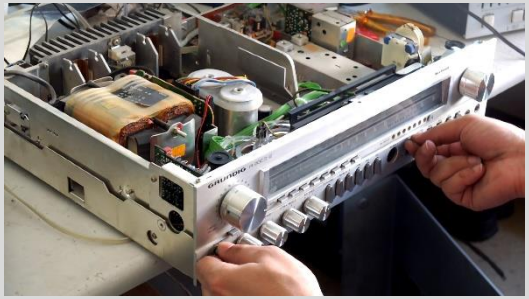
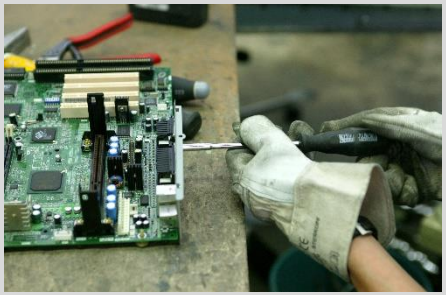





Manual Dismantling of e-waste

Elisabeth Smith, MSc
Dismantling and Recycling Centre

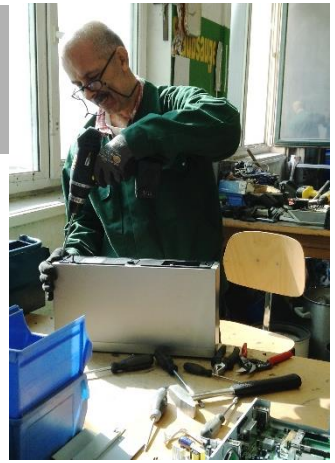
28th November 2019

DRZ DEMONTAGE- UND RECYCLING-ZENTRUM
Eine Einrichtung der VHS Wien
Zertifiziert nach
Im Auftrag und gefördert von
In Kooperation mit

Content

E-Waste Recycling
Conducted by the DRZ

Introduction to
Manual Dismantling



Content

DEMONTAGE- UND RECYCLING-ZENTRUM

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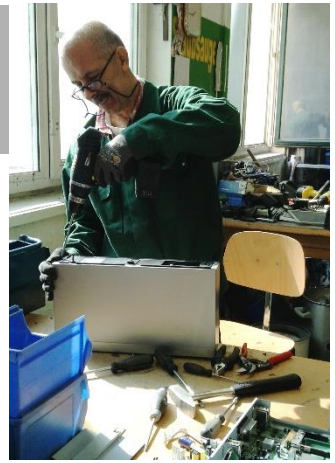


Mission

Socio-Economic Facility supported by the Austrian Unemployment Agency

Longterm unemployed persons →

<u>Temporary job-contracts</u>

- Occupation in DRZ-departments
- Individual coaching and training
- Workshops/ professional training
- Outplacement

→ **Primary Job-Market**

„Vienna`s scrap keeps us busy!“

DEMONTAGE- UND RECYCLING-ZENTRUM

EMAS-Certified Recycling Facility
Social Enterprise for the Integration of Unemployed Persons into the Labour

Large appliances (500 t/a)

Small appliances (1,000 t/a)

WEEE-Treatment:

- ReUse
- Manufacturing of Recycling Products
- Depollution and Manual Dismantling

2-5% → Reuse and UpCycling Products

91-94% → Recyclable fractions

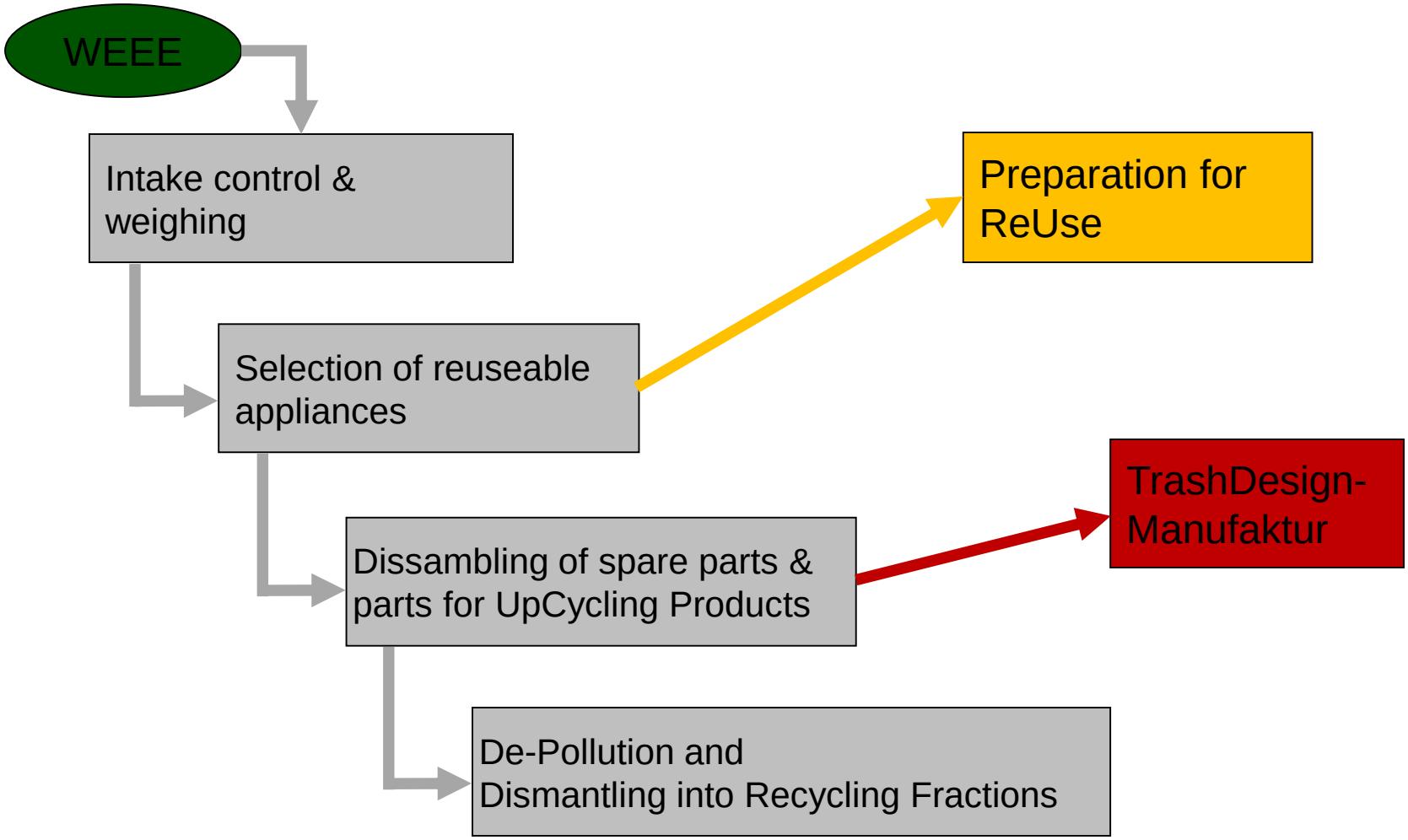
1.5% → Waste for disposal

1.5% → Hazardous waste

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 contaminents (printer, scanners, Hg containing lamps, …)
- WEEE with housings to hard for mechanical depollution („Smasher“)
- WEEE (mainly ICT) from private entities

WEEE treatment steps within DRZ



Preparation for ReUse

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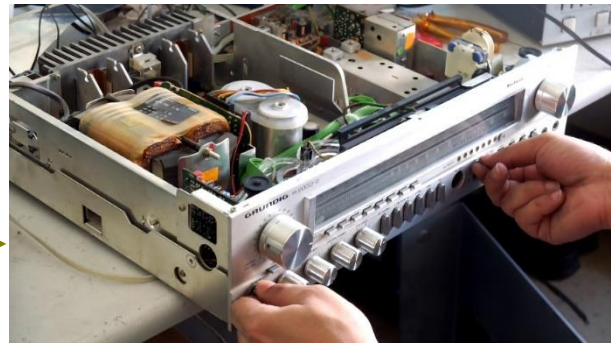
1. Selection of reusable appliances from input stream

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



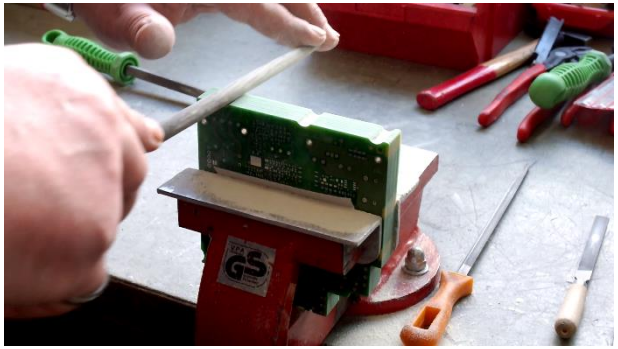
3. Sale of secondhand products

Online Shop:

www.vhs.at/drz/reuse

Upcycling

DEMONTAGE- UND RECYCLING-ZENTRUM



Online Shop:

www.trashdesign.at/

Manual Dismantling

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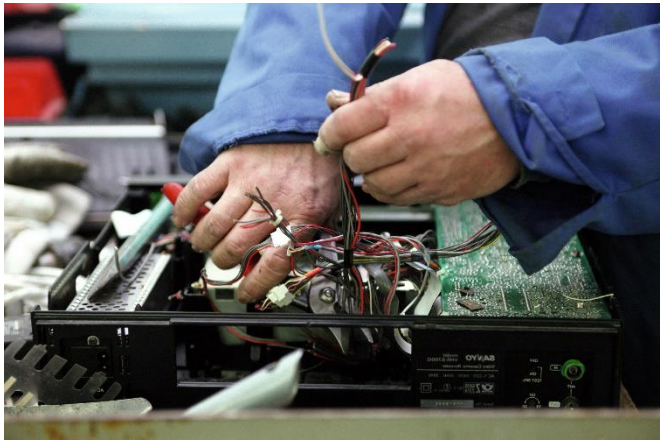
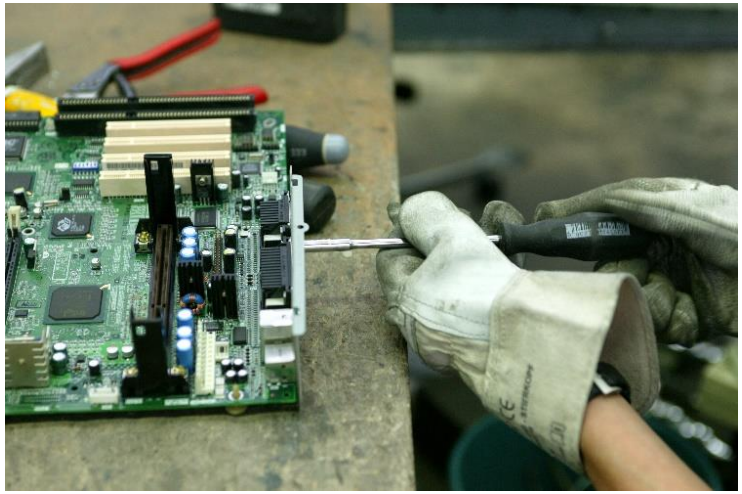
- pure manual dismanlting of appliances
- Cleaner fractions lead to higher recyclingrates within the following treatment step compared to mechanical pre-treatment





Devices with relevant contaminants	Housings too tough for „Smasher“
• Printers • Copiers • Scanners • Luminarias with Hg-containing lamps • ICT containing lead accumulators	• Microwaves • Lawnmowers

Research & Development

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- 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
  - Caluclates 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

DEMONTAGE- UND RECYCLING-ZENTRUM

- 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,…)

Content

DEMONTAGE- UND RECYCLING-ZENTRUM

E-Waste Recycling
Conducted by the DRZ

Introduction to
Manual Dismantling

Manual Dismantling of E-Waste

DEMONTAGE- UND RECYCLING-ZENTRUM

- 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

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Personal Protection Equipment

Work Clothes

For Dismantling of CRT-Appliances:

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

Robust Gloves

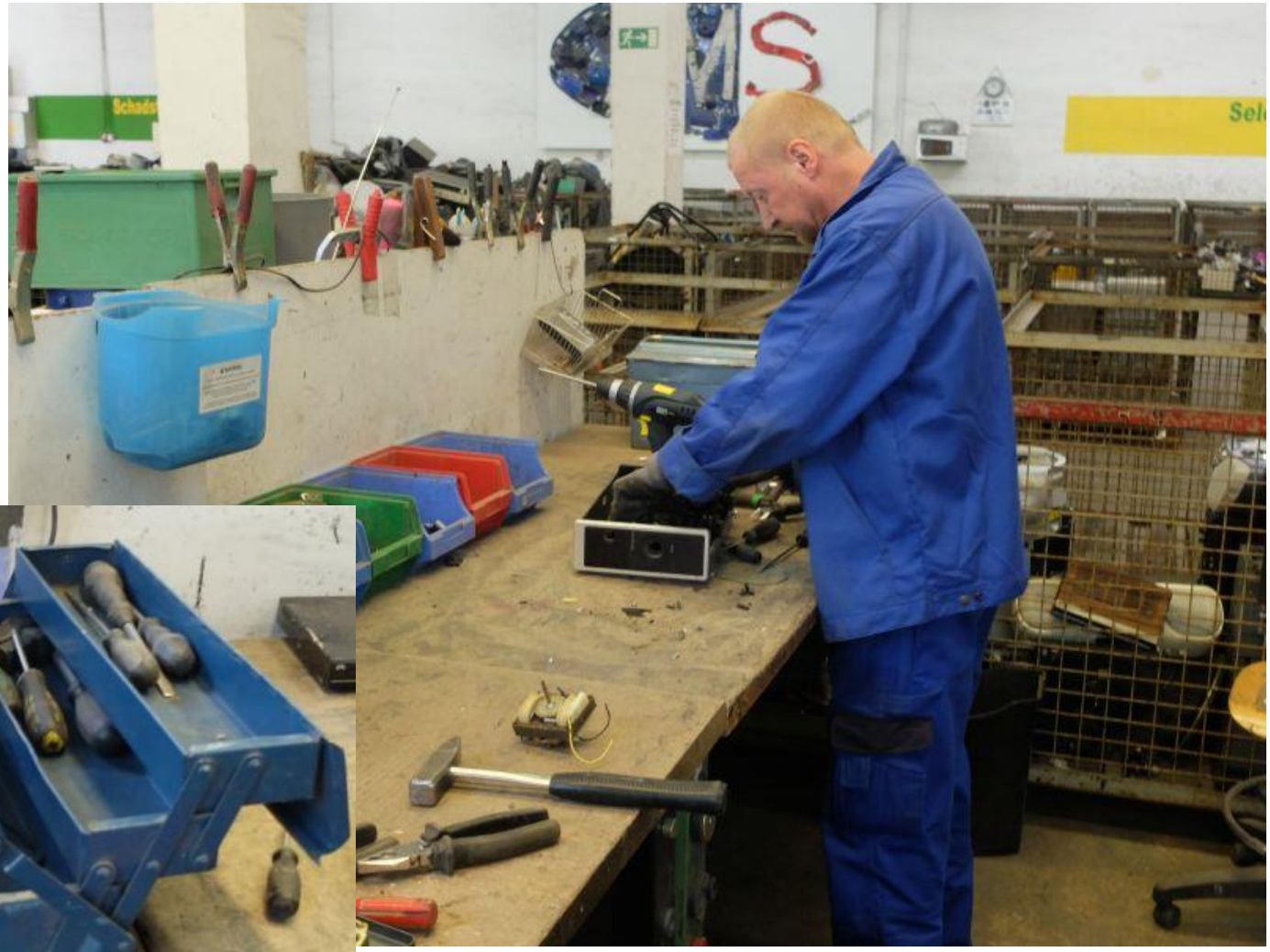
Protective Shoes

Protective Goggles

Dust Masks

Workstation

DEMONTAGE- UND RECYCLING-ZENTRUM



Additional Logistic Equipment

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Industrial Scale

Receptacles for transport and storage

Truck

Forklift Truck and/or Hand Pallet Truck

Further Treatment Possibilities

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CRT glass separation

Crushing of plastics

Stripping Cables

Decontamination of mecury containing lamps

Main Dismantling Steps

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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)

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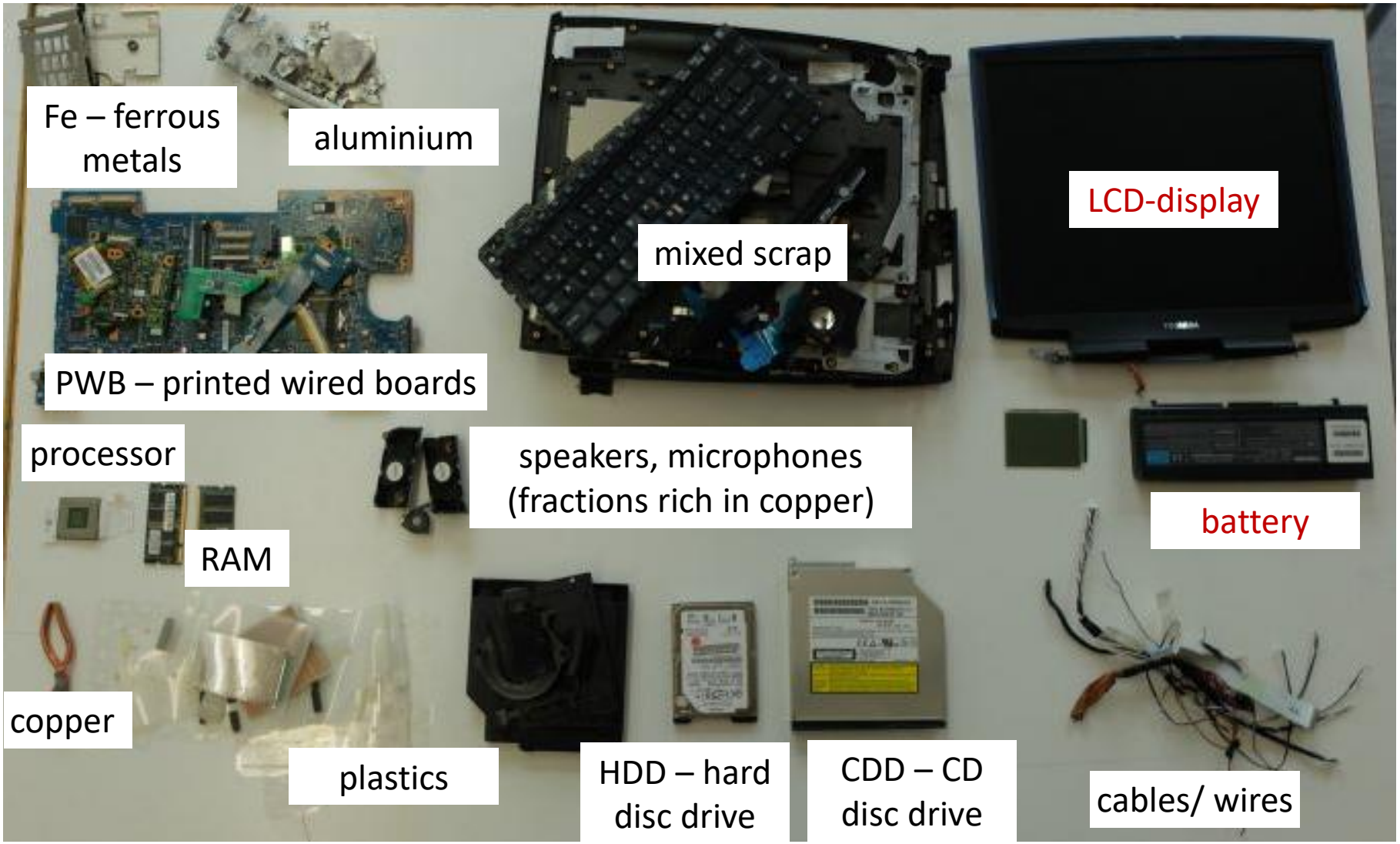

red – hazardous fractions

Dismantling Concepts

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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

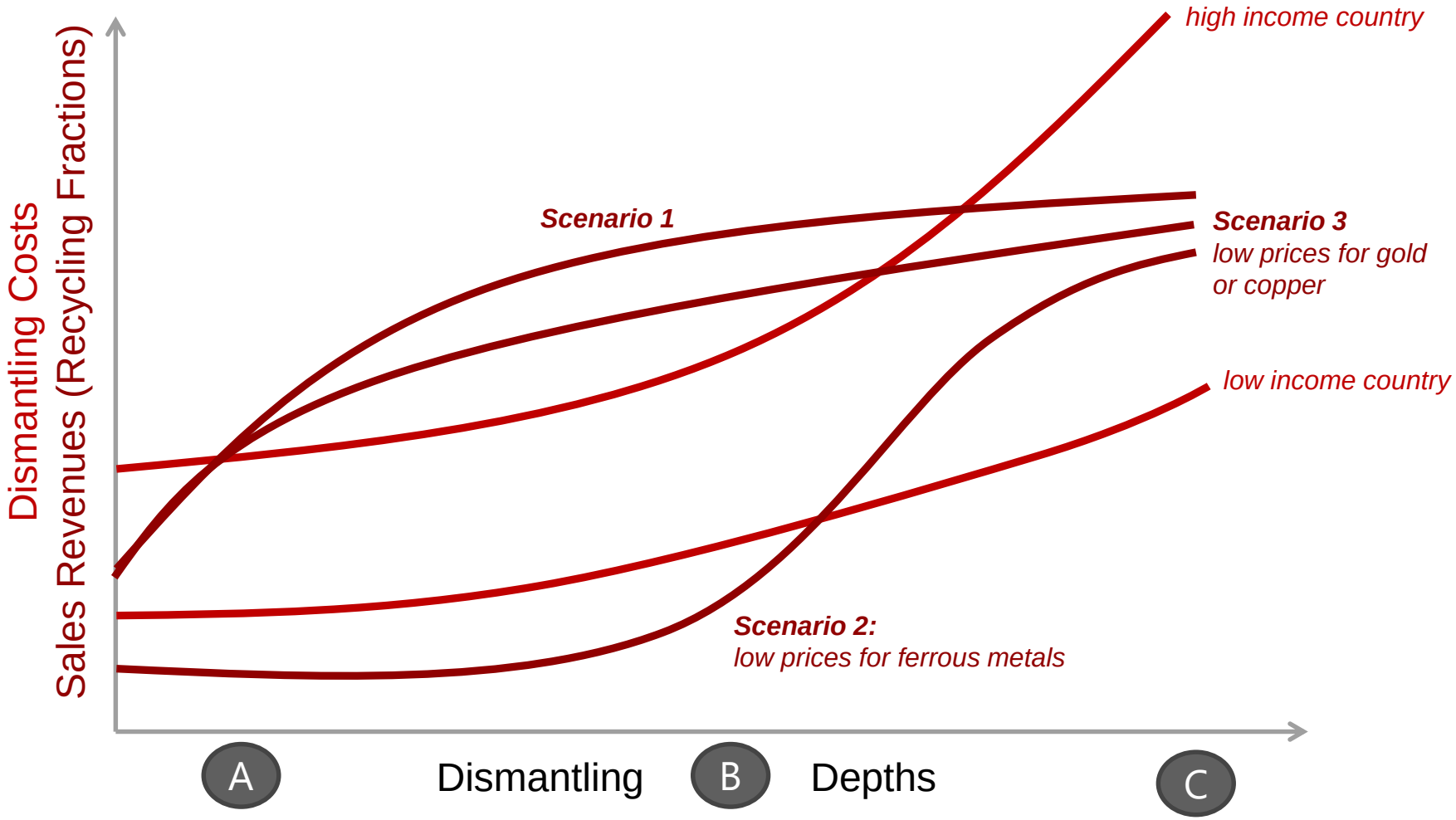
DEMONTAGE- UND RECYCLING-ZENTRUM

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



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

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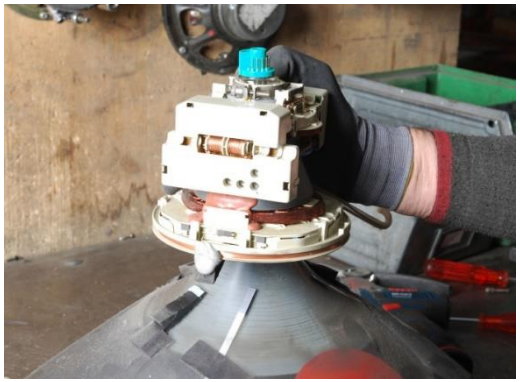
Equalizing air pressure in the CRT glass body to avoid implosion:

Remove the flap in the monitor screen.

Punch a hole into the CRT glass carefully where the flap was fixed.

Critical dismantling steps – CRT

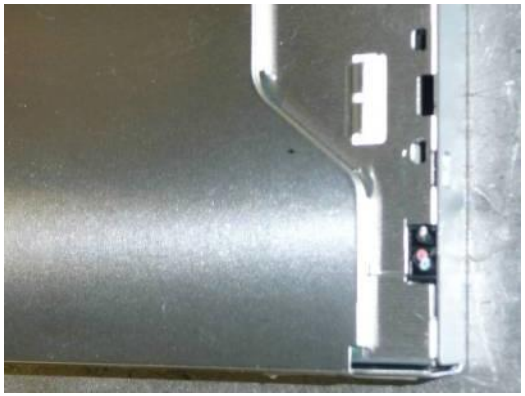


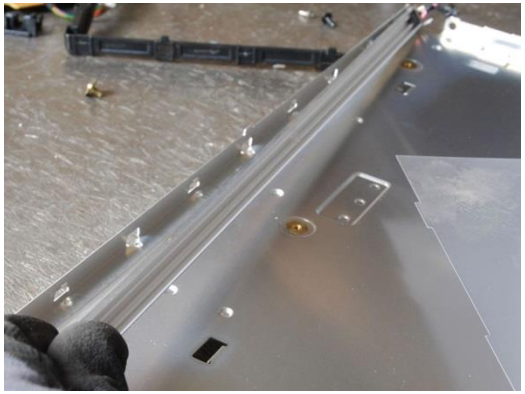
Remove the magnetic deflector from the top of the monitor. Be very careful with this step to avoid that the electro gun on top of the CRT gets destroyed.

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. Depen-ding 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:
https://www.giz.de/en/downloads/giz2019-e-waste-management.pdf

From Worst to Good Practices:
https://www.sustainable-recycling.org/wp-content/uploads/2018/07/worst-practices-web-25.7.18.pdf

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!

DEMONTAGE- UND RECYCLING-ZENTRUM

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