Risk assessment & management of polluted sediments in areas with a nautical necessity
A case study from the Port of Antwerp, Belgium
1. Introduction on the specific port situation
2. Environmental sustainable policy on TBT
3. Case study: risk assessment
4. Case study: monitoring campaign turbidity
Introduction on the specific port situation
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Sedimentation: Maintenance dredging in Scheldt & docks

100 km

Port of Antwerp

20 km

Scheldt River + Tidal Docks, cays on Scheldt river (1999 – 2008): 12.5 million m³/y

→ 92% of dredged material stays in Scheldt estuary
→ 8% (sand) is used for different applications
Introduction on the specific port situation

Classic port activities:
• storage and transshipment
• petro chemistry
• container terminals
• 2 shipyards
Environmental sustainable policy on TBT
Environmental sustainable policy on TBT

2.1 Research on BATNEEC
2.2 Port Regulation
2.3 Monitoring program
2005: program leader of TBT CLEAN (Life-environment program) with as main objective the development of an integrated approach for the removal of tributyltin from waterways and ports

2013: cluster on innovating shipyard techniques with stakeholders and support of Flemish government
2.2 Port Regulation on environment friendly anti-fouling
2.3 Intensive monitoring program on sediment quality
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2.3 Intensive monitoring program on sediment quality
Case study risk assessment
Case study: case study risk assessment

3.1 Study area
3.2 Dredging works
3.3 Pollution
3.4 Project objectives
3.5 Results
3.1 Study area:
Port of Antwerp - Right Bank - Hansa Dock

Historical presence of Shipyards
3.2 Dredging works

Maintenance and nautical dredging works: volume of 700,000 m³ sediment
3.3 Pollution

Study area: previous surveys
3.3 Pollution

Synthesis present data:

• Project area for dredging works is polluted with heavy metals (Cu, Pb), mineral oil (MO), tributyltin (TBT), PCBs and naphtalene.

• The pollution with MO and TBT exceeds the scope of the dredging works by 200% (horizontally and vertically).

• No spreading from pollution on landside.

• Because of a remarkable gradient in concentration of MO and TBT in the docks, some additional samples and analysis were executed.
3.3 Pollution

Gradient in concentration of TBT and MO:

Conc. min. olie Natte Dok 3

Concentratie TBT/DBT/MBT (mg/kg, ds)
3.3 Pollution: TBT before dredging works
3.3 Pollution: MO before dredging works
3.4 Project objectives/questions

- Are there increased risks expected during/after the planned dredging?
- Is there a risk of residual contamination?
- Can precautions be taken in order to remove these risks?
- Can environmental costs and profits in order to remove the residual contamination be quantified?
3.5 Results

• Are there increased risks expected during/after the planned dredging?
  o (Re)suspension of polluted sediments (depending on sediment charge, dock currents, ship movements, ...)
  o TBT and MO dissolve to the liquid phase
  o By removing the top layer of less polluted sediment, deeper potentially more polluted layers go in contact with the dock water.
  
  o Additional analytical testing of the sediment load is needed.
3.5 Results

Is there a risk of residual contamination?
- GIS analysis
3.5 Results

Is there a risk of residual contamination: TBT
3.5 Results

Is there a risk of residual contamination: MO
3.5 Results

Approximately 1.940 kg TBT and 1.000.000 kg MO will be dredged

Amount of TBT dredged (kg)
3.4 Project objectives/questions

• Which precautions be taken in order remove the risks?

  - Monitoring turbidity during dredging activities (16/11/2012 → 28/11/2012)
  - Remediate (removing - covering or combination of both) the most polluted zones (wet docks most and embankments)
Case study: Monitoring campaign turbidity
Case study: Monitoring campaign turbidity

4.1 Study area
4.2 Results
4.3 To be investigated
Case study: Monitoring campaign turbidity
4.1 Sampling locations turbidity
4.2 Results: turbidity is limited in time
4.2 Results: turbidity is limited in space
P4 closer to dredging activities vs. P5 away from dredging activities
4.2 Results: turbidity is limited in space
P4 closer to dredging activities vs. P5 away from dredging activities
Lower turbidity after dredging activities
4.3 Has the increase of turbidity (even though limited in time and space) an influence on water quality?

Follow up – resuspension test

• Simulation of dredging events in laboratory conditions
  ▪ Effects of mobilisation of sediments on quality of overlying water in function of time and different mobilisation scenarios
  ▪ To be executed
Thank you for your attention