicates information collected through investigations by organizations such as the Basel Action Network, Silicon Valley Toxics Coalition, Toxics Link India, SCOPE (in Pakistan), Greenpeace and others.
E-WASTE: Consumer vs industry

- Received about 47 million computers and 100 million mobile phones every year.
- Black market business of dismantling e-waste and recycling workers earned USD 8 per day.
- Releasing toxins that they not only inhale, but release into the air, ground, and water.
- Guiyu has the highest levels of cancer-causing dioxins in the world.
- Pregnancies in Guiyu are six times more likely to result in miscarriages, and 70% of the children there have high blood lead level.

E-WASTE: Guiyu (China) no 1 in the world
E-WASTE : Malaysian situation

✓ Average 8,000 tons per year and keep increasing 3-5% per year.
✓ Fastest growing waste stream.
✓ Inline with rapid growth of the electronics industry.
✓ Poor awareness and enforcement.

Table 6.2 Malaysia : Quantity of Scheduled Wastes Generated by Category, 2008

<table>
<thead>
<tr>
<th>NO.</th>
<th>CATEGORY OF WASTE</th>
<th>QUANTITY OF WASTE (MT / Year)</th>
<th>PERCENTAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gypsum</td>
<td>366,771.99</td>
<td>28.11</td>
</tr>
<tr>
<td>2</td>
<td>Dross / Slag / Clinker</td>
<td>208,319.53</td>
<td>15.96</td>
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<tr>
<td>3</td>
<td>Oil &amp; Hydrocarbon</td>
<td>129,701.99</td>
<td>9.94</td>
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<tr>
<td>4</td>
<td>Mineral Sludge</td>
<td>107,122.05</td>
<td>8.21</td>
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<tr>
<td>5</td>
<td>E-Waste</td>
<td>103,808.63</td>
<td>7.88</td>
</tr>
<tr>
<td>6</td>
<td>Heavy Metal Sludge</td>
<td>91,730.67</td>
<td>7.03</td>
</tr>
<tr>
<td>7</td>
<td>Used Containers</td>
<td>38,676.04</td>
<td>2.98</td>
</tr>
<tr>
<td>8</td>
<td>Acid &amp; Alkali</td>
<td>38,179.66</td>
<td>2.93</td>
</tr>
<tr>
<td>9</td>
<td>Spent Solvent</td>
<td>38,062.81</td>
<td>2.92</td>
</tr>
<tr>
<td>10</td>
<td>Batteries</td>
<td>34,283.69</td>
<td>2.63</td>
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<tr>
<td>11</td>
<td>Mixed Wastes</td>
<td>33,928.70</td>
<td>2.60</td>
</tr>
<tr>
<td>12</td>
<td>Clinical/Pharmaceutical</td>
<td>26,967.95</td>
<td>2.07</td>
</tr>
<tr>
<td>13</td>
<td>Ink &amp; Paint Sludge</td>
<td>18,696.78</td>
<td>1.43</td>
</tr>
<tr>
<td>14</td>
<td>Contaminated Paper &amp; Plastic</td>
<td>17,970.40</td>
<td>1.32</td>
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<tr>
<td>15</td>
<td>Rubber Sludge</td>
<td>15,512.02</td>
<td>1.19</td>
</tr>
<tr>
<td>16</td>
<td>Residue</td>
<td>13,544.07</td>
<td>1.04</td>
</tr>
<tr>
<td>17</td>
<td>Others</td>
<td>6,627.73</td>
<td>0.51</td>
</tr>
<tr>
<td>18</td>
<td>Phenol/Adhesive/Resin</td>
<td>6,184.99</td>
<td>0.47</td>
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<tr>
<td>19</td>
<td>Catalyst</td>
<td>5,225.53</td>
<td>0.40</td>
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<tr>
<td>20</td>
<td>Contaminated Land / Soil</td>
<td>1,324.77</td>
<td>0.10</td>
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<tr>
<td>21</td>
<td>Chemical Waste</td>
<td>1,169.75</td>
<td>0.09</td>
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<tr>
<td>22</td>
<td>Contaminated Active Carbon</td>
<td>934.42</td>
<td>0.07</td>
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<tr>
<td>23</td>
<td>Asbestos</td>
<td>668.94</td>
<td>0.06</td>
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<tr>
<td>24</td>
<td>Mercury</td>
<td>465.31</td>
<td>0.04</td>
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<tr>
<td>25</td>
<td>Photographic Waste</td>
<td>418.77</td>
<td>0.03</td>
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<tr>
<td>26</td>
<td>Sludge Contain Cyanide</td>
<td>84.78</td>
<td>0.01</td>
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<tr>
<td>27</td>
<td>Pesticide</td>
<td>12.26</td>
<td>0.00</td>
</tr>
<tr>
<td>28</td>
<td>Peroxide Agent</td>
<td>5.73</td>
<td>0.00</td>
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<tr>
<td></td>
<td>TOTAL</td>
<td>1,304,898.77</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Figure 8: Trend of domestic consumption of EEE in Malaysia


Figure 9: Future Projection for WEEE in Malaysia for the Year 1981-2020

E-WASTE Management in Malaysia

Households

NGO/ Local Authority/ Private Company

Industries

Partial Recovery Facility

Full Recovery Facility

Integrated Final Treatment and Disposal Facility

Raw waste flow
Treated waste flow
Licensed premises

Malaysian Scheduled Waste Contractor 2010-2011 (update 15/07/2010)
Source: Department of Environment Malaysia

<table>
<thead>
<tr>
<th>States</th>
<th>Partial</th>
<th>Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johor</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>Melaka</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Negeri Sembilan</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Selangor</td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>Kuala Lumpur</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Perak</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Kedah</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Pulau Pinang</td>
<td>38</td>
<td>7</td>
</tr>
<tr>
<td>Perlis</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Kelantan</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Terengganu</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pahang</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sarawak</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Sabah</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
E-WASTE : Sabah situation

✓ 3 incinerators for CLINICAL WASTES (Sipitang - 50 kg/hour, Sandakan - 25 kg/hour, Kota Marudu - 25 kg/hour).
✓ 2 incinerators for OIL WASTES (Sepangar - 95 kg/hour, Sandakan - 100 kg/hour).
✓ Plans to build 2 incinerators before end 1999.
✓ Ongoing project incinerator plant in Labuan
✓ Oils waste, toxic waste and e-waste are not accepted in the landfills (Kayu Madang Dumpsite)

E-waste where??

“Close to 95% of the e-waste that is recycled goes through the informal sector” – WHO, 2010
The Threat of E-Waste

✓ Discarded e-waste contain hazardous materials.
✓ If disposed improperly, they pose a potential threat to human health and the environment.
✓ E-Waste accounts for 40 percent of the lead and 75 percent of the heavy metals found in landfills (Iowa, DNR).
✓ Once electronics are discarded in a landfill, the acidic conditions provide an environment in which lead and other heavy metals may leak out.
✓ If the landfill's liner fails, the groundwater supply may become contaminated.

Why E-WASTE was toxic?

• Solvents to make chips, disk drives and other parts.
• Lead and cadmium in circuit boards.
• Lead and barium in monitors.
• Brominated flame retardants on printed circuit boards, cables and plastic casings.
• Poly-vinyl chloride (PVC) casings.
• Mercury switches and flat screens.
• Brominated flame retardant in plastics
<table>
<thead>
<tr>
<th>Source of e-wastes</th>
<th>Constituent</th>
<th>Health effects</th>
</tr>
</thead>
</table>
| Soldiers in printed circuit boards, glass panels and gaskets in computer monitors | Lead (PB)   | - Damage to central and peripheral nervous systems, blood systems and kidney damage.  
- Affects brain development of children.                                            |
| Chip resisters and semiconductors                                                 | Cadmium (CD)| - Toxic irreversible effects on human health.  
- Accumulates in kidney and liver.  
- Causes neural damage.  
- Teratogenic.                                                                          |
| Relays and switches, printed circuit boards                                         | Mercury (Hg)| - Chronic damage to the brain.  
- Respiratory and skin disorders due to bioaccumulation in fishes.                     |
| Corrosion protection of untreated and galvanized steel plates, decorator or hardner for steel housings | Hexavalent chromium (Cr) VI | - Asthmatic bronchitis.  
- DNA damage.                                                                              |
| Cabling and computer housing                                                       | Plastics including PVC | Burning produces dioxin. It causes  
- Reproductive and developmental problems;  
- Immune system damage;  
- Interferes with regulatory hormones                                                      |
| Plastic housing of electronic equipments and circuit boards.                       | Brominated flame retardants (BFR) | - Disrupts endocrine system functions                                                  |
| Front panel of CRTs                                                                | Barium (Ba) | Short term exposure causes:  
- Muscle weakness;  
- Damage to heart, liver and spleen.                                                   |
| Motherboard                                                                       | Beryllium (Be) | - Carcinogenic (lung cancer)  
- Inhalation of fumes and dust. Causes chronic beryllium disease or berylliosis.  
- Skin diseases such as warts.                                                        |

**Diagram:**
- **Sequestration:** Selenium, which can cause hair loss, nail brittleness, and neurological disorders (e.g., parkinson's and other neurological conditions).
- **Beryllium:** Exposure can cause lung cancer and chronic bronchitis disease (chronic cough and sputum).
- **Mercury:** Exposure through ingestion or inhalation can cause central nervous system damage and kidney damage.
- **Chromium (VI):** Hexavalent chromium is a toxic substance that can cause respiratory and skin disorders due to bioaccumulation in fishes.
- **Arsenic:** Long-term exposure may cause lung cancer, nerve damage, and various skin diseases in other organs.
- **Trichloroethylene (TCE):** Exposure to TCE (bleaching or chemical processes) can cause liver and kidney damage, impaired immune system function, and impaired brain development.
- **Cadmium:** Long-term exposure can cause kidney damage and damage to bone structure in a person's bones.
- **Barium:** Barium can cause kidney damage and dermatological reactions.
- **Brominated flame retardants (BFR):** Exposure to BFRs can cause respiratory problems, production and incorporation of dioxin.
- **Lead:** Lead exposure can cause a host of damage, neurological, blood disorders, kidney damage, and developmental damage to children. Children are especially vulnerable. Acute exposure can cause vomiting, diarrhea, convulsion, coma, or death.
- **Polyvinyl chloride (PVC):** PVC is the most used polymer, it causes respiratory problems, interference with bone health, and food and water contamination.
- **Beryllium:** Exposure to beryllium can cause chronic beryllium disease or berylliosis.
- **Polyacrylamide (PPA):** Exposure to PPA can cause respiratory problems.
- **Dioxin and Furans:** Exposure to dioxin and furans can cause neurological disorders, damage to the brain, respiratory systems, and liver cancer. They are highly toxic to animals and plants, and can be present in the environment.
Local Research: Effects of heavy metal on health


Burn the waste releasing toxic and carcinogenic substances into the air
Retrieve precious metals using very toxic chemicals

Workers exposed to toxic substances
Heavy metals may leach and contaminate groundwater.
When burnt, the metals vaporizes into the air releasing lead and acids.
Collected by illegal waste collector.
Bad to human and environmental health.

Do not dumps your E-WASTE !!!

<table>
<thead>
<tr>
<th>Year</th>
<th>Trashed (Tons)</th>
<th>Recycled (Tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1,710,000</td>
<td>190,000</td>
</tr>
<tr>
<td>2003</td>
<td>1,980,000</td>
<td>210,000</td>
</tr>
<tr>
<td>2004</td>
<td>2,680,000</td>
<td>340,000</td>
</tr>
<tr>
<td>2005</td>
<td>2,270,000</td>
<td>350,000</td>
</tr>
<tr>
<td>2006</td>
<td>2,460,000</td>
<td>380,000</td>
</tr>
<tr>
<td>2007</td>
<td>2,600,000</td>
<td>410,000</td>
</tr>
</tbody>
</table>

% Recycled:
- 2000: 10.0%
- 2003: 9.3%
- 2004: 14.0%
- 2005: 13.7%
- 2006: 13.4%
- 2007: 13.6%

E-WASTE : Trashed vs Recycled
E-WASTE recycle model

E-WASTE recycling processes

- Storage eg. printers
- Mechanical shredding of plastics, printed circuit boards (PCBs) or mixed e-waste
- Separation
  - Plastics
  - Metals
- Burning to recover metals
- Mechanical shredding
- Segregation
- Grinding
- Reuse

- Component recovery
  - Component recovery
  - Component recovery
- Open burning to recover metal
- Metal recovery eg. from plastics
- Coating
- Solder recovery
- Glass recovery
- Cathode ray tubes & glass screens
- Printed circuit boards
- Batteries
E-WASTE Legislation’s (MALAYSIA)

- E-waste has been regulated in Malaysia since 2005;
- Environmental Quality (Scheduled Wastes) Regulations, 2005. This regulation has included e-waste as scheduled wastes.
- The 2005 regulation has replaced the 1989 regulation to enable Malaysia to control trans-boundary movement of e-waste;
- Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2008.

ENVIRONMENTAL QUALITY (SCHEDULED WASTES) REGULATIONS 2005

**SW110**: wastes from the electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or poly-chlorinated biphenyl-capasitors, or containing cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or poly-chlorinated byphenyls (PCB).
E-WASTE: Business Opportunities

Gold + RM ?????

Simple estimation …

What is in a Computer?

<table>
<thead>
<tr>
<th>Ferrous Metal</th>
<th>Plastics</th>
<th>Non-ferrous Metal</th>
<th>Glass</th>
<th>Electronic Boards</th>
</tr>
</thead>
<tbody>
<tr>
<td>32%</td>
<td>23%</td>
<td>18%</td>
<td>15%</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lead, Cadmium, Antimony, Beryllium, Mercury</td>
<td></td>
<td>Gold, Palladium, Silver, Platinum</td>
</tr>
</tbody>
</table>

# Gold and gold component: 0.8%

Waste for 1000 PC
PC weight: 8kg
Total waste: 1000 x 8kg = 8000kg
Heavy metal: 18% x 8000kg = 1440kg
Gold/Silver/Platinum: 12% x 8000kg = 960kg
Gold and gold component: 0.8% x 8000kg = 64kg
* RM 175,000.00/kg (oct. 2011)
What next ....???

- Policy
- Recycle Programs
- Awareness
- Educations
- Enforcements
- Campaigns
- Wait, see and react
- Let nature decide