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Assessment of the effects of leaky sewers on groundwater quality

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Urban subsurface infrastructures like sewer networks are often leaky. Presently, 20% of the sewer network in Germany shows significant damages that can cause sewer leakage. Untreated wastewater may enter the urban aquifer if the water level in the sewer lies above the surrounding water table. The transport of wastewater from leaky sewers to the groundwater is still not well understood. In the framework of the research platform WASSER Leipzig (Water And Sewershed Study of Environmental Risk in Leipzig-Germany) we assess the effects of leaky sewer on groundwater quality. The research is focused on the occurrence and transport of so-called “xenobiotics” such as pharmaceuticals and personal care product (PPCP). Xenobiotics may pose a threat to human health and the ecosystem, but can also be considered as markers for an urban impact on water resources.

In cooperation with the local authorities we established a new test site in Leipzig to quantify the mass fluxes of xenobiotics from a leaky sewer into the groundwater. Corresponding to the leaks which were detected by closed circuit television inspections, monitoring wells were installed up- and downstream of the sewer. Concentrations of eight xenobiotics (technical-nonylphenol, bisphenol-a, caffeine, galaxolide, tonalide, carbamazepine, phenazone, ethinylestradiol) obtained from first sampling programmes were found to be highly heterogeneous without any spatial pattern. On the other hand concentrations of ammonium, chloride and boron increased significantly downstream of the sewer which may be due to wastewater exfiltration, since no other contamination source is known on the water flowpath from the upstream to the downstream wells.

Because of the highly heterogeneous spatial distribution of xenobiotics at the test site, a monitoring concept was developed comprising both high-resolution sampling and an integral approach to obtain representative average concentrations. Direct-push techniques were used to gain insight into the fine-scale spatial distribution of the target compounds. An integral pumping test was performed to determine the total xenobiotic mass fluxes along control planes down- and upstream of the leaky sewer. The last results show that the new monitoring concept seems to be an efficient tool to obtain robust estimates of waste water leakage from a damaged sewer section.