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THE NEED FOR SINKS IN MODERN WASTE MANAGEMENT SYSTEMS

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Abstract
Today`s anthropogenic material turnover is huge and is expected to increase worldwide. After utilization, materials either become recycling products, or they leave the material loop as non-recyclable waste and emission flows. To accommodate these materials without jeopardizing human and environmental health, limited natural sinks like air, water and soil are available. Thus, appropriate man-made sinks (end-of-pipe technologies) have to be provided and utilized by the waste management sector, where natural sinks are missing or overloaded.

The objective of the presentation is to design a modern waste management system with respect to limited sink capacities. The waste sector in Canton Zürich (Switzerland) acts as case study, whereat the focus is on cooper (Cu), zinc (Zn) and polycyclic aromatic hydrocarbon (PAH). From a methodological point of view, substance flows into sinks are inventoried with the tool material flow analysis. Next, the substance flows are assessed, based on a distance-to-target approach, with respect to environmental and resource oriented goals. Finally, an indicator ω aggregates the assessment results and indicates whether the current waste management practice overloads available sink capacities or not. The indicator relates the actual to the critical flows into sinks. If constraints are indicated, measures are developed and evaluated to fulfill environmental and resource oriented goals.

The results show for the year 2013 that the waste sector directs 14 tons per capita (t/cap) materials into sinks (10 t solid waste/cap, 4 t off-gas/cap), which includes 6.5 kg Cu/cap, 2.8 kg Zn/cap and 0.1 kg PAK/cap. The results indicate a) that the disposal of excavated soil to gravel-pits ($\omega=\infty$) and of construction & demolition waste to landfills ($\omega=4$) is limited, b) for Cu, that the input to agricultural soil ($\omega=4$), the disposal of bottom-ashes to landfills ($\omega=2$) and of scrap from incineration plants ($\omega=2$) exceeds critical limits, and c) for PAH, that 90% of all PAH-fractions enter recycling products and landfills, which is in conflict with future quality standards. To overcome the constraints, the most effective options are to a) increase landfill capacities and to use excavated soil for landscape design, b) to recover Cu from bottom-ash and c) to transfer old asphalt to new constructed thermal treatment plants.

Concluding, the need for sinks is huge and the waste sector plays a key role for the utilization of man-made sinks and protection of natural sinks. The long-term planning of appropriate sink capacities effects the control of waste flows and the design of recycling and disposal technologies. The new indicator is a measure for the performance of waste management system with respect to limited sink capacities and supports monitoring and a reporting of in an easy manner.

Keywords
Sink, Final sink, Material flow analysis, Impact assessment