

Interactive comment on “The influence of heterogeneous groundwater discharge on the timescales of contaminant mass flux from streambed sediments – field evidence and long-term predictions¹” by C. Schmidt et al.

C. Schmidt et al.

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We thank the reviewer for the thorough review. We agree with the reviewer that we oversimplified the description of the sorption and, in particular, the desorption processes. We relied our assumptions on data that was obtained from desorption experiments. The data in figure 3 was obtained using equal aliquots. The experiment was designed to elucidate the kinetics of the desorption process. Initially, we hypothesized to have an early, fast desorption rate constant and a second slower one. However, only a very small fraction of the total contaminant load desorbed over the course of the batch des-

¹Invited contribution by C. Schmidt, one of the Union Young Scientist Award winners 2007.

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orption experiment. We concluded that on the timescale of interest, the desorption process is not kinetically limited. We agree with the reviewer that the data is not sufficient to fully support this hypothesis. We are currently conducting repacked column experiments in order to support our assumptions on the desorptive behaviour with a more realistic experimental setup than simple batch experiments. Further we are conducting adsorption-desorption experiments to better define the initial adsorbed amount of contaminants. However, we will not be able to reproduce adsorption timescales that we assume for the field conditions.

Reply to specific comments:

p 972: We will include a short review of the methods that were used in the previous paper to derive the groundwater discharge rates. We will state more clearly that these are results from a previous study. We agree with the reviewer that our estimates of contamination reduction are minimum estimates. We will state that more clearly.

p 978: A sediment description will be included in the final manuscript. As stated in the description of the field site the streambed was constructed and therefore it is relatively homogeneous. We will present the respective data in the revised manuscript.

p 978: We are currently performing adsorption-desorption experiments. We will present the data from both the pure desorption and the adsorption-desorption tests in the revised manuscript.

p 980 and p 984: We will correct our model and include longitudinal dispersion/diffusion. One key issue of forward modelling approaches are the initial conditions. The contamination of the sediments occurred during the 1970s and the 1980s. At this time no environmental monitoring existed. The regular water quality monitoring started in 1993. At this time the concentrations in the surface water were already significantly lower than in the 1980s. The presented conceptual model starts at time $t=0$ when the concentration in the surface water rapidly dropped in 1990/1991. Since aqueous concentrations are not available for the time before 1990, it is hardly possible to simulate

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the period of sediment contamination. Therefore, the initial conditions we applied can only be based on assumptions rather than data.

p987: The sediments of the studied reach of 220 m in length are not the only contamination source of the investigated stream. After leaving the industrial area the stream has a flow length of approximately 3 km before it discharges to the Spittelwasser stream. Our study site is located 1 km downstream of the industrial site. Upstream of the study site, the Schachtgraben receives contaminated drainage water from a landfill and a considerable contaminant discharge from the groundwater and from contaminated streambed sediments resulting in the observed surface water contamination at the study site. Attempts to apply mass balances including different contaminant sources failed because of a high variability of both sources and contaminant concentrations in the surface water. We therefore decided to look at the different sources and to quantify the potential mass fluxes separately.

The issues raised in the technical comments will be incorporated in the final manuscript as the reviewer suggested.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 971, 2008.

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