



Shortcomings of LCA – Examples from Waste Management

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New criteria to evaluate waste management systems

- entropy (or SCE)
- „final sink“





- **Objectives of WM**
 1. **Protection of men and environment**
 2. **Conservation of resources**
 3. **No after-care**
(e.g. after are free landfills, „clean“ cycles)
- **Goals of evaluation: are the objectives reached?**
- **Can the set of LCA-criteria assess if theses goals are reached?**

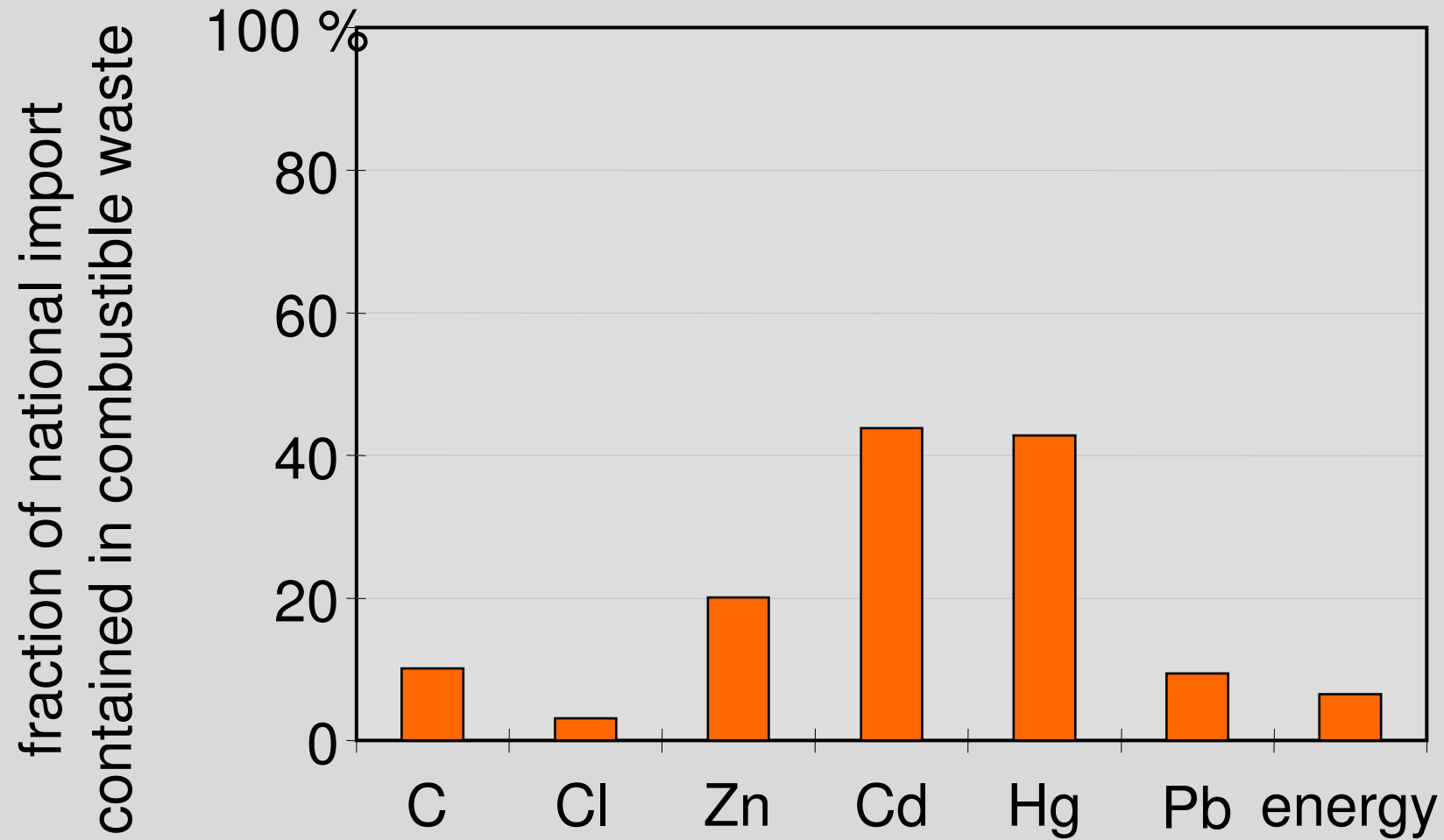




- **How to measure „protection of men“?**
 - In developed countries: matter of course, taken for granted
 - Rest of the world: still main goal!
 - Not included in „classical“ evaluation systems
 - > *distortion of results*
- **How to measure „protection of the environment“?**
 - Selection of criteria:
 - > *What are important emissions from wm?*



How to select relevant criteria?



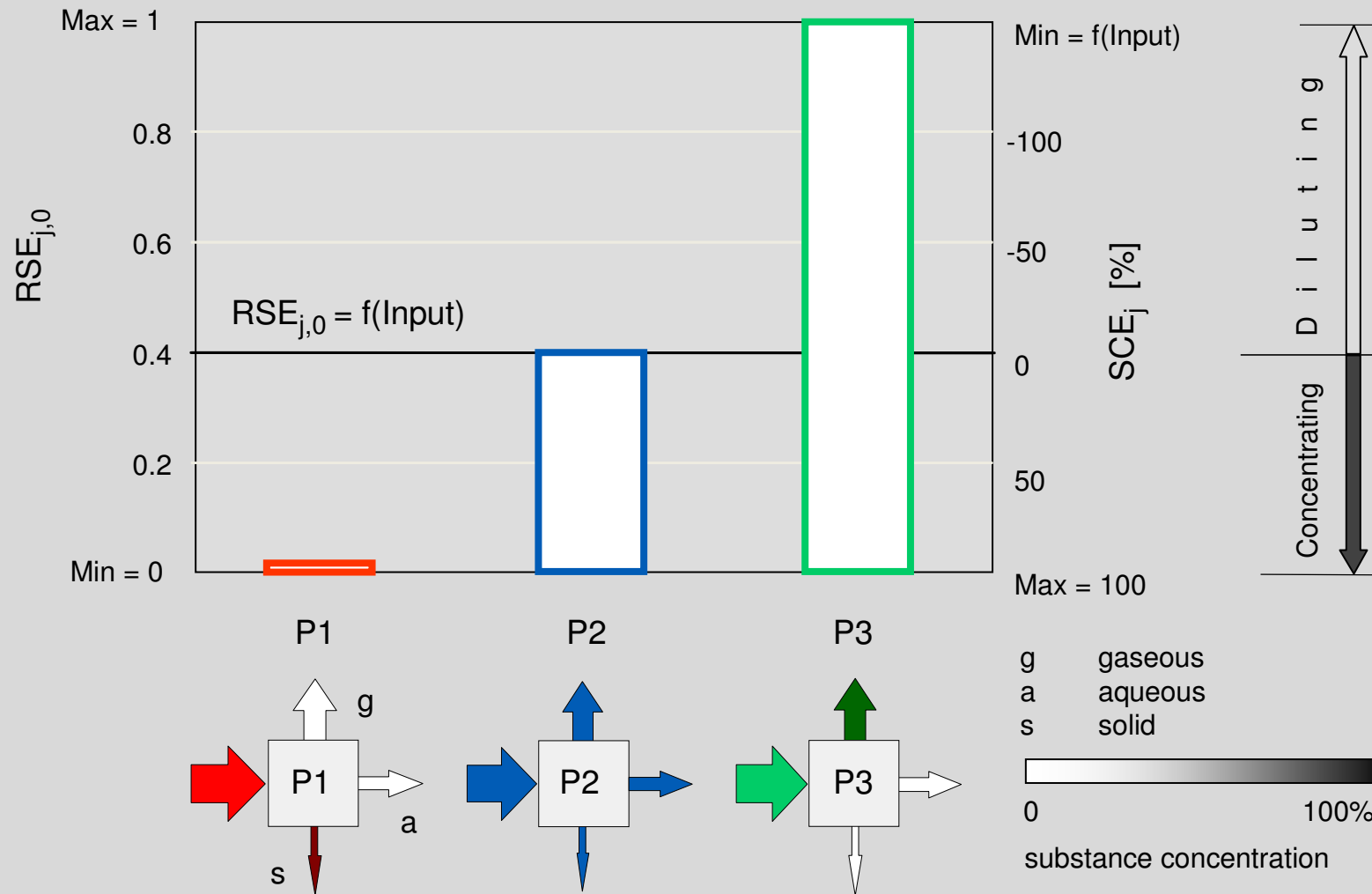


How to measure resource conservation?

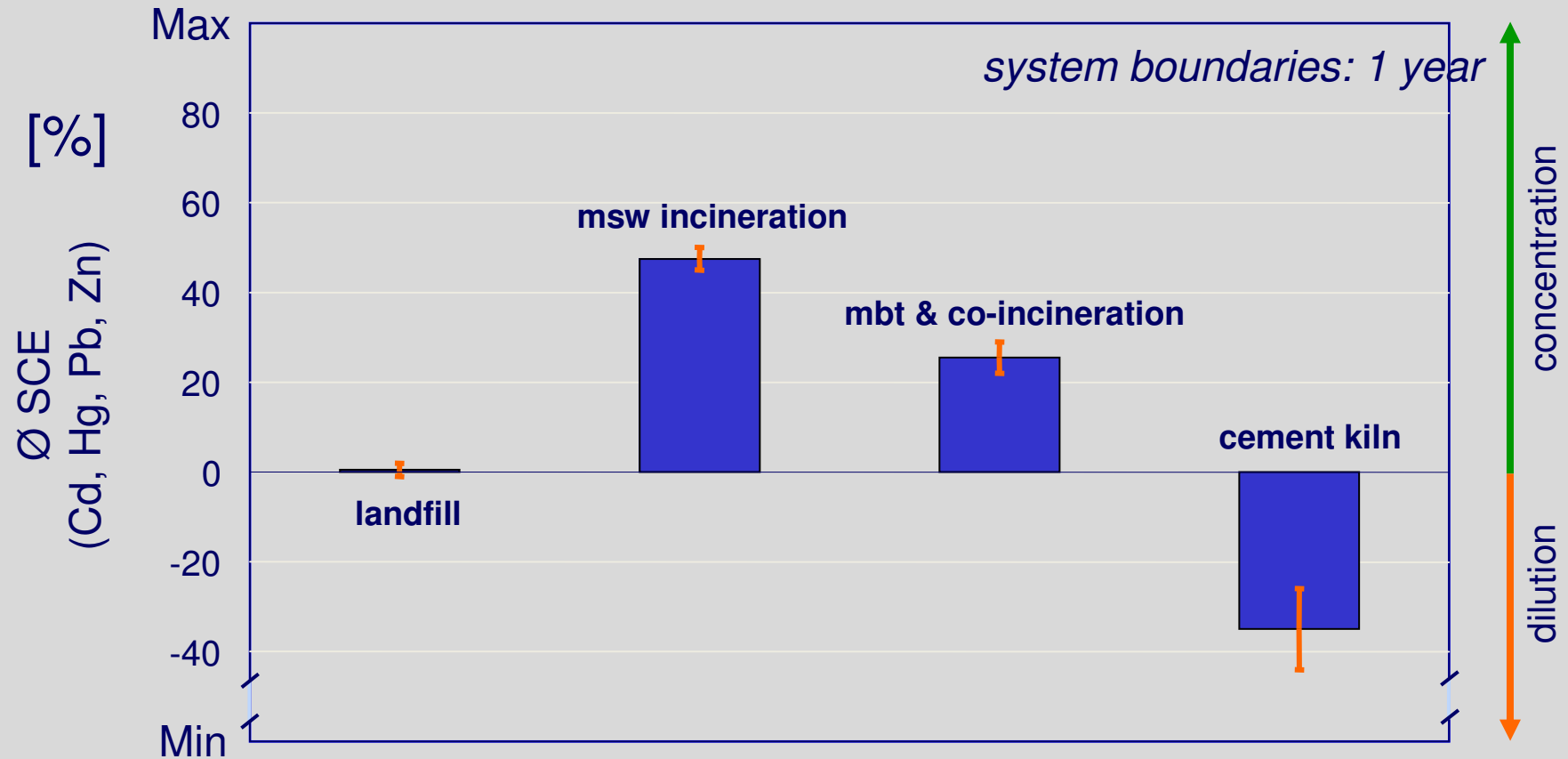
- e.g. use of energy and materials; LCA; MIPS; ecological footprints etc.
- power of systems and processes to concentrate:
 - > resources (ores) as products of concentration
 - > waste management as key process for concentration and dilution



Substance Concentrating Efficiency (SCE)



SCE of waste management options



Quelle: Rechberger & Brunner 2000

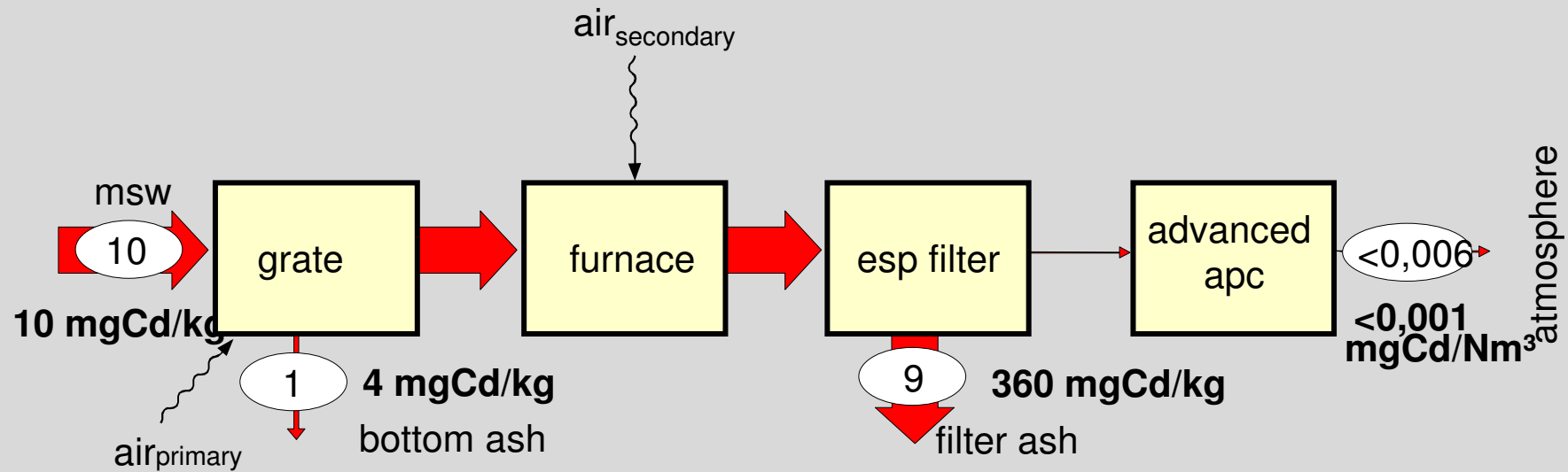
msw: municipal solid waste
mbt: mechanical-biological treatment



SCE requires good data



example cadmium [gCd/t msw]

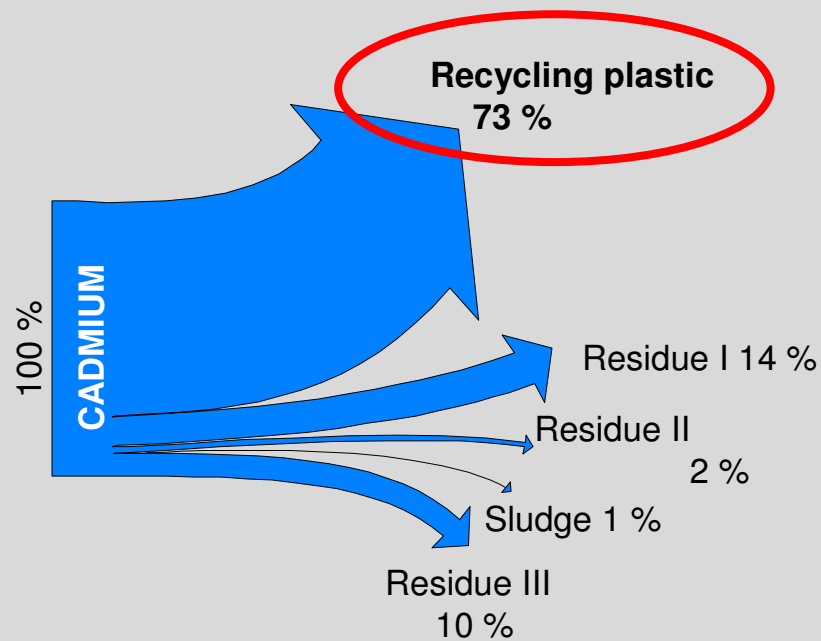


msw: municipal solid waste
esp: electrostatic precipitator
apc: air pollution control

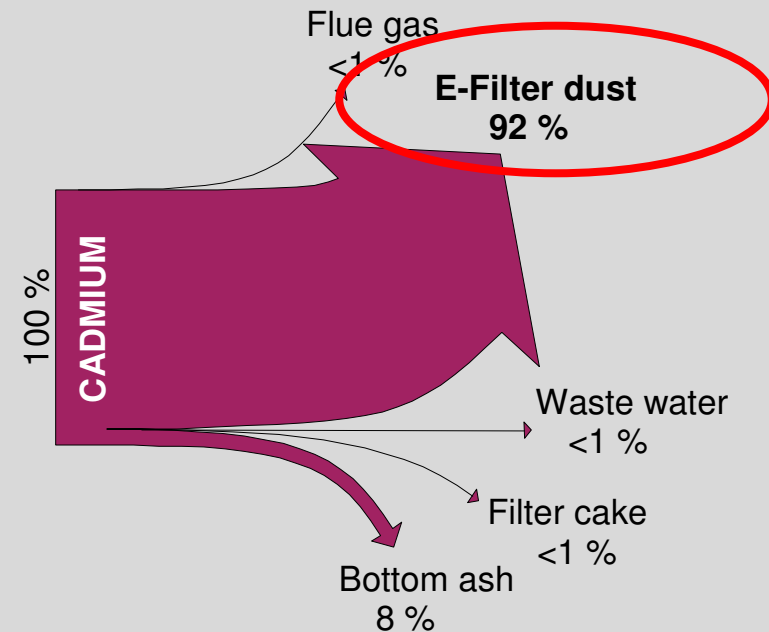




Plastic recycling



MSW incineration





- Objectives of WM

1. Protection of men and environment

2. Conservation of resources

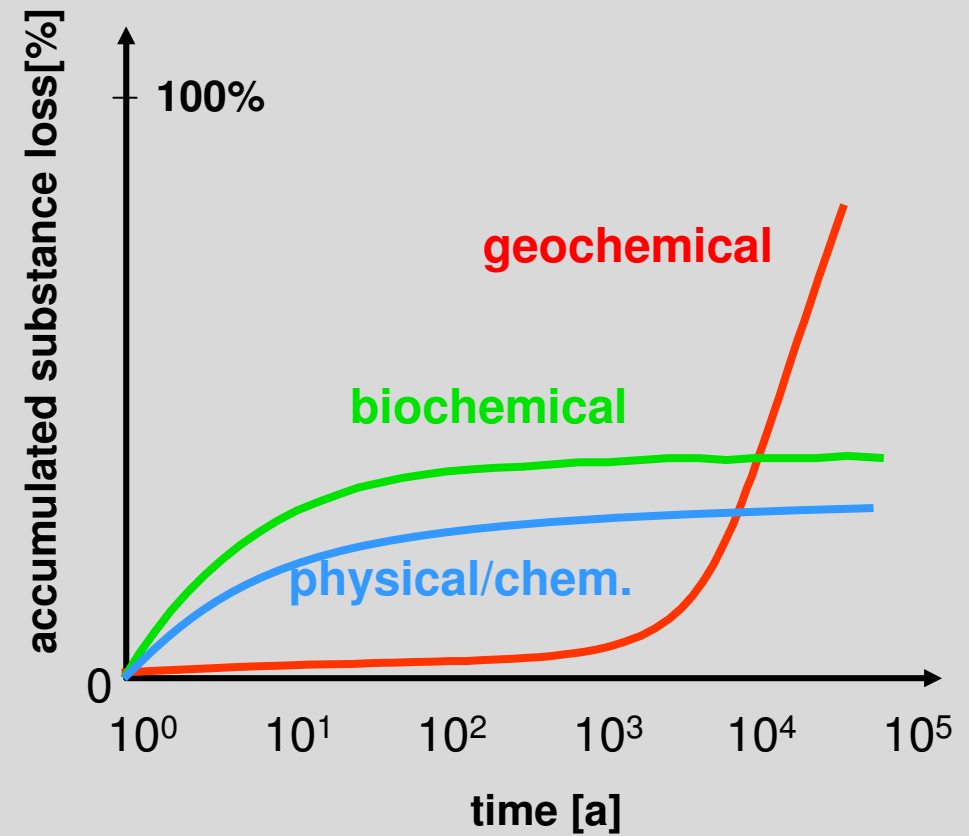
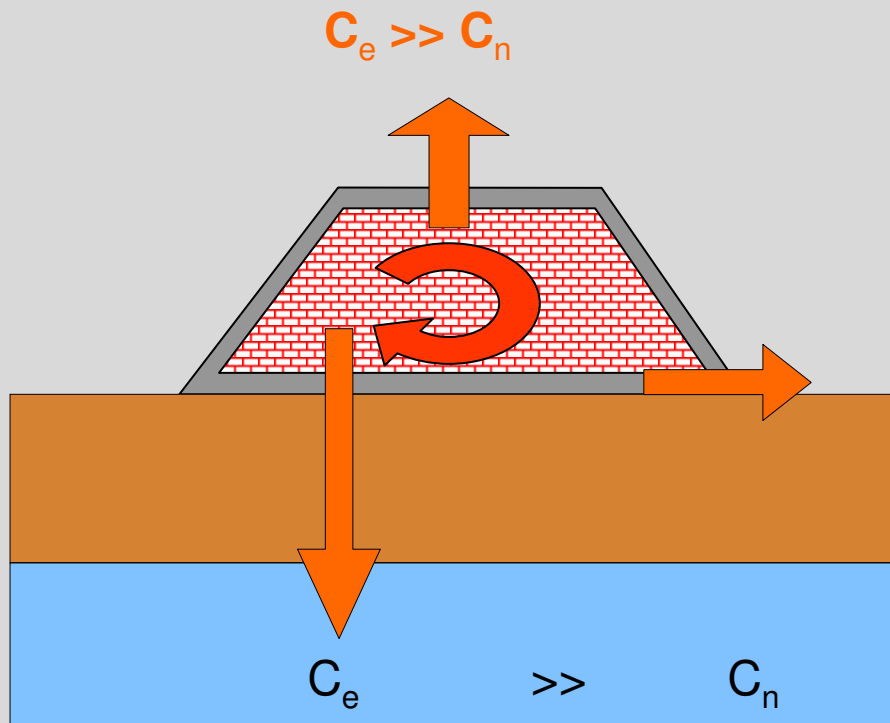
- 3. No after-care**

(e.g. after care free landfills, „clean“ cycles)





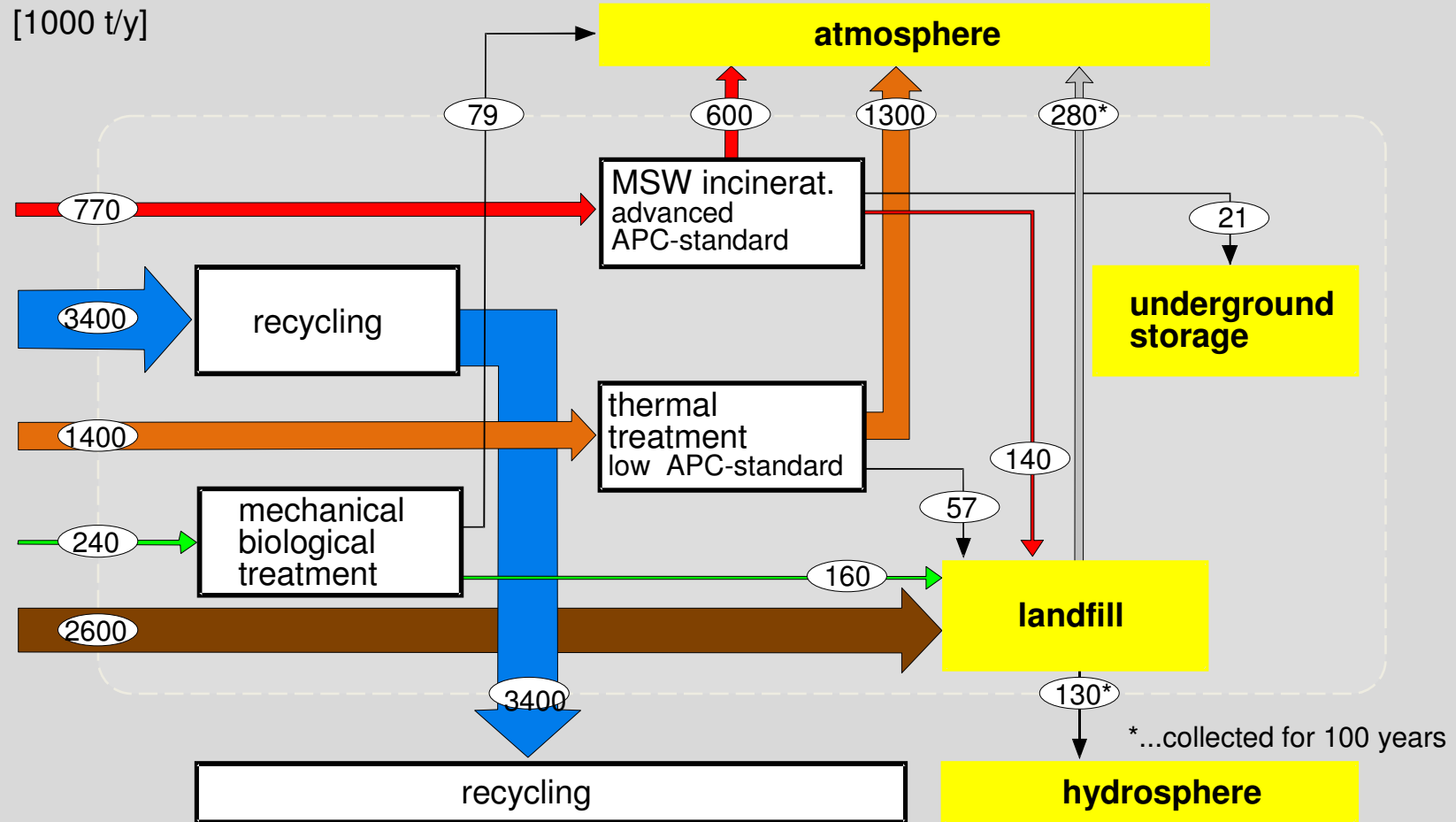
Reactor landfills produce emissions for very long time periods





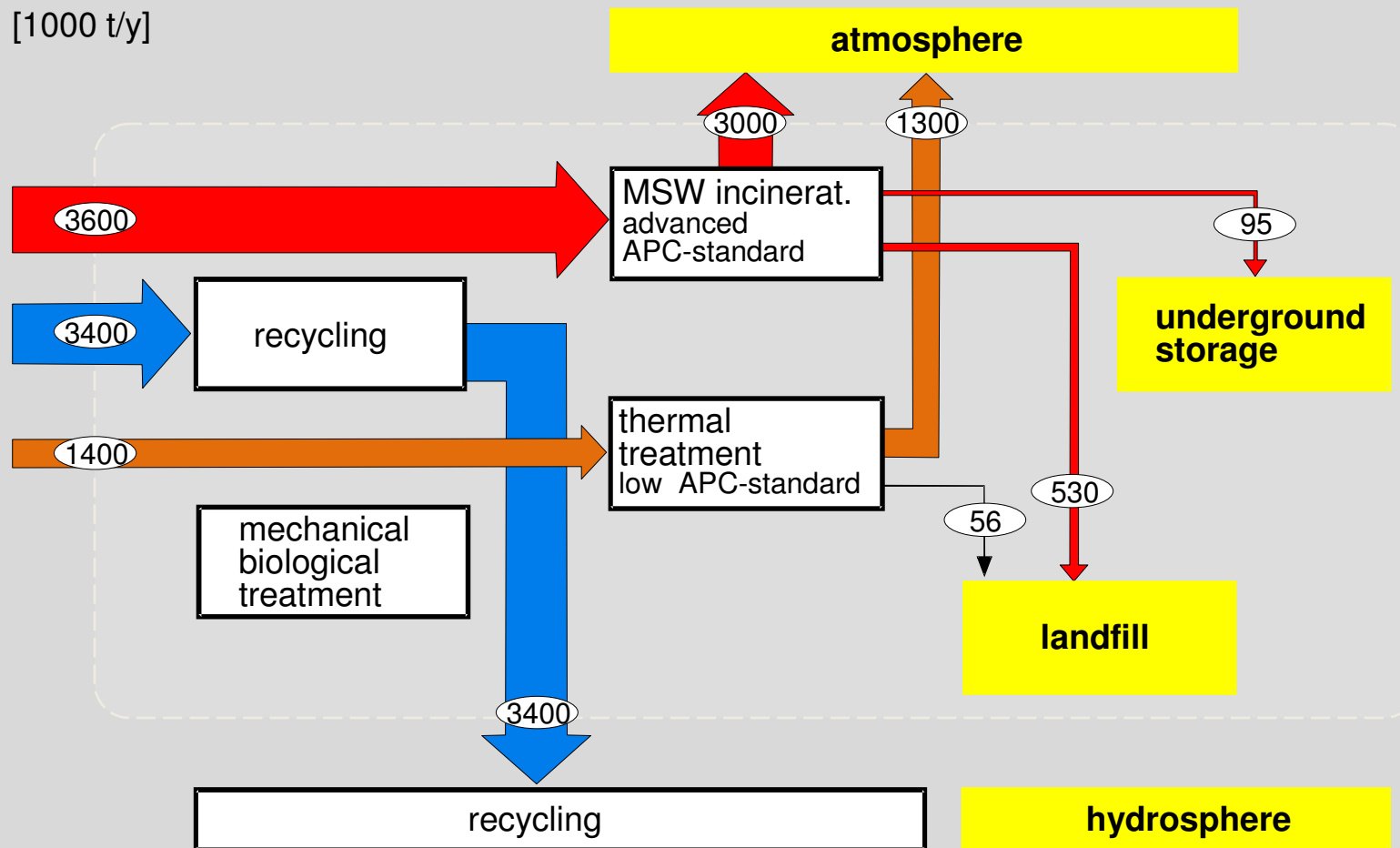
- Appropriate „final sinks“ as an important criteria
- „final sinks“: very long residence time (> 10.000 years) for specific materials
 - E.g. Cl -> Black Sea
 - N -> as N₂ in atmosphere
 - C -> carbonate in sediment
- „final sinks“:
 - sediments, atmosphere
 - underground storage (saltmine)
 - transformation processes
 - landfills -> ?
- Criteria: does a waste management system direct pollutants to final sinks?





Source: R. Fehring, 1997

[1000 t/y]



Source: R. Fehring, 1997

Appropriate sinks ? (example of Cadmium)

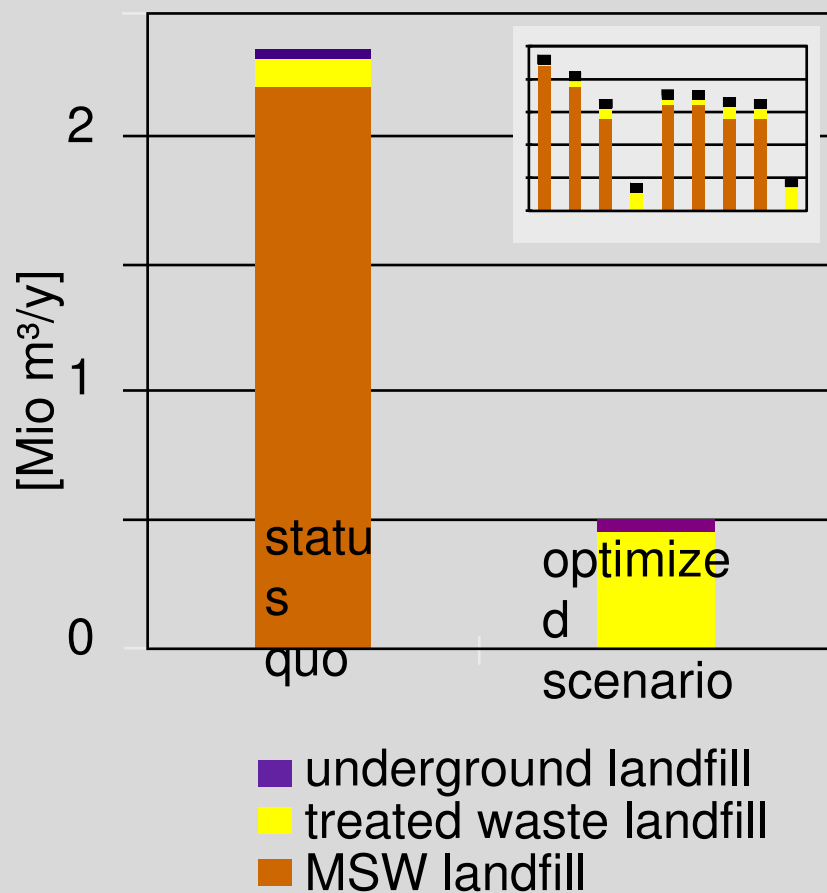
Cadmium in wastes	product	atmosphere	MSW landfill	treated waste landfill	underground storage
37 t/a	[t/y]				
status quo	3	0.3	29	1	4
optimised scenario ASTRA	2	0.1		5	30
co-incineration(cement)	19	2.5		16	
co-incineration (power plant)	3	1.4		33	

Source: Fehringer, R.; Rechberger, H.; Brunner, P.H., 1997

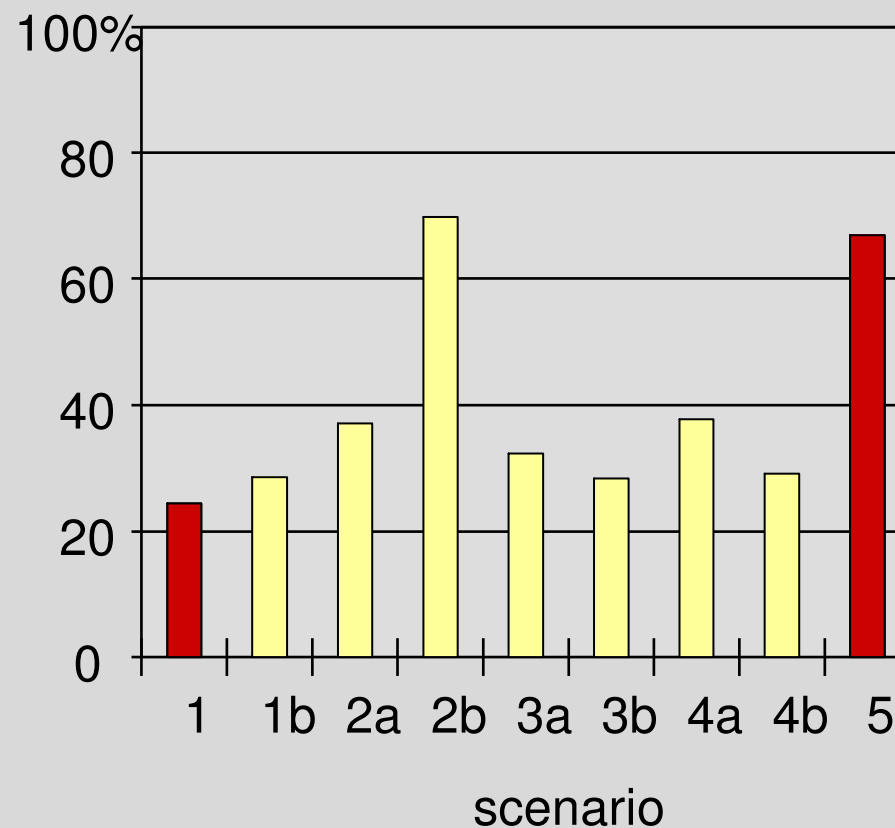




landfill type



materials in appropriate sinks



- **Requirements for assessing waste management systems**

Accounting for:

- concentration and dilution (>SCE)
- fraction in appropriate final sinks
- *long term* emissions

- **Can „conc/dilution“ and „final sinks“ be included in LCA ?**



Thank you

