TWINNING PROJECT EG07/AA/EN10
Integrated Waste and Hazardous Substances Management System

Component 2 / Activity 3.2
Life Cycle Thinking and Material Flow Analysis
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Background RoHS – Life Cycle Thinking

The main reason for the RoHS legislation was/is:

- Protection of the consumer from exposure to hazardous substances (RoHS in the beginning only for consumer E&E)
- However the main challenge with hazardous substances in electronics is the end of life & the recycling of electronics.

The end-of-life/recycling challenge of E-waste is today a priority area within the Basel Convention, a priority in SAICM and is now also addressed via new POPs PBDEs and HBB in the Stockholm Convention.

“Life Cycle Thinking” approach aim for closed loop of the material flow (“graddle to graddle”) leading to Sustainable Production. LCT was a component in the EU Twinning project
Life Cycle Thinking

Life cycle thinking addressed the analysis as well as the management of products, materials and substances:

- Using analytical tools with life-cycle perspective like Life-Cycle Assessment (LCA), Material Flow Analysis (MFA), Substance Flow Analysis (SFA).

- Using management principles for governments like Integrated Product Policy or the Waste Management Hierarchy.

- Management principles for industries like Extended Producer Responsibility or Product Stewardship.

- Is a key basis for Sustainable Production including consideration of future reuse & recycling of products.
Life Cycle Thinking

Analytical Tools for Life cycle thinking

- **Material Flow Analysis (MFA)**: Aim: overview of the flows of environmental relevant materials or substances.
- **Substance Flow Analysis (SFA)**: Aim: to assess environmental impacts caused by products or services.
- **Life-Cycle Assessment (LCA)**: Aim: to assess environmental & human risks caused by substances.
A key aim of material/substance flow analysis is to visualise the complex material flow of a selected system in a simplified but correct manner to e.g. serve as a tool and support for decision making in chemical management or waste management.
Life Cycle of a Chemical

Life Cycle Stages of a Chemical

Mining → Production → Formulation → Use → Service Life → Recovery → Waste Disposal → Mining

re-use

Base for LCA of a chemical is Substance Flow Analysis
Brominated Flame Retardants (PBDE et al.) in Daily Goods

Key goods containing BFRs
- Electrical devices (computer, television, etc.),
- Textiles, carpets, curtains, mattresses
- Transport sector (upholstery car, train, bus)
- Insulation in construction materials

Where do these BFRs finally end up?
Material Flow Analysis of PBDE/BFR Containing Materials in a Country

E&E, Transport, Textile/furniture

Production and use

Waste management

Production

Trade

Use (Stock)

Recycl

Comb.

Landfill (Stock)

Soil

Atmosphere

Hydrosphere

System boundary

Transport, E&E
Textile/furniture
Scenario
Where Do POPs in Ewaste/Used Electronics End-Up?

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 quantitative 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.
What is the flow of PBDE/BFR in recycled materials? What articles are contaminated?

PBDE/BFRs in video tapes (5/5) PBDE in children toys in China (Hirai et al, Paper BFR 2007) (Chen et al., ES&T 43, 4200, 2009)

What is situation of plastic parts for new electronics?
MFA/SFA – Country Application

Example: SFA of mercury (Hg) flow Austria (simplified).

Hg study objective (Denmark): to describe the use of mercury and establish the baseline consumption level prior to the enforcement of legislative restrictions on the use of mercury.
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MFA – Country

Detailed MFA Hg Austria
MFA – software STAN

http://www.iwa.tuwien.ac.at/iwa226/stan.html
Policy making support from MFA/SFA

- Assist the sound implementation of national and international regulation on the use of substances.
- Help to ensure that regulatory actions directly address the main sources of emissions and wastes.
- Supports monitoring the effects of regulatory actions on consumption, emissions and waste generation.

Recommendation: Utilize MFA/SFA and Life Cycle Thinking approaches in policy making.
Thank you for your hospitality!

Best wishes for a sustainable development of Egypt!
Thank you for your attention!

“The dirty dozen”
- PCDD
- PCDF
- PCBs
- Aldrin
- Chlordane
- DDT
- Dieldrin
- Endrin
- HCBs
- Heptachlor
- Toxaphene
- Mirex

“More dirt!”
- PFOA, PFHxS
- DeBDE, PBB, HBCI
- PBDD/F, HBBz, PBB
- TBBPA, TBPAE
- SCCP, MCCP, LCCP
- PCN, HCH,
- Endosulfan,
- PAHs, Nitro-PAH
- Halogenated PAHs
- Sn-Organics
- Hg, Cd, Pb et al.
- Pesticides
- Pharmaceuticals
- Biocides

“The nasty nine” alpha-, beta-, gamma-HCH,
PeCB, Chlordecone, PeBDE, OBDE, HBB, PFOS,
PFOA, PFHxS, PCDD, PCDF, PCBs

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