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compartment transfer rates in horizontal flow constructed wetlands

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A conceptual computer model has been constructed to simulate the compartment transfer rates in horizontal flow constructed wetlands. The model accounts for flow and transport in the variably saturated porous medium as well as biogeochemical change reactions. The most concentrated contaminants such as BTEX, MTBE and gasoline hydrocarbons and dissolved as well as mineral phase electron acceptors are considered. Also of major interest are reduced species with high oxygen demand such as ammonium. The influence of marsh plants on microbial activity, gas transport, water balance and contaminant fate in general is matter of current investigation. The constructed wetlands consist of a coarse sand or fine gravel porous medium. Marsh plants were introduced after installation, however, a number of control basins are operated unplanted. Water levels and through flow rates are adjusted to optimize the remediation efficiency.

The system is likely to be neither reaction nor mixing limited, thus both, values of dispersivity and degradation kinetics may be crucial for remediation efficiency. Biogeochemical modelling is able to delineate in detail (i) the zonation of processes, (ii) temporal variation (breakthrough curves) and (iii) mass balance information. The contributions of biodegradation and volatilisation and the influence of plants (compartment transfer) can generally best be evaluated by the component's mass balance. More efficient mixing is expected in the wetlands with open water body which leads to both, more biodegradation and volatilisation.

An important task is to quantify the role of plants and root systems for contaminant attenuation in constructed wetlands. The long term goal of investigation is to allow for predictions for the design of large scale compartment transfer wetlands that may be applied to remediate the site as a whole.