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Urban metabolism and the need for final sinks

a case study of the city of Vienna

Ulrich KRAL
Paul H. BRUNNER

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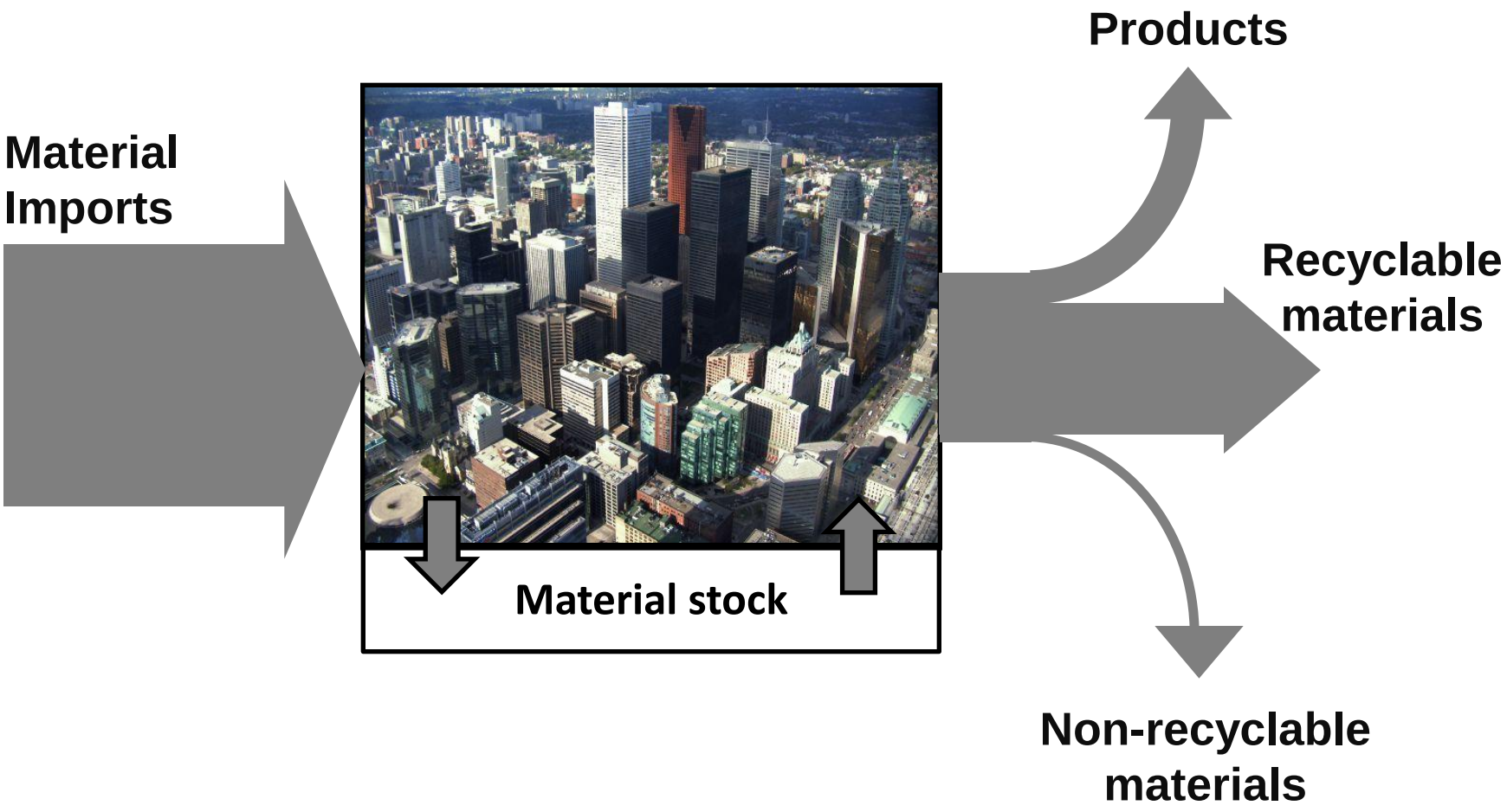
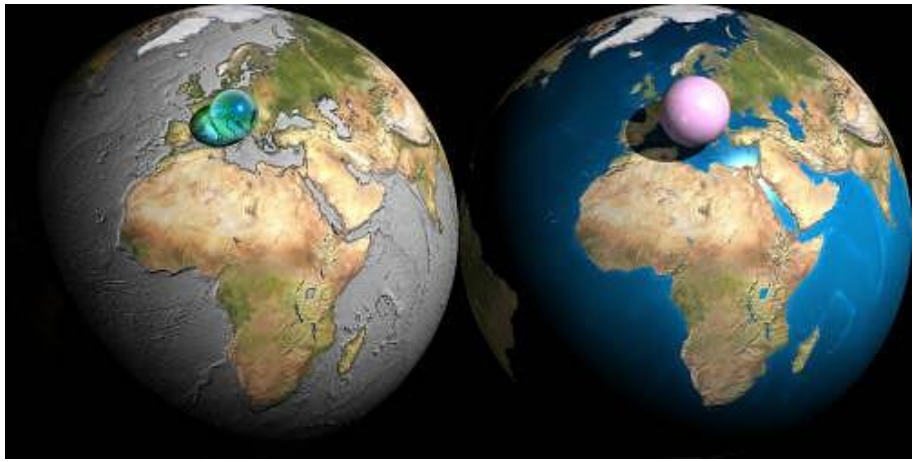
Urban Metabolism

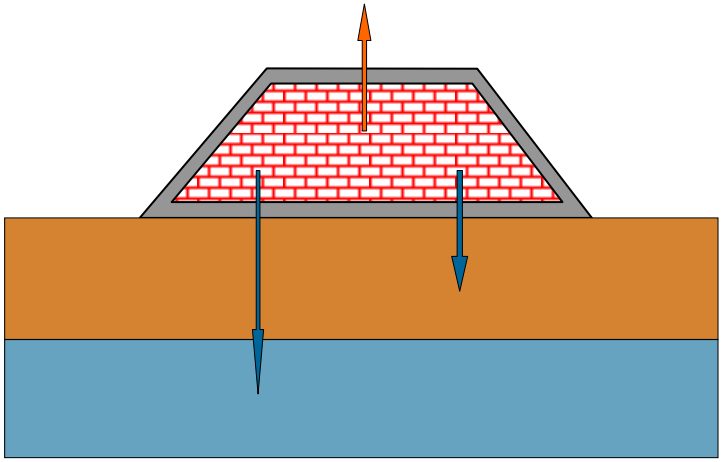


We need sinks …

… that take up non-recyclable materials.



Environmental compartments



e.g. Landfills

What's a sink?

A ***sink*** is a process with more input than output of a specific substance.

A ***final sink*** is a special kind of sink that either holds a substance no longer able to leave the sink by transport, or transforms a substance so that it does not exist in their original form anymore.

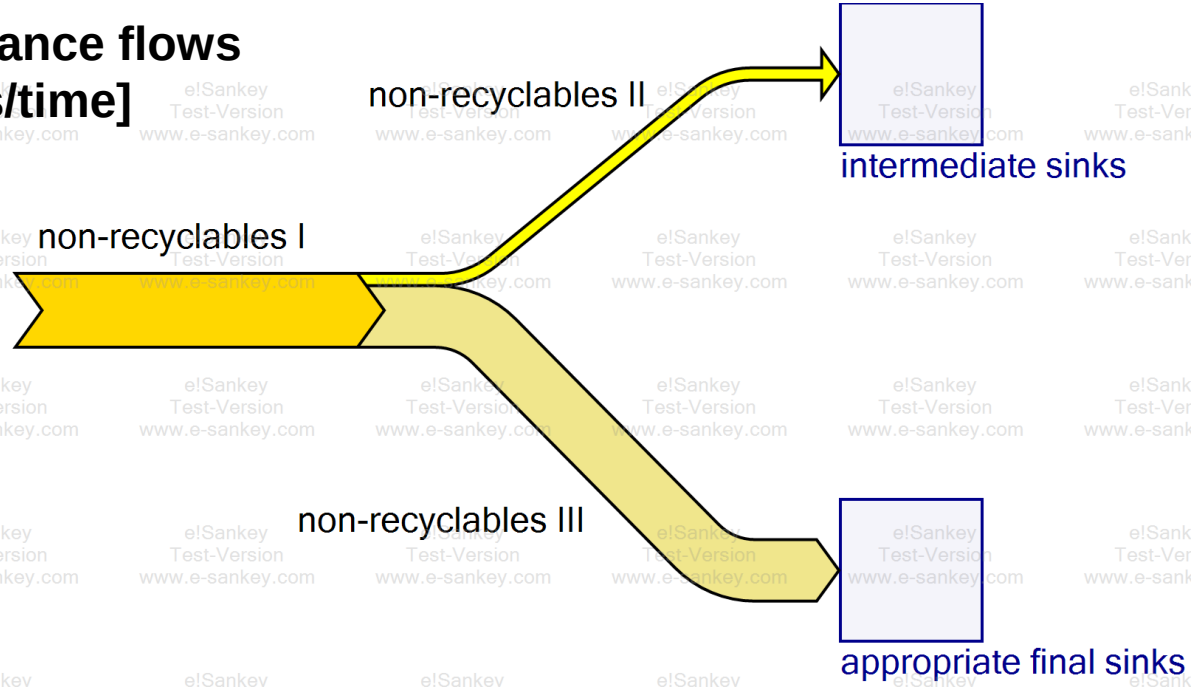
An ***appropriate final sink*** for a substance is a final sink where the concentration, speciation and mobility of a substance poses accepted environmental and health risks.

Categorization of sinks

	Intermediate sink	Final sink
Environment	○ Storage: Urban Soil for persistent substances ○ Transportation: Two environmental compartments that exchange heavy metals	○ Storage: Deep Sea Sediments for persistent substances ○ Transformation: Ambient air for formaldehyde in smoke from cigarettes
Anthroposphere	○ Storage: Storage facilities for waste ○ Transport: Sewer channels for nutrients	○ Storage: Sanitary Landfills for persistent substances ○ Transformation: Thermal Treatment for organic substances

Metric for sustainable resource use

(1) Substance flows [mass/time]



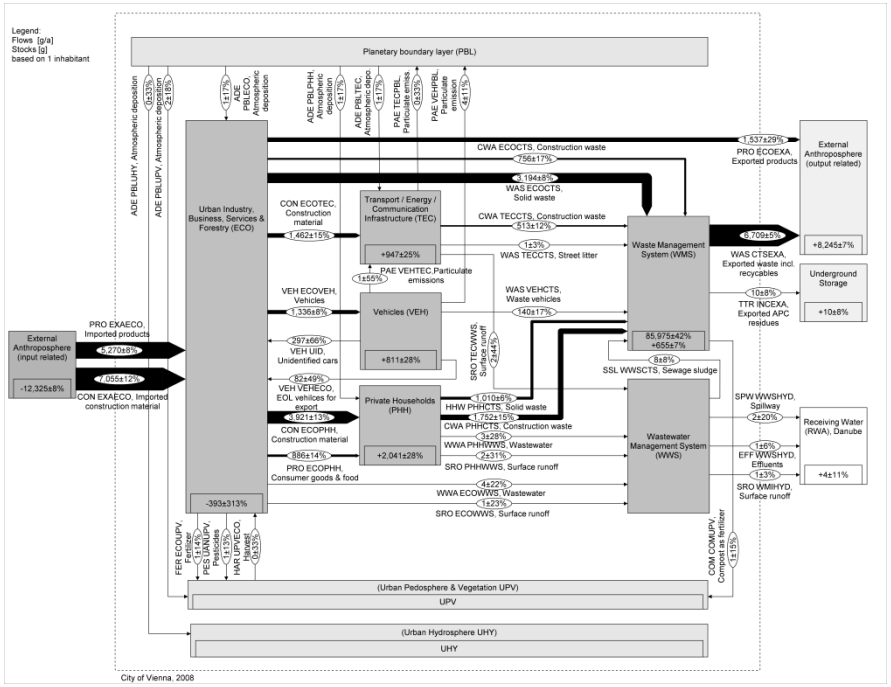
(2) Indicator

$$\alpha = \frac{non - recyclables\ III}{non - recyclables\ I} = \begin{cases} 1 \\ 0 < \alpha < 1 \\ 0 \end{cases}$$

Cu in the city of Vienna (Austria)

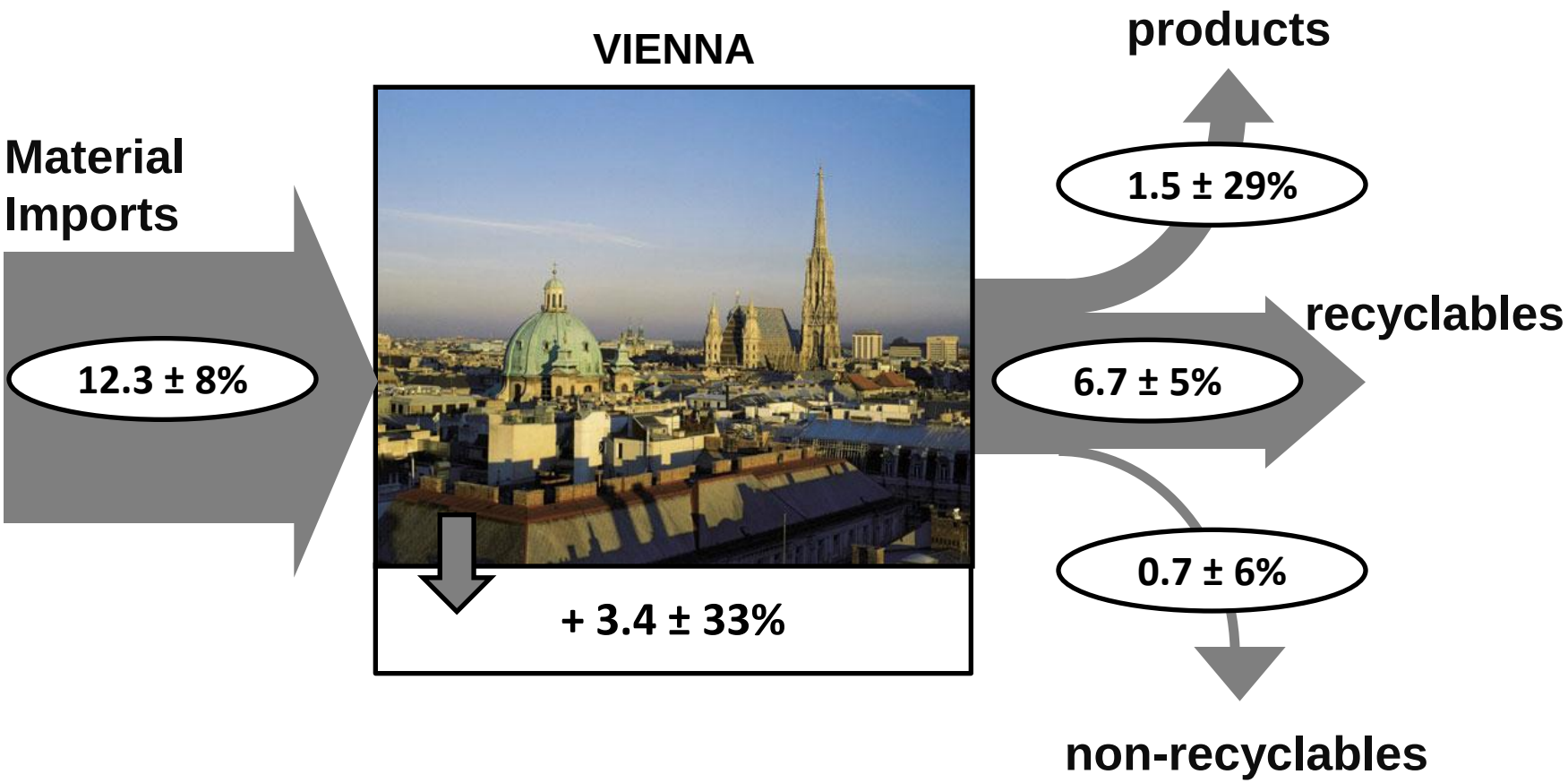
Opening the city as black box …

… through the visualization of Cu flows and stocks

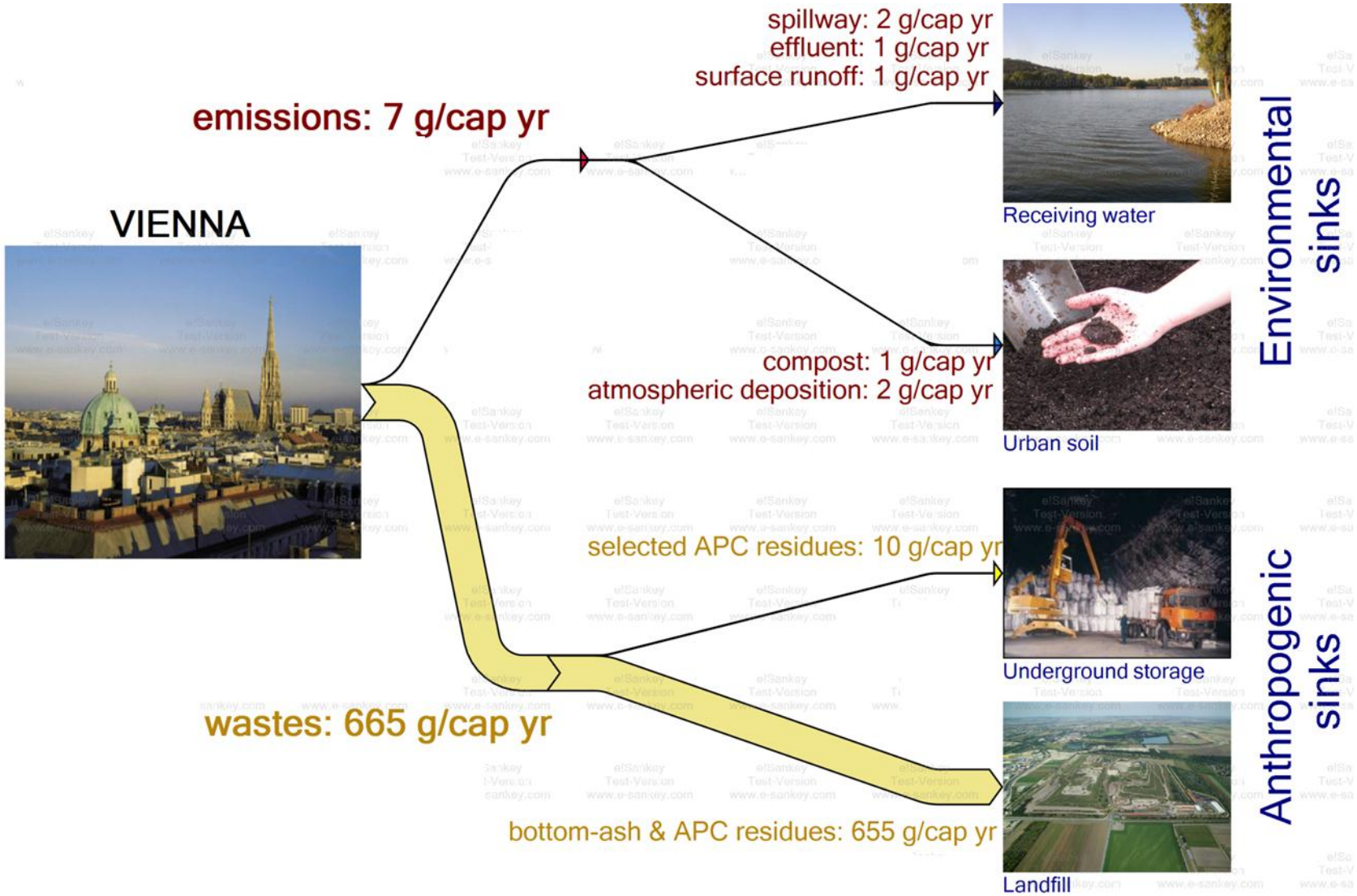


Methodology:
Substance Flow Analysis

Cu flows in kg/cap yr



Where remain the non-recyclables?



http://upload.wikimedia.org/wikipedia/commons/9/93/Danube_between_Slovakia_and_Hungary_near_Patince_2.JPG
http://tomatoheadquarters.com/wp-content/uploads/2012/05/seeding-potting-mix.jpg
http://www.wien.gv.at/umwelt/ma48/entsorgung/images/deponie-rautenweg.jpg

$\alpha = 665/(665 + 7) \cong 99\%$

	Intermediate sinks	Appropriate final sinks
Environment	7 g Cu/cap yr enter: ○ **Hydrosphere & Sediments** Consistent measurements of HM concentrations in sediments are not available. ○ **Urban Soil** Monitoring falls short in sound results.	**Options:** ○ Decrease emissions ○ Increase separation efficiency of WWs ○ Perform risk assessments & sound monitoring
Anthroposphere		665 g Cu/cap yr enter: ○ **Underground storage** 1 Barrier function Accessibility ○ **Landfills** 3 barrier functions Operational concept

α=1

Summery and conclusions

General

- A non-recyclable substance must be directed to an appropriate final sink.
- If it cannot be identified and/or utilized, the use of the substance has to be regulated.
- Cities have to monitor the efficiency in terms of routing substances to appropriate final sinks.

Cu case study

- Waste management sector provides vital sinks.
- Those sinks have to be managed to a certain extend.

- Non-point emission sources are as important as point-sources.
- An combination of risk assessment and monitoring for HM in urban soil & sediments is needed.

TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

Ulrich KRAL, MSc
Vienna University of Technology
Institute for Water Quality, Resource and Waste Management
Karlsplatz 13/226
A-1040 Vienna, Austria

Tel. : +43 (1) 58801 226 55
Fax.: +43 (1) 58801 9 226 55
E-Mail: ulrich.kral@tuwien.ac.at
Internet: iwr.tuwien.ac.at