Sediment monitoring in the Port of Antwerp

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OBJECTIVES
1. Port of Antwerp: Where? What?
2. Trend monitoring program
3. Regular monitoring program
4. Conclusion
Port of Antwerp - intro

- North west Europe
- Distance to the sea: approximately 100 km
Port of Antwerp - intro

Classic port activities:

– storage and transshipment

– petro chemistry

– container terminals

– 2 shipyards
Port of Antwerp - intro

Operational dredging activities:

– river Scheldt: Flemish government

– docks: port authority with own fleet
Sedimentation in tidal zones
Sedimentation in non-tidal zones
Relocation of sediment
Sedimentation of sewer disposal and spillage
Locks

- Annual deposition:
  ~ 550,000 TDM
  ~ 1,200,000 m³

- Deposition caused by contact salty and fresh water

- Dredging for nautical reasons

Sedimentation in the port of Antwerp
Port of Antwerp - intro

Non-process-related reuse:
- Landscaping
- Land restoration

Process-related reuse:
mainly for construction material

Underwater cell (wet dumping)

Dumping on land

Separation and mechanical dewatering

Sediment

Dumping in the waterway

Shore dumping (wet dumping)

(Controlled) dumping (dry dumping)
Port of Antwerp - intro
Port of Antwerp - intro

More info at: www.amoras.be
Trend monitoring program 1

– 2001 ↔ 2010

– Aim:

  – Evolutions in parameters / quality

  – Impact of nautical dredging on sediment quality

  – Impact of harbour activities on sediment quality
Trend monitoring program 1

Method:

- 57 locations on the right bank
- 15 locations on the left bank
- 50 locations nearby harbour activities
Trend monitoring program 1

Method:

- Van Veengrapp
- 4 graps for 1 analysis
- GPS
- Analyses
  - of physical parameters
  - of chemical parameters
- Based on own licenses
- Based on European / Flemish standards
Regular monitoring program in function of dredging activities and the relocation of sediments (program 2)

~ 130 samples/year for 1,000,000 m³ since 1996

Frequently dredged zones
- 2 campaigns a year

Not frequently dredged zones
- 1 campaign a zone

Number of samples based on:
- m² to dredge
- m³ to dredge
- Van Veengrapp Cores! -> difficult
Regular monitoring program in function of dredging activities and the relocation of sediments (program 2)

**Fysical parameters:**
- organic matter
- Clay content
- Grain size distribution

**Chemical parameters:**
- Heavy metals (As, Cd, Cr, Hg, Pb, Ni, Zn)
- PAH’s
- PCB’s
- mineral oil
- pesticides
- TBT – BFR (bromated flame retardants)
- Chlorides and sulfates
- leaching parameters
Monitoring programs results

1. Quality for most parameters gets better

**EOX**

![EOX graph](image1)

**Cadmium**

![Cadmium graph](image2)
Monitoring programs results

Except:

**TBT**

- PoA-zone 28-30
- PoA-zone 31-34
- Linear (Reeks2)

\[ R^2 = 0.0233 \]

**Mineral oil**

- GHA-zone 28-30
- GHA-zone 31-34
- Polynoom (Reeks2)
- Polynoom (GHA-zone 31-34)
- Linear

\[ R^2 = 0.0322 \]

\[ R^2 = 0.348 \]
2. Historical pollution

Left bank ↔ right bank

South ↔ north
3. Relation between concentration and leaching is not clear.
Monitoring programs results

Bottleneck cfr. European waste directive (inert waste):
- Chlorides and sulfates
- Antimony (Sb) leaching
- Mineral oil
Conclusions

1. Relation: harbour activity – sediment quality = difficult
   => Future = establish a “0-situation”

2. Trend monitoring every five years to see evolutions remains important

3. Port of Antwerp = frequent monitoring comparing to other European ports
   ⇒ one European approach!

4. More detailed sampling in order to define:
   - remediations
   - re-use options
   - relation harbour activity v sediment quality

5. Coring remains difficult in silty material