

## The use of lead slags in river embankments: an environmental impact study

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Metal slags are a waste product from the metallurgical or recycling processing. Slags are used in hydraulic engineering, mainly as armourstones to stabilize riverbanks or coasts. However, leaching from slags may be a source of hazardous metals towards the aquatic environment. In the Scheldt estuary (Belgium) tons of monolithic lead slags are used to protect and strengthen its banks. The environmental impact of the use of lead slags in river embankments is investigated.

The lead slags used in the Scheldt estuary were found to contain very high concentrations of lead ( $20 \text{ g kg}^{-1}$ ) and zinc ( $50 \text{ g kg}^{-1}$ ). Leaching, based on standardized laboratory tests, resulted in high metal concentrations in the water. However, the release rate decreased fast and was about 100 times lower after 30 days, but is still two orders of magnitude larger than natural armourstones. Basic modelling indicated that the total lead concentration in the surface water from the Scheldt estuary will increase temporarily with  $2 - 15 \mu\text{g L}^{-1}$  when 9000 tons of lead slag (realistic work) will be deposited on the river bank. Bioaccumulation was tested in a mesocosm with benthic and pelagic organisms exposed to (1) unused slags, (2) slags applied in the estuary and (3) natural armourstones. High accumulation of metals in biota occurred in the organisms exposed to the unused slags. No significant differences existed between metal concentrations exposed to applied slags (3 years) or natural armourstones.

The release of metals from slags pose an environmental risk when used in hydraulic engineering. The release and impact is clear on the short term. Release rates decrease fast and the long term impact was found to be limited. Since lead is a priority pollutant on the list of the Water Framework Directive any release causing deterioration of the aquatic system should be prevented.