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Greece, 4-6 April 2017

**Agenda item 3: Review of Proposed Updated Dumping Protocol Guidelines**

# Updated Guidelines on Management of Dredged Materials

**D R A F T**



UNEP/MAP
Athens, 2017

**Explanatory Note by the Secretariat**

1. The Contracting Parties to the Barcelona Convention at their 19th meeting in Athens, Greece, in 2016 requested the Secretariat to undertake a review of the implementation of the technical guidelines adopted by COP13 under Articles 5 and 6 of the Dumping Protocol to the Barcelona Convention.

2. In view of ensuring synergies, where appropriate, with the London Dumping Protocol which recently issued new/updated generic and specific guidelines, COP19 also requested the Secretariat to update the MAP/MEDPOL respective guidelines taking into account the specificities of the Mediterranean region, the status of the implementation of the Dumping Protocol to the Barcelona Convention as well as the need to ensure a full streamlining of GES and its targets based on the ecosystem approach.

3. In this respect, the Secretariat (MED POL Programme) has worked in two main directions

a) to undertake a simple assessment of dumping activities in the Mediterranean based on the information provided by the Contracting Parties in their reports on measures taken for the implementation of the Dumping Protocol (2005-2013)
b) to draft an updated version of the 2003 MAP/MED POL guidelines on the management of dredged materials

4. The updated guidelines composed of two parts A and B consist of the following:

a) Part A, addressing assessment and management of dredged material, has 7 sections.

b) Sections 1,2,3,4, and 5 are the same as the original guidelines with some textual changes aiming to take into consideration and streamline relevant developments in the MAP legal framework namely the roadmap for implementing the ecosystem approach, the operational objectives, GES definitions and related targets, as well as the Regional Plan on the Management of Marine Litter in the Mediterranean adopted by Decision IG.21/7 COP 18, 2013[1]. The decision-making process has been updated to integrate the basic concept of these updated guidelines which is favoring beneficial use before granting a dumping permit.

c) Section 6 is new, and includes issues to be taken into consideration before taking any decision to grant a dumping permit, addressing beneficial uses of dredged materials which aim to facilitate the application of the provisions of Dumping Protocol considering a new approach to reduce the contamination of the marine ecosystem by dumping of dredged material. In this respect, the updated guidelines recommend the Contracting Parties to limit, as much as possible dumping activities and give priority to beneficial use of dredged materials. The information provided, in this context, is collected and streamlined from different sources which are all cited in the references chapter.

d) Section 7 is an amended and enriched text of Annex III and IV of the original guidelines addressing Best Environmental Practices (BEP) of dumping of dredged material. In the same spirit of section 6 and in view of limiting as much as possible the contamination of marine environment from dumping,

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[1] The sciences of physical and chemical characterization of marine sediments did not exhibit drastic changes except for the instrumental technology used to analyse the sediments, therefore sections 4 and 5 were not subject to major updating. It has also to be noted that the Contracting Parties since 2003 have acquired the knowledge and the know-how related to characterization and normalization procedures and other analytical techniques; therefore, the updated guidelines did not provide ample details about these aspects and consequently Annex I and II of the 2003 original version have been deleted. Nevertheless the references chapter of the updated guidelines include links to several sources of information dealing with the aspects of characterization.

this section provides exhaustive information on BEP's to reduce the contaminants prior to their dumping.

e) Part B, addressing monitoring of dredged materials dumping operations, is almost the same as Part B of the original guidelines. This part is defining the outline for the development of national monitoring programmes for dumping sites before and after dumping in the framework of IMAP and MEDPOL Monitoring Programme in line with IMAP Decision ( IG 22/7, COP 19, 2016) as well as the outline for the assessment of the validity of impact hypothesis.

5. The Secretariat has also prepared an issue paper as an information document on the possibility to consider complementary approaches  to enhance environmental protection from dumping activities. The issue paper introduces the concept of adopting at regional level Upper Thresholds Values, National List of contaminants and National Action Levels for selected trace metals and persistent organic pollutants for dredged materials subject to re suspension, dumping, and relocation with proposed associated national action levels of concentration.

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## List of Abbreviations / Acronyms

| | |
|---|---|
| **BEP** | Best Environmental Practice |
| **Cd** | Cadmium |
| **CDF** | Confined Disposal Facility" |
| **COP** | Conference of the Parties |
| **Cu** | Copper |
| **Cr** | Chromium |
| **DGPS** | Differential Global Positioning System |
| **EIA** | Environmental Impact Assessment |
| **GES** | Good Environmental Status |
| **Hg** | Mercury |
| **IMAP** | Integrated Monitoring and Assessment Programme |
| **MAP** | Mediterranean Action Plan |
| **MED POL** | Programme for the Assessment and Control of Marine Pollution in the Mediterranean Sea |
| **MPA** | Marine Protected Area |
| **Ni** | Nickel |
| **PAH** | Polycyclic Aromatic Hydrocarbons |
| **Pb** | Lead |
| **PCBs** | Polychlorobiphenyls |
| **Sn** | Tin |
| **SPAMI** | Specially Protected Areas of Mediterranean Importance |
| **Zn** | Zinc |

**Introduction**

1. Dredging activities are an essential part of port and harbor activities. Two main dredging categories can be distinguished:

a) Capital dredging, mainly for navigational purposes, to enlarge or deepen existing channel and port areas, or to create new ones; this type of dredging activity also includes some technical activities on the seabed such as trenches for pipes or cables, tunneling, removal of material unsuitable for foundations, or removal of overburden for aggregate extractions;

b) Maintenance dredging, to ensure that channels, berths or construction works are maintained at their designed dimensions.

2. All these activities may produce large quantities of material that have to be commonly environmentally disposed at sea without adverse impacts on the marine and coastal ecosystems of the Mediterranean.

3. It must be also recognised that dredging operations as such may harm the marine environment, especially when they take place in the open sea close to sensitive areas (key habitats, SPAMIs, Marine Protected Areas (MPAs), aquaculture areas, recreational areas, etc.). This is the case in particular when dredging operations have a physical impact (increased turbidity) or lead to the re-suspension or the re-releasing of major pollutants (heavy metals, organic or bacterial pollutants).

4. Dredging operations may result in the re-mobilization of buried pollutants and their suspension, which may, at certain levels, have an adverse impact on the environment, either at sea during dredging or clapping when these sediments are submerged, or on land when these sediments are stored. Dredging can also result in hydromorphological and hydrographic changes to dredged areas and have a more global impact on disposal sites or onshore management.

5. In the above context, the Contracting Parties are urged to exercise control over dredging operations in parallel with that exercised over dumping. Beneficial uses and use of Best Environmental Practice (BEP) for dredging activities are essential pre-condition for dumping, in order to dispose on land and/or minimise the quantity of material that has to be dredged and the impact of the dredging and dumping activities in the maritime area.

6. On the other hand, dredging can have positive environmental effects and externalities. In fact, dredged materials can be integrated, under certain conditions and subject to the existence of a local market, into treatment systems allowing their exploitation, in particular in building materials. They can also be used to recharge beaches in the fight against erosion of the coastline and thus come as an alternative to other more harmful disposal methods. Finally in the case of sediment pollution, dredging can be a removal solution that decontaminates the marine environment, but with the risk of transfering the problem to the land.

7. The basic principle of these updated Guidelines is that immersion or re-suspension of dredging sediments in the coastal zone of the Mediterranean is **undesirable and should be avoided as much as possible**, in order to avoid the deterioration of the Good Environmental Status and or maintain its good status in relation to a number of relevant MAP ecosystem approach based Ecological Objectives and related Operational Objectives and GES targets (1, 2, 2.1, 2.2, 5.1,5.2, 7.1, 7.2, 7.3, 8.1, 9.1,9.2,9.4,10.2) as adopted in 2013 by COP 18 (Decicion IG.21/3). Therefore **land management should be primarily and ultimately considered before any decision on dumping at sea**.

8. The updated guidelines also provide ample information and links related to land disposal and low cost treatment and disposal options[2].

## I. SCOPE OF THE APPLICATION OF THE GUIDELINES

9. Several Articles of the Dumping Protocol[3] provide ground base for the development of the guidelines. Under Article 4.1 of the Protocol, the dumping of waste and other matter is prohibited. Nevertheless, pursuant to Article 4.2 (a) of the Protocol, this principle may be waived and the dumping of dredged material authorized under certain conditions. Under Article 5, dumping requires a prior special permit from the competent national authorities.

10. Furthermore, in accordance with Article 6 of the Protocol, the permit referred to in Article 5 shall be issued only after careful consideration of the factors set forth in the Annex to the Protocol. Article 6.2 provides that the Contracting Parties shall draw up and adopt criteria, guidelines and procedures for the dumping of wastes or other matter listed in Article 4.2 so as to prevent, abate and eliminate pollution. In addition, the Protocol recognizes the importance of on land beneficial uses and BEPs as important steps before granting a dumping permit by relevant authorities.

11. In accordance with Article 9 (8) of the Regional Plan on the Management of the Marine Litter in the Mediterranean, the Contracting Parties should apply by the year 2020 the cost effective measures to prevent any marine littering from dredging activities taking into account the relevant guidelines adopted in the framework of Dumping Protocol of the Barcelona Convention.

12. In this context, the updated Guidelines for the Management of Dredged Materials, provide guidance to the Contracting Parties on the fulfilment of their obligations related to:

(a) the issue of permits for the dumping of dredged material in accordance with the provisions of the Protocol; and Article 9 (8) of the Regional Plan on the Management of the Marine Litter in the Mediterranean
(b) monitoring, sampling and assessment methods consistent with IMAP Decision
(c) transmission to the Secretariat of reliable data on the inputs of contaminants by the dumping of dredged material and other harmful impacts on marine and coastal ecosystems.

13. The updated guidelines are designed to allow Contracting Parties to manage dredged material without polluting the marine environment. In accordance with Article 4.2 (a) of the Dumping Protocol, these updated guidelines relate specifically to the dumping of dredged material from ships and aircraft. They do not concern either dredging operations or the disposal of dredged material by methods other than dumping.

14. The updated guidelines are presented in two parts. Part A deals with the assessment and management of dredged material, while part B provides guidance on the design and conduct of monitoring of marine dumping sites.

15. The updated guidelines commences with a guidance on the conditions under which permits might be issued. Sections 4, 6 and 7 address the relevant considerations related to the characteristics, composition of the dredged material and priority is given to beneficial uses and low cost treatment of dredged material (part A). In case dumping at sea is to be considered, guidance on the monitoring of

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[2] In this respect advice is available from a number of international organisations, including the Permanent International Association of Navigation Congresses (PIANC) 1986: Disposal of Dredged Material at Sea (LDC/SG9/2/1). Through its Environmental Policy Framework and close links with industry in developing Cleaner Industrial Production Technologies, the United National Industrial Development Organisation (UNIDO) is able to offer expert advice and training to enhance capabilities to develop an integrated management plan for dredged waste materials.
[3] Amended text of 1995

the dumping site is provided in part B. The references provide extensive information, among others, on analytical techniques and normalization procedures which could be used by national authorities to implement these updated Guidelines.

## II. CONDITIONS UNDER WHICH PERMITS FOR DUMPING OF DREDGED MATERIAL MAY BE ISSUED

### PART A ASSESSMENT AND MANAGEMENT OF DREDGED MATERIAL

#### 1. Characterization of dredged material

16. For the purpose of these updated guidelines, the following definition[s] apply[ies]:
"dredged material" means any sedimentary formation (clay, silt, sand, gravel, rocks, and any indigenous parent rock material) removed from areas that are normally or regularly covered by sea water, by using dredging or other excavation equipment; For any other relevant definition, the text of Art. 3 of the Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircrafts or Incineration at Sea, applies.

#### 2. Disposal of dredged material

17. In the vast majority of cases, dumping harms the natural environment so before taking any decision to grant a dumping permit other methods of disposal should be considered. In particular, all possible beneficial uses of dredged material should be primarily and ultimately assessed and (see section 6) considered before granting dumping at sea permit.

#### 3. Decision making process

18. In case where, after exploring all possibilities of beneficial use of dredged materials according to section 6 of part A of these updated guidelines, dumping operations at sea should be considered, it is recommended to select proper dumping sites to maintain GES for the Mediterranean sea and to minimise the impact on commercial areas, MPA's, SPAMII's, key habitats and recreational fishery areas. This approach is a major consideration in resource protection and is covered in greater detail in Part C of the Annex to the Protocol.

19. In order to define the conditions under which permits for the dumping of dredged material may be issued, the Contracting Parties should develop on a national and/or regional basis, as appropriate, a decision-making process (Fig .1) for evaluating the properties of the material and its constituents, having regard to the protection of human health and the marine environment.

20. The decision-making process, for dumping at sea of dredged materials, is based on a set of criteria developed on a national and/or regional basis, as appropriate, which meet the provisions of Articles 4, 5, and 6 of the Protocol and are applicable to specific substances. These criteria should take into consideration the experience acquired on the potential effects on human health and the marine environment.

21. These criteria may be described in the following terms:
(a) physical, chemical and geochemical characteristics (e.g. sediment quality criteria);
(b) application of beneficial use decision-making approach as mentioned in section 6 of part A of these guidelines;
(c) biological effects of the products of the dumping activity (impact on marine ecosystems);
(d) reference data linked to particular methods of dumping or to dumping sites;
(e) environmental effects that are specific to dumping of dredged material and are considered undesirable outside and/or in close proximity to the designated dumping sites;

(f) the contribution of dumping to already-existing local contaminant fluxes (flux criteria);

22. Criteria should be derived from studies of sediments that have similar geochemical properties to those to be dredged and/or to those of the receiving system. Depending upon the natural variation in sediment geochemistry, it may be deemed necessary to develop individual sets of criteria for each area in which dredging or dumping is conducted.

23. The decision-making process, with respect to the background natural baseline reference levels and to some specified contaminants or biological responses and with the aim to maintain GES as adopted in 2013, may lay down an upper and a lower reference threshold, giving rise to three possibilities:

(a) material which contains specified contaminants or which causes biological responses in excess of the relevant upper threshold should generally be considered as unsuitable for dumping at sea;
(b) material which contains specified contaminants or which causes biological responses below the relevant lower threshold should generally be considered of low environmental concern for dumping at sea;
(c) material of intermediate quality should be subject to more detailed assessment before suitability for dumping at sea can be determined.

24. When the criteria and the associated regulatory limits cannot be met (case (a) above), a Contracting Party should not issue a permit unless detailed consideration in accordance with Part C of the Annex to the Protocol indicates that dumping at sea is, nonetheless, the least detrimental option, compared with other disposal techniques. If such a conclusion is reached, the Contracting Party should:

(a) implement a programme for the reduction at source of pollution entering the dredged area, where there is a source that can be reduced by such a programme, with a view to meeting the established criteria;
(b) take all practical steps to mitigate the impact of the dumping operation on the marine environment including, for example, the use of containment (capping) or treatment methods;
(c) prepare a detailed marine environment impact hypothesis;
(d) initiate monitoring (follow-up activity) designed to verify any predicted adverse effects of dumping, in particular with respect to the marine environment impact hypothesis;
(e) issue a specific permit;
(f) report to the Organisation on the dumping which has been carried out, outlining the reasons for which the dumping permit was issued.

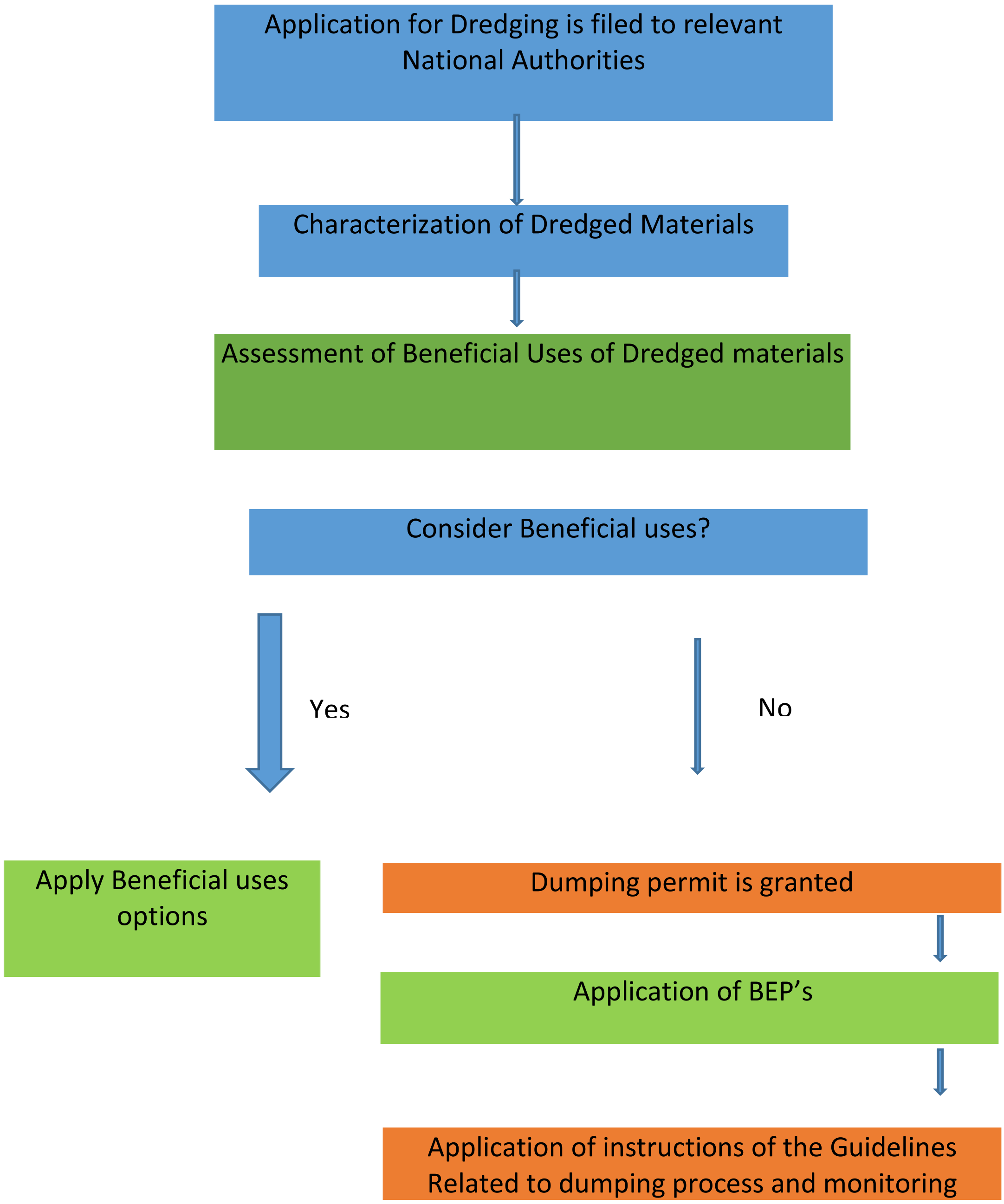


Figure (1) Decision making process of the updated guidelines

25. Additional criteria for evaluating the need for dumping and alternatives to dumping are provided herewith to assist the national authorities in the decision making process This paragraph introduces detailed factors, to determine the evaluation of the need for dumping, and alternatives to dumping. They are therefore to be evaluated, if applicable, for each proposed dumping on an individual basis using information included in these updated guidelines.

26. The need for sea dumping is to be determined by evaluation of the following factors:

(a) Degree of treatment -useful and feasible- for the dredged materials to be dumped and whether or not it has been or will be treated to this degree before dumping;
(b) The relative environmental risks, impact and cost for dumping as opposed to other feasible alternatives as mentioned in section 6 of part A of these updated Guidelines.
(c) Irreversible or irretrievable consequences of the use of alternatives to dumping.

27. A need for dumping is considered to have been demonstrated when a thorough evaluation of the factors listed above has been made, and the relevant authorities, as the case may be, have determined that the following conditions exist, where applicable:

(a) There are no practicable improvements which can be made in process technology or in overall possible treatment to reduce the adverse impacts of the dredged materials on the marine ecosystems;
(b) There are no practicable beneficial use alternatives which have less adverse environmental impacts or potential risk than dumping.
(c) Treatment alternatives or improvements in processes and alternative methods of disposal are practicable when they are available at reasonable incremental cost and energy expenditures, which need to be competitive with the costs of dumping, taking into account the environmental benefits derived from such activity, including the relative adverse environmental impacts associated with the use of alternatives to dumping.

28. Impacts of the Proposed Dumping on Esthetic, Recreational and Economic Values are determined on an individual basis using the following considerations:

(a) Potential for affecting recreational use and values of sea waters, inshore waters, beaches, or shorelines;
(b) Potential for affecting the recreational and commercial values of living marine resources;
(c) For all proposed dumping, full consideration will be given to such non quantifiable aspects of esthetic, recreational and economic impact, such as:

(i) Responsible public concern for the consequences of the proposed dumping;
(ii) Consequences of not authorizing the dumping including without limitation, on esthetic, recreational and economic values with respect to the municipalities and industries involved.

29. The assessment of the potential for impacts on esthetic, recreational and economic values is based on an evaluation of the appropriate characteristics of the material to be dumped, allowing for conservative rates of dilution, dispersion, and biochemical degradation during movement of the materials from a disposal site to an area of significant recreational or commercial value. The following specific factors are to be considered in making such an assessment:

(a) Nature and extent of present and potential recreational and commercial use of areas which might be affected by the proposed dumping;
(b) Existing water quality, and nature and extent of disposal activities, in the areas which might be affected by the proposed dumping;
(c) Applicable GES's values and its targets and assessment criteria;

(d) Visible characteristics of the materials (e.g., color, suspended particulates) which result in an unacceptable esthetic nuisance in recreational areas;
(e) Presence in the material of pathogenic organisms which may cause a public health hazard either directly or through contamination of fisheries or shellfisheries;
(f) Presence in the material of toxic chemical constituents released in volumes which may affect humans directly;
(g) Presence in the material of chemical constituents which may be bioaccumulated or persistent and may have an adverse effect on humans directly or through food chain interactions;
(h) Presence in the material of any constituents which might significantly affect living marine resources of recreational or commercial value.

**4. Assessment of the characteristics and composition of the dredged material**

a) Physical characterisation

30. For all dredged material to be dumped at sea, the following information should be obtained:
(a) quantity of dredged material (gross wet tonnage);
(b) method of dredging (mechanical dredging, hydraulic dredging, pneumatic dredging, and application of BEP's);
(c) rough preliminary determination of sediment characteristics (i.e. clay/silt/sand/gravel/rock).

b) Chemical and biological characterisation

31. In order to assess the capacity of the site to receive dredged material, both the total amount of material and the anticipated or actual loading rate at the dumping site should be taken into consideration. Chemical and biological characterisation is also needed to fully assess the potential impact. Information may be available from existing sources, for example from field observations on the impact of similar material at similar sites, or from previous test data on similar material tested not more than five years previously, and from knowledge of local discharges or other sources of pollution, supported by a selective analysis. In such cases, it may be unnecessary to measure again the potential effects of similar material in the vicinity.

32. Chemical, and as appropriate biological, characterisation will be necessary as a first step in order to estimate gross loading of contaminants, especially for new dredging operations. The requirements for the elements and compounds to be analysed are set out in Section 5. The purpose of testing under this section is to establish whether the dumping at sea of dredged material containing contaminants might cause undesirable effects, especially the possibility of chronic or acute toxic effects on marine organisms or human health, whether or not arising from their bioaccumulation in marine organisms and especially in food species.

33. The following biological test procedures might not be necessary if the previous physical and chemical characterisation of the dredged material and of the receiving area, and the available biological information, allows an assessment of the environmental impact on an adequate scientific basis.

If, however:

(a) the previous analysis of the material shows the presence of contaminants in quantities exceeding the upper reference threshold in paragraph 23 (a) above or of substances whose biological effects are not understood,
(b) if there is concern for the antagonistic or synergistic effects of more than one substance,
(c) or if there is any doubt as to the exact composition or properties of the material, it is necessary to apply suitable biological test procedures.

34. These procedures, which should involve bio-indicators species may include the following:

(a) acute toxicity tests;
(b) chronic toxicity tests capable of evaluating long-term sub-lethal effects, such as biotests covering an entire life cycle;
(c) tests to determine the potential for bioaccumulation of the substance of concern;
(d) tests to determine the potential for alteration of the substance of concern.

35. Substances in dredged material may undergo physical, chemical and biochemical changes when deposited in the marine environment. The susceptibility of dredged material to such changes should be considered in the light of the eventual fate and potential effects of the dredged material. This may be reflected in the impact hypothesis and also in the monitoring programme.

c) Exemptions

36. Dredged material may be exempted from the testing referred to in paragraphs 31 to 34 of these guidelines if it meets one of the criteria listed below; in such cases, the provisions of the Parts B and C of the Annex to the Protocol (see Sections 6 and 7 below) should be taken into account.

(a) dredged material is composed almost exclusively of sand, gravel or rock; such materials are frequently found in areas of high current or wave energy, such as streams with large bed loads or coastal areas with shifting bars and channels;
(b) dredged material is composed of previously undisturbed geological material;
(c) dredged material is suitable for beneficial uses and is composed predominantly of sand, gravel or shell, with particle sizes compatible with information included in section 6-part A of these updated guidelines.

37. In the case of Capital dredging projects national authorities may, taking into account the nature of the material to be dumped at sea, exempt part of that material from the provisions of these guidelines, after representative sampling. However, Capital dredging in areas which may contain contaminated sediments should be subject to characterisation in accordance with these guidelines, notably paragraph 33.

**5. Guidelines on dredged material sampling and analysis**

a) Sampling for the purpose of issuing a dumping permit

38. For dredged material which requires detailed analysis (i.e. which is not exempted under paragraph 36 above), the following guidelines indicate how sufficient analytical information may be obtained for the purpose of issuing a permit. Judgment and knowledge of local conditions will be essential in the application of these guidelines to any particular operation (see paragraphs 49 and 50).

39. An in situ survey of the area to be dredged should be carried out. The distribution and depth of sampling should reflect the size of the area to be dredged, the amount to be dredged and the expected variability in the horizontal and vertical distribution of contaminants. In order to evaluate the number of samples to be analysed, different approaches might be retained.

40. The table that follows gives an indication of the number of samples to be analysed in relation to the number of m3 to be dredged in order to obtain representative results, assuming a reasonably uniform sediment in the area to be dredged.

| Amount dredged (m3 in situ) | Number of stations |
|---|---|
| Up to 25000 | 3 |
| from 25 000 to 100 000 | 4-6 |
| from 100 000 to 500 000 | 7-15 |

| | |
|---|---|
| from 500 000 to 2 000 000 | 16-30 |
| > 2 000 000 | extra 10 per million m3 |

41. Core samples should be taken where the depth of dredging and the expected vertical distribution of contaminants warrant; otherwise a grab sample is considered appropriate. Sampling from the dredger is not acceptable.

42. Normally, the samples from each location should be analysed separately. However, if the sediment is clearly homogeneous with respect to sediment features (grain-size fractions and organic matter load) and expected level of contamination, it may be possible to take composite samples from adjacent locations, two or more at a time, provided care has been taken to ensure that the results give a justified mean value for the contaminants. The original samples should be retained until the procedure for the issue of a permit has been completed, in case the results indicate that further analysis is necessary.

b) Sampling in the case of the renewal of a dumping permit

43. If a survey indicates that the material is essentially below the lower reference threshold in paragraph 23 (b) above and no new events of pollution have taken place indicating that the quality of the material has deteriorated, surveys need not be repeated.

44. If the dredging activity involves material with a contaminant content between the upper and lower reference thresholds in paragraph 23 (a) and (b) above, it may be possible, on the basis of the initial survey, to reduce either the number of sampling stations or the number of parameters to be measured. However, sufficient information must be provided to confirm the initial analysis for the purpose of issuing a permit. If such a reduced sampling programme does not confirm the earlier analysis, the full survey should be repeated.

45. However, in areas where there is a tendency for sediments to show high levels of contamination, or where contaminant distribution changes rapidly in response to varying environmental factors, analysis of the relevant contaminants should be frequent and linked to the permit renewal procedure.

c) Provision of Input Data

46. The sampling scheme described above provides information for the purpose of issuing permits. However, the scheme can at the same time provide a suitable basis for estimating of total inputs and, for the time being in the current situation, can be considered the most accurate approach available for this purpose. In this context it is assumed that materials exempt from analysis represent insignificant inputs of contaminants and therefore it is not necessary to calculate or to report contaminant loads.

d) Parameters and methods

47. Since contaminants concentrate mainly in the fine fraction (> 2 mm) and even more specifically in the clay fraction (> 2 mm), analysis should normally be carried out on the fine fraction sample (> 2 mm). It will also be necessary, in order to assess the likely impact of contaminant levels to provide information on:

(a) grain size fractions (% sand, silt, clay);
(b) load of organic matter;
(c) dry matter (% solids).

48. In those cases where analysis is required, it should be mandatory for primary metal substances With respect to organochlorines, polychlorobiphenyls (PCBs) should be analysed on a case-by-case basis in non-exempt sediments because they remain a significant environmental contaminant. Other organohalogens should also be measured if they are likely to be present as a result of local inputs.

49. In addition, the authority responsible for issuing permits should carefully consider specific local inputs, including the likelihood of contamination by arsenic, polycyclic aromatic hydrocarbons (PAH) and organotin compounds. The authority should make provision for the analysis of these substances as necessary.

50. The following should be taken into account in this connection:

(a) potential routes by which contaminants could reasonably have been introduced into the sediments;
(b) probability of contamination from agricultural and urban surface run-off;
(c) spills of contaminants in the area to be dredged, in particular as a result of port activities;
(d) industrial and municipal waste discharges (past and present);

51. Further guidance on the selection of determinants and methods of contaminant analysis under local conditions, and on procedures to be used for harmonisation and quality assessment purposes, will be found in the Technical Annexes to these guidelines as adopted, and updated periodically, by the Contracting Parties.

52. National relevant authorities are the ultimate responsible for the application of national normalized and standardized methods for sampling and analysis of determinants. References include information that could be consider in this matter.

## 6. Considerations before taking any decision to grant a dumping permit

### *6.1 Dredging Operations*

53. Dredging operations may result in the re-mobilization of buried pollutants and their suspension, which may, at certain levels, have an adverse impact on the environment, either at sea during dredging or clapping when these sediments are submerged, or on land when these sediments are stored. Dredging can also result in hydromorphological and hydrographic changes to dredged areas and have a more global impact on disposal sites or onshore management.

54. On the other hand, dredging can have positive environmental effects and externalities. In fact, dredged materials can be integrated, under certain conditions and subject to the existence of a local market, into treatment systems allowing their exploitation, in particular in building materials. They can also be used to recharge beaches in the fight against erosion of the coastline, and thus come as an alternative to more structural solutions. Finally, in the case of sediment pollution, dredging can be a removal solution that decontaminates the marine environment, but transfers the problem to the land.

55. It is important, while assessing the value of sediment as a resource, to consider opportunities for beneficial uses of dredged material, taking into account the physical, chemical and biological characteristics of the material. Generally, a characterization carried out in accordance with part A of these updated Guidelines will be sufficient to match a material to possible beneficial uses in water, at the shoreline and on land.

### *6.2 Classifications of Dredged materials*

a) Rock

*56.* Rock may vary from soft marl via weak rocks (for example, sandstone and coral) to hard rocks (such as granite and basalt). Rock may also vary in size from large to small, depending on the dredging equipment used and the type of material. Rock may also result from blasting, cutting, or ripping and is seldom of only one material type. Whether the rock can be used economically depends on its quantity and size. Rock is a valuable construction material and may be used for both terrestrial and aquatic projects. Usually, dredged rock is not contaminated.

b) Gravel and Sand

57. Gravel and sand (granular) are generally considered the most valuable materials derived from a dredging project. Gravel and sand are suitable for most engineering uses without processing. Some additional processing (such as freshwater washing) may be needed for certain agricultural or product uses. Granular material can be used for beach nourishment, parks, turtle nesting beaches, bird nesting islands, wetlands restoration and establishment, and many other applications. Granular material is usually not contaminated.

c) Consolidated Clay

58. Consolidated clay varies from hard to soft clay and is material obtained from capital dredging. The material may occur as lumps or as a homogeneous mixture of water and clay, depending on the material type and the dredging equipment used. If the water content is high, dredged clay may have to be dewatered before being transported. Possible uses of consolidated clay range from forming industrial products, such as bricks and ceramics, to building erosion control structures, such as dikes and berms. Consolidated clay is not usually contaminated.

d) Silt/Soft Clay

59. Silt and soft clay are the most common materials acquired from maintenance dredging in rivers, canals, and ports. These materials are most suitable for agricultural purposes (such as topsoil) and all forms of wildlife habitat development. Depending on national regulations and laws, mildly contaminated silt and soft clay may be used for some engineered uses or product uses such as bricks, tiles, and ceramics. Because of the high water content, silt and soft clay must be dewatered for any product use. Dewatering can require months or years and, depending on the draining process used, can require temporary storage.

e) Mixture (rock/sand/silt/soft clay)

60. Capital dredged material usually occurs in layers as deposited from some past hydraulic process and may require the use of different dredging methods. Maintenance dredged material is usually a mixture of materials such as boulders, lumps of clay, gravel, organic matter, and shells, with varying densities. Even though engineered and product uses will be somewhat restricted because of the mixture, mixed material may be used for a wide range of beneficial uses, such as land reclamation, habitat improvement, and landfill capping.

### *6.3 Beneficial uses and Low Cost Treatment*

61. Beneficial use may be defined as "any use alternatives which prevent the dumping of dredged materials at Sea". A great variety of options are available, and the main types can be distinguished as follows: coastal protection, e.g. beach nourishment, onshore/offshore feeding, managed retreat; agriculture, horticulture, forestry; habitat development or enhancement, e.g. aquatic habitats, bird habitats, mudflats, wetlands; amenity development or enhancement, e.g. landscaping; raising low-lying land; land reclamation, e.g. for industrial development, housing, infrastructure; production of construction material, e.g. bricks, clay, aggregates and ; construction works, e.g. foundation fill, dikes. Operational feasibility, that is, the availability of suitable material in the required amount at a particular time, is a crucial aspect of many beneficial uses

a) Beach Nourishments

62. The influences of waves and tidal currents keep beach material in continuous motion. Where the prevailing wave direction is at an angle to the beach of less than 90 degrees, some material will be moved along the beach or foreshore or even offshore in a process called littoral transport. This movement is most rapid under storm conditions. If the moved material is not replaced, the beach and eventually the shoreline will erode. If lost beach material is not replaced naturally, beach nourishment may be necessary to enhance the beach profile and moderate the wave climate at the shoreline. In addition to the improvement of beaches for coast protection, improvement may also be required for recreation beaches. Recreation beaches may be improved or new beaches may be created. Dredging can supply the required large quantities of sand and gravel-sized material for beach nourishment. A life span of 10 years is a common design target for many beach nourishment schemes but a shorter life may be acceptable, particularly where the cost of nourishment material is low.

*Recommended materials: Gravel and Sand.*

b) Berm Creation

63. Dredged material may be used for creating berms or embankments to modify shoreline wave climate and thus improve beach stability. The berm may also be designed to alter wave direction and modify the rate or direction of local sediment transport. Generally, the berm is aligned roughly parallel to the beach, but the optimum alignment at a specific site will be determined by the direction of the most destructive wave climate.

64. The formation of berms may provide a particularly attractive use for a wide range of dredged material. Because the berm is generally a submerged formation, most or all of the formation usually can be created by the bottom discharge of dredged material from hoppers. Berms may gradually erode and be dispersed, but the dispersed material will probably benefit the local coastal regime, either through beach feeding or by increasing foreshore levels.

65. Modification of the wave climate by berms may also improve recreational opportunities for surfing, swimming, sailing, and other activities. Care must be taken in placement of the berm to avoid interference with other users such as fisheries, ports, harbors, outfalls, and intakes.

*Recommended Sediment Types: rock,gravel and sand, consolidated clay and mixture*

c) Capping

66. Capping involves the placement of clean dredged material over a deposit of contaminated dredged material in open-water or upland locations as a means of isolating the contaminated sediment from the surrounding environment. Open-water caps provide a wave-and current-resistant layer on top of previously deposited contaminated materials. Sand, clay, or mixed materials may be used for open-water capping, whereas clay is usually most suitable for upland locations.

d) Land Creation

67. Land creation using dredged material includes filling, raising, and protecting an area that is otherwise periodically or permanently submerged. The creation of coastal land may also involve constructing a perimeter enclosure for protection against erosion by waves and currents. This may not be necessary in estuarine waters or in other sheltered coastal locations that have a small tidal range. Coarse or fine dredged material may be used in land creation. The suitability of a particular dredged material for land creation will depend largely on the intended use of the land. Material from maintenance dredging is usually silt or sand, while material from capital dredging may be of almost

any kind or may be mixed. Sometimes the fine-grained material may be separated from the coarse material and the two resulting materials used in different ways.

68. Fine material will require a long time to drain and consolidate; therefore, the strength achieved may be low. Land created using these fine-grained materials may be limited to recreational uses, such as parks, or uses where the imposed loads will be small. If land must be created rapidly, material from capital dredging are primarily used. Where longer development times are acceptable, materials from maintenance dredging may also be used. Land created for industrial development or to accommodate roads or railways normally requires only sand or coarser material. Often the constraints of time and the availability of suitable material limit the use of dredged material in land creation. Such constraints may be overcome by long-term planning, which provides for land creation over extended periods. Land creation may also be constrained by compelling environmental considerations.

*Recommended Sediment Types: rock, gravel and sand, consolidated clay, silt/soft clay, mixture*

e) Land Improvement

69. Dredged material may be used for land improvement when the quality of existing land is not adequate for a planned use or where the elevation of the land is too low to prevent occasional flooding. As with land creation, the suitability of a particular dredged material for land improvement will depend largely on the intended use of the improved land.

70. Proven methods have been developed for land improvement by filling with the fine material, such as silts and clays, produced by maintenance dredging. Various dewatering techniques may be utilized, such as: subdividing the placement area to allow filling to a limited depth on a rotational basis; reworking the filled area with low ground-pressure agricultural or earth-moving equipment; and mixing coarse-grained material with the fine-grained upper layer.

71. Dredged material of fluvial origin is primarily eroded top soils and organic matter that may be used on land of poor agricultural quality to improve the soil structure. Even material dredged from a saline environment may, after treatment, be suitable for use as topsoil. Mildly contaminated soils can be used for non consumptive land uses. Land improved using fine material is generally of lower strength than land improved using coarse-grained material. Potential applications include dairy and arable farming, recreation areas, playing fields, golf course, parks, light residential development or light commercial storage areas.

*Recommended Sediment Types: rock, gravel and sand, consolidated clay, silt/soft clay, mixture.*

f) Replacement Fill

72. Dredged material may be used as a replacement fill when the physical qualities are superior to soils near the dredging site. In industrial fill sites, peat and clayish soils are usually removed and replaced by sand or other granular dredged material to improve physical properties needed to meet building requirements. Weak soils may be replaced with sand from construction of tunnels, bridges, fairways, and ports. Fine-grained soils do not have the necessary physical properties for industrial fill in most civil works projects; however, green areas or parks may be suitable applications. Some examples of replacement fills include:

(a) Filling holes in the landscape left from gravel or clay mining.
(b) Removal of soft layers so that an area is reclaimed with dredged sand.
(c) Trenching peat or soft clay and filling with sand to get a more stable layer of soil; for example, for abutments, tunnels, roads, and railways.
(d) Filling obsolete canals and docks to improve the use of the land.

*Recommended Sediment Types: rock, gravel and sand, mixture*

g) Shore Protection

73. Shore protection methods include dike construction as well as beach nourishment and underwater berms, which were discussed earlier. Dike construction may use dredged material in the form of a pumped sand, directly dredged clay material, or rock. Rock produced by dredging may be used as riprap slope protection, armor stone, groins, or breakwater core material. Dredging does not usually produce large quantities of rock, but where it does, a range of useful engineering applications exists. *Recommended Sediment Types: rock, gravel and sand, consolidated clay*.

h) Construction Materials

74. Some dredged material can be used as construction material. In some parts of the world, dredging to obtain construction material is a common practice. Because of the growing demand for construction materials and dwindling inland resources, this may be an important beneficial use. In many cases, dredged material consists of a mixture of sand and clay fractions, which requires some type of separation process. Dewatering may also be required because of high water content.

75. Depending on the sediment type and processing requirements, dredged material may be used as: concrete aggregates (sand and gravel); backfill material or in the production of bituminous mixtures and mortar (sand); raw material for brick manufacturing (clay with less than 30 per cent sand); ceramics, such as tile (clay) pellets for insulation or lightweight backfill or aggregate (clay); raw material for the production of riprap or blocks for the protection of dikes and slopes against erosion (rock, mixture); and raw material for the production of compressed blocks for security walls at military installations and for gated communities and home subdivisions.

*Recommended Sediment Types: rock, gravel, sand, silt, clay, mixture*

i) Decorative Landscaping Products

76. Dredged material can be blended with recycled residual materials such as glass, gypsum, plastic bottles, and automobile interiors, etc. to manufacture statues, figures, garden benches, stepping patio pavers, plant vases, artificial rocks and water fountains. These products can be used to landscape gardens, backyards, swimming pool environments, monument stones, miniature golf courses, highway rest areas, tourist welcoming centers, zoos, and theme parks such as Disney World.

*Recommended Sediment Types: sand, silt, clay, mixtures*

j) Topsoil

77. Maintenance dredging in harbours, access channels, and rivers produce mixtures of sand silt, clay and organic matter that can be excellent ingredients for topsoil. Some dredged materials may be excellent topsoil as they are. Other dredged material may require blending with other residual materials such as organic matter (yard waste, wastepaper, storm debris, etc.) and bio-solids (human sewage sludge or animal manure) to manufacture enhanced fertile topsoil. The dredged material may be used to improve soil structure for agricultural purposes. For production of food, uncontaminated material must be used. For other uses, the allowed contaminant level will depend on the use of the

topsoil. In some cases, suitable material may be placed in a thin layer directly by pumping. After dewatering, the material is suitable topsoil for seeding and planting.

78. Dewatering may require several years, depending on the granular texture of the dredged material and is influenced by additional substances or by the type of dewatering process. Dredged material from coastal or tidal areas will require special attention to salinity, since most agricultural species can not tolerate and grow in salty soil. Salinity may be reduced naturally by rain or by the dewatering process. Other uses of topsoil might include using dredged material to cap poor soils or to cover a fill of coarse material (e.g., urban or industrial waste sites). Dredged material can also be used in the manufacture of blended artificial topsoil products. The blended topsoil can be used for athletic fields such as sport fields and ball fields, home landscaping, golf courses, parks, brownfield redevelopment, etc. Required topsoil specifications for a specific use can be met through blending appropriate materials together in specific amounts.

*Recommended Sediment Types: sand, silt, clay, mixtures*

k) Fish and Wildlife Habitats

79. Dredged material can be used beneficially to enhance or create various wildlife habitats. This may be either incidental to the project purpose or planned. For example, nesting meadows and habitat for large and small mammals and songbirds have been developed on upland or floodplain (seasonally flooded) dredged material placement sites. Numerous examples are available where dredged material has been used to create nesting islands for water birds and waterfowl.

80. Many technical considerations are necessary for the creation of nesting islands. An island can be built where none existed, and vegetation states (bare ground versus sparse herb cover versus tree/shrub habitat) can be managed using periodic dredged material applications. The types of dredged material can be manipulated to provide proper substrates for nests; in that view, softer silts and clays can be capped with sand, shell, and cobbles. The placement of the dredged material can be manipulated to provide the most acceptable habitat characteristics.

81. Upland wildlife habitats are typically dredged material containment areas that are no longer used or have long periods between maintenance dredged material placement. This allows native vegetation to grow and provide food and cover for wildlife. Site management is minimal, but can be intensified to provide special food crops, overwintering waterfowl feeding areas, and numerous other natural resource opportunities.

*Recommended Sediment Types: rock, gravel and sand, consolidated clay, silt/soft clay, mixture*

l) Fisheries Improvement

82. Appropriate placement of dredged material can improve ecological functions of fishery habitat. Fishery resource improvement can be demonstrated in several ways. Bottom relief created by mounding of dredged material may provide refuge habitat for fish. Fine-grained sediment transport can be stabilized by planting seagrasses or capping with shell or other coarse dredged material. The seagrasses or shell caps additionally improve fishery habitat.

*Recommended Sediment Types: rock, gravel and sand, consolidated clay, silt/soft clay, mixture*

m) Wetland Restoration

83. Dredged material has been extensively used to restore and establish wetlands. Where proper sites can be located, wetlands restoration is a relatively common and technically feasible use of dredged material. Wetlands restoration or rehabilitation using dredged material is usually a more acceptable alternative to creation of a new wetland. Many of the natural wetlands in the Mediterranean region are

degraded or impacted, or have been destroyed, and the recovery of these wetlands is more important than the creation of new ones. Most former wetlands still have hydric soils, even though the hydrologic characteristics of the site may have been altered. When a new wetland is created, hydric soil conditions, appropriate hydrologic conditions, and wetland vegetation must all be introduced to the site. Creation of a new wetland would also mean replacing one habitat type with another, which is not always desirable. Long-term planning, design, maintenance, and management are necessary to maintain a created wetland.

84. Wetland restoration using dredged material can be accomplished in several ways. For example, dredged material can be applied in thin layers to bring degraded wetlands up to an intertidal elevation, as has been done extensively in south Louisiana. Dewatered dredged material can be used in wind and wave barriers to allow native vegetation to regrow and restore the viability of a wetland. Dredged material sediment can be used to stabilize eroding natural wetland shorelines or nourish subsiding wetlands. Dewatered dredged material can also be used to construct erosion barriers and other structures that aid in restoring a degraded or impacted wetland.

Recommended Sediment Types: consolidated clay, silt/soft clay, mixture

Table (2) summarizes the beneficial uses and low cost treatment information.

| Examples of beneficial Use | Rock | Gravel& Sand | Consolidated Clay | Silt/Soft Clay |
|---|---|---|---|---|
| Land Creation | x | x | x | x |
| Land Improvement | x | x | x | x |
| Berm Creation | x | x | x | |
| Shore protection | x | x | x | |
| Replacement fill | x | x | | |
| Beach Nourishment | | x | | |
| Capping | | x | x | |
| Construction materials | x | x | x | x |
| Aquaculture | | | x | x |
| Topsoil | | | | x |
| Wildlife habitats | x | x | x | x |
| Fisheries improvement | x | x | x | x |
| Wetland restoration | | | x | x |
| Decorative landscaping products | x | x | | x |

### *6.4 Confined disposal*

85. Confined disposal means that the dredged material is placed in an engineered containment structure, that is, within dikes or bunds, or in natural or constructed pits, or borrow pits. This isolates the material from surrounding waters or soils during and after placement. Other terms used in the literature for this type of placement include “confined disposal facility" (CDF), “diked disposal site” and “containment area”. CDFs may be constructed in open waters (known as island CDFs), at near-shore sites or on land. The function of CDFs is to retain the dredged material solids whilst releasing the carrier water. For facilities receiving contaminated material, an additional objective is to provide the efficient isolation of contaminants from the surrounding area. To achieve this, depending on the degree of intended isolation, CDFs may be equipped with a complex system of control measures such as surface covers and liners, treatment of effluent, surface runoff and leachate.

### *6.5 Treatment of dredged material*

86. Treatment is defined as the processing of contaminated dredged material to reduce its quantity or to reduce the contamination. Treatment methods range from separation techniques, in which contaminated mud is separated from relatively clean sand, to incineration. Some techniques are well developed but others are still in the early stages of development. The problem is scale: treatment is often expensive.

### *6.6 Decision process for beneficial uses*

a) *Contaminant Status of Materials*

87. Evaluating the contaminant status of the dredged material is the first step to determine if the material is acceptable for beneficial use. In general, highly contaminated sediments will not normally be suitable for most proposed beneficial use applications and particularly for proposed wildlife habitat development projects. However, after appropriate examination, testing, and treatment, the material may be classified as suitable. Dredged material from ongoing activities (maintenance dredging) should be re-evaluated periodically to ensure that the sediment contamination level has not worsened since the last dredging cycle. These updated Guidelines provide ample and detailed information related to the assessment of the level of contamination of dredged materials.

b) *Site Selection*

88. Selecting a placement site and choosing a beneficial use are interdependent decision processes. Dredged material may have multiple beneficial use options and there may be several different potential placement sites. Often, the characteristics of the sediments determine or limit the types of sites that may be selected and the beneficial uses that can be achieved. Once a potential use and site have been identified, various implications should be assessed such as technical feasibility, environmental acceptability, cost/benefits, and legal constraints.

c) *Technical Feasibility*

89. The technical feasibility of implementing a particular beneficial use at a designated site must be evaluated. Various constraints must be considered, such as pumping distance, water depth, access, etc. If technical feasibility constraints will not allow the proposed beneficial use and/or selected site, then alternate beneficial uses or disposal options must be pursued.

d) *Environmental Acceptability*

90. Before any substantial work can be undertaken, the environmental impact prior, during, and subsequent to construction of the proposed project must be investigated. An Environmental Impact Assessment (EIA) and/or impacts hypothesis should be performed on all projects. The chosen beneficial use options may be pursued if it is concluded that the environmental effects will not be significantly harmful. Permission to undertake the dredged material placement may be denied if the proposed work is likely to have any significant adverse environmental effects.

e) *Cost/Benefit*

91. After one or more potential beneficial use options have been identified and the engineering methods have been defined, estimated costs and benefits should be analysed. The costs are usually estimated by standard methods. Options for beneficial use may lower the cost for disposal of dredged material in many instances, but increase costs in other scenarios. Costs are frequently lower when distances from dredging site to disposal site are reduced. In cases with higher costs, the increase may be more than offset by the value of the benefits. Although difficult to quantify, intangible benefits

should always be taken into account when assessing overall costs and benefits. These benefits may include improved habitat, aesthetic enhancement, a more viable local community, and other benefits.

f) *Legal Constraints*

92. Early and concentrated coordination between relevant authorities e.g. local interest groups, and environmental protection agencies is mandatory. Some beneficial use options or sites selected may be prohibited or rendered inappropriate by law or regulation.

**7. Best Environmental Practices for dredging and dredged material management**

93. The applicability of BEPs is generally varying according to the particular circumstances of each operation and it is clear that different approaches may then be appropriate. Generally, the objectives of BEPs are to:

(a) Minimize the impacts of dredging operation on the marine ecosystems
(b) Minimize the effects caused by the deposit of dredging materials
(c) Optimize the quantities for deposit
(d) Improve sediment quality

94. Optimization of the quantities for deposit:

A. Keep volume of dredged material minimal

To this aim, operators would consider the following:

a. Minimize need for dredging such as:

i. *in fluid mud areas: introduce the concept of Navigable depth based on:*
(a) physical and chemical evaluation of the sediment (including rheometry and densitometry)
(b) full scale trials

Proposed BEP:
Dredging only the amount of material required for maintaining a particular density level to allow navigation. This may require e.g. continuous underway measurement of sediment density by using a nuclear transmission gauge or measurement of shear forces.

*ii. in areas with sandy waves.*

Proposed BEP:
Selective dredging of sand waves and other mobile sand structures

*iii. hydraulic engineering*

Proposed BEP:
Use of hydraulic structures to reduce sedimentation
iv. *accurate monitoring of dredged depths at an appropriate frequency*

Proposed BEP:
Accurate positioning systems e.g.:
(a) microwave systems
(b) radio wave technology
(c) differential Global Positioning System (DGPS)
(d) apply rapid survey equipment
(e) continuous measurement systems

(f) echo sounders
(g) swath/multi beam systems

95. Optimization of dredging operations management through accurate survey systems

i. *availability of survey data on board*

Proposed BEP:
(a) online visualization of updated bathymetric charts, including topographic data, coastlines, deposit areas, dredge position, dredge head position
(b) tidal information

ii. *process evaluation*

Proposed BEP:
(a) visualization/evaluation of dredged tracks/profiles/zones
(b) dredging intensity chart
(c) in case of muddy material, sand and gravel: establish optimum overflow time by analysis of load diagrams

B. Improve dredging process, through

i. *effective dredging process control*

Proposed BEP:
(a) Continuous on-line measurements and presentation e.g. of area, heading, speed of the dredgers and position of the suction head/buckets/cutter/backhoe/grab/ wheel/...
(b) measurement of mixture velocity and concentration
(c) measurement of macro production (load diagram)
(d) hopper-measurement system monitoring the filling process

ii. *output improving techniques*

Proposed BEP:
(a) best suited suction head/cutters wheel/ backhoe/buckets
(b) submerged dredge-pumps
(c) degassing installations

iii. *selective dredging techniques*

Proposed BEP:
(a) selective dredging to e.g. separate contaminated material

C. Improve sediment quality

96. Improvement of sediment quality through an in situ operation before dredging and after deposit and improvement of physical aspects (cohesion, consistency, density) of dredged material

Proposed BEP:
(a) where relevant, increase sediment density by physical means e.g. vibration or mechanical separation

Proposed BEP:
(a) hydro cyclones for separation of granulometric fractions
(b) flotation

(c) dewatering (under development) (consider potential problems
(d) with process water and associated contaminants e.g. re- circulation will reduce problems)

D. Minimize the impacts of dredging

97. Minimizing the impacts in reducing the increase in turbidity and minimizing oxygen depletion

<u>Proposed BEP</u>:

(a) use excavation tools /dredger heads appropriate to minimize turbidity
(b) use silt screens/shields
(c) minimize overflow by e.g. recirculation of overflow water
(d) use specially designed dredgers to dredge contaminated sediments
(e) avoid the use of dredgers which introduce large amounts of suspended sediments into the water column where this may lead to problems with oxygen depletion or contamination e.g. agitation dredgers
(f) avoid periods when dredging induced turbidity will lead to unacceptable reductions in oxygen levels due to high temperatures.

## PART B MONITORING OF DREDGED MATERIAL DUMPING OPERATIONS

### 1. Definition

98. In the context of assessing and regulating the environmental and human health impacts of dredged material dumping operations, monitoring is defined as all measures whose purpose is to determine, from the repeated measurement of a contaminant or an effect, whether direct or indirect, of the introduction of this contaminant into the marine environment, the spatial and temporal modifications undergone by the receiving zone as a result of the activity under consideration.

### 2. Rationale

99. Monitoring of dredged material dumping operations is generally undertaken for the following reasons:

(a) to establish whether the dumping permit conditions have been respected - conformity control - and consequently have, as intended, prevented adverse effects on the receiving area as a consequence of dumping;
(b) to improve the basis on which permit applications are assessed by improving knowledge of the field effects of major discharges which cannot be directly estimated by a laboratory evaluation or from the literature;
(c) to provide the necessary evidence to demonstrate that within the framework of the Protocol the monitoring measures applied are sufficient to ensure that the dispersive and assimilative capacities of the marine environment are not exceeded, and so dumping operations do not cause damage to the environment and deteriorate GES.

### 3. Objectives

100. The purposes of monitoring are to determine contaminant levels in all sediments above the lower reference threshold in paragraph 23(b) of the guidelines and in bio-indicator organisms, and the biological effects and consequences for the marine environment of the dumping of dredged material and, ultimately, to help managers to combat exposure of organisms to dredged materials and associated contaminants.

101. Whenever possible, the monitoring programme should be aligned with the current MEDPOL monitoring programmes for the Ecological Objectives 5, 8, 9, and 10, in line with the Integrated Monitoring and Assessment Programme (IMAP) of the Mediterranean Sea and Coast and Related Assessment Criteria set out in Decision IG. 22/7 of the COP 19.

### 4. Strategy

102. Monitoring operations are expensive since they require considerable resources both to carry out measurement and sampling programmes at sea and the subsequent analytical work on the samples. In order to approach the monitoring programme in a resource-effective manner, it is essential that the programme has clearly defined objectives, that the measurements made can meet those objectives, and that the results are reviewed at regular intervals in relation to the objectives.

103. Since the effects of dredged material dumping are likely to be similar in many areas, there appears to be little justification for monitoring all sites, particularly those receiving small quantities of dredged material. It would be more effective to carry out more detailed investigations at a few carefully chosen sites based on risk-based approach e.g. those subject to large inputs of dredged material) in order to obtain a better understanding of the processes and effects involved.

104. This is particularly the case for zones which present the same physical, chemical and biological characteristics, or nearly the same characteristics, for which there is strong presumptive evidence that the effects of dredged material dumping are similar, and it is very difficult to justify monitoring of all sites on scientific and economic grounds, , particularly for those receiving small quantities of dredged material (e.g. less than 25,000 tons per year).

**5. Impact Hypothesis**

105. In order to establish such objectives, it is first necessary to derive an impact hypothesis describing predicted effects on the physical, chemical and biological characteristics both of the dumping zone and of the surrounding zones. The impact hypothesis forms the basis for defining the field monitoring programme.

106. The aim of an impact hypothesis is to provide, on the basis of the available information, a concise scientific analysis of the potential effects of the proposed operation on human health, living resources, marine life, amenities and other legitimate uses of the sea. For this purpose, an impact hypothesis should incorporate information on the characteristics of the dredged material and on conditions at the proposed dumping site. It should encompass both temporal and spatial scales of potential effects.

107. One of the main requirements of the impact hypothesis is to produce criteria which describe the specific environmental effects of dumping activities, taking into account the fact that such effects have to be avoided outside the designated dredging and dumping zones (see Part A, Section 3).

**6. Premilinary Evaluation**

108. The preliminary evaluation should be as comprehensive as possible. The primary areas of potential impact should be identified as well as those considered to have the most serious consequences for human health and the environment. Alterations to the physical environment, risks to human health, devaluation of marine resources, and interference with other legitimate uses of the sea are often seen as priorities in this regard.

109. The expected consequences of dumping could be described in terms of the habitats, processes, species, communities and uses affected by the dumping in line with GES definitions and targets. The precise nature of the predicted change, response, or interference (effect) could then be described. The GES and the effect should be described (quantified) together in sufficient detail to eliminate any doubt as to the parameters to be measured during post-operational field monitoring. In the latter context, it might be essential to determine "where" and "when" the impacts can be expected.

**7. Reference Baseline**

110. In order to develop an impact hypothesis, it may be necessary to conduct a baseline survey and checking the GES's values which describe not only the environmental characteristics, but also the variability of the environment. It may also be helpful to develop sediment transport, hydrodynamic and other mathematical models, to determine the possible effects of dumping.

111. Where either physical or chemical effects at the seabed are expected, it will be necessary to examine the benthic community structure in areas where the dredged material disperses. In the case of chemical effects, it may also be necessary to examine the chemical quality of the sediments and the biota (including fish), in particular the major pollutant contents.

112. In order to assess the impact of the proposed activity on the surrounding environment, it will be necessary to compare the physical, chemical and biological quality of the affected areas with reference sites located away from dredged material dumping pathways. Such areas can be identified during the early stages of the impact assessment.

**8. Impact Hypothesis Verification : Defianig the Monitoring Programme**

113. The measurement programme should be designed to ascertain that physical, chemical and biological changes in the receiving environment are within baseline survey values and don't affect adversely the achievement or maintenance of GES.

114. The measurement programme should be designed to determine:
(a) whether the zone of impact differs from that projected; and,
(b) whether the extent of changes outside the zone of direct impact is within the scale predicted.

115. The first question can be answered by designing a sequence of measurements in space and time that circumscribe the projected zone of impact to ensure that the projected spatial scale of change is not exceeded.

116. The second question can be answered by making physical, chemical and biological measurements that provide information on the extent of change that occurs outside the zone of impact, after the dumping operation takes place (verification of a null hypothesis). Then, before any programme is drawn up and any measurements are made, the following questions should be addressed:

(a) what testable hypothesis can be derived from the impact hypothesis?
(b) what exactly should be measured to test these impact hypotheses?
(c) in what compartment or at which locations can measurements most effectively be made?
(d) for how long should measurements continue to be made to meet the original aim?
(e) what should be the temporal and spatial scale of the measurements made?
(f) how should the data be processed and interpreted?

117. It is recommended that the choice of contaminants to be monitored should depend primarily on the ultimate purposes of monitoring. It is definitely not necessary to monitor regularly all contaminants at all sites and it should not be necessary to use more than one substrate or effect to meet each aim.

**9. Monitoring**

118. The dumping of dredged material has its primary impact at the seabed. Thus although a consideration of water column effects cannot be discounted in the early stages of monitoring planning, it is often possible to restrict subsequent monitoring to the seabed.

119. Where it is considered that effects will be largely physical, monitoring may be based on remote methods such as side-scan sonar, to identify changes in the character of the seabed, and bathymetric techniques (e.g. echo sounding) to identify areas of dredged material accumulation. Both these techniques will require a certain amount of sediment sampling to establish ground-truth. In addition, multispectral scanning can be used for monitoring the dispersion of suspended material (plumes, etc.).

120. Tracer tests may also be proved useful in following the dispersal of the dredged material and assessing any minor accumulation of material not detected by bathymetric surveys. Where, in relation to the impact hypothesis, either physical or chemical effects at the seabed is expected, it will be necessary to examine the benthic community structure in areas where the dredged material disperses. In the case of chemical effects, it may also be necessary to examine the chemical quality of the biota (including fish).

121. The spatial extent of sampling will need to take into account the size of the area designated for dumping, the mobility of the dumped dredged material and water movements which determine the direction and extent of sediment transport. It should be possible to limit sampling within the dumping site itself if effects in this area are considered to be acceptable and their detailed definition

unnecessary. However, some sampling should be carried out to aid the identification of the type of effect which may be expected in other areas and for scientific purposes.

122. The frequency of surveying will depend on a number of factors. Where a dumping operation has been going on for several years, it may be possible to establish the effect at a steady state of input and repeated surveys would only be necessary if changes are made to the operation (quantities or type of dredged material dumped, method of disposal, etc.). If it is decided to monitor the recovery of an area which is no longer used for dumping dredged material, more frequent measurements might be needed.

**10. Notification**

123. The Contracting Parties should inform the Organisation of their monitoring activities. Concise reports on monitoring activities should be prepared and transmitted to the Organisation as soon as they are available, in conformity with Article 26 of the Barcelona Convention. Reports should detail the measurements made, results obtained and how these data relate to the monitoring objectives and confirm the impact hypothesis. The frequency of reporting will depend upon the scale of dumping activity, the intensity of monitoring and the results obtained.

**11. Feedback**

124. Information gained from field monitoring (and/or other related research) can be used to:

(a) modify or, in the best of cases, terminate the field monitoring programme;
(b) modify or revoke the permit;
(c) refine the basis on which applications for permits are assessed.

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