Why do we Need a New Knowledge Base for Goal Oriented Waste Management?

Paul H. Brunner

Vienna University of Technology
Institute for Water Quality, Ressource and Waste Management
www.iwa.tuwien.ac.at

What is a “knowledge base” for goal oriented waste management?

” information necessary to set up a waste management system”

1. wastes
   - mass flow, composition, speciation, properties …
2. waste treatment processes
   - transfer coefficients, energy demand, economic data …
3. waste management systems
   - goals and hierarchies
   - resources management
   - environmental management

Goal oriented waste management

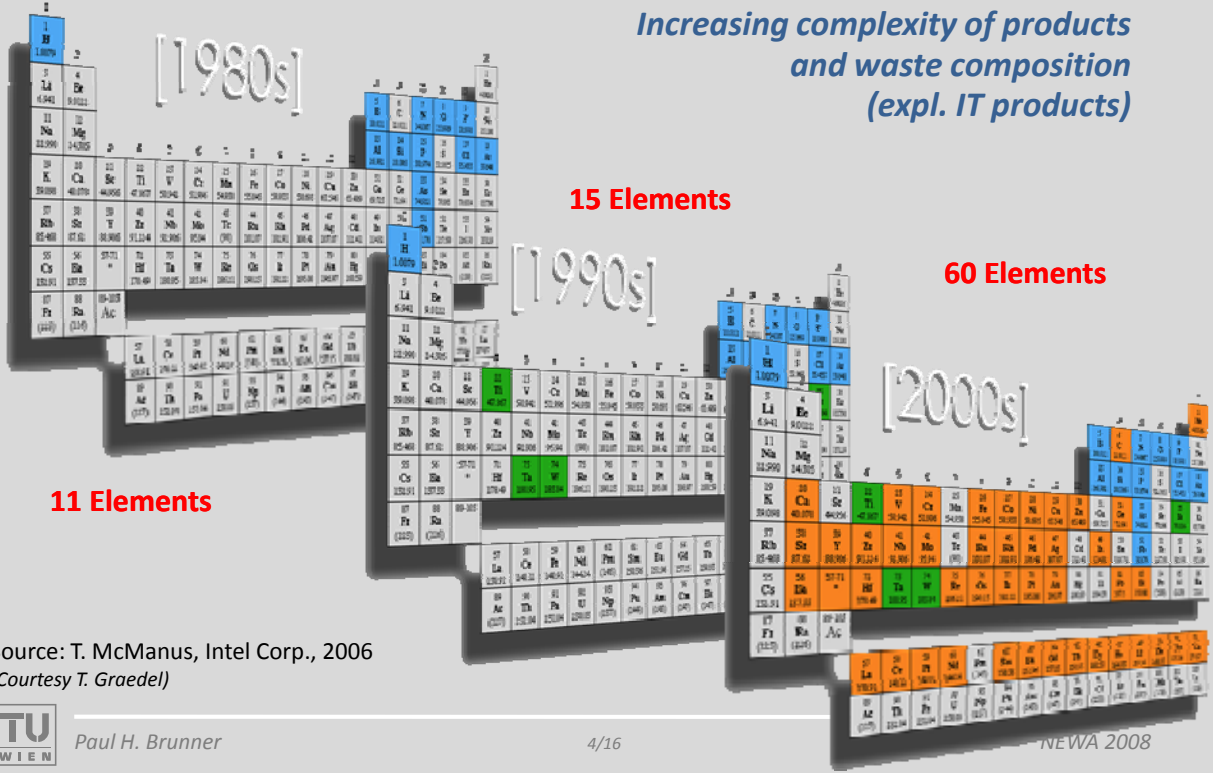
1. Protection of men and environment
2. Conservation of resources
3. Sustainability: solve waste problems here and now –> no aftercare

Knowledge base must:

- be tailored to ensure that waste management can reach these goals
- supply information for the design, operation and control of waste management systems on both micro- and macroeconomic level

Why do we need a new knowledge base – level of wastes

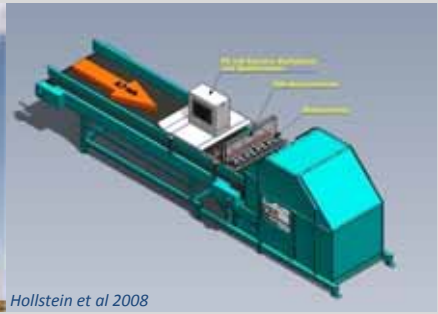
Increasing complexity of products and waste composition (expl. IT products)



Source: T. McManus, Intel Corp., 2006
(*Courtesy T. Graedel*)

Why do we need a new knowledge base – level of processes

from low-tech to high-tech waste treatment requires more information



Hollstein et al 2008

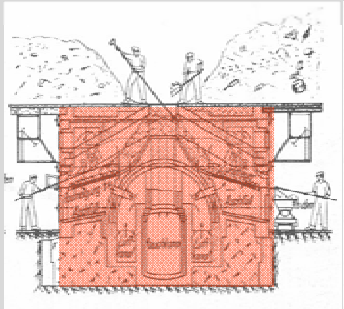
volume
mass
water content
hazards

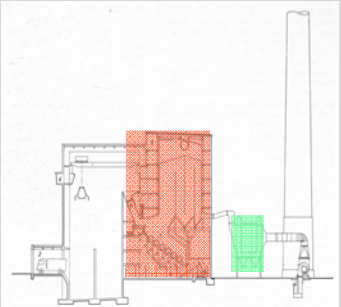
mass
energy content
$C_{biogenic}$ H, N,
Hg, Cd, Cl, PCBs
etc.

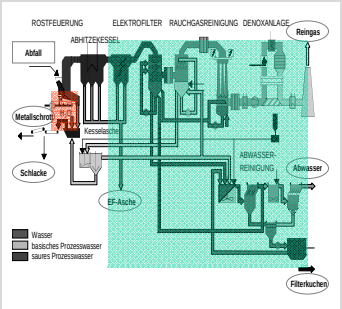
mass, density, volume
C, Cl,
polyethylene, PVC
Fe, Cu, Sb, Cd, Pb,
etc.

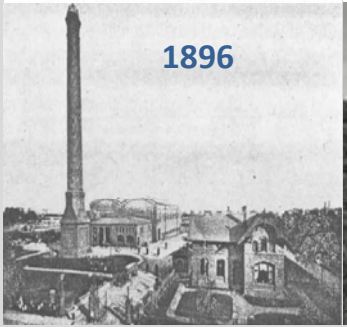
Increasing environmental constraints , expl. incineration

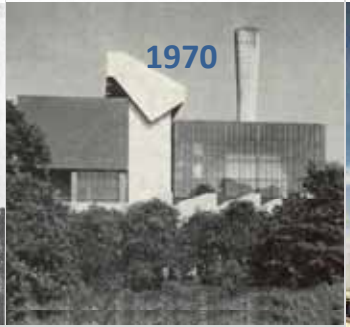
energy content, „particle size“	+ LoI, WC, C, Fe, fly ash/ bottom ash properties	+ $C_{biogenic}$, H, N, Cl, S, N, Hg, dioxins, ... nanoparticles?



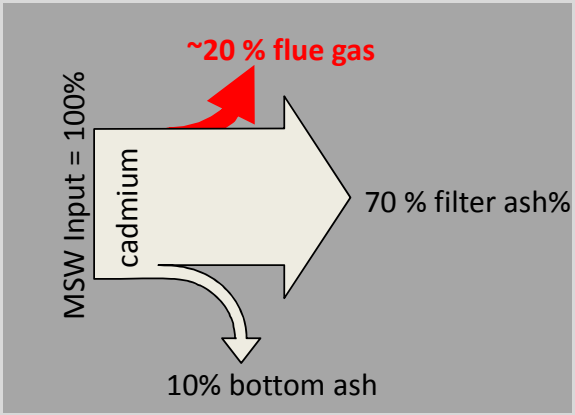


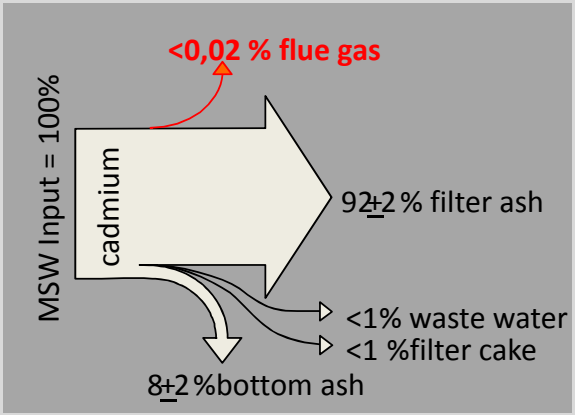






Process information, neccesary part of knowledge base (expl. Incineration)

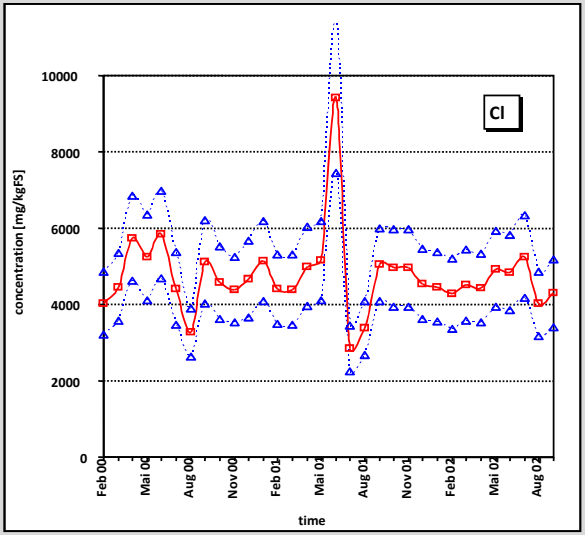


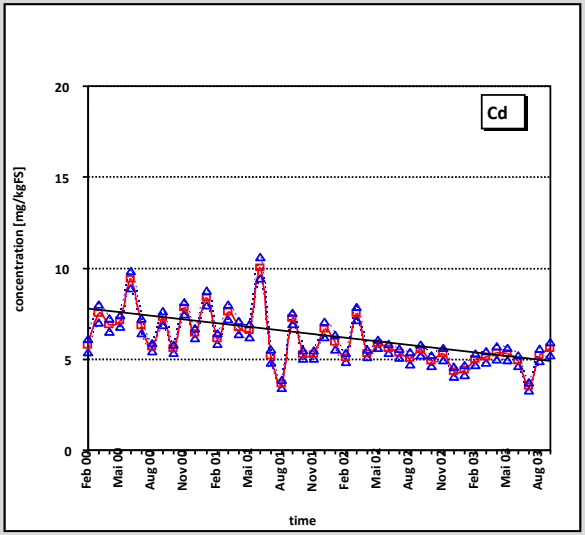


1970		1990
	Transfer coefficients	
0.1	Bottom ash	0.08
0.7	Filter ash	0.92
0.2	Flue gas	0.0002

Time series for better waste management

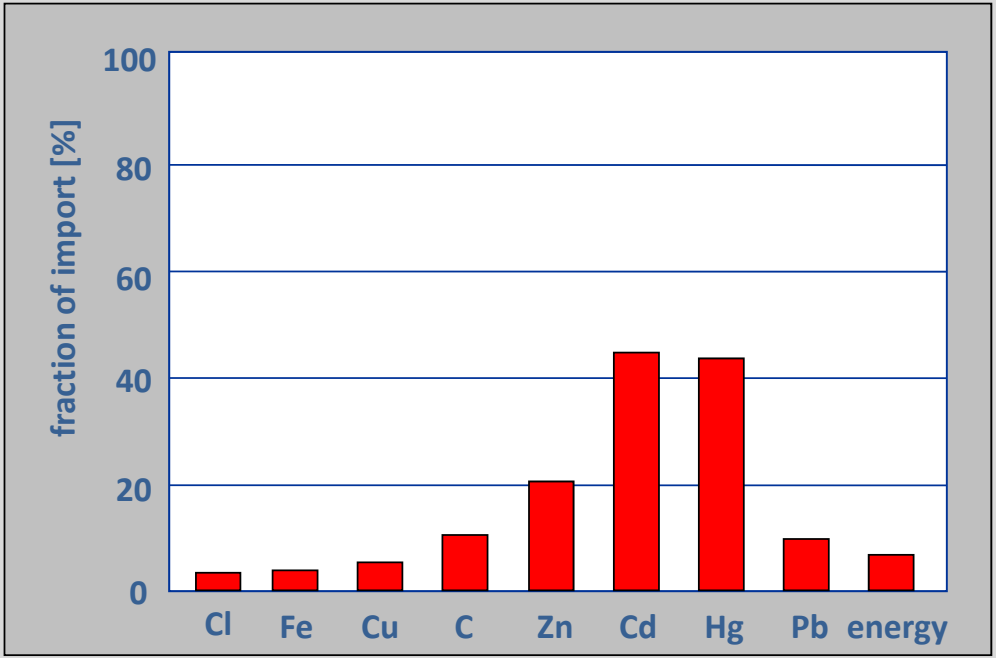
Monthly mean values of Cl and Cd in MSW determined from products of incineration





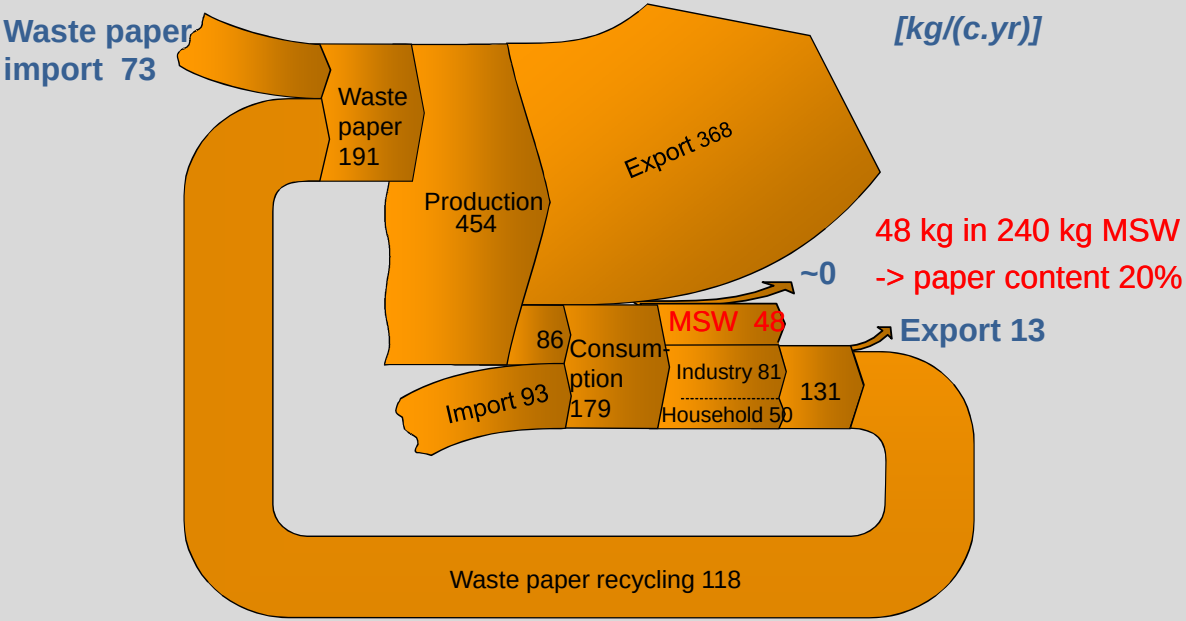
Source: Morf et al. 2003; Morf et al. 2004

Selecting parameters for waste characterisation, (expl. MSW incineration)



substance flows in MSW as a fraction of total import

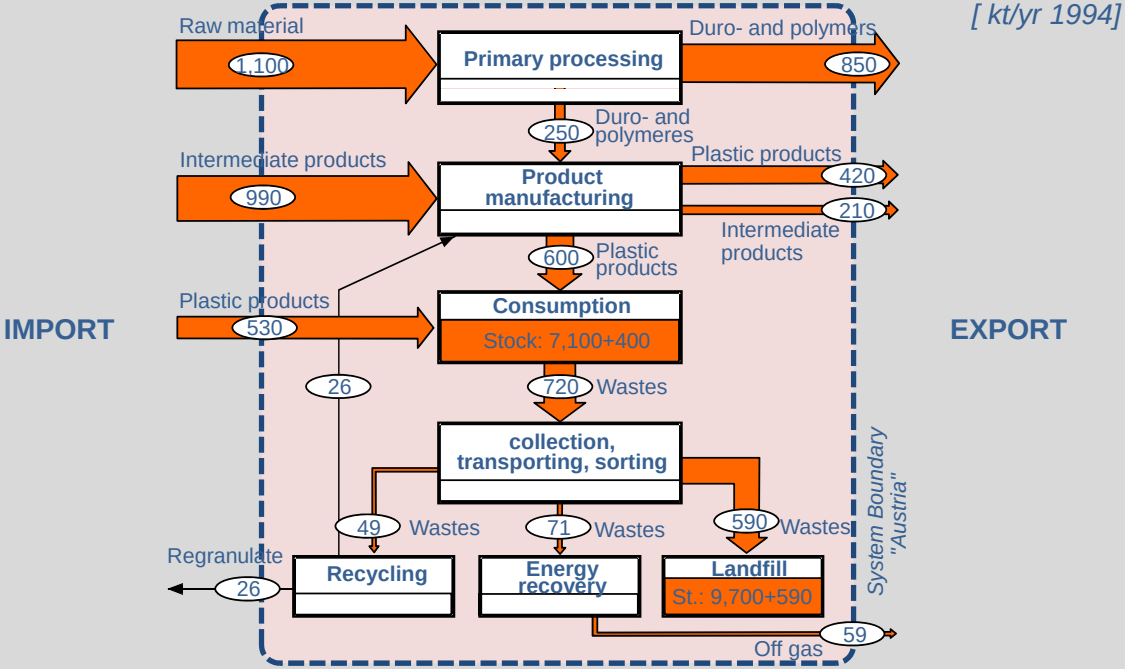
Better decisions by expanding knowledge base (expl. paper in Austria)



Data: Austrian Paper Industry, 1996

Better decisions by expanding knowledge base (ex. plastic wastes)

[kt/yr 1994]



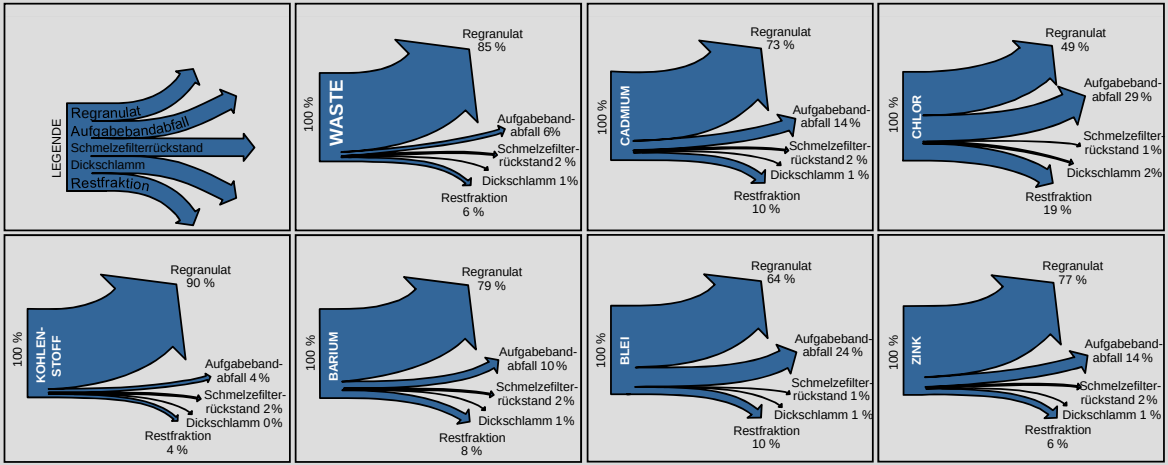
Source: R. Fehringer, 1998

Better decisions by expanding information base (ex. plastic additives)

Additives in plastics	Total consumption	Total stock	Packaging material	
	in kt/yr	in kt	in kt/yr	in %*
Plastics	1,100	7,100	200	**18**
Softeners	14	140	0.2	**2**
Ba/Cd- stabilizers	0.27	2.6	0.0002	**<1**
Pb-stabilizers	1.8	18	0.002	**<1**
Fire retardants	2.3	22	0	**~0**

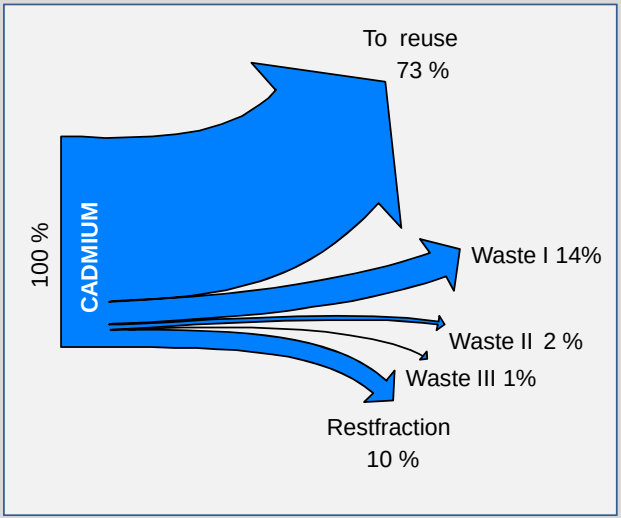
* *% of total consumption*

Knowledge base must include process information (expl. plastic recycling)

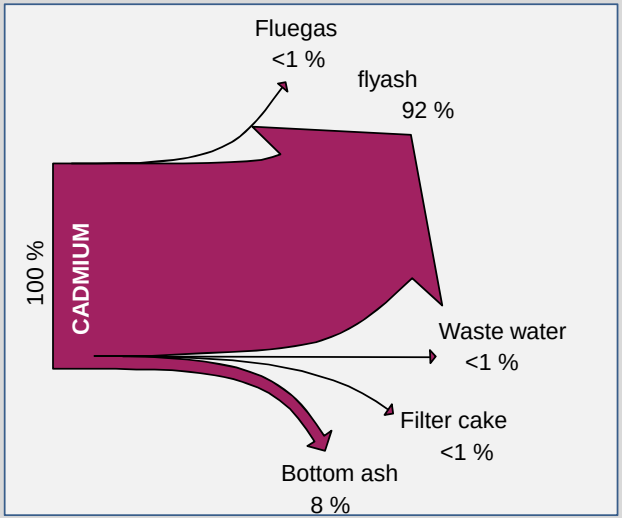


Knowledge base allows informed decisions (expl. plastic wm)

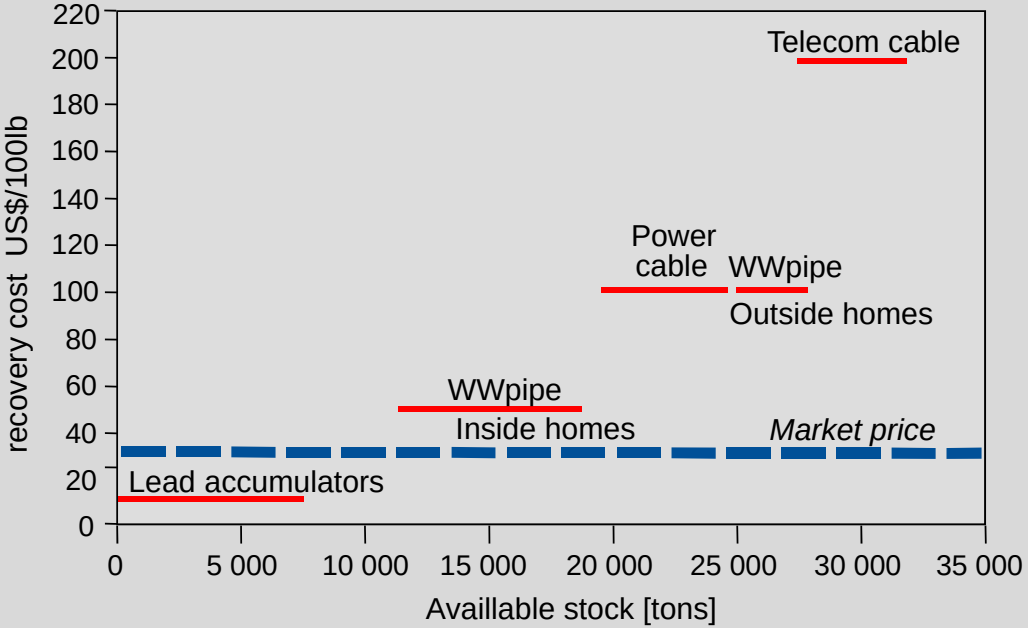
Plastic waste recycling



Plastic waste incineration (MSW)



Economic data necessary for wm knowledge base (expl. lead)



Source: Lohm et al., 1998

Conclusion: Elements of a wm knowledge base

- standard definitions of:
  - waste categories -> operational character of waste definition!
  - treatment processes, wm systems (incl. systems boundary)
- data sets *(including uncertainty!)* on wastes, processes and wm systems:
  - mass flows and waste properties
  - substance concentrations and flows, chemical speciation
  - time series
  - geographic data
  - resource data
  - environmental data
- economic data:
  - collection and treatment processes
  - wm and resource systems
- implementation:
  - ownership, management, transparency, availability

Thank you