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DRAFT GUIDELINES ON THE MANAGEMENT OF DREDGED MATERIAL

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The document contains the text of the new draft guidelines on the management of dredged material and it is submitted to the present meeting for analysis and approval.

In particular, in order to assist the experts in their analysis, the document has been prepared as follows:

1) on the left hand side of each page you will find the text presented at the Meeting in Valencia, 20-22 May 1996; sections underlined, ~~crossed~~, in [brackets] or in *italic* indicate where amendments are proposed;

2) on the right hand side of each page you will fin the new amended text;

3) editorial corrections appear in *italics*;

4) corrections on the substance are presented underlined

DRAFT GUIDELINES ON THE MANAGEMENT OF DREDGED MATERIAL

Preface	**Preface**
These draft guidelines**[**~~, prepared by Spanish experts on behalf of MAP,~~**]** are designed to assist the Contracting Parties in the **[**~~future~~**]** implementation of the Protocol for the Prevention of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration at Sea, hereinafter referred to as "the Protocol", in the management of dredged material; the Protocol was signed by 16 Contracting Parties in 1995 and is not yet in force.	These draft guidelines are designed to assist the Contracting Parties in the implementation of the Protocol for the Prevention of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration at Sea, hereinafter referred to as "the Protocol", in the management of dredged material; the Protocol was signed by 16 Contracting Parties in 1995 and is not yet in force.
These guidelines are adapted from those of the **[**~~Oslo Commission~~**]**	These guidelines are adapted from those adopted the 24th of July, 1998, by the Contracting Parties of the Convention for the protection of the marine Environment of the North-East Atlantic, 1992, and from the Dredged material assessment Framework, adopted in December, 1995, by the Contracting Parties to the London Convention on the Prevention of Marine pollution by Dumping of Wastes and Other Matter, 1972, as amended, 1993. By some aspects, they might be considered as specifically adapted to the technical-economic context of the Mediterranean basin.
It is implicit that general considerations and detailed procedures described in the guidelines may not be applicable in all national or local circumstances.	It is implicitly recognised that general considerations and detailed procedures described in the guidelines may not be applicable in all national or local circumstances.

Introduction	Introduction
	Dredging activities are an essential part of the maritime activities. Three main dredging categories can be distinguished: Õ **Capital dredging**: mainly for navigational purposes, to enlarge or deepen existing channel and port areas, or to create new ones; at the same type of dredging activity belong also some specific and technical activities which are taking place on the sea bottom e.g. trenching for pipes, cables, tunnelling, removal of material unsuitable for foundations, or removal of overburden for aggregate extraction; Õ **Maintenance dredging**, to ensure that channels, berths or construction works are maintained at their designed dimensions (i.e. counteracting sedimentation and changes in morphology); and Õ **Clean-up dredging**, corresponding to the deliberate removal of contaminated materiel from the marine environment, for human health and environmental protection purposes. All these activities are producing more or less large quantities of materials which have to be disposed. A part of these materials may be polluted by human activities in such a way that some serious ecological constraints have to be assigned where the sediments are dumped.
These guidelines are designed to assist Contracting Parties in the management of dredged material in a way that will prevent pollution of the marine environment. In accordance with Article **[**~~6.2~~**]** of the Protocol, the guidelines specifically address the disposal of dredged material by [deposition or] dumping in marine and estuarine waters.	These guidelines are designed to assist Contracting Parties in the management of dredged material in a way that will prevent pollution of the marine environment. In accordance with Article 3.3 of the Protocol, the guidelines specifically address the deliberate disposal of these dredged material by dumping in marine and estuarine waters.

It should be recognised that both removal and disposal of dredged sediments may cause harm to the marine environment.	**Unchanged text**
Consequently, Contracting Parties are encouraged to exercise control over dredging operations as well as **[**~~disposal~~**]** using a Best Environmental Practice (BEP) approach to minimise the quantity of material that has to be dredged and to minimise the impact of the dredging and disposal activities in the maritime area. Advice on environmentally acceptable dredging techniques 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).	Consequently, Contracting Parties are encouraged to exercise control over dredging operations as well as the subsequent dredged material dumping, using a Best Environmental Practice (BEP) approach, to minimise the quantity of material that has to be dredged and to minimise the impact of the dredging and disposal activities in the maritime area. Advice on environmentally acceptable dredging techniques 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).
The Guidelines are presented in two parts. Part A deals with the assessment and management of dredged material **[**~~disposal~~**]**, while part B provides guidance on the design and conduct of monitoring of marine and estuarine **[**~~disposal~~**]** sites.	The Guidelines are presented in two parts. Part A deals with the assessment and management of dredged material **[**~~disposal~~**]**, while part B provides guidance on the design and conduct of monitoring of marine and estuarine dumping sites.
In this context it should be noted that, for each permitted dredging operation, regulatory agencies should conclude their assessment with a concise **Impact Hypothesis** (see Part B, paragraph 5-11). This Impact Hypothesis will provide the principal basis for the design of post-operational monitoring activities.	**Unchanged text**
The Guidelines commence with a summary of those Articles and Annexes to the 1995 Dumping Protocol which relate to the control of dredging activities, followed by guidance on the conditions under which permits might be issued. Sections 3, 5 and 6 address the relevant considerations of the Annex III of the Protocol under the headings of dredged material characteristics (Annex, Section A), characteristics of the dumping site and methods of deposit (Annex, Section B) and general considerations and conditions (Annex, Section C). Section 4 provides additional guidance on the sampling and analysis of dredged material.	**Unchanged text**

PART A **ASSESSMENT AND MANAGEMENT OF DREDGED MATERIAL**	
	0. DREDGED MATERIAL CHARACTERISATION 1. In the context of these guidelines: **Õ** "dredged material" are deemed to be any sedimentary formation (clay, silt, sand, gravel, rocks, ..) which are removed from areas that are normally or regularly covered by marine and estuarine water, by using dredging or other excavation equipment. **Õ** "dumping" means any deliberate disposal in the marine area of wastes or other matter from vessels **[**or aircraft**],** whether or not previous transport of such waste or other material occurs
1. REQUIREMENTS OF THE DUMPING PROTOCOL	
1.1 In accordance with Article 4 of the Protocol, the dumping of dredged material may be authorised under some conditions.	1.1 Under Article 4-1 of the Protocol, the dumping of waste and other mater is forbidden. Nevertheless, in accordance with Article 4 of the Protocol, the dumping of dredged material may waive this principle and may be authorised under some conditions.
1.2 National relevant authorities of the Contracting Parties are required under Article 5 to issue a permit prior to dumping.	**Unchanged text**
1.3 Furthermore, in accordance with Article 6, the permit referred to in Article 5 shall be issued only after careful consideration of the factors set forth in the Annex of the Protocol. Article 6.2 establish 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.	1.3 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 of the Protocol. Article 6.2 establish 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.
1.4 These Guidelines for the Management of Dredged Material, which include advice on dredged material sampling and analysis, have been prepared for the purpose of providing guidance to the Contracting Parties on: a) the fulfilment of their obligations to issue permits for the dumping of dredged material in accordance with the provisions of the Protocol;	**Unchanged text** **Unchanged text**

b) the provision of reliable data on the input of contaminants to Protocol waters by the dumping of dredged material.	(b) the transmission to the secretariat reliable data on the input of contaminants to Protocol waters by the dumping of dredged material.
2. CONDITIONS UNDER WHICH PERMITS FOR DUMPING OF DREDGED MATERIAL MAY BE ISSUED	
2.1 In order to define the conditions under which permits for dumping of dredged material may be issued, Contracting Parties should develop criteria on a national basis, which meet the provisions of Articles 4, 5, and 6 of the Protocol.	2.1 In order to define the conditions under which permits for dumping of dredged material may be issued, Contracting Parties should develop on a national basis, a decision making process which gives the possibility to evaluate the proprieties of the material and their constituents, with respect to the protection of human health and maritime area. The decision making process is based on a set of criteria developed on a national basis, which meet the provisions of Articles 4, 5, and 6 of the Protocol, and which apply to specific substances. It might be advisable that these criteria take into consideration the acquired experience relating to the potential effects on human health and maritime area.
2.2 These criteria may be described in terms of: (a) chemical characteristics **[**~~and/or biological effects~~**]** (e.g. sediment quality criteria); (b) reference data linked to particular methods of **[**~~disposal~~**]** or **[**~~disposal~~**]** sites; (c) specific environmental effects that are considered undesirable outside designated **[**~~disposal~~**]** sites; (d) the contribution of **[**~~disposal~~**]** to local contaminant fluxes.	2.2 These criteria may be described in terms of: (a) physical and chemical characteristics (e.g. Sediment quality criteria); (b) biological effects of the dumping activity (impact on the marine ecosystems); (c) reference data linked to particular methods of dumping or to dumping sites; (d) specific environmental effects that are considered undesirable outside designated dumping sites; (e) the contribution of dumping activities to local contaminant fluxes (fluxes criteria)
2.3 Criteria should be derived from studies of sediments that have similar geochemical properties to those from the ones to be dredged and/or to those of the receiving system. Thus, depending upon natural variation in sediment geochemistry, it may be necessary to develop individual sets of criteria for each area in which dredging or disposal is conducted.	**Unchanged text**

	2.3bis The decision making process may, with respect to some specific contaminants or some specific biological responses, point out an upper and lower level giving three possible actions: a. material which contains specified contaminants or which causes e.g. biological responses, in excess of the relevant upper levels should generally be considered as unsuitable for disposal at sea; b. material which contains specified contaminants or which causes e.g. biological responses, below the relevant upper levels should generally be considered of little environmental concern for disposal at sea; c. material of intermediate quality should require more detailed assessment before suitability for disposal at sea can be determined.
2.4 In the event that the criteria and the associated regulatory limits cannot be met, a Contracting Party should not issue a permit unless a detailed consideration of the Annex Section C, indicates that sea disposal is, nonetheless, the option of least detriment. If such a conclusion is drawn, a Contracting Party should: (a) provide for the realisation of a source-reduction programme where there is a source to reduce, with a view to meeting the established criteria; (b) take all practical steps to mitigate the impact of the dumping operation on the marine and estuarine environment including, for example, the use of containment or treatment methods; (c) prepare a detailed impact hypothesis; (d) initiate monitoring designated to verify any predicted adverse effects of the dumping; (e) issue a specific permit.	2.4 When the criteria and the associated regulatory limits cannot be met (case a) above), a Contracting Party should not issue a permit unless a detailed consideration of the Annex Section C, indicates that sea disposal is, nonetheless, the option of least detriment, compared with other disposal technical solutions. If such a conclusion is drawn, a Contracting Party should: (a) provide for the realisation of a source-reduction programme concerning the inputs of pollutants in the dredged area, where there is a source to be reduced by such a programme, with a view to meet the established criteria; **Unchanged text** **Unchanged text** (d) initiate monitoring designated to verify any predicted adverse effects of the dumping (follow-up activity), in particular with respect to the Impact hypothesis; **Unchanged text**

	(f) report to the Organisation of the dumping which has been carried out, while outlining the reasons for which the dumping permit have been issued.
When it is unlikely that disposal management techniques will alleviate the harmful effects of contaminated materials (see Section 7), containment and/or treatment technologies may be used to avert environmental damage. In such cases, selective dredging or separation of the more contaminated fractions (e.g. by use of hydrocyclones) may be employed to minimise the quantifies of material for which such measures are required.	**Unchanged text**
2.5 (5.11) With a view to evaluating the possibilities for harmonising or consolidating criteria referred to in 2.1-2.4 above, including any sediment quality criteria, Contracting Parties are requested to inform the Organisation of the criteria adopted, as well as the scientific basis for the development of these criteria.	**Unchanged text**
2.6 An important element of these guidelines for the management of dredging activities is the preparation of an **Impact hypothesis** for each marine disposal operation. In concluding their assessments of the environmental implications of these operations, prior to the issue of a permit, Contracting Parties should formulate Impact hypotheses in accordance with the guidance provided in Part B, paragraph 6 - 9.	**Unchanged text**
3. ASSESSMENT OF THE CHARACTERISTICS AND COMPOSITION OF DREDGED MATERIAL	
(a) Amounts and composition (b) Amount of **substances** and material to be deposited per day (per week, per month) (c) Form in which it is presented for dumping, i.e. whether as a solid, sludge or liquid	
3.1 For all dredged material to be **[**~~disposed of~~**]** at sea, the following information should be obtained: **Õ** gross wet tonnage requested; **Õ** method of dredging; **Õ** preliminary determination of sediment characteristics;	3.1 For all dredged material to be <u>dumped</u> at sea, the following information should be obtained: **Õ** <u>quantity of dredged material</u> (gross wet tonnage); **Õ** method of dredging (<u>mechanical dredging, hydraulical dredging, pneumatic dredging, dredger in motion or stopped</u>, ...); **Õ** preliminary determination of sediment characteristics (i.e. <u>clay / silt / sand / gravel / boulder), on the basis of visual determination</u>;

3.2 In order to assess the capacity of the area for receiving dredged material both the total amount of material and the anticipated or actual loading rate at the <u>disposal</u> site should be taken into consideration.	3.2 In order to assess the capacity of the area for receiving dredged material both the total amount of material and the anticipated or actual loading rate at the <u>dumping</u> site should be taken into consideration.
3.3 In the absence of appreciable pollution sources, dredged material may be exempted from the testing referred to in paragraph 3.5 and 3.8 of these Guidelines if it meets one of the criteria listed below in such cases the provisions of the Annex Sections B and C (see sections 5 and 6 below) should be taken into account	3.3 **[**~~In the absence of appreciable pollution sources~~**]**, dredged material may be exempted from the testing referred to in paragraph 3.5 and 3.8 of these Guidelines if it meets one of the criteria listed below; in such cases the provisions of the Annex Sections B and C (see sections 5 and 6 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;	**Unchanged text**
	(abis) dredged material is composed of previously undisturbed geological material.
(b) dredged material is for beach nourishment or restoration and is composed predominantly of sand, gravel, or shell with particle sizes compatible with material on the receiving beaches; and	**Unchanged text**
(c) dredged material not exceeding 10 000 tons per year from small, isolated and single dredging operations may be exempted only where this can be supported by existing local information on sediment quality.	(c) dredged material not exceeding 10 000 tons per year from small, isolated and single dredging operations may be exempted only where <u>the dredging area is situated out of any appreciable source of pollution</u> <u>and where</u> this can be supported by existing local information on sediment quality <u>which gives the possibility to be reasonably confident that the dredged materials have not been contaminated from historic sources</u>.
In the case of Capital dredging projects, which may affect the marine environment, national authorities may take account of the nature of the material to be disposed of to sea in exempting part of the material from the provisions of these guidelines relating to sampling and analysis.	**Unchanged text**

	Remark
On the other hand, capital dredging removed from areas which may include contaminated sediments should be subject to characterisation in accordance with these guidelines, notably paragraph 3.5.	On the other hand, Capital dredging removed from areas which may include contaminated sediments should be subject to characterisation in accordance with these guidelines, notably paragraph 3.5.
(d) Properties: physical (e.g. solubility and specific gravity), chemical and biochemical (e.g. oxygen demand, nutrients) and biological (e.g. presence of viruses, bacteria, yeasts, parasites).	
3.4 For dredged material that does not meet the exemptions in paragraph 3.3, further information will be needed to fully assess the 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 knowledge of local discharges or other sources of pollution, supported by a selective analyses.	3.4 For dredged material that does not meet the exemptions in paragraph 3.3, a further stepwise complete characterisation concerning their chemical and biological characteristics will be 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 knowledge of local discharges or other sources of pollution, supported by a selective analyse. In such a case, it is likely unnecessary to measure again the potential effects of similar material in the vicinity.
3.5 Chemical characterisation will be necessary as a first step to estimate gross loading of contaminants, especially for new arising of dredged material. The requirements for the elements and compounds to be analysed are set out in Chapter 4.	**Unchanged text**
(e) Toxicity (f) Persistence (g) Accumulation in biological materials or sediments	
3.6 The purpose of testing under this section is to establish whether the disposal at sea of dredged material containing contaminants might cause undesirable effects, especially the possibility of chronic or acute toxic effects on marine organism or human health, whether or not arising from their bioaccumulation in marine organism and especially in food species.	**Unchanged text**

3.7 The following biological test procedures might not be necessary if the previous characterisation of the material and of the receiving area allows an assessment of the environmental impact. If, however, the previous analysis of the material shows the presence of contaminants in considerable quantifies or of substances whose biological effects are not understood, and if there is concern for antagonistic or synergistic effects of more than one substance, or if there is any doubt as to the exact composition or properties of the material, it is necessary to carry out suitable biological test procedures. These procedures may include the following: **Õ** acute toxicity tests; **Õ** chronic toxicity tests capable of evaluating long-term-term sub-lethal effects, such as bioassays covering an entire life cycle; **Õ** tests to determine the potential for bioaccumulation of the substance of concern.	3.7 The following biological test procedures might not be necessary if the previous <u>physical and chemical</u> characterisation of the material and of the receiving area, <u>and the available biological information</u>, allows an assessment of the environmental impact, <u>on a scientific and adequate basis</u>. If, however: **Õ** the previous analysis of the material shows the presence of contaminants in considerable quantifies or of substances whose biological effects are not understood, **Õ** if there is concern for antagonistic or synergistic effects of more than one substance; **Õ** or if there is any doubt as to the exact composition or properties of the material, it is necessary to carry out suitable biological test procedures. These procedures, <u>which should incorporate species that are considered appropriately sensitive and representative</u>, may include the following: **Õ** acute toxicity tests; **Õ** chronic toxicity tests capable of evaluating long-term sub-lethal effects, such as bioassays covering an entire life cycle; **Õ** tests to determine the potential for bioaccumulation of the substance of concern; **Õ** <u>tests to determine the potential for alteration of the substance of concern</u>.
(h) Physical, chemical and biochemical changes of the waste after release	
3.8 Substances in dredged material may undergo physical, chemical and biochemical changes when entering 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 a monitoring programme.	**Unchanged text**

(i) Probability of production of taints or other changes reducing marketability of resources (fish, shellfish, etc.)	
3.9 Proper dumping site selection rather than a testing application is recommended. Site selection to minimise impact on commercial or recreational fishery areas is a major consideration in resource protection and is covered in greater detail in Section C of the Annex to the Protocol. (Further guidance for the application of Section C of the Annex is given in section 6 below).	**Unchanged text**
4. GUIDELINES ON DREDGED MATERIAL SAMPLING AND ANALYSIS	
<u>Sampling for the purpose of issuing a dumping permit</u>	
4.1 For dredged material which requires detailed analysis (i.e. which is not exempted under the Guidelines in paragraph 3.3), the following guidelines indicate how sufficient analytical information may be obtained for permitting purposes. Judgement and knowledge of local conditions will be essential in the application of these guidelines to any particular operation (see § 4.10).	**Unchanged text**
4.2 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. Core samples should be taken where the depth of dredging and expected vertical distribution of contaminants warrant; otherwise a grab sample is considered appropriate. Sampling from barges is not advisable.	**Unchanged text**
4.3 The number of sampling stations should be adjusted according to the exchange characteristics and the size of the area to be dredged, e.g. less for open areas and more for enclosed and semi-enclosed areas.	4.3 The number of sampling stations should be adjusted according to <u>the size and to the exchange characteristics of the area</u> to be dredged, e.g. less for open areas and more for enclosed and semi-enclosed areas. The following table gives an indication of the number of separate sampling stations required to obtain representative results, assuming a reasonably uniform sediment in the area to be dredged.

	Amount dredged (m3 in situ) Up to 25000 from 25000 to 100000 from 100000 to 500000 from 50000 to 2000000 > 2000000	**Number of stations** 3 4 - 6 7 - 15 16 - 30 extra 10 per million m3
4.4 Normally, the samples form each location should be analysed separately. However, if the sediment is clearly homogeneous with respect to sediment features (grain size fractions and organic matter) and expected level of contamination, it may be possible to 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 permitting procedure has been completed, should the results indicate that further analysis is necessary.	4.4 Normally, the samples form each location should be analysed separately. However, if the sediment is clearly homogeneous with respect to sediment features (grain size fractions and organic matter <u>load</u>) and expected level of contamination, it may be possible to 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 permitting procedure has been completed, should the results indicate that further analysis is necessary.	
<u>Sampling in the case of renewal of dumping permit</u>		
4.5 If a survey indicates that the material is essentially clean and no new events have taken place, surveys need not be repeated more frequently than once every 3 years.	4.5 If a survey indicates that the material is essentially clean and no new events have taken place <u>indicating that the quality of the material has deteriorated</u>, surveys need not be repeated more frequently than once every 3 years.	
4.6 It may be possible on the basis of the initial survey, to reduce either the number of sampling stations or the number of parameters while still providing sufficient information to confirm the initial analysis for permitting purposes. If such a reduced sampling programme does not confirm the earlier analysis, the full survey should be repeated. If the list of parameters for repetitive measurement is reduced, a further analysis of the complete list is advisable at 3 year intervals.	4.6 It may be possible on the basis of the initial survey, to reduce either the number of sampling stations or the number of parameters <u>to be measured</u>, while still providing sufficient information to confirm the initial analysis for permitting purposes. If such a reduced sampling programme does not confirm the earlier analysis, the full survey should be repeated. If the list of parameters for repetitive measurement is reduced, a further analysis of the complete list is advisable at 3 year intervals.	
4.7 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.	4.7 *<u>A contrario</u>*, 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.	

Provision of Input Data	
4.8 The sampling scheme described above provides information for permitting purposes. However, the scheme should at the same time provide a suitable basis for the estimation of total inputs and, for the time being, can be considered the most accurate approach available for this purpose. In this context it is assumed that materials exempted from analysis represent insignificant inputs of contaminants and therefore it is not necessary to calculate or to report contaminant loads.	**Unchanged text**
Determinants and methods	
4.9 Analysis should normally be carried out on the whole sample but material greater than 2 mm grain size should be excluded. It will also be necessary, in order to allow assessment of data on contaminant levels in terms of their likely impact, to provide information on: **Õ** weight of solid material per unit of volume of dredged material; **Õ** grain size fractions (% sand, silt, clay); **Õ** total organic carbon (TOC) **[**below 2 mm**]**.	4.9 Since contaminants concentrate mainly in the fine fraction (< 2 mm) and even more specifically in the clay fraction (< 2 Fm), analysis should normally be carried out on the whole sample but material greater than 2 mm grain size should be excluded. It will also be necessary, in order to allow assessment of data on contaminant levels in terms of their likely impact, to provide information on: **Unchanged text**
4.10 In those cases where analysis is required, analysis should be mandatory for substances listed in Technical Annex 1. With respect to organochlorines, PCBs should be analysed in non-exempted sediments because they remain a significant environmental contaminant. Other organohalogens should also be measured if they are likely to be present on a result of local inputs.	**Unchanged text**
4.11 In addition, the permitting authority should carefully consider specific local inputs including the likelihood of contamination e.g. by arsenic, oils, PAH and triorganotins. The authority should make provision for the analysis of these substances as necessary.	**Unchanged text**

	Considerations for additional chemical characterisation are as follows: **Õ** potential routes by which contaminants could reasonably have been introduced to the sediments; **Õ** probability of contamination from agricultural and urban surface run-off; **Õ** spills of contaminants in the area to be dredged; **Õ** industrial and municipal waste discharges (past and present); **Õ** source and prior use of dredged material (e.g. beach nourishment); and **Õ** substantial natural deposits of minerals and other natural substances (e.g. asbestos).
4.12 Further guidance on the selection of determinants and methods of contaminant analysis in localised circumstances, and on procedures to be used for normalisation and quality assessment purposes, will be found in the Technical Annexes to these guidelines as adopted, and updated periodically, by the Contracting Parties.	**Unchanged text**
5. CHARACTERISTICS OF DUMPING SITE AND METHOD OF DEPOSIT	
5.1 Matters relating to dump site selection criteria are addressed in greater detail in studies prepared by GESAMP' (Reports and Studies No. 16: Scientific Criteria for the Selection of Waste Disposal Sites at Sea, IMO 1982) and by ICES (Ninth Annual Report of the Oslo Commission, Annex 6).	**Unchanged text** The selection of a site for sea dumping involves considerations of environmental parameters but also economic and operational feasibility.

(a) Geographical position, depth and distance from coast (b) Location in relation to living resources in adult or juvenile phases (c) Location in relation to amenity areas	
5.2 Basic site characterisation information to be considered by national authorities at a very early stage of assessment of a new site should include the co-ordinates of the dumping area (latitude, longitude), as well as its location with regard to:	5.2 In order to be able to assess a new dumping site, basic site characterisation information have to be considered by national authorities at a very early stage of the decision making process. These information should include the co-ordinates of the dumping area (latitude, longitude), as well as its geographical location with regard to:
Õ distance to nearest coastline;	**Õ** nearest coastline;
Õ recreational areas;	**Õ** recreational areas;
Õ spawning and nursery areas;	**Õ** fish, crustaceans and molluscs spawning, recruitment and nursery areas;
Õ known migration routes of fish or marine mammals;	**Õ** known migration routes of fish or marine mammals;
Õ sport and commercial fishing areas;	**Õ** sport and commercial fishing areas
Õ fish culture areas;	**Õ** fish culture areas;
Õ aquaculture areas;	**Õ** aquaculture areas;
Õ areas of natural beauty or significant cultural or historical importance;	**Õ** areas of natural beauty or significant cultural or historical importance;
Õ areas of special scientific, biological or ecological importance;	**Õ** areas of special scientific, biological or ecological importance;
Õ shipping lanes;	**Õ** shipping lanes;
Õ military exclusion zones;	**Õ** military exclusion zones;
Õ engineering uses of seafloor (e.g. potential or ongoing seabed mining, undersea cables, desalination or energy conversion sites).	**Õ** engineering uses of seafloor (e.g. potential or ongoing seabed mining, undersea cables, desalination or energy conversion sites).
	5.2bis The use of open-sea dumping sites at distant off-shore locations is seldom an environmental desirable solution to the prevention of marine pollution by contaminated dredged material.

(d) Methods of packing, if any (e) Initial dilution achieved by proposed method of release	
5.3 For dredged materials, the only data to be considered under this item should include information on: **Õ** disposal method (e.g. hopper discharge; discharge through pipes); **Õ** dredging method (e.g. hydraulic or mechanical).	**Unchanged text**
(f) Dispersion, horizontal transport and vertical mixing characteristics (g) Existence and effects of current and previous discharges and dumping in the area (including accumulative effects)	
5.4 For the evaluation of dispersal characteristics, data should be obtained, as appropriate, on the following: **Õ** water depths (maximum, minimum, mean); **Õ** water stratification in various seasons and weather conditions (depth and seasonal variation of pycnocline); **Õ** tidal period, orientation of tidal ellipse, velocities of minor and major axis; **Õ** mean surface drift (net): direction, velocity mean; **Õ** mean bottom drift (net): direction, velocity ; **Õ** storm (wave) induced bottom currents (velocities); **Õ** wind and wave characteristics, average number of storm days per year; **Õ** concentration and composition of suspended solids.	**Unchanged text**

5.5 The basic assessment of a site, either a new or an existing one, shall include the consideration of possible effects that might arise by the increase of certain constituents or by interaction (e.g. synergistic effects) with other substances introduced in the area, either by other dumping or by river input and discharges from coastal areas, by exploitation areas and maritime transport, as well as through the atmosphere. The existing stress on biological communities as a result of such activities should be evaluated before any new or additional disposal operations are established. The possible future uses of the sea area should be kept under consideration.	5.5 The basic assessment of a site, either a new or an existing one, shall include the consideration of possible effects that might arise by the increase of certain constituents or by interaction (e.g. synergistic effects) with other substances introduced in the area, either by other dumping or by river input and discharges from coastal areas, by exploitation areas and maritime transport, as well as through the atmosphere. The existing stress on biological communities as a result of such activities should be evaluated before any new or additional dumping operations are established. The possible future uses of resources and amenities in the sea receiving area should be kept under consideration.
5.6 Information from baseline and monitoring studies at already established dumping sites will be important in this evaluation of any new dumping activity at the same site or nearby.	**Unchanged text**
6. GENERAL CONSIDERATIONS and CONDITIONS	
(a) Interference with shipping, fishing, recreation, mineral extraction desalination, fish and shellfish culture, areas of special scientific importance and other legitimate uses of the sea	
NATURE OF THE IMPACT OF DREDGED MATERIAL DISPOSAL	
6.1 Particular attention should be given to dredged material containing oil or substances that have a tendency to float following re-suspension in the water column. Such materials should hot be dumped in a manner or at a location which may lead to interferences with fishing, shipping, amenities or other beneficial uses of the marine environment.	6.1 (10.11) Particular attention should be given to dredged material containing significative quantities of oil or substances that have a tendency to float following re-suspension in the water column. Such materials should hot be dumped in a manner or at a location which may lead to interferences with fishing, shipping, amenities or other beneficial uses of the marine environment.
6.2 The disposal of dredged material should not interfere with, or devalue, legitimate commercial and economic uses of the marine environment. The selection of disposal sites should take into account the nature and extent of both commercial and recreational fishing and fish culture as well as the spawning, nursery and feeding areas that sustain them.	6.2 The dumping of dredged material should not interfere with, or devalue, legitimate commercial and economic uses of the marine environment. The selection of dumping sites should take into account the nature and extent of both commercial and recreational fishing and fish culture as well as the spawning, nursery and feeding areas that sustain them.
6.3 In selecting disposal sites, the habitats of rare, vulnerable or endangered species should be avoided, taking into account the preservation of the biodiversity.	6.3 In selecting dumping sites, the habitats of rare, vulnerable or endangered species should be avoided, taking into account the preservation of the biodiversity.

6.4 Besides toxicological effects and bioaccumulation of the constituents of the dredged material, other potential impacts on marine life should be considered, such as modification of behaviour, nutrient enrichment, oxygen depletion, turbidity, modification of the sediment composition and blanketing of the sea floor.	6.4 Besides toxicological effects and bioaccumulation of the constituents of the dredged material, other potential impacts on marine life should be considered, such as: **Õ** alteration of fish sensorial capacities and behaviour, in particular regarding the natural predators; **Õ** nutrient enrichment; **Õ** oxygen depletion; **Õ** increasing turbidity; **Õ** modification of the sediment composition and blanketing of the Sea floor.
	Physical impact
6.5 All dredged materials, whether or not contaminated, have a significant physical impact at the point of disposal. This impact includes covering of the seabed **[**~~(and smothering of benthic organisms)~~**]** and local enhancement of suspended solids levels. Physical impact may also result from the onward transport particularly in finer fractions, by wave and tidal action and residual current movements. In relatively enclosed waters, such as some estuarine situations, oxygen-consuming sediments (e.g. organic carbon-rich) could adversely affect the oxygen regime of receiving systems.	6.5 All dredged materials, whether or not contaminated, have a significant physical impact at the point of disposal. This impact includes covering of the seabed and local enhancement of suspended solids levels. Physical impact may also extend to zones outside the dumping zone, resulting from the onward transport particularly in finer fractions, by wave and tidal action and residual current movements. In relatively enclosed waters, such as some estuarine situations, oxygen-consuming sediments (e.g. organic carbon-rich) could adversely affect the oxygen regime of receiving systems. In the same way, dumping of sediments with high levels of nutrients may significantly affect the nutrient fluxes and, subsequently, in extreme cases, contribute significantly to the eutrophication of the receiving zone.

	Biological impact
6.6 Biological consequences of these physical impacts include smothering of benthic organisms in the dumping area.	6.6 Biological consequences of these physical impacts include smothering of benthic organisms in the dumping area. Nevertheless, after dumping activities stopped, in some circumstances, a modification of the ecosystem may intervene, in particular when the physical characteristics of the sediments which constitute the dredged material are very different from those of the receiving zone.
Disposal may in certain special circumstances interfere with migration of fish (e.g. the impact of high turbidity on salmonids in estuarine areas) or of crustacean (e.g. if deposition occurred in the coastal migration path of crabs).	**Unchanged text**
	Economical impact
6.7 An important consequence of the physical presence of dredged material disposal activities is interference with fishery activities and, in some instances, with navigation and recreation. The former relates to both smothering of areas potentially used for fisheries and interference with fixed fishing gear; shoaling following dumping can lead to navigational hazards and clay or silt deposition may be a nuisance in recreational areas. These problems can be aggravated if the spoil is contaminated with bulky harbour debris such as wooden beams, scrap metal, pieces of cable etc.	**Unchanged text**
Approaches to management	
6.8 This section deals only with management techniques to minimise the physical effects of dredged material disposal. Measures to control the contamination of dredged materials are covered in other sections of these Guidelines.	**Unchanged text**
6.9 The key to management lies in careful site selection (see section 5) and assessment of conflict between marine resources and activities. These notes are intended to supplement these considerations.	**Unchanged text**

6.10 In most cases, blanketing of an area of seabed is accepted as a environmental cost of disposal. To avoid excessive use of the seabed, the number of sites should be limited as far as possible and each site should be used to the maximum extent possible without interfering with navigation. Once deposition stops, hydrodynamic forces will re-sort the nature of the sediments and re-colonisation takes place.	6.10 In most cases, blanketing of an area of seabed is accepted as a environmental cost of disposal. To avoid excessive use of the seabed, the number of sites should be limited as far as possible and each site should be used to the maximum extent possible without interfering with navigation (sand-shoals formation). Once deposition stops, hydrodynamic forces will re-sort the nature of the sediments and re-colonisation takes place.
6.11 Effects can be reduced by ensuring as far as possible that the sediments in the dredged material and receiving area are similar. Locally, biological impact may be further reduced if the deposition area is naturally subject to physical disturbance. Where this is not possible, consideration should be given where clean, fine materials are concerned to a deliberately dispersive style of **[**~~disposal~~**]** to reduce blanketing on a small site.	6.11 Effects can be reduced by ensuring as far as possible that the sediments in the dredged material and receiving area are similar. Locally, biological impact may be further reduced if the deposition area is naturally subject to physical disturbance. Where this is not possible, consideration should be given where clean, fine materials are -concerned to a deliberately dispersive style of dumping to reduce blanketing on a small site.
6.12 With capital and maintenance dredging, the material may be different in character to the sediments at the receiving site and re-colonisation may be affected. Where bulky material such as rock and clay material is deposited, there may be interference with fishing activity, even in the long term. It may prove possible to use capital materials in the construction of artificial reefs for fishery or recreational purposes or for habitat creation; in this case, advice from ecologists or fishery biologists is essential.	**Unchanged text** It may prove possible to use capital materials in the construction of artificial reefs for fishery or recreational purposes or for habitat creation. Therefore, any construction of artificial reefs might be **preceded** by a impact study; in this case, advice from ecologists or fishery biologists is essential.
6.13 The infilling of depressions, deliberate capping or contained disposal of dredged material deposits may be used in certain circumstances to avoid interferences with fishery or other legitimate activities.	**Unchanged text**
6.14 Temporal restrictions on dumping activities may be appropriate (e.g. tidal and seasonal restrictions). Interference with fish or crustacean migration or spawning or with seasonal fishery activity may be avoided by timing restrictions on disposal activity. Trench digging and refilling activities may also interfere with migratory patterns; similar control are appropriate. In mitigating the impact of disposal within estuaries on migrating fish, silt screens have been used to reduce the suspended solids levels, but these have proved hard to manage effectively.	**Unchanged text**

6.15 Where appropriate, disposal vessels should be equipped with accurate positioning systems. Disposal vessels and operations should be inspected regularly to ensure that the conditions of the **[**~~disposal~~**]** permit are being complied with and that the crew are aware of their responsibilities under the permit. Where rubbish is a problem, it may be necessary to specify that the disposal vessel (or dredger) is fitted with a grid to facilitate removal for disposal (or recovery) on land, rather than being dumped at sea. Ships' records and automatic monitoring and display devices (e.g. black-boxes), where these have been fitted, should be inspected to ensure that **[**~~disposal~~**]** is taking place at the specified **[**~~disposal~~**]** site.	6.15 Where appropriate, disposal vessels should be equipped with accurate positioning systems. Disposal vessels and operations should be inspected regularly to ensure that the conditions of the <u>dumping</u> permit are being complied with and that the crew are aware of their responsibilities under the permit. Where rubbish is a problem, it may be necessary to specify that the disposal vessel (or dredger) is fitted with a grid to facilitate removal for disposal (or recovery) on land, rather than being dumped at sea. Ships' records and automatic monitoring and display devices (e.g. black-boxes), where these have been fitted, should be inspected to ensure that <u>dumping</u> is taking place at the specified <u>dumping</u> site.
6.16 Monitoring is an essential component of management action (see Part B).	**Unchanged text**
(b) In applying these principles, the practical availability of alternative land-based methods of treatment, disposal or elimination or of treatment to render the matter less harmful for sea dumping, will be taken into consideration or: <u>Evaluation of disposal options - Beneficial uses</u>	
6.17 In the special case of dredged material, sea disposal is often an acceptable disposal option, though opportunities should be taken to encourage the productive use of dredged material for, for example, **[**~~marsh creation, beach nourishment, land reclamation or use in aggregates~~**]**.	6.17 In the special case of dredged material, and depending on the physical and chemical characteristics of the material, sea disposal is often an acceptable disposal option, though opportunities should be taken to encourage the productive use of dredged material for, <u>such as</u>, for example: **Õ** <u>Engineered uses</u>: land creation and improvement, beach nourishment, offshore berms, capping materials and fill; **Õ** <u>Agricultural and product uses</u>: aquaculture, construction material, liners; and **Õ** <u>Environmental enhancement</u>: restoration and establishment of wetlands, terrestrial habitats, nesting islands, and fisheries.
6.18 For contaminated dredged materials, consideration should be given to the use of special methods to mitigate their impact, in particular with respect to contaminant inputs. In extreme cases of contamination, alternative methods of treatment or land disposal may be necessary, taking into account the best environmental practice.	**Unchanged text**

6.19 If the foregoing analysis shows a land alternative to be more practical, a license for sea disposal should not be given.	6.19 If the foregoing analysis shows a land alternative to be more practical, a license for sea dumping should not be given.
7. DISPOSAL MANAGEMENT TECHNIQUES	
7.1 Ultimately, the problems of contaminated dredged material disposal can be solved effectively only by implementing programmes and measures for the progressive elimination of polluting discharges to waters from which dredged materials are taken.	**Unchanged text**
Until this objective is met and for cases where there is historical contamination, the problems of contaminated dredged material may be addressed by using disposal management techniques.	7.1 bis. **Unchanged text**
7.2 "Disposal management techniques" refers to actions and processes through which the impact of persistent and potentially toxic substances contained in dredged material may be reduced to, or controlled at, a level which does not constitute a hazard to human health, harm to living resources and marine life, damage to amenities or interference with other legitimate uses of the sea. In this context they may, in certain circumstances, constitute additional methods by which dredged material containing organohalogens or many other toxic substances may be rendered biologically harmless and which may constitute "special care" in the disposal of dredged material containing substances listed in Technical Annex 1.	**Unchanged text**
7.3 Relevant techniques include the utilisation of natural physical, chemical and biological processes as they affect dredged material in the sea; for organic material these may include physical, chemical or biochemical degradation and/or transformation that results in the material becoming non-persistent, non-toxic and/or non-biologically available. Beyond the considerations of Sections B and C of the annex to the Protocol, disposal management techniques may include burial on or in the sea floor followed by clean sediment capping, utilisation of geochemical interactions and transformations of substances in dredged material when combined with sea water or bottom sediment, selection of special sites such as in abiotic zones, or methods of containing of the material in a stable manner (including on artificial islands).]	**Unchanged text**

7.4 Utilisation of such techniques must be carried out in full conformity with other Annex to the Protocol considerations, such as comparative assessment of alternative disposal options, and **[**~~these Guidelines~~**]** should always be associated with post-disposal monitoring to assess the effectiveness of the techniques and the need for any follow-up management action.	7.4 Utilisation of such techniques must be carried out in full conformity with other Annex to the Protocol considerations, such as comparative assessment of alternative disposal options, and should always be associated with post-disposal monitoring (**ecological follow-up**) to assess the effectiveness of the techniques and the need for any follow-up management action.

PART B **MONITORING OF DREDGED MATERIAL <u>DUMPING</u> OPERATIONS**	
Definition [1. In the context of assessing and regulating environmental and human health impacts of dredged material **[**~~disposal~~**]** operations monitoring is the repeated measurement of a contaminant or an effect whether direct or indirect in the marine environment.].	Definition 1. In the context of assessing and regulating environmental and human health impacts of dredged material <u>dumping</u> operations, monitoring is <u>defined as the whole</u> measures the aim of which is to determine, **from** the repeated measurement of a contaminant or an effect, whether direct or indirect in the marine environment, <u>the spatial and temporal modifications which are supported, by the **receiving zone, as a consequence of the considered activity.**</u>
<u>Objectives</u>	<u>Motives</u>
2. Monitoring of dredged material **[**~~disposal~~**]** operations is generally undertaken for the following reasons: i) to establish whether licensing conditions have, as intended, prevented adverse effects on the receiving area as a consequence of dumping; ii) to improve the basis on which license applications are assessed by improving knowledge of field effects from large discharges which are not readily estimated by laboratory or literature assessment; iii) to provide the necessary evidence to demonstrate within the framework of the Protocol that the control measures applied are sufficient to ensure that the dispersive and assimilative abilities of the marine environment are not exceeded, so causing environmental damage.	2. Monitoring of dredged material <u>dumping</u> operations is generally undertaken for the following reasons: i) to establish whether licensing conditions <u>are respected - conformity control - and consequently</u> have, as intended, prevented adverse effects on the receiving area as a consequence of dumping; **Unchanged text** **Unchanged text**
Objectives	
3. The purposes of monitoring are to determine contaminant levels in organisms, the biological effects and consequences for the marine environment due to the dumping of dredged material and, ultimately, to allow managers to control exposures of the organisms of concern to dredged materials and associated contaminants.	**Unchanged text**

Strategy	
4. Monitoring operations are expansive for they require considerable resources both at sea and in subsequent working up of samples.	4. Monitoring operations are expansive for they require considerable resources both at sea to pour carry out measures and sampling campaigns and in subsequent analytical working up of samples.
In order to approach the monitoring programme in a resource-effective manner, it is essential that the programme should have clearly defined objectives, that measurements made can meet those objectives, and that the results be reviewed at regular intervals in relation to those objectives. The monitoring scheme should then be continued, reviewed or even terminated, as appropriate.	In order to approach the monitoring programme in a resource-effective manner, it is essential that the programme should have clearly defined objectives, that measurements made can meet those objectives, and that the results be reviewed at regular intervals in relation to those objectives.
	Since the effects of dredged material disposal are likely to be similar in many areas, there appears to be little justification for monitoring all sites, particularly those receiving small quantifies of dredged material. It would be more effective to carry out more detailed investigations at a few carefully chosen sites (e.g. those subject to large inputs of dredged material) to increase understanding of effects and processes. In the zones which present the same physical, chemical or biological characteristics, or nearly the same characteristics, there is strong presumptive evidence that the effects of dredged material dumping be likely similar. On scientific or economic grounds, it is very difficult to justify monitoring of all sites, particularly those receiving small quantities of dredged material (e.g. less than 25.000 tons per year). It is therefore more appropriate, and cost effective, to concentrate on detailed investigations at a few carefully chosen sites (e.g. those subject to large inputs of dredged material) to obtain a better understanding of involved processes and effects.

Impact hypothesis	
5. In order to establish such objectives, it is first necessary to derive an **Impact Hypothesis** describing predicted effects on the physical, chemical and biological environment.	5. In order to establish such objectives, it is first necessary to derive an Impact Hypothesis describing predicted effects on the physical, chemical and biological environment of the dumping zone as well as the outside dumping zone. **The Impact Hypothesis forms the basis for defining the monitoring programme.** **In the greatest part of cases,** the Impact Hypothesis concerning the area outside the dumping zone will be a null hypothesis, which means that not significant change can be detected.
6. An Impact Hypothesis should integrate information on the characteristics of the dredged material and proposed **[**~~disposal~~**]** site conditions. The aim is to provide a concise scientific analysis of the potential effects on human health, living resources, marine life, amenities and other legitimate uses of the sea. It should encompass both the temporal and spatial scales of potential effects.	6. 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 dumping activities on human health, living resources, marine life, amenities and other legitimate uses of the seas. For this purpose**,** an Impact hypothesis should integrate information on the characteristics of the dredged material and proposed dumping site conditions. It should encompass both the temporal and spatial scales of potential effects. One of the main requirements of Impact Hypothesis is to elaborate 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 zones (see Part A, chapter 2).
	Preliminary evaluation
7. The preliminary evaluation should be as comprehensive as possible. The primary areas of potential impact should be identified and are 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.	**Unchanged text**

8. The expected consequences of disposal (targets) could be described in terms of habitats, processes, species, communities and uses affected. The precise nature of the change, response, or interference (effect) predicted could then be described. The target and the effect together could be described (quantified) in sufficient detail so that there would be no doubt as to the parameters to be measured during post-operational monitoring. In the latter context it might be essential to determine "where" and "when" the impacts can be expected.	8. The expected consequences of disposal (targets) could be described in terms of habitats, processes, species, communities and uses affected by the dumping. The precise nature of the change, response, or interference (effect) predicted could then be described. The target and the effect together could be described (quantified) in sufficient detail so that there would be no doubt as to the parameters to be measured during post-operational monitoring. In the latter context, it might be essential to determine "where" and "when" the impacts can be expected.
	Reference baseline
9. In order to develop **[**~~this~~**]** hypothesis, it may be necessary to conduct a baseline survey which describes not only the environmental characteristics, but also the variability of the environment. It may be helpful to develop sediment transport, hydrodynamic and other models, to determine possible effects of disposal.	9. In order to develop an impact hypothesis, it may be necessary to conduct a baseline survey which describes not only the environmental characteristics, but also the variability of the environment. It may be helpful to develop sediment transport, hydrodynamic and other models, to determine possible effects of disposal. 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 biota (including fish), as well as the major pollutants contents in the biota (including fish). Then, before any programme is drawn up and any measurements are made, the following questions should be addressed: In order to assess the impact, it will be necessary to compare the physical, chemical or 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.

	Impact hypothesis verification: defining the monitoring programme
	9 bis The measurement programme should be designed to ascertain that physical, chemical and biological changes in the receiving environment are within those projected and do not exceed the predictive impact hypothesis. Measurements 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. 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. Considering the second question, it can be answered by 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: i) what exactly should be measured ? ii) what is the purpose of monitoring a particular variable, contaminant or biological effect; iii) in what compartment or at which locations can measurements most effectively be made ? iv) for how long should the measurements continue to be made to meet the originally defined aim ? v) what should be the temporal and spatial scale of measurements **[**~~made to test the hypothesis~~**].**	Then, before any programme is drawn up and any measurements are made, the following questions should be addressed: 0) <u>what testable hypothesis can be derived from the Impact Hypothesis</u> ? i) what exactly should be measured to test these Impact hypothesis ? ii) what is the purpose of monitoring a particular variable, contaminant or biological effect ? iii) in what compartment or at which locations can measurements most effectively be made ? iv) for how long should the measurements continue to be made to meet the originally defined aim ? v) what should be the temporal and spatial scale of measurements made ?

10. It is recommended that the choice of contaminants to be monitored should depend primarily on the ultimate purposes of monitoring. One should certainly not have to monitor regularly for ail contaminants at ail sites and it should not be necessary to use more than one substrate or effect to meet each aim.	**Unchanged text**
11. A major requirement is to develop criteria describing the specific environmental effects of dredging <u>activities</u> that should be prevented outside designated dredging and disposal areas (see Part A, section 2).	**Cancelled**
Monitoring	
12. The **[**~~disposal~~**]** 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.	12. The <u>dumping</u> 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.
13. 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. echosounding) to identify areas of dredged material accumulation. Both of these techniques will require a certain amount of sediment sampling to establish ground-truth. In addition, multispectral scanning can be used for monitoring dispersion of suspended material (plumes, etc.).	**Unchanged text**
14. Tracer tests may also prove useful in following the dispersal of the dredged material and assess any minor accumulation of material not detected by bathymetric surveys.	**Unchanged text**
15. When a contaminated dredged material is deposited, it may be necessary to measure its chemical components to ensure that unacceptable accumulation of these components does not occur.	**Cancelled**.
16. 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 biota (including fish).	16. Where, <u>considering the impact hypothesis</u>, 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 biota (including fish).

17. In order to assess the impact, it will be necessary to compare the physical, chemical or biological quality of the affected areas with reference sites located away from dredged material [dispersal] pathways. Such areas can be identified during the early stages of the impact assessment.	**Cancelled (Moved 9bis)**
18. The spatial extent of sampling will need to take into account the size of the area designated for dumping, any areas of possible short dumping, the mobility of the dumped dredged material and water movements which will determine the direction and extent of sediment transport. It may be possible to limit sampling within the disposal site itself as effects in this area are accepted and their definition in detail may be 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 rigour.	**Unchanged text**
19. The frequency of survey will depend on a number of factors. Where a **[**~~disposal~~**]** 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 (quantifies or type of dredged material deposited, method of disposal, etc.).	19. The frequency of survey will depend on a number of factors. Where a <u>dumping</u> 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 (quantifies or type of dredged material deposited, method of disposal etc.).
20. If it were decided to monitor the recovery of an area which was no longer used for dredged material disposal, more frequent measurement might be needed.	**Unchanged text**
21. Since the effects of dredged material disposal are likely to be similar in many areas, there appears to be little justification for monitoring all sites, particularly those receiving small quantifies of dredged material. It would be more effective to carry out more detailed investigations at a few carefully chosen sites (e.g. those subject to large inputs of dredged material) to increase understanding of effects and processes.	**Cancelled (Moved in the Strategy)**

	Notification
22. Concise statements of monitoring activities should be prepared. g Parties should inform the Secretariat of their monitoring activities. Reports should detail the measurements made, results obtained and how these data relate to the monitoring objectives. The frequency of reporting will depend upon the scale of **[**~~disposal~~**]** activity and the intensity of monitoring. Contracting Parties should inform the Secretariat of their monitoring activities and submit reports when they are available.	22. Contracting Parties should inform the Secretariat of their monitoring activities. Concise statements of monitoring activities should be prepared and will be transmitted to the secretariat when they are available. Reports should detail the measurements made, results obtained and how these data relate to the monitoring objectives <u>and confirm the impact hypothesis</u>. The frequency of reporting will depend upon the scale of <u>dumping</u> activity, the intensity of monitoring <u>and the obtained results</u>.
	Feedback
	23. Information gained from field monitoring (and/or other related research studies) can be used to: a) modify or, in the best case, terminate the field monitoring programme; b) modify or revoke the permit; c) refine the basis on which applications to dump dredged material at sea are assessed

TECHNICAL SUPPLEMENTS TO THE GUIDELINES FOR THE MANAGEMENT OF DREDGED MATERIAL

TECHNICAL ANNEX 1

Analytical Requirements for dredged Material Assessment	
1. This Annex amplifies the analytical requirements set out in paragraph 4.9 - 4.12 of the Guidelines for the Management of Dredged Material.	**Unchanged text**
2. A tiered approach to testing is recommended. At each tier it will be necessary to determine whether sufficient information exists to allow a management decision to be taken or whether further testing is required.	**Unchanged text**
3. As a preliminary to the tiered testing scheme, information required under section 3.1 of the Guidelines will be available. In the absence of appreciable pollution sources and if the visual determination of sediment characteristics leads to the conclusion the dredged material meets one of the exemption criteria under paragraph 3.3 of the Guidelines then the material will not require further testing.	**Unchanged text**
4. The sequence of tiers is as follows: **Õ** assessment of physical properties; **Õ** assessment of chemical properties; **Õ** assessment of biological properties and effects. A pool of supplementary information, determined by local circumstances may be used to augment each tier.	**Unchanged text**
5. It is important that the assessment procedure must at each stage take account of the method of analysis.	**Unchanged text**
	5bis Analysis should be carried out on the whole sediment (< 2 mm).

Tier I: PHYSICAL PROPERTIES	
It is strongly recommended that the following determinations are carried out: Õ grain size (% sans, silt, clay) Õ percent solids (dry matter) Õ density/specific gravity Õ organic matter (as total organic carbon).	In addition to the visual determination of sediments characteristics, as required on paragraph 3.1 of the guidelines, it is strongly recommended that the following determination be carried out:
Tier II: CHEMICAL PROPERTIES	
Primary group determinants:	
In all cases when chemical analysis is required the concentrations of the following trace metals should be determined: Cadmium (Cd) Copper (Cu) Mercury (Hg) Zinc (Zn) Chromium (Cr) Lead (Pb) Nickel (Ni)	**Unchanged text**
In addition the concentrations of the following polychlorinated biphenyl (PCB) congeners should be determined: IUPAC Nº 28, 52, 101, 118, 153, 138 et 180 Analysis should be carried out on the whole sediment (< 2 mm) The determination of PCBs will not be necessary when: Õ there are no known sources (point or diffuse) of contamination or historic inputs; Õ the sediments are predominantly coarse; and Õ the levels of total organic carbon are low.	In addition the concentrations of the following polychlorinated biphenyl (PCB) congeners should be determined (analysis should be carried out on the whole sediment (< 2 mm)): **Unchanged text** **Moved above** The polycyclic aromatic hydrocarbons (PAHs) should also be determined. The determination of PCBs and PAHs will not be necessary when: Õ sufficient information from previous investigations indicate the absence of contamination (cf. paragraph 3.3 c) of the Guidelines); Õ there are no known sources (point or diffuse) of contamination or historic inputs; Õ the sediments are predominantly coarse; and Õ the levels of total organic carbon are low.
Secondary group determinants:	
Based upon local information of sources of contamination (point sources or diffuse sources) or historic inputs, other determinants may be applicable, for instance:	Based upon local information of sources of contamination (point sources or diffuse sources) or historic inputs, other determinants may require analysis, for instance:

arsenic; other chlorobiphenyls (IUPAC Nos 18, 31, 44, 66/95, 110, 149, 187 et 170); organophosphorus pesticides; hydrocarbures polycyclic aromatic hydrocarbons (PAHs) **[**oil**];** organochlorine pesticides; tri-organic compounds, polychlorinated dibenzodioxins (PCDDs)/polychlorinated dibenzofurans (PCDFs).	
Tier III: BIOLOGICAL PROPERTIES AND EFFECTS	
[~~No guidance is offered at this stage~~.**]**	In a significant number of cases the physical and chemical properties dot not provide a direct measure of the biological impact. Moreover, they do not adequately identify all the physical disturbances and all sediments-associated constituents present in the dredged material. If the potential impacts of the dredged material to be dumped cannot be adequately assessed on the basis of the chemical and physical characterisation, biological measurements should be carried out. 1. Toxicity bioassays The primary purposes of the biological assays is to provide direct measures of effects of all sediment constituents acting together, taking into account their bioavailability. For ranking and classifying the acute toxicity of harbour sediments prior to maintenance dredging, short term bioassays may often suffice as screening tool. C To evaluate the effects of the dredged material, acute bioassays can be carried out with pore water, en elutriate or the whole sediment. In general, a set of 2-4 bioassays is recommended with organisms from different taxonomic groups (e. g. crustaceans, molluscs, polychaetes, bacteria, echinoderms); C In most bioassays, survival of the test species is used as an endpoint. Chronic bioassays with sub-lethal endpoint (growth, reproduction, etc.) covering a significant part of the test species life cycle may provide a more accurate prediction of potential impacts of dredging operations. However, standard test procedures are still under development;

The outcome of sediment bioassays can be unduly influenced by factors other than sediment-associated chemicals. Confounding factors like ammonia, hydrogen sulphide, grain size, oxygen concentration and pH should therefore be determined during the bioassay.

Guidance on the selection of appropriate test organisms, use and interpretation of sediment bioassays is given by e.g. EPA/CE (1991/1994) and IADC/CEDA (1997) while guidance on sampling of sediments for toxicological testing is given by e.g. ASTM (1994).

2. Biomarkers:

Biomarkers may provide early warning of more subtle (biochemical) effects at low and sustained levels of contamination. Most biomarkers are still under development but some are already applicable for routine application on dredged material (e.g. one which measures the presence of dioxin-like compounds - Murk *et al.,* 1997) or organisms collected in the field (e.g. DNA strand/breaks in flat fish).

3. Microcosm experiments:

There are short-term microcosm tests available to measure the toxicant tolerance of the community e.g. Pollution Induced Community Tolerance (PICT) (Gustavson and Wangberg, 1995).

4. Mesocosm experiment:

Because of the costs and time involved these experiments are not applicable in the process of authorising permits but are useful in cases where the extrapolation of laboratory testing to field condition is complicated **r** environmental conditions are very variable and hinder the identification of toxic effects as such. The results of these experiments would be then available for future permitting decisions.

	5. Field observation of benthic communities: Monitoring in the surrounding of the disposal site of benthic communities *e.g. in situ* (fish, benthic invertebrates) can give important clues to the condition of marine sediments and are relevant as a feed-back or refinement process for authorising permits. Field observations give insight into the combined impact of physical disturbance and chemical contamination. Guidelines on the monitoring of benthic communities are provided by e.g. the Paris Convention, 1992, ICES. 6. Other biological properties: Where appropriate, other biological measurements can be applied in order to determine e.g. the potential for bioaccumulation and for tainting.
SUPPLEMENTARY INFORMATION	
The need for this information will be determined by local circumstance and may form an essential part of the management decision. Appropriate data might include: redox potential, sediment oxygen demand, total nitrogen, total phosphorus, iron, manganese, mineralogical information or parameters for normalising trace metal data (e.g. aluminium, lithium, scandium see Technical Annex 2).	

TECHNICAL ANNEX 2

NORMALISATION TECHNIQUES FOR STUDIES ON THE SPATIAL DISTRIBUTION OF CONTAMINANTS[1]

Unchanged text

[1] Extrait de 1989 ACMP Report (Section 14) ICES Coop.Res.Rep.167, pp 68-76.

DRAGOSPA

FLOW DIAGRAM

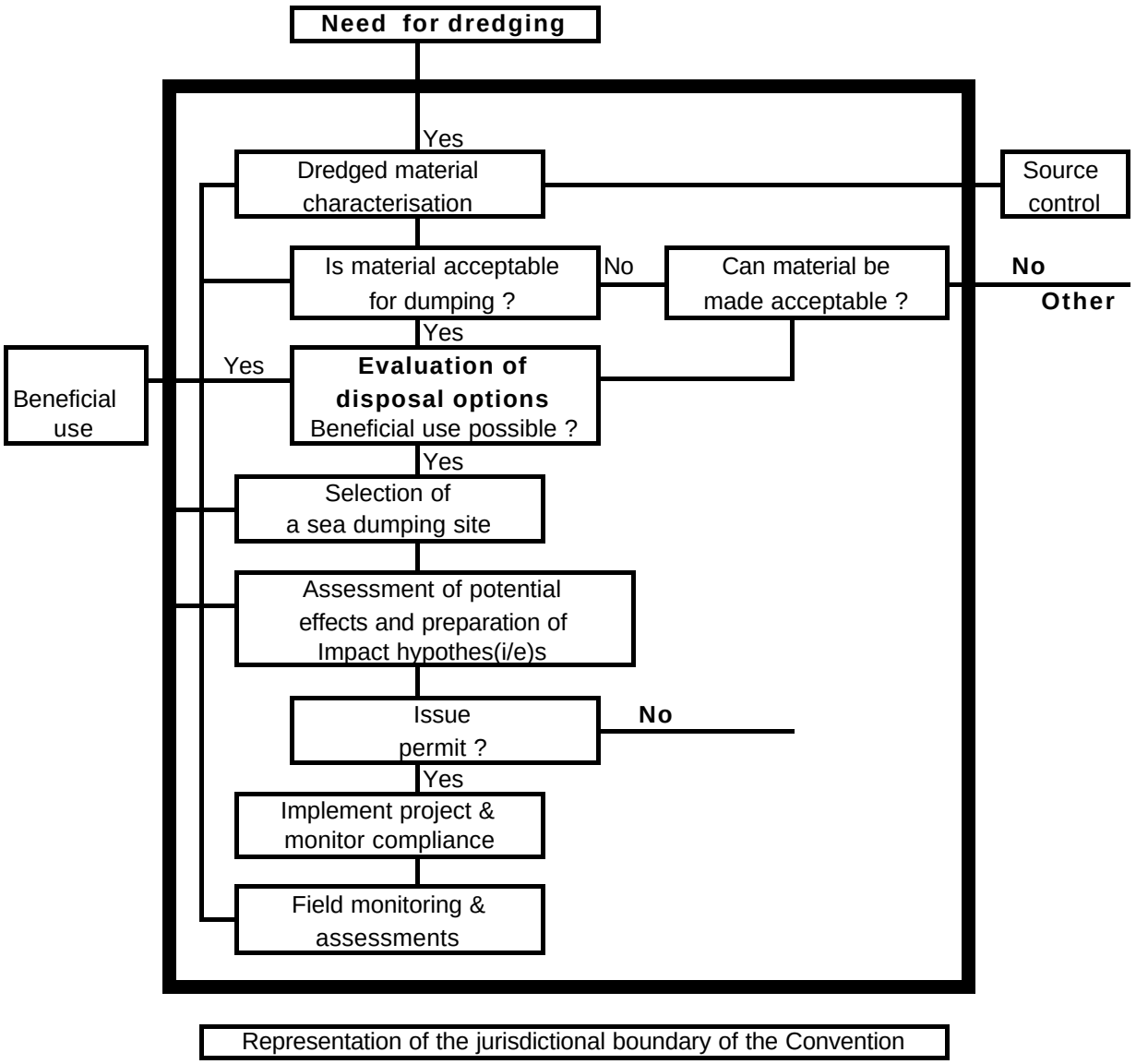


Tableau 1: A typical approach for the determination of physical and chemical parameters in marine sediments

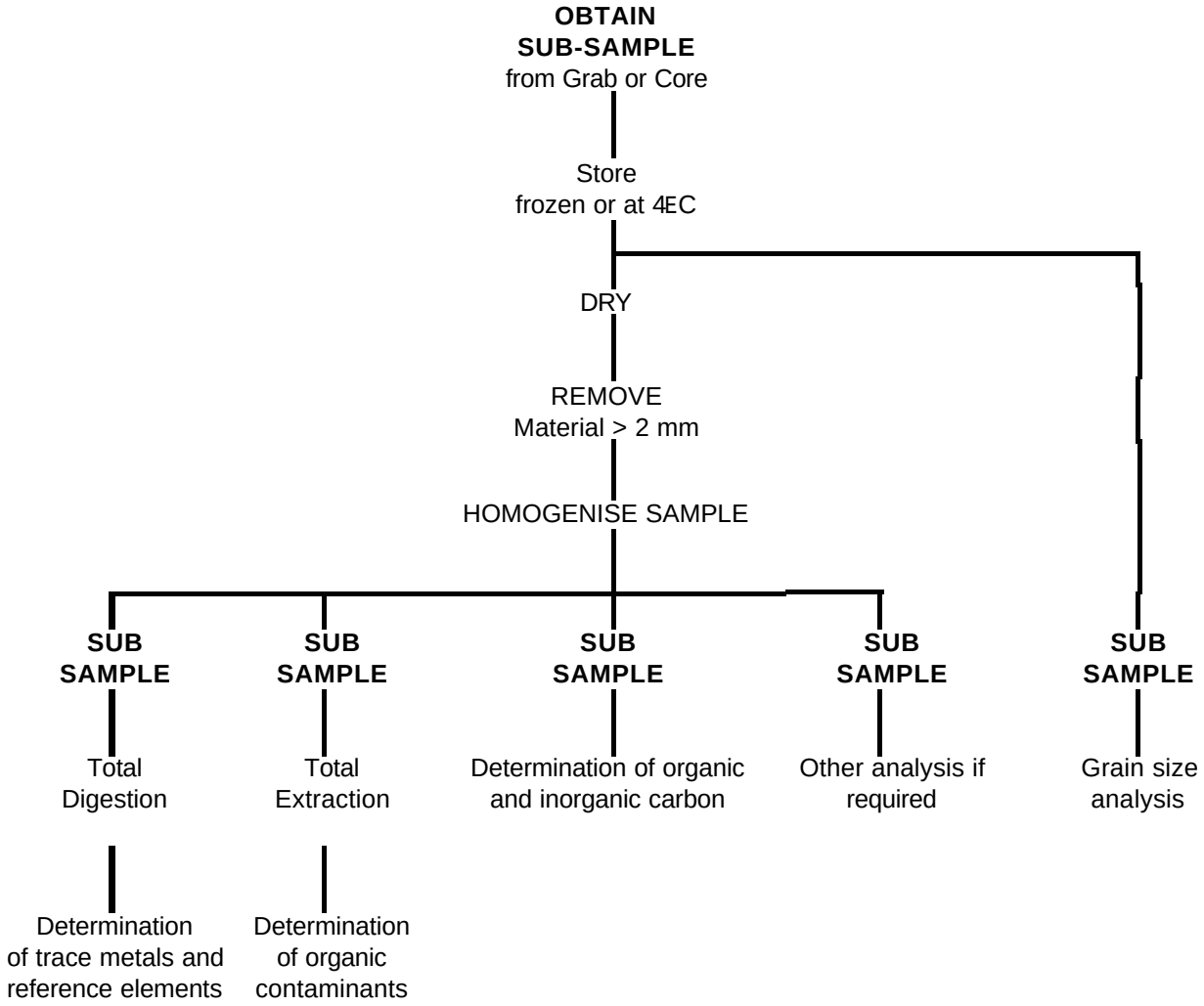


Tableau 2: SUMMARY OF NORMALISATION FACTORS

NORMALISATION FACTOR	GRAIN SIZE (Fm)	INDICATOR	ROLE
Textural			Determines physical sorting and depositional pattern of metals
Sand	2000 à 63	Coarse-grained metal-poor minerals / compounds	Usually diluent of trace metal concentrations
Mud	< 63	Silt and clay size metal-bearing minerals / compounds	Usually overall concentrator of trace metals
Clay	< 2	Metal-rich clay minerals	Usually fine-grained accumulator of trace metals
Chemical			
Si		Amount and distribution of metal-poor quartz	Coarse-grained diluter of contaminants
Al		All silicates but used to account for granular variations of metal-rich fine silt and clay size Al-silicates	Chemical tracer of Al-silicates, particularly the clay minerals
Li, Sc		Structurally combined in clay minerals and micas	Tracer of clay minerals, particularly in sediments containing Al-silicates in all size fractions
Organic carbon		Fine-grained organic matter	Tracer of organic contaminants. Sometimes accumulator of trace metals like Hg and Cd.
Fe, Mn		Metal-rich silt and clay size Fe-bearing clay minerals. Fe-rich heavy minerals and hydrous Fe and Mn oxides	Chemical tracer for Fe-rich clay fraction. High absorption capacity of organic and inorganic contaminants
Carbonates		Biogenic marine sediments	Diluter of contaminants. Sometimes accumulate trace metals like Cd and Cu.

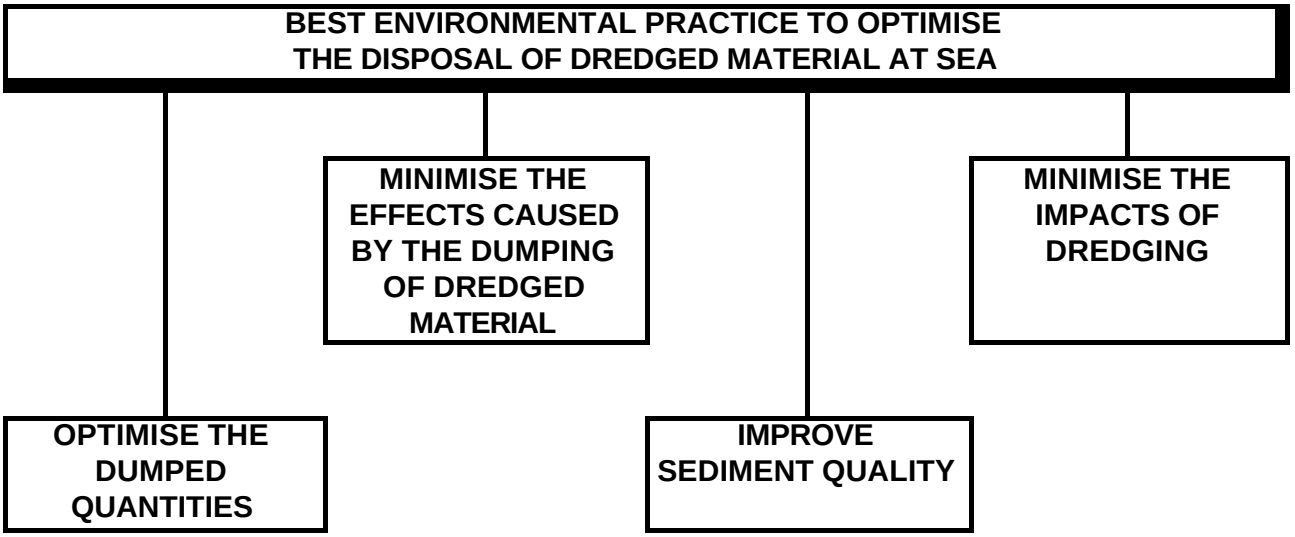
BEST ENVIRONMENTAL PRACTICE (BEP)

Introduction

This Technical Annex was prepared bearing in mind that, although the guidelines strictly only apply to the disposal of dredged material, Contracting Parties are encouraged also to exercise control over dredging operations.

This Technical Annex has as its aim to provide guidance to national regulatory authorities, operators of dredging vessels and port authorities on how to minimise the effects on the environment of dredging and disposal operations. Careful assessment and planning of dredging operations are necessary to minimise the impacts on marine species and habitats.

The items given as BEP under the different headings of this Technical Annex are given as examples. Their applicability will generally vary according to the particular circumstances of each operation and it is clear that different approaches may then be appropriate. More detailed information on dredging techniques and processes can be found in Guide 4 of the IADC/CEDA series on Environmental Aspects of Dredging.



Point A Õ **Minimisation** of **the** effects caused by the disposal of dredged material is comprehensively described **in** the main body of these guidelines.

Point B Õ **Optimisation** of the disposed quantities, Point C "Improvement of sediment quality" and Point D "Minimise the Impacts of Dredging" do not fall within the strict remit of the Protocol, but are very relevant to the prevention of pollution of the marine environment resulting from the dumping of dredged materials.