The impact of sacrificial anodes and coatings of inland and marine vessels on water quality in the docks of the port of Antwerp

Svetlana Samsonova, Wim Van Steelandt & Eric de Deckere

The docks in the Port of Antwerp is one of the waterbodies for which the status has to be reported in function of the European Water Framework Directive. The criteria that have to be reached are well described and the Antwerp Port Authority is following up the needs and possible measures to improve the water quality in the docks. For this purpose the continuous monitoring of selected water parameters along with the assessment of the emissions from the diffuse sources are organized in the port area.

The number of specific port activities is monitored and is an integral part of the water emission inventory, such as *shipping, road traffic, railways, engineering structures placed into water or on the shore of a harbour*. The emissions of Zn and Al resulting from corrosion of sacrificial anodes of ships and the emissions of Cu and PAH's caused by the leaching of hull coating products are calculated based on the activity rates and emissions factors for shipping from the year 2010 when 14 887 marine ship visits and 92 759 inland ship visits were registered.

The environmental quality standards (EQS) for water are regulated by the European Water Frame Directive. According to the monitoring data, the metals **Cd**, **Cu**, **Ag**, **Zn** are exceeding the EQS. For PAH's benzo(a)pyrene, sum (indeno(1,2,3-cd)pyrene + benzo-(ghi)perylene), fluoranthene are exceeding the targets. The study reveals the contribution of the diffuse sources in the overall emission picture:

- 899 kg of Al (or 44% of the net emissions of aluminium in the docks)
- **520 kg of Zn** (56%) from sacrificial anodes
- **5 393 kg of Cu** (92%) from coatings of marine vessels
- **11 kg of PAH's** (5%) from coatings of inland vessels with the following distribution: acenaphthene (7%), acenaphthylene (5%), anthracene (6%), benz[a]anthracene (4%), **benzo(a)pyrene** (4%), benzo[b]fluoranthene (4%), **benzo[ghi]perylene** (2%), benzo[k]fluoranthene (4%), chrysene (2%), dibenzo[a,h]anthracene (19%), phenanthrene (1%), **fluoranthene** (1%), fluorene (5%), **indeno[1,2,3-cd]pyrene** (18%), naphthalene (14%), pyrene (5%).

The new water emissions inventory is based on the activity data from the year 2015 and will be released in summer 2017.