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Sinks as integrative elements of the anthropogenic metabolism

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The anthropogenic metabolism is an open system requiring exchange of materials and energy between the anthroposphere and the environment. Material and energy flows are taken from nature and become utilized by men. After utilization, the materials either remain in the anthroposphere as recycling products, or they leave the anthroposphere as waste and emission flows. To accommodate these materials without jeopardizing human and environmental health, limited natural sinks are available; thus, man-made sinks have to be provided where natural sinks are missing or overloaded.

The oral presentation (1) suggests a coherent definition of the term “sink”, encompassing natural and man-made processes, (2) presents a framework to analyse and evaluate anthropogenic material flows to sinks, based on the tool substance flow analysis and impact assessment methodology, and (3) applies the framework in a case study approach for selected substances such as Copper and Lead in Vienna and Perfluorooctane sulfonate in Switzerland. Finally, the numeric results are aggregated in terms of a new indicator that specifies on a regional scale which fractions of anthropogenic material flows to sinks are acceptable.

The following results are obtained: In Vienna, 99% of Cu flows to natural and man-made sinks are in accordance with accepted standards. However, the 0.7% of Cu entering urban soils and the 0.3% entering receiving waters surpass the acceptable level. In the case of Pb, 92% of all flows into sinks prove to be acceptable, but 8% are disposed of in local landfills with limited capacity. For PFOS, 96% of all flows into sinks are acceptable. 4% cannot be evaluated due to a lack of normative criteria, despite posing a risk for human health and the environment.

The case studies corroborate the need and constraints of sinks to accommodate inevitable anthropogenic material flows.