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Metal transfer and retention in the Dutch Meuse River

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Although the water quality of the Dutch Meuse River has significantly improved in the past decades, it remains considerably impacted by industrial discharges and historic metal mining in the upstream river basin. To assess the transport and fate of metals, the annual suspended sediment loads and the annual particulate and dissolved loads of five metals (Cd, Zn, Cu, Pb, Cr) were examined for four monitoring locations in the Dutch Meuse River (Eijsden (4.5 km downstream from the Belgian-Dutch border), Stevensweert (61.2 km), Belfeld (101 km) , and Keizersveer (247.5 km)) for the 2000-2006 period. The annual loads were estimated using sediment and metal rating curves based on daily to monthly water and suspended sediment sampling and daily discharge measurements.

The results of the analysis show that the total annual metal loads are strongly correlated with mean annual discharge. Between Eijsden and Stevensweert, the annual dissolved loads of Zn increase by 111% and of Pb by 57% on average, which can probably be attributed to metal inputs from the Geul catchment, which has been affected by historic mining activities. Between the Stevensweert and Belfeld monitoring stations, notably the dissolved Pb and Cr loads increase, which is probably due to inputs from the Voer tributary river. These increases in dissolved loads are positively correlated with annual discharge.

In general, the suspended sediment loads decrease by 48% on average between Eijsden and Keizersveer and the annual decreases are positively correlated with annual discharge, which can be attributed to sediment retention in floodplains during periods of high discharge. The annual particulate metal loads display a similar spatio-temporal pattern, although the correlation with discharge is less strong. On average, the metal

concentrations in the suspended sediment decrease by 10% to 45% in downstream direction, which causes the share of particulate metal transport relative to the total metal load to decrease in downstream direction. This may be due to desorption of metals or near-channel and in-channel exchange with less contaminated sediment. The major hydrochemical composition of the river water does not noticeably change between Eijsden and Keizerveer, but the clay and organic matter content of the suspended sediment does change. This indicates that sediment deposition and resuspension play a key role in metal transfer and retention in the Meuse River.