

# Chemical analyses of dredge disposal sites at the Belgian Continental Shelf

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**Introduction:** The Belgian Continental Shelf (BCS) contains five dredge disposal sites. Sites nearby the port of Zeebrugge are intensively used with average annual dredge deposition amounts (1998-2008) of 0.8 to 2.0 ton dry matter (TDM)/m<sup>2</sup> while dredge deposition at sites nearby Oostende (0.35 TDM/m<sup>2</sup>) and Nieuwpoort (0.65 TDM/m<sup>2</sup>) was less intensive. The chemical and biological status of each deposition site as well as nearby control zones are evaluated twice a year. This presentation summarizes the evolution of the sediment chemical status from 2005 to 2011.

**Methods:** All chemical compounds were determined on the <63µm sediment fraction. Polychlorobiphenyls (PCBs) were analysed by soxhlet extraction with hexane:acetone (3:1) followed by aluminium oxide and silica clean up and GC-ECD analysis. Polycyclic aromatic hydrocarbons (PAHs) were determined by saponification, aluminium oxide clean up and LC-fluorescence analysis (2005-2006) or pressurized liquid extraction with florisil clean up and GC-MS analysis (2006-2011). Metals Cu, Cr, Cd, Ni, Zn, Al, Fe, Pb and As were analysed by wet destruction with HClO<sub>4</sub>, HNO<sub>3</sub> and HF with quantitation by ICP-OES or ICP-MS. For the determination of Hg, a dry combustion with oxygen was performed, followed by Au-adsorption and AAS-quantitation.

Statistical analysis was done by linear mixed effect modeling in R 2.15.3, taking into account the effect of season, time, sampling location and impact or control zone.

## Results:

Significant reductions in heavy metal concentrations were found for most dredge disposal sites for As (5.5-8%/year), Pb (2.5-7% year) Cu (3.5-5.5%/year), Cd (6-11.5%/year) and Cr (4-5.5%/year) with highest reduction rates found at the west of the BCS, i.e. at disposal site Nieuwpoort. At sites Oostende and Nieuwpoort, Zn concentrations were significantly increasing (10-12%/year). Trends in Hg concentrations were not consistent between different disposal sites with no significant trend at sites Br&W S1, Zeebrugge Oost and Nieuwpoort, a decrease at

the Oostende impact zone (4%/year) and an increase at the Br&WS2 impact zone (15%/year).

Concentrations of PAHs were constant in impact and control zones at four disposal sites. At Nieuwpoort, however, a decrease of 15 EPA PAHs (naphthalene excluded) of 8%/year was detected. PCB concentrations were increasing at Oostende and Zeebrugge Oost.

## Discussion:

Within OSPAR region II, i.e. the Greater North Sea, Pb and Cd concentrations revealed strong reductions in heavy metal concentrations since the 1990's followed by relatively small changes between 1998-2007 [1]. On the dredge disposal sites of the BCS, trends for most heavy metal concentrations were still significantly decreasing from 2005 to 2011, probably due to further technological and regulatory advances in industry. Remarkably, Zn concentrations revealed an opposite trend at two disposal sites. It will be investigated whether this can be linked to the use of Zn based antifouling agents as an alternative for Sn based antifouling agents [2]. Considering the high toxicity of Hg, the increase of Hg concentrations at the Br&WS2 impact zone needs to be further followed up, although it should be stressed that concentrations at impact zone were systematically lower than at control zones.

The lack of decreased PCB concentrations from 2005-2011 show the persistency of PCBs, possibly coupled to inputs from Belgian ports or the Scheldt Estuary. PAH contamination was only reduced at Nieuwpoort. This is also the site with lowest disposal intensity and highest reductions in heavy metal concentrations between 2005 and 2011, suggesting that PAH and heavy metal contamination at Nieuwpoort originates from historical pollution.

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**References:** [1] OSPAR, Quality Status Report (2010) *J Soils Sediments* **11**:111-122; [2] Turner (2010) *Marine poll bull* **60**:159-271.