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Agenda item 7: Technical Guidelines and related Assessments

Summary of Selected Dredgers Technologies

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Explanatory Note by the Secretariat

1. The present document has been prepared by the Secretariat, in line with the request of the Regional Meeting of Experts to review the Draft Desalination and Dumping Protocol Guidelines, held in Loutraki, Greece on 4-6 April 2017, to complete the section on BEP with new dredging technologies for consideration by the MED POL Focal Points meeting. The Meeting request is included in the Meeting Conclusions and Recommendations (see document UNEP(DEPI)/MED WG. 439/Inf.6).

2. The present document thus provides information on different technologies, with the view to support national authorities in reaching the most environmentally friendly decision in case a dumping permit is granted. Information, which is not exhaustive, has been collected from different sources and should be carefully reviewed on a case-by-case basis.

1. Auger (Horizontal Auger, Worm wheel) Dredge

(a) Advantages

-Reported as an ideal instrument to dredge polluted sediments without resuspension of the fines and with a high degree of accuracy.
 -Ability to remove thin layers while retaining mixture density and capacity.
 -Due to the calm and controlled dredging process, there is no significant increase in turbidity. Spillage is limited to millimeters rather than centimeters. These results were obtained during bulk dredging in layers of 0.5 m thickness as well as in clean-up operations in layers of only 0.1 m thickness. Depending on the soil, the maximum layer thickness to be dredged in one cut can be 50 to 70 percent of the outer diameter of the auger, in other words, the auger dredge is suitable for bulk dredging. Small horizontal cutter dredges can accurately cut to 2 inches in depth. Dredging with the auger dredge is a relatively safe method to remove contaminated sediments especially when operating in careful manner (low speed, use cover and screen and not use water jets for sediment loosening etc.).

(b) Dredging Depth: Most of this type dredges are applicable on depth up to 6 meters. Some types could dredge until 35 m.

(c) Production Rates: 45-200 m³/hr. for HAM larger models – up to 800 m³/hr. (density: 1.3 t/m³).

(d) Percent Solids Concentration by Weight (under optimal conditions): 10-30.

2. Bucket wheel Dredge

(a) Advantages: Small bucket wheel dredges can control sediment cuts to 4 inches in depth. Both Auger and Bucket wheel dredges are used widely in USA and Europe for different environmental dredging projects (contaminated sediments removal). Advantage of both types: reasonable accuracy both vertical and horizontal.

(b) Dredging Depth: up to 30 meters (without submersible pump – up to 18-19 m). Transportable medium dredges: 10-15 m. Portable dredges: 6-8 m.

(c) Production Rates:

- portable: 75-450 m³/hr.
- medium transportable: 150-1800 m³/hr.
- large: 500-2500 m³/hr.

(d) Percent Solids Concentration by Weight (under optimal conditions): 10-3

3. Disk-Bottom Drag head (Environmental Disk Cutter)

(a) Advantages:

-The environmental disc cutter can be tilted, enabling a profile to be dredged in a flexible way; Advantages include: Selective and accurate dredging of (contaminated) sediments; Dredging accuracy +/- 10cm; It is equipped with an accurate positioning system (DGPS), which is linked to a monitoring computer (The actual profile to be dredged is defined beforehand in a digital terrain model). This is a powerful feature because contaminated underwater environments are not always flat; Accuracy in delivery level within 10 cm.

-Minimum spill and turbidity (no detectable turbidity of dredged material).

-High solid concentrations.

-Comparing to conventional dredging equipment, dredging of thin layers does not affect the production level.

(b) Dredging Depth: Not indicated in found sources. Supposed to be 15-20m.

(c) Production Rates: 200-300 m³/hr.

(d) Percent Solids Concentration by Weight (under optimal conditions): average concentrations 70%.

4. IHC Environmental Dredge head

(a) Advantages:

- Ability for selective dredging in thin layers. Capable of dredging a layer of 15 to 20cm.
- Minimal disturbance.
- Delivery of the spoil through a pipeline up to 5km ashore. .

(b) Dredging Depth: Up to 15m

(c) Production Rates: 250 - 300 m³/hr.

(d) Percent Solids Concentration by Weight (under optimal conditions): near in-situ.

5. Airtight Grab Bucket Refresher with Pumping System

(a) Advantages:

Water Refresher is a high-density, long-distance, pressure-feeding dredger equipped with an airtight grab bucket fitted with hydraulic pump. The airtight grab bucket reduces the spread of turbidity during dredging, enabling the dredging of high-density sludge. The high-pressure feed pump used in this system enables pressurized long-distance feeding of approximately 10 km.

The system is portable and can be disassembled for overland transportation by a 10-ton truck and trailer. The system can also be operated both in closed-water areas, such as lakes and ponds, and at sea.

(b) Dredging Depth: According to capability of used backhoe dredger (usually up to 15m).

(c) Production Rates: 100 m³/hr.

(d) Percent Solids Concentration by Weight (under optimal conditions): Over 70%.

6. Clean Sweeper (Mud Scraper) High-Density Sludge Dredging Unit

(a) Advantages:

- The dredged soil is of a very high density.
- Little excess water treatment (to provide transportation of high density mix).
- Almost no turbidity.
- The dredged surface can be made level.

(b) Dredging Depth: According to capability of used dredger (usually up to 15m).

(c) Production Rates: Not indicated in found resources. Supposed to be approximately 300-400m³/hr.

(d) Percent Solids Concentration by Weight (under optimal conditions): 70% to 100% at inlet, 70-80% at outlet.

7. Clean-Up Shielded Auger Head

(a) Advantages:

- Low turbidity.
- No resuspension.
- High precision due to modern measuring equipment.
- Released gas removal.
- Highly regarded for its excellent performance in the Clean-Up Method (Patent No 830887 and 846837).

(b) Dredging Depth: Up to 20m.

(c) Production Rates: 380-1,500 m³/hr. According to other sources: 200-450 m³/hr. Differences may be explained by measuring production on various grounds.

(d) Percent Solids Concentration by Weight (under optimal conditions): 30-40%.

8. Pneuma Dredging System

(a) Advantages:

- Low turbidity.
- No re-suspension.
- The system can pump slurry with a relatively high solids content with little generation of turbidity.

(b) Dredging Depth: Demonstrated on depth up to 30 meters depending on the unit selected. Theoretically it may be used on much more depth.

(c) Production Rates: from 40 to 2,000 cubic meters per hour depending on the unit selected. Minimal indicated rate: 45-300 m³/hr.

(d) Percent Solids Concentration by Weight (under optimal conditions): 25-40%.

9. Oozer Dredging System

(a) Advantages:

- Low turbidity.
- No resuspension.
- It does not agitate the bottom sludge, thus preventing sludge from spreading during dredging.
- Can be used for high-density, thin-layer sludge dredging.
- Excellent remote control of dredging conditions and quality.
- Since the swing speed can be adjusted from 0 to 20m/min, the dredge can be effective in removing suspended sediments.

(b) Dredging Depth: Demonstrated up to 18m. Theoretically may be used on more depth.

(c) Production Rates: 340-580 m³/hr.

(d) Percent Solids Concentration by Weight (under optimal conditions): can pump sediments at in-situ density. In literature indicated the minimum rate of 60%.

10. Slope Cleaner

(a) Advantages:

- Ability of removing silt between stones and from slopes.
- Low turbidity.
- Re-suspended silt is separated from environment.

(b) Dredging Depth: Not indicated in available sources. Supposed to be up to 20m accordingly to carrier – backhoe dredger.

(c) Production Rates: about 700 m³/hr.

(d) Percent Solids Concentration by Weight (under optimal conditions): Not indicated in available sources. Supposed to be equal to those of suction dredges (10-15%).

11. Swan 21 High Density Dredging System

(a) Advantages:

- The amount of secondary pollution produced by this unit is extremely low compared with many other high-density sludge dredgers.
- It is possible to dredge mud with a high sludge content.
- The dredged ground surface can be made level.
- Dredging as thin as 30 cm to 50 cm is possible.
- High-density dredging is possible even for silt with a high water content (over 300%).
- The extensive introduction of automation technology has achieved high accuracy, high efficiency, and less requirement of manpower for dredging operations.

(b) Dredging Depth: 3 to 17m.

(c) Production Rates: 140 m³/hr.

(d) Percent Solids Concentration by Weight (under optimal conditions): over 80%.

12. Scoop Head Dredge

(a) Advantages:

- Removal of soft, fine-grained material with a minimum of environmental disturbance.
- Minimum turbidity and addition of transport water.
- High density.
- Accurate horizontal and vertical positioning.
- The angle of the scoop-head with the ladder is adjustable with the help of the support frame.

(b) Dredging Depth: 3-28 m,

(c) Production Rates: At a competitive level to traditional-dredging equipment (cutters, trailers) and it is much better than most of the new dredgers developed for environmental reasons (auger dredge, scraper dredgers, Pneuma dredgers). However it is not indicated exactly in the available sources.

(d) Percent Solids Concentration by Weight (under optimal conditions): Not indicated exactly. Supposed to be about 40%.

The Scoop dredger is an upgraded cutter suction dredger, on which a two-sided drag head is mounted to allow dredging on two opposing swings. It has no rotating cutting devices, so it minimizes turbidity. The Scoop dredger can work at depths from 3-28 m. The angle of the scoop head with the ladder is adjustable.

13. The Eriksson System Contaminated Sediment Removal and Dewatering

(a) Advantages:

- No turbidity generation.
- Elevating practically dry weight sediments due to simultaneous removal and dewatering.
- Cells can be arranged so that only targeted sediment regions are removed. .

(b) Dredging Depth: Not indicated. Supposed to be more than 20m. Theoretically unlimited.

(c) Production Rates: Not indicated.

(d) Percent Solids Concentration by Weight (under optimal conditions): Practically 100% dry weight.

14. Submersible Dredge Pumps

(a) Advantages:

- No turbidity generation.
- Suitable to wide range of material including small stones.
- Portability.
- Universality.

(b) Dredging Depth: Not indicated. Supposed to be about 20m.

(c) Production Rates: Up to 700 m³/hr.

(d) Percent Solids Concentration by Weight (under optimal conditions): Up to 70%.

15. Underwater Archimedean Screw Vehicle

(a) Advantages:

- Low turbidity generation.
- Selective dredging of fine-grained upper layer, releasing sand.
- Portability and maneuverability.
- Ability to work in confined areas, under piers, sips etc.
- Working without personnel contact with contaminated sediments.

(b) Dredging Depth: Not indicated. Supposed to be about 20m.

(c) Production Rates: Up to 76 m³/hr (in-situ).

(d) Percent Solids Concentration by Weight (under optimal conditions): Declared as sufficiently high.

16. Viscous Excavator (Rotary Dredge Cutter head)

(a) Advantages:

- Low turbidity generation.
- Suitable to wide range of viscous material.
- Portability.

(b) Dredging Depth: Depends on dredge.

(c) Production Rates: Depend on dredge. Comparable to those of conventional cutter heads.

(d) Percent Solids Concentration by Weight (under optimal conditions): 50-60%.