Manual Dismantling of e-waste

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Content

E-Waste Recycling Conducted by the DRZ

Introduction to Manual Dismantling
Content

E-Waste Recycling
Conducted by the DRZ

Introduction to
Manual Dismantling
Mission

Socio-Economic Facility supported by the Austrian Unemployment Agency

Temporary job-contracts
- Occupation in DRZ-departments
- Individual coaching and training
- Workshops/ professional training
- Outplacement
EMAS-Certified Recycling Facility
Social Enterprise for the Integration of Unemployed Persons into the Labour Market

**WEEE-Treatment:**
- ReUse
- Manufacturing of Recycling Products
- Depollution and Manual Dismantling

- **Large appliances (500 t/a):**
  - 91-94%
  - 2-5%
  - 1.5%
  - 1.5%
  - 1.5%

- **Small appliances (1,000 t/a):**
  - 91-94%
  - 2-5%
  - 1.5%
  - 1.5%
  - 1.5%

Reuse and UpCycling Products
Recyclable fractions
Waste for disposal
Hazardous waste
Vienna`s scrap keeps us busy!
Input Streams

- All WEEE except CRT and cooling appliance
- Mixed small and large WEEE from 3 amenity sites in Vienna
- Pre-selected small WEEE with high content of contaminants (printer, scanners, Hg containing lamps, ...)
- WEEE with housings too hard for mechanical depollution („Smasher“)
- WEEE (mainly ICT) from private entities
WEEE treatment steps within DRZ

- Intake control & weighing
- Selection of reuseable appliances
- Dissambling of spare parts & parts for UpCycling Products
- De-Pollution and Dismantling into Recycling Fractions
- Preparation for ReUse
- TrashDesign-Manufaktur
Preparation for ReUse

1. Selection of reusable appliances from input stream

2. Preparation for reuse:
   Cleaning, safety test, functional test

3. Sale of secondhand products

Online Shop:
www.vhs.at/drz/reuse
Upcycling

Online Shop:
www.trashdesign.at/
Manual Dismantling

• pure manual dismantling of appliances

• Cleaner fractions lead to higher recycling rates within the following treatment step compared to mechanical pre-treatment

<table>
<thead>
<tr>
<th>Devices with relevant contaminants</th>
<th>Housings too tough for „Smasher“</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Printers</td>
<td>• Microwaves</td>
</tr>
<tr>
<td>• Copiers</td>
<td>• Lawnmowers</td>
</tr>
<tr>
<td>• Scanners</td>
<td></td>
</tr>
<tr>
<td>• Luminarias with Hg-containing lamps</td>
<td></td>
</tr>
<tr>
<td>• ICT containing lead accumulators</td>
<td></td>
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</tbody>
</table>
Research & Development

- Project partner within two EU funded projects
  - CloseWEEE: Establishment of an information platform for recyclers - RIC
  - RUN: Collection and re-distribution of used notebooks

- Cooperation with universities and other research institutions in and outside of Austria
  - Activities at „Kinderuni“ in Vienna
  - Active contributor to E-waste Academy for Managers in 2014 (El Salvador) and 2016 (Kenya)
  - E-Waste trainings in Cambodia, Columbia and Ghana
  - Business Plans for E-waste dismantling facilities in Uganda, Ethiopia, Cambodia

- Business Plan Calculation Tool
  - Based on 3 dismantling depth
  - Calculates required resources (manpower, space, infrastructure etc) and break even
  - Publically available via Step website (www.step-initative.org)

- Member of the Solving the E-Waste Problem (Step) Initative, ReUse Network Austria and RepaNet
Support for international development

• Training programmes at our facility in Vienna

• Training workshops at the location
  • Dismantling
  • Downstream processes
  • Plant layout
  • Financial planning

• Support to develop a business plan for the set-up of a manual dismantling facility taking into account national framework conditions

• Broad network of relevant stakeholder on international level (academia, private sector, NGO, IGO,...)
E-Waste Recycling
Conducted by the DRZ

Introduction to
Manual Dismantling
Manual Dismantling of E-Waste

- Separation of reusable appliances

- Depollution: assured removal and controlled disposal of hazardous components

- Provide high valuable substances (like precious metals, rare earth metals) for recovery without losses

- Adequate conditioning of materials contained in electronic appliances for further mechanical recycling/material recovery
Required Tools
Personal Protection Equipment

For Dismantling of CRT-Appliances:

- Cut-Resistant Apron
- Arm Protection
- Cut-Resistant Gloves

Work Clothes

Robust Gloves

Protective Shoes

Dust Masks

Protective Goggles
Workstation
Additional Logistic Equipment

Industrial Scale

Receptacles for transport and storage

Truck

Forklift Truck and/or Hand Pallet Truck
Further Treatment Possibilities

- CRT glass separation
- Crushing of plastics
- Stripping Cables
- Decontamination of mercury containing lamps
Main Dismantling Steps

1. Opening of the appliance (separation of the housing from the rest of the appliance)
2. Localization, identification and removal of hazardous components
3. Dismantling and separation of the remaining components into marketable fractions
Output Fractions (from dismantling a notebook)

- Fe – ferrous metals
- aluminium
- PWB – printed wired boards
- processor
- RAM
- copper
- plastics
- HDD – hard disc drive
- CDD – CD disc drive
- cables/ wires
- LCD-display
- mixed scrap
- speakers, microphones (fractions rich in copper)
- battery
- red – hazardous fractions
Dismantling Concepts

Level A) **Hazardous components** and **high valuable components**, like printed circuit boards are removed only and the remaining parts are destined to mechanical separation/recycling.

Level B) Apart from removing hazardous components **manual dismantling** of components into more or less pure materials and recyclable fractions is conducted **where viable with reasonable effort**.

Level C) Appliances are dismantled up to a point, at which further **separation into pure materials** is not possible without mechanical shredding.

- dismantling HDD, CDD
- obtaining more pure metals (copper, etc.)
- removing impurities from plastic parts
Dismantling Concepts

Applied dismantling level depends on / is limited by

- Dismantling Costs (especially labour costs)
- Purchase conditions
- Input of material (complete or cherry picked?)
- Dismantling efficiency
- Quality of output material
- Available purchasers for output fractions
- Technical limitations
- Overhead (housing, management, administration, etc.)
- Heath & safety aspects
- Potential environmental pollution

Material knowledge is crucial !!!!
Sales Revenues vs Dismantling Costs

Scenario 1

Scenario 2: low prices for ferrous metals

Scenario 3
low prices for gold or copper
Dos and Don’ts: Examples

- Manual separation of aluminium and copper

- Treatment of compressors from refrigerators without collecting the containing oil
Critical dismantling steps – CRT

Equalizing air pressure in the CRT glass body to avoid implosion:

Remove the flap in the monitor screen.

Punch a hole into the CRT glass carefully where the flap was fixed.
Critical dismantling steps – CRT

Remove the magnetic deflector from the top of the monitor. Be very careful with this step to avoid that the electro gun on top of the CRT gets destroyed.

Separate the getter platelet from the electro gun and store the getter platelet in drums protected against ingress.

Unscrew the CRT glass from the front plastic casing and break off the electron gun from the tube with a hammer or a small axe just below the gun.
Critical dismantling steps – FPD / LCD

The black connection at the bottom left and right indicate where the backlight lamps are attached. Carefully lift and remove the steel cover at this point to avoid the breakage of the lamps.

Remove the backlights carefully and place them aside. Depending on the screen model, the backlights can be removed before or after taking apart the LCD module.

Avoid the breakage of the backlight as mercury vapour can be released. The lamps should be stored in a closed container which disposes of a mechanism preventing the release of air from the inside at the insertion of further lamps. If a lamp is broken it should be placed immediately into the container.
Additional Resources

Manual dismantling instructions:
https://ric.werecycle.eu/

Training material:

From Worst to Good Practices:

GIZ webinar series for e-waste recyclers
https://www.youtube.com/watch?v=-k4-lTyLV8&list=PLE-AQTsQB0uMOrJadvRbCKpwvdAquE__e&index=5
Thank you for your attention!

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