Dredging regulation in Brazil: Management of contaminated sediments

09/08/2015
Part 1: Background Brazilian Dredging Regulation;
  – Resolução Conama 344/04
  – Resolução Conama 454/12

Part 2: Cases Study – South East Brazil
BACKGROUND OF BRAZILIAN REGULATION

Before 2004:

- No dredging regulation
- Each environmental agency used a different criterion
- No pattern (soil Brazilian guidelines or international guidelines even waste guideline)
- No further studies – just sediment chemical analysis

2004

- Published first dredging Regulation: Resolução Conama 344/04.

- Aquatic disposal decision was based on:

  - Chemical analyses:
    - Metallic elements (As, Cd, Pb, Cr, Cu, Zn, Ni, Hg)
    - Organic compounds: PAHs, PCBs and organochlorine pesticides

- Toxicity tests – not specified (whole sediment, elutriate, interstitial water)
• Two action levels (Level 01 – low probability biota effects and Level 02 – higher probability) based on international sediment guidelines:
  o Threshold Effect Level (TEL) / Probable Effect Level (PEL) for freshwater systems (Canada)
  o Effects Range-Low (ERL) / Effects Range-Median (ERM) for marine and estuarine sediments (USA)

• International Guidelines (Level 01 and Level 02) are based on field and laboratory experiments;
• These levels are a first step (line of evidence) on decision process;
• Brazil did not develop own guidelines
Resolução Conama 344/04.

• Results of Chemical characterization were compared with these 2 action levels;
  • < Level → 1 no further investigations;
  • > Level 1 < Level 2 (Some metals and PAHs) or > Level 2 → Toxicity Tests

• Results of toxicity tests – Another line of evidence;

• Generally the decision was made based on chemical analyses and toxicity tests;

• In some cases other studies could be carried on – not specified on Regulation;
Resolução Conama 344/04.

• Based on these Evaluations → Contractor applied for Disposal Permit to Environmental Agency:

  • Ocean Disposal
  • Confined disposal
    • Confined Disposal Facility – CDF
    • Confined Aquatic Disposal - CADs
BACKGROUND OF BRAZILIAN REGULATION

2012
- Revoked 344/04 and publishing of a new legislation - 454/12
- Aquatic disposal decision still based on chemical analyses and toxicity tests

MAIN CHANGES
- Action levels Review: Based on worldwide dredging guidelines and Brazilian database (2004 – 2011)
  - Changes are:
    - As - ↑ national background was higher than former Action Level 1
    - Cd - ↓ Level 2 was above than action levels worldwide
    - Hg - ↑ Levels 1 and 2 were below action levels worldwide
  - PAH sum included 16 priority compounds (13 before)
  - List includes TBT
MAIN CHANGES

• Non-mandatory to analyze the whole list of chemical compounds; parameters selection based on site history – according to environmental agency decision

• Definition of “significant toxic effect” → toxicity >50%

• Introduction of DCU – dredging characterization unit – defined based on dredging plan
Sampling

Dredging
Plan: 5,0 m
excavation

1 sample each meter + a superficial
Total 6 samples each point
Discrete Sampling

5 points 6 layers caract.

Total 30 samples

Gaps Model mapping not suitable Ocean Disposal
Discrete sampling

Increase points and samples

Better model charact. not suitable OD

17 points = 102 samples
Sampling method is chosen by the contractor and approved by Env. Agency → Discrete X DCU

Dredging Characterization Unit

Composite sample

5 DCU → total 30 composite
Fewer samples

Better model mapping suitable or not for OD
MAIN CHANGES

• If Sediment classified **not suitable** for Ocean disposal based on 2 lines of evidence (chemical analyses and toxicity tests)

• Contractor → Possibility to carry on Complementary studies for applying for Ocean disposal
  
  o Bioaccumulation Tests (preferentially Lab. Tests) or field (as an alternative);
  o Sediment Elutriation tests (Lab Tests)
  o Management of the disposal to minimize impacts (e.g. controlled disposal, disposal with diffusor, covering the sediment on disposal area)
Introduction of the Concept: “Beneficial Use of Dredged Material”

- Most of dredged material is clean and suitable for beneficial uses such as beach restoration, shore protection, agricultural uses, habitat enhancement, and many other applications.

- However, this beneficial use was not explored because of costs and the prevailing view that dredged material is waste.

- Regulation encourages the Beneficial Use of Dredged Material and partnership among contractor and other institutions such as Universities, private and public companies.
BACKGROUND OF BRAZILIAN REGULATION

MAIN CHANGES

• Directives for onshore Sediment disposal

• Results are compared with Soil Guidelines based on risk assessment
  • Industrial Scenery
  • Agriculture Scenery
  • Residential Scenery

o Depending on the results and the Soil uses on deposition area:
  o Hydraulic embankment
  o Controlled disposal facility – directly on soil (dike) without contact with groundwater;
  o Confined disposal facility – CDF with soil isolation (High Density Polyethylene – HDPE blanket)
  o Licensed landfill
STUDY CASES

BRAZIL

SP

SP COASTAL AREA

STUDIED AREA

#1

#2

#3
STUDY CASE #1

- Environmental licensing: 2006
- Dredging activities: started 2008
- Total volume to be dredged: about 4.0 million m$^3$ (there still an amount of sediment to be dredged)
- Sediment volume for oceanic disposal – 3.4 million m$^3$
- Sediment confined – about 600,000 m$^3$
  - Technology chosen → Geotextile Tubes

2008: Before dredging

2011: Geotextile tube technology
STUDY CASE #1

- Geobags dewatering cells

- Complementary treatment - effluent had reached the guidelines before releasing to the water body

- After geobags dewatering, the bags were covered

- The area is being used for ship containers

- Geobags units being filled

- First ship uploading equipment
STUDY CASE #2

- Environmental licensing: 2006
- Dredging: 2008 (CDF) 2008-2010 (oceanic disposal)
- Total licensed volume to be dredged: 2,5 million m³
- Sediment volume for oceanic disposal – 1,0 million m³
- Sediment confined – 500,000 m³
  - Technology Chosen → CDF

There is still an amount of sediments to be dredged - on environmental agency process
• 05 cells;
• Filled sequentially;
• Sedimentation/Water clarification;
• Effluent drained to Treatment Station (reach guidelines);

Total área: 410,000 m$^2$
Dike height: 2,5 m
Sediment Deposited height: 2,0 m
STUDY CASE #2

Panoramic view – effluent treatment station

Reagent dosage

Field lab

Reagent addition

Effluent Treatment Station
Examples of Monitoring CDFs or Controlled disposal

Geotechnical monitoring
Evaluation CDF geotechnical stability, isolation, drainage processes.

Groundwater monitoring
To assess the CDFs tightness by monitoring groundwater in wells installed in the vicinity of CDFs.

Effluent and water body (surficial water) monitoring program
To evaluate the effectiveness of the effluent treatment and the water body quality after effluent releasing.
Ocean Disposal Area → Managed by Companhia Docas do Estado de São Paulo (Codesp) – It is the port authority in the state of São Paulo, Brazil.

Ocean Disposal área:
20 miles from coast
10 squares 2 km X 2 km – total area 10 km x 4 km

Liceced by Federal Environmental Agency.

CODESP manage the disposal among several contractors and is responsible for monitoring to Federal Environmental Agency.
OCEANIC DISPOSAL AREA

- Monitoring program

- **Monthly:** metals, PAHs, grain size and toxicity tests with amphipod in the whole sediment

- **Quarterly:** benthic community, **whole list** of contaminants (454 Regulation), grain size and toxicity tests with amphipod in the whole sediment

- **Semiannually:** Chemical analyses (metals, SVOC, PCB, organochlorine pesticides) in aquatic organisms of public interest for consumption. Even if no direct relationship (dredging X chemical findings in organisms) – environmental agency requirement.

- All 10 squares and surroundings are monitored
Bathymetry

✓ Elevation 1 meter – indicator of sediment accumulation

Alternation squares or dredging suspension

✓ Based on chemical analyses and toxicity tests (depends on results and frequency) → dredging disposal must be changed among squares or stop dredging (extreme case).
REFERENCES


WEDA, 2013. Environmental Dredging Award. Available at: <https://www.westerndredging.org/phocadownload/2013EnvironmentalAwards/weda%202013%20embraport%20application.pdf>

Thank you!

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