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Agenda item 7: Technical Guidelines

Updated Guidelines for the Dumping of Inert Uncontaminated Inorganic Geological Materials

UNEP/MAP
Athens, 2023

Note by the Secretariat

The 22nd Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols (COP 22, Antalya, Türkiye, 7-10 December 2021) adopted Decisions IG.25/1 and IG.25/19, i.e., Medium-Term Strategy 2022-2027 and the Programme of Work and Budget for 2022-2023 respectively, which called for updating of the "Guidelines for the Dumping of Inert Uncontaminated Geological Materials" (COP14, Portoroz, Slovenia, 8-11 November, 2005) in synergy with the IMO London Protocol.

The need to update the Guidelines was substantiated by recent initiatives and developments on the global and regional levels, particularly the London Convention/London Protocol (LC/LP), International Maritime Organization (IMO), in their document "Specific Guidelines for Assessment of Inert, Inorganic Geological Material" (LC 30/16);[1] and the forthcoming LC/LP Guidance for Selecting Sites for Sea Disposal and for Developing Site Management and Monitoring Plans;[2] OSPAR Commission, HELCOM, and other relevant technical documents including UNEP/MAP-MED POL, *inter alia*, the "Updated Guidelines on Management of Dredged Materials; the Compendium of Best Practices for Implementation of Dumping Protocol."[3]

The Secretariat prepared a proposal for updating the Guidelines for the "Dumping of Inert Uncontaminated Geological Materials" in line with the requirements of Articles 4.2 and 6.2 of the Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration (Dumping Protocol). The proposed updates include enhanced definition for the Inert Uncontaminated Inorganic Geological Materials in concurrence with IMO London Protocol; promoting the use of valuable inert uncontaminated inorganic geological materials for alternative uses; as well as significant improvements on monitoring of disposal of inert, uncontaminated inorganic geological materials in line with UNEP/MAP's Integrated Monitoring and Assessment Programme based on the Ecosystem Approach.

The proposed Updated Guidelines were reviewed by the "Meeting to Review the Updated Guidelines for the Dumping of Inert Uncontaminated Geological Materials and Sharing Best Practices to Support Implementation of the Dumping Protocol" (videoconference, 13-14 February 2023). The Meeting accepted the updated Guidelines with minor modifications and recommended their submission to the MED POL Focal Points Meeting (May 2023).

The updated Guidelines are presented herein for the consideration of the Meeting of the MED POL Focal Points with the aim of submission to the Meeting of the MAP Focal Points (September 2023) for approval, and COP23 (December 2023) for adoption. Specifically, the original text of the 2005 Guidelines as adopted by COP14 is presented along with the amendments which were proposed by the Secretariat to the "Meeting to Review the Updated Guidelines for the Dumping of Inert Uncontaminated Geological Materials and Sharing Best Practices to Support Implementation of the Dumping Protocol" (videoconference, 13-14 February 2023). These "initial" amendments are shown in **blue typeset**. During the aforesaid Meeting, additional modifications were proposed by a number of participants and approved by the Meeting. These "additional" modifications are illustrated in **green typeset**. The proposed "initial" amendments by the Secretariat and the "additional" modifications by the aforesaid Meeting are presented herein for the consideration and approval of the MED POL Focal Points Meeting.

[1] IMO LC 30/16, annex 4 (2008)

[2] The draft report is available as document LC/SG 42/2/2 for the March 2019 meeting of the LC/LP Scientific Groups on the IMODOCS website

[3] UNEP/MED WG.509/42 updated in UNEP/MED WG.554/4

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INTRODUCTION

These Guidelines; herein referred to as the "Updated Guidelines" are an update of the 2005 Guidelines, intended to assist the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) in the implementation of the Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration at Sea (the Dumping Protocol); hereinafter referred to as "the Protocol", with regard to the dumping of inert, uncontaminated, inorganic geologic materials into the Mediterranean Sea (articles 4.2 and 6.2).

The Protocol was adopted on 16 February 1976 by the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea. The Protocol was amended and signed by 16 Contracting Parties on 10 June 1995.

The Updated Guidelines provide an update of a number of aspects including expanded definition of inert uncontaminated inorganic geologic materials; the criteria for their determination; identification of disposal sites; nature of potential impacts of dumping operations; as well as establishing monitoring requirements based on the Integrated Monitoring and Assessment Programme (IMAP) and its agreed sampling methodologies.

These guidelines are intended for use by national authorities in evaluating applications for the dumping of inert, uncontaminated, inorganic geological materials so as to prevent pollution in the Mediterranean Sea in a manner consistent with the provisions of the 1972 London Convention (Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter, 1972) and/or the 1996 Protocol thereto.

It is, however, implicitly recognized that the general considerations and detailed procedures described in these guidelines are not applicable in their entirety to all national or local situations.

PART A

Definitions

1. Article 4 of the Dumping Protocol lists the type of waste that may be considered for disposal at sea. Articles 4.2 and 6.2 address the dumping of inert, inorganic geological materials into the Mediterranean Sea.

2. For the purpose of these Updated Guidelines, materials may be considered as Inert, Uncontaminated, Inorganic Geological Materials, (herein referred to collectively as "materials") if the following conditions are met:

   a. The material is inert, and the relative hazards are confined to physical impacts.
   b. The chemical nature of the material (including uptake of any elements or substances from the material by biota) is such that the only effects will be due to its physical properties.
   c. The inert material will not interact with biological systems other than through physical processes.
   d. The geological material is comprised of only the solid mineral portion of the Earth (such as rocks and minerals) and it has not been altered from its original state by physical or chemical processing in a way that would result in different or additional impacts to the marine environment, compared with those expected from unaltered material.
   e. The geological material is inorganic if: (i) the materials are of inorganic mineral origin; and (ii) the materials contain no more than incidental and trivial amounts of compounds with carbon chemically bound to hydrogen.

In this regard, the waste that meets the "dredged material" criteria for disposal at sea, as mentioned under paragraph 18 of the "Updated Guidelines on Management of Dredged Material," can be also considered as "Inert, Uncontaminated, Inorganic Geological Material" if it meets one of the exemption criteria under paragraph 26(a) of the Dredged Material Guidelines.

Scope

3. For the scope of application of the current Guidelines, Figure 1 provides a waste management decision-making tree for selection of the applicable Guidelines to be used, taking into consideration the level of contamination of the waste and its origin. The decision should be made based on the analyses indicated in "Updated Guidelines on Management of Dredged Material.

4. The schematic shown in Figure 2 provides a clear indication of the stages in the application of the Guidelines where important decisions should be made and is not designed as a conventional "decision tree". In general, national authorities should use the schematic in an iterative manner ensuring that all steps receive consideration before a decision is made to issue a permit. The guidelines contain the following elements:

   a. Waste Characterization – the assessment of the characteristics and composition of materials to be disposed at sea (Part B);
   b. Waste Prevention Audit and Waste Management Options (Part B);
   c. Action List (Part B);
   d. Identify and Characterize Dump Sites (Part B);
   e. Determine Potential Impacts and Prepare Impact Hypothesis(es) - Assessment of potential effects and expected consequences of the material dumping operation and preparation of a statement (Part B);
   f. Prepare management and monitoring program based on the impact hypothesis for the application of the materials dumping permit (Part C)
   g. Issue Permit – requirements and criteria for issuing a disposal permit (Part D).

h. If permit is issued, implement dumping and monitor the operation to establish whether the dumping permit conditions have been respected (Part C);
i. Field monitoring and assessment to demonstrate that the dumping operation do not cause damage to the environment and deteriorate GES (Part C);

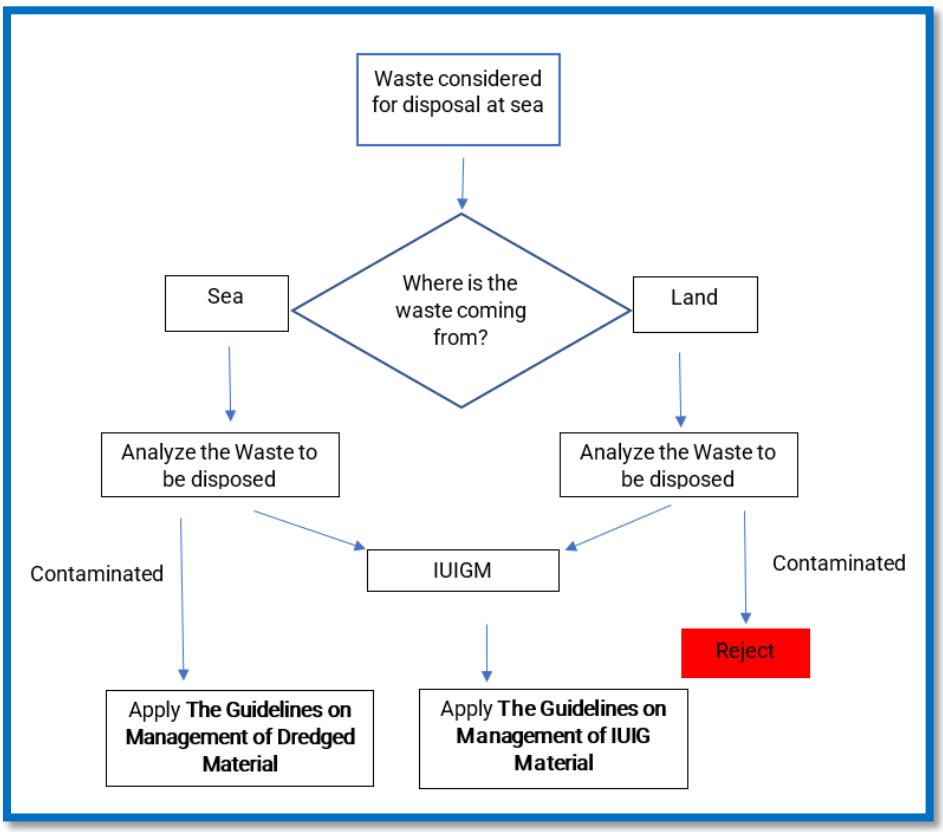

Figure 1: Waste Management decision tree for application of the Guidelines

5. In principle, the assessment process starts with "waste characterization" which examines the materials to be dumped. This first step is followed by an assessment of the presence of practicable opportunities to re-use, recycle or treat the waste in lieu of dumping. In case this is not possible, an action list is drawn for the materials to be disposed-off whereby an assessment is undertaken to ensure that these materials are acceptable for dumping. In the affirmative, the dumping site is identified and characterized; potential effects are determined; and an impact hypothesis is prepared along with a management and monitoring plans. At this stage, the issue of permitting is addressed. If permitting is legally possible, then dumping of the assessed material is implemented, and compliance to dumping requirements is monitored. This is followed by field monitoring and assessment of the impacts of dumped materials on site. At this stage, the process is repeated, looking again at potential effects resulting from the field dumping activities, and reconsidering potential effects. If necessary, the management and monitoring plans are updated as appropriate.

6. In general, national authorities should use the flow chart presented in Figure 2 in an iterative manner ensuring that all steps receive appropriate consideration, including consideration of Best Environmental Practices (BEP) before a decision is made to issue or decline a permit.

7. In addition, the Guidelines present in Annex A examples of the methodologies and techniques on disposal site according to the "Compendium of Best Practices for Implementation of Dumping Protocol (2023)."

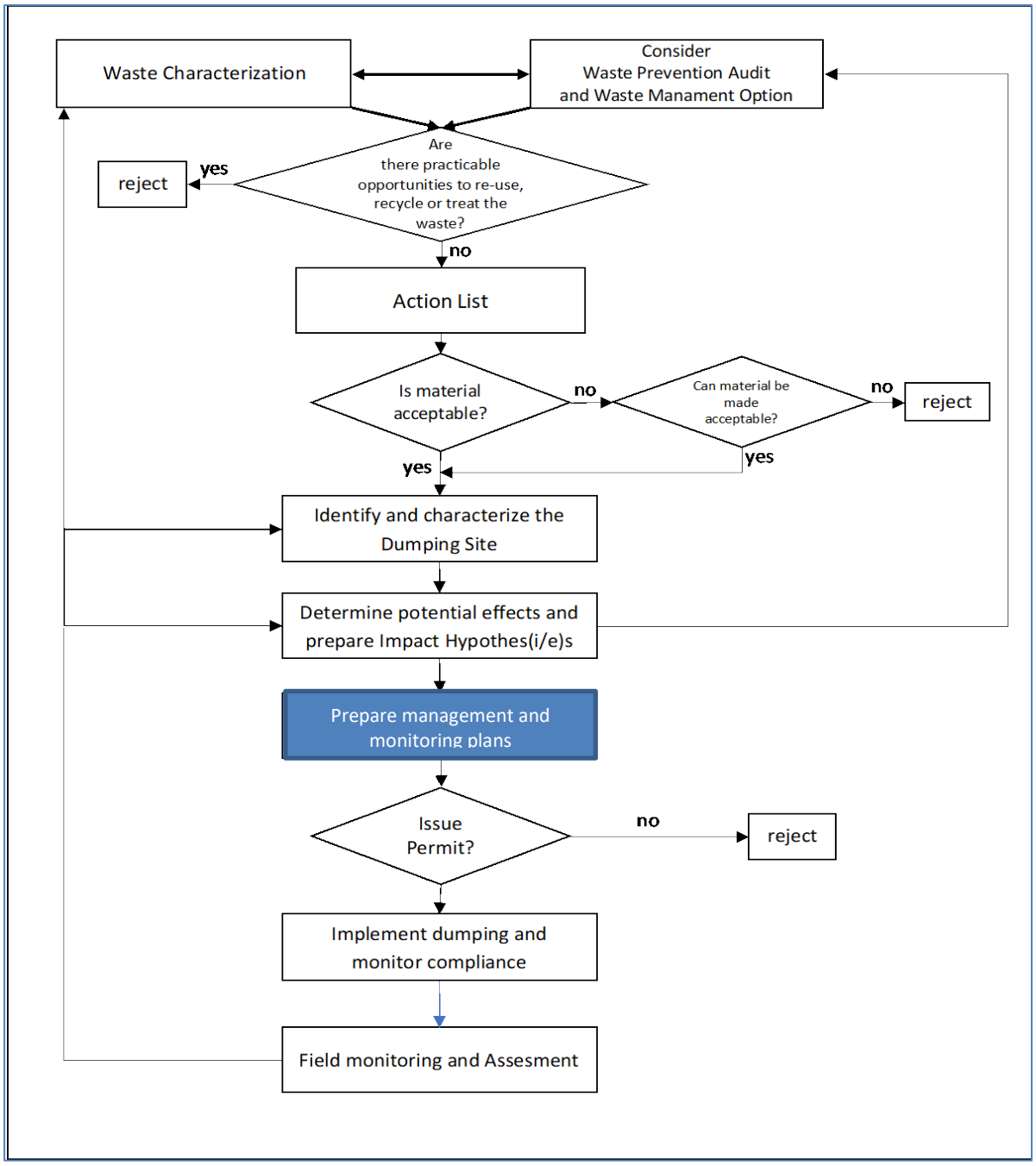

Figure 2: Flow chart of the step-by-step approach for the assessment framework to apply the updated guidelines for the dumping of inert uncontaminated inorganic geological materials

PART B

1. ASSESSMENT AND MANAGEMENT OF DUMPING OPERATIONS AT SEA

1.1 Requirements of the dumping protocol

8. In accordance with Article 4.1 of the Protocol, the dumping of inert, inorganic geological materials, is prohibited.

9. Nevertheless, under the terms of Article 4.2(d) (as Amended in 1995, Article 4.2(e)) of the Protocol, an exception may be made to this principle for the dumping of inert, inorganic geological materials. ~~which may be authorized under certain conditions (the removal to the maximum extent of material capable of creating floating debris or otherwise contributing to pollution of the marine environment),~~ Under the terms of Article 5, the dumping of wastes or other matter listed in Article 4.2 requires a prior special permit from the competent national authorities.

10. Furthermore, in accordance with Article 6.1 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 and taking into consideration article 20 of the Offshore Protocol.

11. 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.

12. Article 7 of the Protocol states that incineration at sea is prohibited.

1.2 Waste prevention audit

13. The initial stages in assessing alternatives to dumping should, as appropriate, include an evaluation of:

a. types, amounts and relative hazards of wastes generated. In case the material is inert, the relative hazards are confined to physical impacts;
b. details of the production process and the sources of wastes within that process; and
c. feasibility of the following waste reduction/prevention techniques:
    i. clean production technologies;
    ii. process modification;
    iii. input substitution; and
    iv. on-site, closed-loop recycling.

14. In general terms, if the required audit reveals that opportunities exist for waste prevention at source, an applicant is expected to formulate and implement a waste prevention strategy in collaboration with relevant local and national agencies which includes specific waste reduction targets and provision for further waste prevention audits to ensure that these targets are being met. Permit issuance or renewal decisions shall assure compliance with any resulting waste reduction and prevention requirements.

15. For this category of material, the most pertinent issue will be waste minimization.

1.3 Consideration of waste management options

16. Beneficial uses and land management should be primarily and ultimately considered before any decision on dumping at sea. Therefore, relevant authorities should determine that there are no practicable beneficial uses alternatives which have less adverse environmental impacts or potential risk than dumping.

17. Applications to dump wastes or other matter shall demonstrate that appropriate consideration should be given to the following hierarchy of waste management options, which implies an order of increasing environmental impact:

a. re-use, such as refilling of mines;
b. off-site recycling such as road construction and building materials; and
c. disposal on land, and in water.

18. A permit to dump wastes or other matter shall be refused if the permitting authority determines that appropriate opportunities exist to re-use, recycle or treat the waste without undue risks to human health or the environment or disproportionate costs. The practical availability of other means of disposal should be considered in the light of a comparative risk assessment involving both dumping and the alternatives.

1.4 Assessment of the characteristics and composition of material to be disposed at sea

19. The character and form of the material and the basis on which it is characterized as geological and inert uncontaminated inorganic materials in the marine environment should be specified in accordance with Article 1 of the Dumping Protocol. Chemical analysis can be used to determine if a particular material contains elevated levels of contaminants (such as metals or organic constituents) relative to natural or ambient condition. Details of analyses and methods that shall be completed are provided in Appendix 1 of the "Updated Guidelines on Management of Dredged Materials".

20. From this specification, it should be demonstrated that the chemical nature of the materials (including uptake of any elements or substances from the material by biota) is such that the only effects will be due to its physical properties. Thus, the assessment of the environmental impacts will be based solely upon origin mineralogy and the total amount and physical nature of the materials.

21. Characterization of the wastes and their constituents shall take into account:

a. Origin;
b. Size, quantities, or volume of waste material;
c. Physical parameters: density, buoyancy, grain size, form in which it is intended to be dumped;
d. Geo-chemical characteristics: type, mineralogy and average composition;
e. If needed, level of contaminants relative to natural or ambient conditions;
f. Amount of material, anticipated or actual loading rate of material at the disposal site; and
g. Anticipated or actual deposit and accumulation rate of material at the deposit site.

22. The purpose of waste characterization under this section is to establish a baseline information to determine whether the disposal at sea of the materials might cause adverse effects, especially the possibility of chronic or acute effects on marine organisms, habitats, biological communities or human health arising from the physical properties of the material. This must be reflected in the impact hypothesis and also in the monitoring program. Table 1 provides a list of potential physical impacts of the materials to be disposed and their potential environmental and biological effects.

23. A detailed description and characterization of the materials is an essential precondition for the consideration of alternatives and the basis for a decision as to whether a waste may be dumped. If a waste is so poorly characterized that proper assessment cannot be made of its potential impacts on human health and the environment, that waste shall not be dumped.

24. Information about the biological impact 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.

Table 1: Potential Physical Impacts of materials disposal and their potential environmental and biological effect (adapted from PIANC, 2009 as described in IMO 2019).

Physical Change	**Potential Environmental Effect**	**Biological Impact**
Altered topography/bathymetry	Altered hydrodynamics and sedimentation regimes (erosion or accumulation of sediment)	• habitat destruction or alteration • changes to species distribution, e.g., wetland loss, movement of spawning grounds • erosion of habitats (such as seagrass beds) • Burial and smothering of benthos
Re-suspension of sediment matrix into water column	Transportation of suspended sediment plumes from the disposal sites	• plumes from the disposal sites spread to sensitive areas, such as seagrass beds, algal beds or coral reefs. • Reduction in water column primary production of phytoplankton
	Reduced light penetration	sub-lethal effects or death of light sensitive organisms and habitats
Sedimentation of the inert uncontaminated inorganic geological materials	Accumulation or dispersion of sediments	Alteration in habitats of the receiving environment: • Burial and smothering of benthos in the accumulated area (temporary or permanent) • Reduced function, growth, or survivorship of sessile benthic fauna through clogging of feeding mechanisms or smothering (especially filter-feeding organisms and sensitive habitats)
	disposal of sediment that is different from sediments at the disposal site	Habitat destruction or alteration
Rock blasting	Shock waves	Physiological response

25. If the potential impacts of the materials to be disposed cannot be adequately assessed based on the chemical and physical characterization and available information, biological testing may be conducted. Further detailed guidance on biological testing is provided in in Appendix 1 of the "Updated Guidelines on Management of Dredged Materials."

1.5 Action list

26. The Action List provides a screening mechanism for determining whether a material is considered acceptable for dumping. However, as inert materials will not interact with biological systems other than through physical processes, the initial screening should be judged by considering answers to the following questions:

a. Does the material meet the eligibility criteria for inert uncontaminated inorganic geological materials as defined in Part A of this Guideline?
b. Have all possibilities of beneficial use of the material been explored and considered?
c. What are the particle size characteristics of the material?
d. Does the material tend to disperse or deposit?
e. Is there a basis for concern about risks to human health related to impact on seafood?
f. Are the benthic assemblages allowing for the effects of any physical perturbation?

1.6 Selection of the dumping site

27. Prior to site selection, a primary obligation of the applicant is to assess whether there are alternatives to ~~ocean~~ marine disposal. Opportunities should be explored for beneficial uses, when environmentally, technically and economically feasible to do so. In addition, the characteristics of the waste must be determined as indicated previously.

28. If marine disposal is found to be the appropriate management option, one or more potential disposal sites should be identified and characterized to understand the receiving environment and better understand potential impacts. In order to limit potential impacts, priority should be given to the use of existing sites that have been selected to ensure that any impacts of disposal actions are spatially limited, and any monitoring efforts are focused and effective. In case where use of an existing site is not operationally feasible, criteria for selecting a new site for dumping operations should be determined so as to minimize interference with the environment and with other current and potential users of the sea.

29. Due to their inert nature, materials can be disposed into existing disposal sites permitted for dredged material. ~~However, disposal of dredged material into disposal sites of inert uncontaminated inorganic geological materials should be carefully considered before decision is made.~~

1.6.1 Identification of candidate sites

a) Site location

30. The criteria for selecting a new site for dumping operations should be determined so as to minimise interference with the environment and with other current and potential users of the sea. Basic information on the site under consideration should include the coordinates (latitude and longitude) of the disposal site, as well as its location with regards to:

a. the nearest coastline;
b. recreational areas;
c. spawning, recruitment and nursery areas of fish, crustaceans and molluscs;
d. known migration routes of fish or marine mammals;
e. commercial and sport fishing areas;
f. mariculture areas;
g. areas of natural beauty or significant cultural or historical importance;
h. areas of special scientific, biological or ecological importance;
i. navigation restrictions (including shipping lanes)
j. military exclusion zones;
k. Engineering uses of the seafloor (e.g. potential or ongoing seabed mining, undersea cables, desalination or energy production sites).

31. Location of disposal sites should take advantage of natural sediment transport processes, including potential benefits associated with dispersive sites that enable transport of sediments into sediment starved areas.

32. Consideration should be given to future plans for infrastructures.

33. Once the basic information of candidate sites is collected, a map should be drawn by the applicant. The map should include the identification of environmentally sensitive areas and potentially incompatible uses within the zone of siting feasibility. The accumulation of such maps will create a pool of candidate sites to be considered for future purposes.

b) Size consideration

34. Consideration also has to be given to the size and capacity of the dumping site for future use as a dumping ground for other inert, inorganic geological materials in the area. In such cases, the following aspects should be taken into consideration:

a. The dumping site should be large enough to contain the bulk of the anticipated waste material within the site limits or within a predicted impact area after dumping;
b. The capacity of the dumping site should be sufficient to accommodate the anticipated volumes of solid and/or liquid waste to be diluted to near background levels before or upon reaching the boundaries of the site;
c. The dumping site should be deep enough such that mounding or height of the waste materials at the site does not cause interference with shipping and boating;
d. The size and capacity of the dumping site should be sufficiently large to contain the anticipated volumes of waste for a pre-determined period of time;
e. The dumping site should be sufficiently deep and large to allow the necessary monitoring to be carried out without undue expenditure of time and money.

35. The presence of other dumping sites in the vicinity of a proposed new site has to be taken also into account, since they could affect decisions relating to the amounts and types of wastes to be dumped at the site and the frequency of dumping operations. This condition also applies for existing dumping sites under consideration for new disposal operations.

1.6.2 Characterization of candidate sites

a) Characteristics of the water column and sediments

36. Site selection criteria should include the physical, chemical and biological characteristics of the seabed and water column in the surrounding area in which the site is to be located. This information can be obtained from the literature, but fieldwork should be undertaken to fill the gaps.

37. Overall, baseline studies are needed to provide a basis for selection of a site. In cases where the applicant will conduct the baseline studies, the sampling and analysis plans using appropriate techniques should be submitted to the national authority for review prior to conducting the baseline studies.

Physical characteristics

38. It must first be established whether the subject area is dispersive or depositional in nature. A dispersive site, generally one in a high-energy hydrodynamic environment is unlikely to contain fine-grained sediments. A depositional site, which generally reflects a low energy hydrodynamic environment, is likely to contain fine-grained sediments.

39. Non-dispersive, retentive (accumulative) sites are generally associated with non-significant transport of materials, and disposed wastes are expected to stay within a pre-determined disposal site footprint. Retentive sites typically have low current speeds and are situated in areas where sediments tend to accumulate naturally.

40. In each case, the indigenous biological assemblages will reflect the structure and texture of the sediment and associated hydrodynamic conditions. There are also locations that change from depositional to dispersive because of hydrodynamic variability.

41. Particular attention should be paid to constituents of the waste which float on the surface or which, in reaction with seawater, may produce floating substances and which, because they are confined to a two-dimensional rather than a three-dimensional medium, may disperse very slowly. The possibility of the reaccumulation of such substances as a result of the presence of surface

convergences, which may interfere with amenities, as well as fisheries and shipping, must be investigated.

42. In general, the most important physical factors influencing the transport and mixing of waste consist of:

a. the oceanic flow environment: several types of motion contribute significantly to turbulence and shear levels, resulting in the mixing of waste; these include surface waves, tidal and inertial oscillations, wind driven surface currents and the internal circulation of the ocean;
b. turbulent diffusion: this process influences the spreading of waste through turbulent eddies;
c. shear induced diffusion: this process results in the advection of waste due to variations in velocities with depth; and
d. vertical mixing: this waste mixing process is caused by the intermittent hydrodynamic instability of water.

43. The physical impact may also extend to zones outside the dumping ~~zone~~ site as such, resulting from the forward movement of the dumped material due to wave and tidal action and residual current movements, especially in the case of fine fractions.

44. Analyses of these physical phenomena as well as waste characterization data (as described in Part B of this Guideline) is required to predict the behavior of waste once it has been disposed at sea, using, inter alia, modelling tools.

45. The following data should be collected and be used for understanding the hydrodynamic of the subject area and to determine the possible effects of dumping (analytical methodologies techniques are provided in Annex A of these Guidelines):

a. Detailed bathymetry of the candidate sites and surrounding areas;
b. Expected water temperature and salinity (including thermoclines and haloclines) at the time of disposal and any relevant temporal/seasonal fluctuations;
c. Expected background turbidity and natural fluctuations at the time of disposal and any relevant temporal/seasonal fluctuations;
d. Identification of the dispersive nature of the site, including assessment of the seasonal current flow, tidal cycles, wave climate, and up-welling at the candidate disposal sites;
e. Currents at several locations in the water column: within one (1) meter of the bottom, mid-depth, and within 1 meter of the surface. In open water areas, one lunar cycle might be adequate to determine tidal constituents for modelling. However, in nearshore areas with complex topographic inputs or areas affected by seasonal conditions, such as storm surge or peak river discharge, measurements are required for the months likely to have highest bottom currents as well as months in which disposal will take place.
f. Mean direction and velocity of the surface and bottom drifts.
g. Re-suspension or sediment concentration measurements within 1 meter of the bottom are necessary where currents are strong enough to cause re-suspension.
h. Other current and wave information may be required including:
    i. Tidal period and orientation of the tidal ellipse
    ii. Average number of storm days per year
    iii. Velocities of storm-wave induced bottom currents
    iv. General wind characteristics

46. Sediment stability is an important factor which needs to be taken into account in any assessment of materials disposal sites. Mass submarine movements can involve enormous volumes of sediment. These occur in the form of slumps, slides, debris flows and turbidity currents, which are

activated by a number of factors, including tectonic events, sediment overloading, erosion and changes in sediment compaction.

47. Consideration also needs to be given to the potential of material left on the seabed to snag fishing gear, taking into account its location, condition and the existence of any fishery exclusion zones.

Chemical Characteristics

48. Sampling and analysis should be conducted for background natural baseline ~~reference~~ levels of expected chemicals of concern in the water column and the sediment (first survey as described in Section 1.7.3 of this Guideline) (analytical methodologies techniques are provided in Annex A of these Guidelines):

a. Mercury, cadmium, lead, copper, other heavy metals
b. High molecular weight hydrocarbons (including oil and grease)
c. PCBs (polychlorinated biphenyls) and PAHs (polycyclic aromatic hydrocarbons)
d. Other contaminants of concern may need to be characterized based on site history (e.g., polybrominated diphenyl ethers (PBDEs), dioxins and furans, tributyltin (TBT), chlorinated pesticides, and nutrients).

Biological considerations

49. An evaluation of the biological sensitivity of potential dumping areas needs to be made, either through a study of existing data or, if necessary, by means of new surveys. The main considerations are summarized below (analytical methodologies techniques are provided in Annex A of these Guidelines):

a. fishing grounds and aquaculture sites: dumping in active fishing areas can affect the living resources, interfere with fishing vessels and may damage or foul fishing gear;
b. breeding and nursery grounds: certain grounds, although not in use for fishing, may be important for fish stocks through their role as spawning, nursery or feeding areas;
c. migration routes: migrating species use their acute senses of detection to find their native region or to move from one area to another; noise resulting from the dumping operation and the dumped materials may disrupt the physiological detection processes used by the fish, resulting in migrating species becoming confused as to their migration routes;
d. areas of high productivity or other special interest: some areas may be judged to require particular attention because of unusually high biological productivity; the dumping in such areas could impact production.
e. areas with sensitive, endangered, or at-risk species and habitat: at the point of disposal, dumped material can be harmful and include covering of the seabed and a localized increase in the levels of suspended solids. This could impact the composition of known sensitive species, pelagic and benthic species, endangered or at-risk species, and habitat at or near the load site(s).

50. To avoid excessive use of and impacts on the seabed, the number of dumping sites should be limited in so far as possible. To the maximum extent possible, each site should be used without interfering with navigation.

1.7 Assessment of potential effects – impact hypothesis

1.7.1 General considerations and conditions

51. Any adverse environmental impact of the disposal at sea of the materials should be minimized through the implementation of the pollution prevention plan and best environmental practices. Such adverse effects should in any case be limited to the following:

a. deep sea dump sites;
b. the coastal and estuarine area of the Mediterranean Sea;
c. recycling facilities; and,
d. waste disposal facilities and sites.

52. Assessment of potential effects should lead to a concise statement of the expected consequences of the sea or land disposal options, i.e., the "Impact Hypothesis." It provides a basis for deciding whether to approve or reject the proposed disposal option and for defining environmental monitoring requirements. As far as possible, waste management options causing dispersion and dilution of contaminants in the environment should be avoided and preference given to techniques that prevent the input of the contaminants to the environment.

53. 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 materials and on conditions at the proposed dumping site. It should encompass both temporal and spatial scales of potential effects. [4]

54. An analysis of each disposal option should be considered in light of a comparative assessment of the following concerns: human health risks, environmental costs, hazards (including accidents), economics and exclusion of future uses.

a. If this assessment reveals that adequate information is not available to determine the likely effects of the proposed disposal option, including potential long-term harmful consequences, then this option should not be considered further. In addition,
b. If the interpretation of the comparative assessment shows the dumping option to be less preferable, a permit for dumping should not be given.

1.7.2 The nature of impact on the marine environment

55. Adverse effect resulting from the physical properties of the dumped materials at the disposal site may include changes in natural physical and chemical fluxes and perturbation of the seabed and water column and cause noise interference. The impact of increased exposures of organisms to these adverse effects may result in short and long-term effects on pelagic and benthic invertebrates, fish and fisheries and on users of the sea.

56. As indicated in the “Common methodologies and techniques for the assessment and monitoring of adverse impacts of dumping activities, updated in 2023, Ecological Objective 11 on underwater noise and Common Indicators 26 and 27 are unlikely to be relevant for monitoring of disposal sites as underwater noise from general shipping is much more likely to be a significant source of underwater noise than disposal activities. Further details can be found in Annex A of the Updated Guidelines.

57. The following paragraphs present a conceptual model for the impact hypothesis as suggested in the “Common methodologies and techniques for the assessment and monitoring of adverse impacts of dumping activities”:**Error! Bookmark not defined.**

a. The potential effects of material disposal can be regarded as a set of bottom-up causes and primary effects, in which the physical system (both in the water column and on the bed) is altered and which in turn affect the health of the biological system. The eventual effects on the biological system and its anthropogenic uses can be regarded as a set of top-down responses, e.g., the effects on the higher levels of the ecological system (such as fishes, seabirds and marine mammals) as well as on fisheries and conservation objectives. The knowledge of these effects and the linkages between the different responses can be

[4] A clear aim of the impact hypothesis is proposed in the Updated Guidelines.

regarded as a conceptual model which, by the nature of the system and the potential changes to marine disposal, is naturally very complex.[5]

b. The disposal material will have the potential to affect the water column, the bed conditions and their biota. Reductions in water clarity through an increased turbidity may in turn affect the primary production by the phytoplankton. The deposited sediment will change the nature of the bed sediment if it is of a different particle size and it can have a smothering effect on the bed community. Both of these features will affect the structure of the bed community and in turn the demersal and benthic fishes feeding on that bed community.

c. Contaminated particles should not be relevant for the materials that pass the eligibility criteria. However, the dumping operation could resuspend contaminated particles which may already be present in sediments within and in the vicinity of the dumping site. Contaminated sediments in and around the sediments of dumping site should be identified during pre-disposal surveys and considered in the impact assessment.

d. During the preparation of an impact hypothesis, the Contracting Parties to the Barcelona Convention should take into consideration the two types of disposal sites, i.e., retentive (accumulative) and dispersive and these will require a different impact hypothesis.

e. In the case of a retentive site, where the material deposited will remain within the vicinity of the site, the assessment should delineate the area that will be substantially altered by the presence of the deposited material and should examine the severity of these alterations. The assessment should specify the likelihood and scale of residual impacts outside the primary zone where the bulk of the deposited material remains.

f. In the case of a dispersive site, the assessment should include a definition of the area likely to be altered in the shorter term by the proposed deposit operation (i.e., the near field) and the severity of associated changes in that immediate receiving environment. It should also specify the likely extent of long-term transport of material from this area and what this flux represents in relation to existing transport fluxes in the area; thereby permitting a statement regarding the likely scale and severity of effects in the long-term and far-field.

1.7.3 Construction of the impact hypothesis

58. With a view to assessing the potential magnitude of impacts from dumping activities, a plume modeling should be established. For that purpose, baseline surveys data of the proposed dumping sites and surrounding zone as well as background data on the characterization of the waste material, as noted in Part B of these Guidelines, are essential.

59. Impact hypotheses can be of three different types as can be inferred from Table 2:

Table 2: Examples of different types of impact hypotheses

Type	**Examples of Different Types of Hypotheses**
Operational	Does the extent of dispersion from the disposal site exceed that predicted?
	Can the disposal site receive the required amount?
Environmental	Do suspended solids levels exceed critical levels for fish?
	Do the changes degrade the overall health/quality of the environment?
Effects on users/uses	Does the depth of accumulation of material at the disposal site cause concern for navigation?

[5] See Figures 2.1 and 2.2 in MEMG (2003)

60. In constructing an impact hypothesis, particular attention should be given to, but not limited to:

a. Potential impacts on amenities (e.g., presence of floatables, turbidity, odor, discoloration and foaming)
b. Possible effect on marine life, fish and shellfish culture, fish stocks and fisheries, seaweed harvesting and culture, as well as effect on local communities living near islands or near marine protected areas.
c. Sensitive areas (e.g., spawning, nursery or feeding areas), habitat (e.g., biological, chemical and physical modification), migratory patterns and marketability of resources.
d. Possible effect on other uses of the sea (e.g. impairment of water quality for industrial use, such as desalination plants, underwater corrosion of structures, interference with ship operations from floating materials, interference with fishing, mariculture, or navigation through deposit of waste or solid objects on the sea floor and protection of areas of special importance for scientific or conservation purposes).

61. Interference with the migration or spawning of fish or crustaceans, or with seasonal fishery activities, may be avoided by the imposition of timing restrictions on disposal operations.

62. When assessing the impact of disposal operations, it may be necessary to compare the physical and, where appropriate, the chemical or biological quality of the affected area with reference to sites located away from the disposal site. Experience of the selection of reference sites for biological and physical monitoring can be acquired from monitoring programmes carried out in the vicinity of dumping site. Such areas can be identified during the early stages of impact assessment.

63. Even the least complex and most innocuous wastes may have a variety of physical, chemical and biological effects. Impact hypotheses cannot attempt to reflect them all. It must be recognized that even the most comprehensive impact hypotheses may not address all possible scenarios such as unanticipated impacts. It is therefore imperative that the monitoring programme be linked directly to the hypotheses and serve as a feedback mechanism to verify the predictions and review the adequacy of management measures applied to the dumping operation and at the dumpsite. It is important to identify the sources and consequences of uncertainty. The only effects requiring detailed consideration in this context are physical impacts on biota.

64. In the case of repeated or multiple dumping operations, or when other interferences occur in the vicinity of the disposal site, a cumulative effect approach should be used. The potential impact assessment of multiple stressors should include the combined risks to human health or the environment. It will also be important to consider the possible interactions with other waste dumping practices in the area, existing or planned.

65. The Compendium of Best Practices for Implementation of Dumping Protocol (2023) recommends that the tiered approach to testing is adopted as best practice to address the impact hypotheses in a cost-effective and consistent manner. The tiered approach to testing consists of successive levels of investigation, each with increasing effort and complexity. 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. This approach generates the information necessary to evaluate the proposed disposal material. It provides for optimal use of resources by focusing the least effort on operations where the potential (or lack thereof) for unacceptable adverse impact is clear and expending the most effort on operations requiring more extensive investigation to determine the potential (or lack thereof) for impact. This approach is described in the “Updated Guidelines on Management of Dredged Materials” in Annex A of these Guidelines where the sequence of tiers is as follows:

a. assessment of physical properties.
b. assessment of chemical properties.

c. assessment of biological properties and effects.

66. Where monitoring is required, the effects and parameters described in the hypotheses should help to guide field and analytical work so that relevant information can be obtained in the most efficient and cost-effective manner.

67. Where the impact-hypothesis indicates any transboundary impacts, a consultation procedure should be initiated in accordance with Part D of these updated Guidelines.

68. Each assessment should conclude with a statement supporting a decision to issue or refuse a permit for dumping.

PART C

2. MANAGEMENT AND MONITORING FOR THE DISPOSAL AT SEA OF INERT, UNCONTAMINATED INORGANIC GEOLOGICAL MATERIALS

69. Site management and monitoring plans should set out the framework for management, mitigation, and monitoring of impacts during project implementation. They should detail the control strategies for the project, including environmental objectives, auditable performance criteria, and mitigating corrective actions.

2.1 Management of the disposal operations

70. This section deals with management techniques to minimise the physical effects of disposal of the material and is based on the approaches to management in the "Updated Guidelines on Management of Dredged Materials."

71. Management techniques should be used to minimize the physical effects of the disposal operation once it has been predicted by the impact assessment.

72. The key to management lies in careful site selection and assessment of the conflict between marine resources, the marine environment and activities. In addition, appropriate methods of deposit should be chosen to minimize the environmental effects.

73. All measures should be taken to allow recolonization to take place once deposition stops.

74. Where appropriate, deposit vessels should be equipped with accurate positioning systems and the activities of the vessels should be reported to the permitting or supervising authority. Deposit vessels and operations should be inspected regularly to ensure that the conditions of the deposit permit are being complied with and that the crew are aware of their responsibilities under the permit. Ships' records and automatic monitoring and display devices (e.g. black boxes), where these have been fitted, should be inspected to ensure that deposit is taking place at the specified deposit site.

75. To avoid excessive degradation of the seabed as a whole, the number of sites should be limited as far as possible, and each site should be used to the maximum extent that will not interfere with navigation or any other legitimate use of the sea.

76. Effects can be reduced by ensuring that, as far as possible, the material and the sediments in the receiving area are similar. Locally, the biological impact may be further reduced if the sedimentation area is naturally subject to physical disturbance (horizontal and vertical currents). Where this is not possible, and the materials are clean and fine, a deliberately dispersive style of dumping should be utilised so as to limit blanketing to a small site.

77. Temporal restrictions on dumping activities may have to be imposed (for example tidal and seasonal restrictions). Interference with fish or crustacean migration or spawning or with seasonal fishing activities may be avoided by imposing a calendar for dumping operations.

78. The rate of deposition can be an important consideration since it will often have a strong influence on the impacts at the deposit site. It may therefore need to be controlled to ensure that the environmental management objectives for the site are not exceeded.

2.2 Monitoring operations for the material disposal at sea

2.2.1 Objectives and definition

79. For the purposes of assessing and regulating the environmental and human health impacts of disposal operations, monitoring is defined as the repeated measurement of an effect, whether direct or indirect, on the marine environment and/or of interferences with other legitimate uses of the sea.

80. Monitoring of dumping operations is generally undertaken for the following reasons:

a. to establish whether the dumping permit conditions have been respected - *compliance monitoring* - 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.

81. It should be noted that baseline surveys need to be carried out prior to any disposal activities take place in order to define the existing environmental conditions so that subsequent monitoring is able to establish any changes resulting from the disposal activities.

82. As concluded in the document on the "Common methodologies and techniques for the assessment and monitoring of adverse impacts of dumping activities," when undertaking monitoring of disposal operations, it is necessary to consider Ecological Objectives (EO9) on Contaminants and occasionally EO11 on Underwater Noise, as well as EO5 on Eutrophication in line with the Integrated Monitoring and Assessment Programme (IMAP) of the Mediterranean Sea and Coast.

2.2.2 Impact hypothesis verification: Defining the monitoring programme

83. The Impact Hypothesis forms the basis for defining the monitoring programme. It is derived from the predicted effects on the physical, chemical and biological characteristics of the areas in and around the disposal site (see Part B of these Guidelines).

84. While numerous potential effects can be envisaged, it is only those of potential significance (however defined) that require monitoring. It is then necessary to derive testable hypotheses for each of those potentially significant effects and to determine what measurements are required to test them. The primary consideration for impact hypotheses should be tailored to specific information such as site characteristics, site-specific species, local spatial and temporal scales of variable parameters and the permit terms and conditions.

85. In designing a monitoring programme, the following questions must be answered:

a. What testable hypotheses can be derived from the impact hypothesis?
b. What exactly should be measured?
c. What is the purpose of monitoring a specific variable or physical, chemical or biological effect?
d. In what compartment and at which locations can measurements be made most effectively?
e. For how long should the measurements be carried out to meet the defined aim?
f. With what frequency should measurements be carried out?
g. What should be the temporal and spatial scale of the measurements made to test the impact hypothesis?
h. How should the data from the monitoring programme be managed and interpreted?

86. The measurements required for monitoring can be divided into (i) those within the zone of predicted impact and (ii) those outside, and should determine:

a. if the actual zone differs from that projected; and
b. if the extent of change projected outside the zone of impact is within the scale predicted.

87. The former can be ascertained by designing a sequence of measurements in space and time with a view to ensuring that the projected spatial scale of change is not exceeded. The latter can be shown through measurements which provide information on the extent of the change occurring outside the impact zone as a result of the dumping operation. These measurements are often based on a null hypothesis, i.e. that no significant change can be detected.

2.2.3 Common methodologies and techniques for assessing adverse effects

88. This section is based on the "Common methodologies and techniques for the assessment and monitoring of adverse impacts of dumping activities," and its 2023 update**Error! Bookmark not defined.** which a re linked to the IMAP Guidance/Monitoring Protocols included in Annex A (Parts I and II) of these Guidelines.

89. Impacts on the seabed and associated biota in and around the disposal site are usually the most important impacts due to the bulk nature of the material. However, water column impacts may be relevant in some cases. Best practices for such monitoring are provided in Annex A (Parts I and II). Novel technologies for monitoring which are gaining prominence are also provided in Annex A (Part III).

90. The main environmental components and features relevant to monitoring disposed material operations is given in Table 3.

Table 3: The main environmental components and features relevant to monitoring disposal operations (MEMG, 2003), examples of the methodologies and techniques that can be used are given in Annex A.

Component	**Feature**
Hydrography:	Tidal excursion
	Wind-driven circulation
	Bed currents
	Short-term circulation
	Long-term circulation
	Sediment movement
Water Column:	Light penetration
	Turbidity/Suspended solids
	Contaminants in water/suspended solids
	Particulate organic carbon
Seabed –Physical:	Bathymetry Bed forms
	Sediment physical characteristics
	Marine litter including macro-and micro-plastics
Seabed –Chemistry:	Sediment chemistry –contaminants
	Sediment chemistry –organic carbon
	Sediment properties –pH, redox
Seabed –Biology:	Biotope
	Epibenthos
	Benthic infauna
Top Predators:	Fish
	Seabirds
	Mammals

91. Where it is considered that effects will be largely physical, one component of monitoring may be based upon remote methods such as side-scan sonar to identify changes in the character of the seabed and bathymetric techniques and multibeam bathymetry to identify areas of disposed material accumulation. Both techniques may require some sediment sampling to establish "ground truth".

92. In order to assess the impact, it will be necessary to compare the physical, chemical and biological quality of the affected areas with reference sites located away from dispersal pathways. Such areas can be identified during the early stages of the impact assessment.

93. Note that baseline surveys need to be carried out prior to any disposal activities take place in order to define the existing environmental conditions so that subsequent monitoring is able to establish any changes resulting from the disposal activities, as specified in Part B of these Guidelines.

94. The spatial extent of sampling will need to take into account the size of the area designated for dumping, the mobility of deposited material and water movements which will determine the direction and extent of sediment transport.

95. The frequency of surveys 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 occasionally to check that effects are within those predicted or if changes are made to the operation such as the quantities or type of material, the method of deposit etc.

96. The range of common components and features that may be necessary (based on the impact hypothesis) to be monitored at and in the vicinity of a disposal site can be organised into the categories as shown in Table 3 above (MEMG, 2003). As explained in the “Compendium of Best Practices for Implementation of Dumping Protocol,[3] it is recommended that the tiered approach to monitoring is adopted as best practice to address the impact hypotheses in a cost-effective and consistent fashion. An example of tiered monitoring is described in the “Common methodologies and techniques for the assessment and monitoring of adverse impacts of dumping activities” (para 46-47).

97. In order to assist those Contracting Parties that are at early stages of developing waste assessment and monitoring actions, the London Convention/London Protocol has developed guidance for low cost, low technology field monitoring for the assessment of the effects of disposal in marine waters of dredged material or inert, inorganic, geological material (IMO, 2016) that may be useful for some Parties. The objective of the guidance document is to provide practical information about using low technology and low-cost tools that are useful for monitoring of possible environmental impacts associated with marine disposal of either dredged material or inert, inorganic geological materials. ~~The primary audiences for this guidance are countries that are in the early stages of developing waste assessment and monitoring actions in concert with permit programs for disposal of wastes and other matter into marine waters which are consistent with the Dumping Protocol of Barcelona Convention.~~ However, this monitoring should be adequate to give convincing results, without jeopardising the aim of the monitoring. These Guidelines could be considered BEP for such countries, which are at the early sage of establishing monitoring programmes and are recommended for those interested Contracting Parties. Nevertheless, Contacting Parties should consider increasing the monitoring efficiency, over time, if the Contracting Parties have capacity.

98. Concise reports on monitoring activities should be prepared and made available to relevant stakeholders and other interested parties. Reports should detail the measurements made, the results obtained and the manner in which these data relate to the monitoring objectives and confirm the impact hypothesis. The frequency of reporting will depend on the scale of the dumping operation, the intensity of monitoring and the results obtained.

2.2.4 Quality assurance

99. Quality assurance may be defined as all planned and systematic activities implemented to provide adequate confirmation that monitoring activities are fulfilling requirements related to quality.

100. The results of monitoring activities should be reviewed at regular intervals in relation to their objectives in order to provide a basis for:

a. modifying or terminating the field monitoring programme;
b. amending or revoking the dumping permit;
c. redefining or closing the dumping site; and
d. modifying the basis for assessing dumping permits in the Mediterranean Sea.

101. The results of any reviews of monitoring activities should be communicated to all Contracting Parties involved in such activities. The licensing authority is encouraged to take relevant research findings into consideration with a view to the modification of monitoring programmes.

PART D

3. REQUIREMENTS FOR THE ISSUANCE OF PERMIT ~~AUTHORIZATION OF~~ FOR ~~MATERIALS~~ DUMPING AT SEA

3.1 Requirements for a permit application

102. The Protocol establishes the permitting requirements for the sea disposal operations of a *single* dumping activity.

103. Any application for a permit must contain data and information specifying:

a. Characterization of the wastes and their constituents;
b. Types, amounts and sources of the materials to be dumped;
c. Location and characteristics of the dumping site(s);
d. History of previous dumping operations and/or past activities with negative environmental impacts;
e. Method of dumping;
f. Proposed site management; and
g. Monitoring plan.

3.2 Main considerations during the issue of a permit

104. Article 6.1 of the Dumping Protocol states that a permit shall be issued only after careful consideration of the factors set forth in the Annex to the Protocol, guidelines and procedures adopted by the Contracting Parties.

105. Before considering the dumping of the materials at sea, every effort should be made to determine the practical availability of alternative land-based methods of treatment, disposal or elimination.

106. Only those materials which have been specified as inert uncontaminated inorganic geological materials according to the eligibility criteria described in Part A of these Guidelines, and found acceptable for sea deposit, based on the impact assessment, will be considered for dumping.

107. In special cases where it is decided to dump the materials at sea, this should be regarded as an exception. The practical availability of other means of disposal should be considered in the light of a comparative assessment of:

a. their characteristics: chemical, biological and physical.
b. their potential impact on the environment, including:
   i. their effects on marine habitats and communities, and other legitimate uses of the sea;
   ii. the effect of their onshore re-use, recycling, or disposal, including potential impacts on land, surface and groundwater and air pollution; and
   iii. the impact of the use of the necessary energy and materials (including an overall assessment of the use of energy and materials and the savings achieved through re-use, recycling or disposal options), including transportation and the resultant environmental impact.

c. their potential impact on human health, including:
   i. the identification of routes of exposure and the analysis of potential impacts on sea and land re-use, as well as of recycling and disposal options, including the potential secondary impacts of energy use; and
   ii. the quantification and evaluation of the safety risks associated with onshore re-use, recycling and disposal, compared with disposal at sea.

d. their technical and practical feasibility, including:
   i. the identification of the practical limitations of disposal alternatives, taking into account the characteristics of the inert, inorganic geological materials and oceanographic considerations.

e. economic considerations, including:
   i. an analysis of the full cost of inert, inorganic geological materials re-use, recycling or disposal alternatives, including their secondary impacts; and
   ii. a review of costs in relation to benefits in such areas as resource conservation and the economic benefits of steel recycling.

108. Opportunities should be provided for public review and participation in the permit evaluation process.

3.3 Conditions for issuing a permit

109. A decision to issue a permit should be based on the elements provided by a pre-disposal site survey. If the characterization of these conditions is insufficient for the formulation of an impact hypothesis, additional information will be required before any final decision is made with regard to issuing a permit.

110. A decision to issue a permit should only be made where all the impact assessments are complete, taking into account the defined criteria, and where the monitoring requirements have been determined. The conditions set out in the permit should be such as to ensure, in so far as practicable, that environmental disturbance and detriment are minimised, and that benefits are maximised.

111. Permit conditions should be drafted in plain and unambiguous language and will be designed to ensure that:

Where the comparative assessment reveals that adequate information is not available to determine the likely effects of the proposed disposal option, including the potential long-term harmful consequences, then this option should not be considered further. In addition, where analysis of the comparative assessment shows that the dumping option is less preferable than a land alternative, a permit should not be issued for the dumping.

112. Each assessment should conclude with a statement in support of a decision to either issue or refuse a permit for dumping.

113. In the event that the determined criteria cannot be met, a Contracting Party should not issue a permit unless a detailed assessment shows that disposal at sea is nonetheless the least detrimental option. Where such a conclusion is reached and a permit is issued, the Contracting Party should take all practical steps to mitigate the impact of the disposal operation on the marine environment.

114. Regulators should strive at all times to enforce procedures which ensure that environmental changes are as far below the limits of allowable environmental change as practicable, taking into account technological capacities and economic, social and political considerations.

115. Regulators should validate at all times that;

a. the material is deposited at the selected deposit site;
b. any necessary deposit management techniques identified during the impact analysis are carried out; and
c. any monitoring requirements are fulfilled, and the results reported to the permitting or supervising authority.

116. The authority responsible for issuing the permit should take into consideration relevant research findings when specifying permit requirements.

3.4 Supplemental conditions for issuing a permit for an existing dumping site

117. The issuing of a permit for materials disposal at a site where past dumping activities were carried out should be based on a comprehensive review of results and objectives of existing monitoring programmes. The review process provides an important feedback and informed decision-making regarding the impacts of further disposal activities, and whether a permit may be issued for further dumping operations on site. Furthermore, such a review will indicate whether the field-monitoring programme needs to be continued, revised or terminated.

3.5 Consultation procedure

118. The consultation procedure should be undertaken further to the following steps:

1. A relevant Contracting Party which is considering whether to issue a permit under Part D ~~C~~ of these Guidelines shall start this consultation procedure at least 32 weeks before any planned date of a decision on that question by sending to MAP a notification containing:
    a. an assessment prepared in accordance with Part B of these Guidelines, including the summary in accordance with Part B of these Guidelines;
    b. an explanation why the relevant Contracting Party considers that the requirements of Part B of these Guidelines may be satisfied;
    c. any further information necessary to enable other Contracting Parties to consider the impacts and practical availability of options for re-use, recycling and disposal.
2. MAP shall immediately send copies of the notification to all Contracting Parties.
3. If a Contracting Party wishes to object to, or comment on, the issue of the permit, it shall inform the Contracting Party which is considering the issue of the permit not later than the end of 16 weeks from the date on which the MAP circulated the notification to the Contracting Parties and shall send a copy of the objection or comment to the MAP. Any objection shall explain why the Contracting Party which is objecting considers that the case put forward fails to satisfy the requirements of Part B of this Guideline. That explanation shall be supported by scientific and technical arguments. MAP shall circulate any objection or comment to the other Contracting Parties.
4. Contracting Parties shall seek to resolve by mutual consultations any objections made under the previous paragraph. As soon as possible after such consultations, and in any event not later than the end of 22 weeks from the date on which the MAP circulated the notification to the Contracting Parties, the Contracting Party proposing to issue the permit shall inform the MAP of the outcome of the consultations. The MAP shall forward the information immediately to all other Contracting Parties.
5. If such consultations do not resolve the objection, the Contracting Party which objected may, with the support of at least two other Contracting Parties, request the MAP to arrange a special consultative meeting to discuss the objections raised. Such a request shall be made not later than the end of 24 weeks from the date on which the MAP circulated the notification to the Contracting Parties.
6. MAP shall arrange for such a special consultative meeting to be held within 6 weeks of the request for it, unless the Contracting Party considering the issue of a permit agrees to an extension. The meeting shall be open to all Contracting Parties, the operator of the installation in question and all observers to MAP. The meeting shall focus on the information provided in accordance with Part B of these Guidelines. The chairman of the meeting shall be MAP Coordinator, or a person appointed by MAP Coordinator. Any question about the arrangements for the meeting shall be resolved by the chairman of the meeting.
7. The chairman of the meeting shall prepare a report of the views expressed at the meeting and any conclusions reached. That report shall be sent to all Contracting Parties within two weeks of the meeting.

8. The competent authority of the relevant Contracting Party may take a decision to issue a permit at any time after:
    a. the end of 16 weeks from the date of dispatch of the copies under sub paragraph 2 of the consultation procedure, if there are no objections at the end of that period;
    b. the end of 22 weeks from the date of dispatch of the copies under sub paragraph 2 of the consultation procedure, if any objections have been settled by mutual consultation;
    c. the end of 24 weeks from the date of dispatch of the copies under sub paragraph 2 of the consultation procedure, if there is no request for a special consultative meeting;
    d. receiving the report of the special consultative meeting from the chairman of that meeting.
9. Before making a decision with regard to any permit under these Guidelines, the competent authority of the relevant Contracting Party shall consider both the views and any conclusions recorded in the report of the special consultative meeting, and any views expressed by Contracting Parties in the course of this procedure.
10. Copies of all the documents which are to be sent to all Contracting Parties in accordance with this procedure shall also be sent to those observers who have made a standing request for this to the MAP/MEDPOL.

References

Birchenough SNR, Parker RE, Ware S, et al. 2010. Capability as a routine tool for monitoring marine environments. (Project ME1401) final report to UK Department for Environment, Food and Rural Affairs.

Dumping Protocol and Amendments, United Nations Environment Programme, Mediterranean Action Plan. Barcelona Convention. https://www.unep.org/unepmap/who-we-are/contracting-parties/dumping-protocol-and-amendments

Environment and Climate Change Canada. Disposal at sea permit application guide: excavated material characterization. Appendix E: Excavated material characterization. Government of Canada. https://www.canada.ca/en/environment-climate-change/services/disposal-at-sea/permit-applicant-guide/excavated-material/excavated-waste-material-characterization.html#toc0

GESAMP 2019. Guidelines or the monitoring and assessment of plastic litter and microplastics in the ocean (Kershaw P.J., Turra A. and Galgani F. editors), (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP/ISA Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 99, 130p. http://www.gesamp.org/site/assets/files/2002/rs99e.pdf

Gillmore ML, Price GAV, Golding LA, et al. 2021. The diffusive gradients in thin films (DGT) technique predicts sediment nickel toxicity to the amphipod, Melita plumulosa. Environmental Toxicology and Chemistry. 40(5): pp.1266–1278.

HELCOM Guidelines for Management of Dredged Material at Sea. Adopted by HELCOM 36-2015 on 4 March 2015 and amended by HELCOM 41-2020 on 4 March 2020. https://helcom.fi/wp-content/uploads/2016/11/HELCOM-Guidelines-for-Management-of-Dredged-Material-at-Sea.pdf

IMO Publication Reference I547 (2017). Guidelines on Low Cost, Low Technology Compliance Monitoring Assessment of Permit Compliance for Disposal of Wastes and Other Matter at Sea. Prepared by Environment and Climate Change Canada for the Scientific Groups of the London Convention and Protocol (9 March 2016). https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Low%20Cost%20Low%20Tech%20Compliance%20Monitoring_Manuscript%20as%20approved%20at%20LC%2038.pdf

IMO Publication Reference IA531E (2014). Specific Guidelines for assessment of inert, inorganic material. Waste Assessment Guidelines under the London Convention and Protocol: 2014 edition. LC 30/16, annex 4 (2008). International Maritime Organization. London Convention. https://www.imo.org/en/OurWork/Environment/Pages/wag-default.aspx

IMO 2019. Guidance for Selecting Sites for Sea Disposal and for Developing Site Management and Monitoring Plans. https://www.imo.org/en/OurWork/Environment/Pages/wag-default.aspx

Madricardo F, Ghezzo M, Nesto N, et al. 2020. How to Deal with Seafloor Marine Litter: An Overview of the State-of-the-Art and Future Perspectives. Frontiers in Marine Science.

MEMG (2003). Group Co-ordinating Sea Disposal Monitoring. Final Report of the Dredging and Dredged Material Disposal Monitoring Task Team. Sci. Ser., Aquat. Environ. Monit. Rep., CEFAS, Lowestoft, (55): 52pp. https://www.cefas.co.uk/publications/aquatic/aemr55.pdf

NOC 2020. National Marine Facilities Technology Roadmap 2020/21. National Oceanography Centre, National Marine Facilities, National Environment Research Council, United Kingdom. https://noc.ac.uk/files/documents/about/ispo/COMMS1155%20NMF%20TECHNOLOGY%20ROADMAP%20202021%20V4.pdf

OSPAR Guidelines for the Management of Dredged Material at Sea. Agreement 2014-06. OSPAR Commission. https://www.ospar.org/documents?d=34060

PIANC 2009. Long-Term Management of Confined Disposal Facilities for Dredged Material. The World Association for Waterborne Transport Infrastructure. Report No. 109. https://www.pianc.org/publications/envicom/long-term-management-of-confined-disposal-facilities-for-dredged-material

UNEP(DEC)/MED IG.16/09. Guidelines for the Dumping of Inert Uncontaminated Geological Materials. 14th Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols. Portoroz (Slovenia), 8-11 November 2005. https://wedocs.unep.org/bitstream/handle/20.500.11822/6006/05ig16_9_eng.pdf?sequence=1&isAllowed=y

UNEP(DEPI)/MED IG.22/28. Decision IG.21/3. On the Ecosystems Approach including adopting definitions of Good Environmental Status (GES) and target. 18th Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols. Istanbul, Türkiye, 3-7 December 2018. https://wedocs.unep.org/bitstream/handle/20.500.11822/6008/13ig21_09_annex2_21_03_eng.pdf

UNEP(DEPI)/MED IG.23/15. Decision IG.23/12. Updated Guidelines on Management of Dredged Materials. 20th Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols. Tirana, Albania, 17-20 December 2017. https://wedocs.unep.org/bitstream/handle/20.500.11822/21881/17ig23_15_eng.pdf?sequence=1&isAllowed=y

UNEP/MED IG.25/4. Decision IG.25/1: UNEP/MAP Medium-Term Strategy 2022-2027. 22nd Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols. Antalya, Turkey, 7-10 December 2021. https://wedocs.unep.org/bitstream/handle/20.500.11822/37098/21ig25_04_eng.pdf?sequence=1&isAllowed=y

UNEP/MED IG.25/27. Decision IG.25/6, 2021. Amendments to the Annex to the Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration at Sea. 22nd Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols. Antalya, Turkey, 7-10 December 2021. https://wedocs.unep.org/bitstream/handle/20.500.11822/37128/21ig25_27_2506_eng.pdf?sequence=1&isAllowed=y

UNEP/MED IG.25/27. Decision IG.25/19: Programme of Work and Budget for 2022-2023. 22nd Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols. Antalya, Turkey, 7-10 December 2021. https://wedocs.unep.org/bitstream/handle/20.500.11822/37141/21ig25_27_2519_eng.pdf?sequence=1&isAllowed=y

UNEP/MED WG.467/5. IMAP Guidance Factsheets: Update for Common Indicators 13, 14, 17, 18, 20 and 21; New proposal for Candidate Indicators 26 and 27. 7th Meeting of the Ecosystem Approach Coordination Group. Athens, Greece, 9 September 2019. https://wedocs.unep.org/bitstream/handle/20.500.11822/29727/19wg467_05_eng.pdf?sequence=1&isAllowed=y

UNEP/MED WG.482/13. Monitoring Guidelines/Protocols for Sampling and Sample Preservation of Marine Biota for IMAP Common Indicator 17: Heavy and Trace Elements and Organic

Contaminants. Integrated Meetings of the Ecosystem Approach Correspondence Groups on IMAP Implementation (CORMONs). Videoconference, 1-3 December 2020.

UNEP/MED WG.482/14. Monitoring Guidelines/Protocols for Sample Preparation and Analysis of Marine Biota for IMAP Common Indicator 17: Heavy and Trace Elements and Organic Contaminants. Integrated Meetings of the Ecosystem Approach Correspondence Groups on IMAP Implementation (CORMONs). Videoconference, 1-3 December 2020.

UNEP/MED WG.482/17. Monitoring Guidelines/Protocols for Sampling and Sample Preservation of Sea Food for IMAP Common Indicator 20: Heavy and Trace Elements and Organic Contaminants. Integrated Meetings of the Ecosystem Approach Correspondence Groups on IMAP Implementation (CORMONs). Videoconference, 1-3 December 2020.

UNEP/MED WG.482/18. Monitoring Guidelines/Protocols for Sample Preparation and Analysis of Sea Food for IMAP Common Indicator 20: Heavy and Trace Elements and Organic Contaminants. Integrated Meetings of the Ecosystem Approach Correspondence Groups on IMAP Implementation (CORMONs). Videoconference, 1-3 December 2020.

UNEP/MED WG.509/41. Common methodologies and techniques for the assessment and monitoring of adverse impacts of dumping activities. Meeting of the MED POL Focal Points. Videoconference, 27-28 May and 6-7 October 2021. https://wedocs.unep.org/bitstream/handle/20.500.11822/36209/21wg509_41_eng.pdf?sequence=1&isAllowed=y

UNEP/MED WG.509/42. Compendium of Best Practices for Implementation of Dumping Protocol. Meeting of the MED POL Focal Points. Teleconference, 27-28 May and 6-7 October 2021. https://wedocs.unep.org/bitstream/handle/20.500.11822/36210/21wg509_42_eng.pdf?sequence=1&isAllowed=y (updated in UNEP/MED WG.554/4).

UNEP/MED WG.554/4. Compendium of Best Practices for Implementation of Dumping Protocol. Meeting of the MED POL Focal Points (2023). Meeting to Review the Updated Guidelines for the Dumping of Inert Uncontaminated Geological Materials and Sharing Best Practices to Support Implementation of the Dumping Protocol. Teleconference, 13-14 February 2023.

Annex A

Examples for monitoring the main environmental components and features relevant to material disposal operations for assessment of adverse impacts of dumping activities

UNEP/MED WG.554/4 Compendium of Best Practices for Implementation of the Dumping Protocol (2023), referred in Part C of this Guideline

Part I

Introduction

This annex summaries the recommendations described in Part C (monitoring) of Document WG.554/4 "Compendium of Best Practices for Implementation of Dumping Protocol (2023)," with examples for monitoring the main environmental components and features relevant to material disposal operations for assessment of adverse impacts of dumping activities. Therefore, Contracting Partiers should take into consideration the methodologies and techniques presented below when they are establishing their relevant monitoring programmers as referred in Part C Chapter 2.2.3 in these Guidelines.

Component	Feature	Examples of the methodologies and techniques
Hydrography:	Tidal excursion	Subsurface drogues followed by boat with radar and DGPS position fixing and should be monitored per tide with spring and neap coverage. Also, navigational charts usually provide information about tidal speed and direction at a number of points (i.e., 'Tidal Diamonds' on Admiralty charts).
	Wind-driven circulation	Surface drogues followed by boat with DGPS position fixing under several wind conditions. Also, Ocean Current Surface Radar (OSCR) and Acoustic-Doppler Current Profile (ADCP) Imaging can be used.
	Bed currents	Bottom landers with recording current meters. Also, seabed drifters - deployment of plastic drifters, each tagged and with reward for recovery.
	Short-term circulation	Direct-reading current meters (DRCM) or recording current meter (RCM), deployed over tidal cycles and under differing spring-neap conditions. They can be deployed in conjunction with other water parameter measurement devices (e.g., depth, temperature, salinity/conductivity, oxygen, turbidity) to define water masses. In addition, ADCPs can be used.
	Long-term circulation	Recording current meter (RCM) deployed over a lunar cycle.
	Sediment movement	Bottom landers deploying a range of optical sensors and water sampling equipment. Also, a variety of sediment tracers are in use e.g., fluorescent tracers.
Water Column:	Light penetration	The simplest device is the Secchi disk that measures water transparency. UNEP/MAP has a relevant monitoring guidelines/protocols in UNEP/MED WG.482/6: Monitoring Guidelines/Protocols for Determination of Hydrographic Physical Parameters. Also, one can deploy underwater light meters to measure photosynthetically active radiation (PAR) penetration with depth.
	Turbidity/Suspended solids	Techniques for testing of turbidity may include (UNEP/MED WG.509/41): • Use of water displacement samplers at several depths, to give depth profile, then filtering water through filters to give weight of suspended solids; • Optical instruments can measure turbidity by monitoring optical backscatter (OBS) or transmission. OBS instruments are more sensitive to fine sediments (14-170 μm) in suspension than acoustic instruments. They need calibration to give values of suspended sediment concentration. Continuous monitoring equipment for this is available and can be deployed from vessels or installed on buoys or fixed structures to ensure appropriate coverage around the dumping operation. • Acoustic monitoring of turbidity may be achieved using instruments based upon acoustic backscatter. An increased concentration of suspended sediments leads to an increase in the backscattered acoustic energy. Acoustic instruments are more sensitive to coarse (75-250 μm) sediments in suspension. They also need calibration to give values of suspended sediment concentration. As for optical instruments, continuous monitoring equipment for this is available and can be deployed from vessels or installed on buoys or fixed structures to ensure appropriate coverage around the dumping operation.

Component	Feature	Examples of the methodologies and techniques
	Contaminants in water/suspended solids	Water samples are collected using standard oceanographic samplers and filters to give suspended load and dissolved phase for analysis of inorganic or organic contaminants. UNEP/MAP has two relevant monitoring guidelines/protocols: • UNEP/MED WG.482/15: Monitoring Guidelines/Protocols for Sampling and Sample Preservation of Seawater for IMAP Common Indicator 17: Heavy and Trace Elements and Organic Contaminants. • UNEP/MED WG.482/16: Monitoring Guidelines/Protocols for Sample Preparation and Analysis of Seawater for IMAP Common Indicator 17: Heavy and Trace Elements and Organic Contaminants.
	Particulate organic carbon	Water samples are filtered to collect particulate matter. Techniques that can be used include either percentage Loss-on-Ignition, CHN analyser or use wet oxidation technique followed by spectrophotometry or titration.
Seabed – Physical:	Bathymetry	Echo sounder and multibeam bathymetry to provide accurate recording of depth variations across disposal sites
	Bed forms *(i.e., the shape of the seabed including sand waves, mega ripples, rock outcrops etc.)*	• Photography to give presence of different ripple types, rock surfaces, crevices, sediment pockets in hard substratum. • Side-scan sonar for sweep of area giving 2-dimensional interpretation. • Bed-profiling, e.g., Sub-bottom profilers and RoxAnn (http://www.sonavision.co.uk/products.asp?cat_id=1), giving bed features (substratum types, bed forms, major changes of bed.
	Sediment physical characteristics *(i.e., sediment particle size, density, water content, permeability etc.)*	• A subjective assessment following grab or core sampling - skilled visual assessment into mud, muddy-sand, mud, etc. • Detailed particle size analysis of samples taken by grab or core; granulometric analysis using sieving for the coarse fraction and laser granulometry (e.g., Malvern, Frisch), Coulter Counter, or pipette analysis for the finer fraction if <5% by weight. • Geotechnical analyses for e.g., bulk density, liquid/plastic limits, consolidation, permeability and shear strength (Fitzpatrick and Long, 2007). • Sediment Profile Imaging – This allows rapid data acquisition during field sampling and a wide variety of physical and biological parameters can be measured from each image, including: - Grain-size major mode and range (gravel, sand, silt, clay). - Depth of the apparent Redox Potential Discontinuity (RPD). - Calculation of the Organism-Sediment Index, allowing rapid identification and mapping of disturbance gradients in surveyed areas. - Infaunal Successional Stage. - Evidence of excess organic loading and high sediment oxygen demand. - More details can be seen at: https://www.inspireenvironmental.com/2015/12/04/sediment-profile-imaging%20-%20:~:text=Sediment%20Profile%20Imaging%20allows%20rapid%20data%20acquisition%20during,%28gravel,%20sand,%20silt,%20clay%29.%20Small-scale%20surface%20boundary%20roughness
	Marine litter including macro- and micro-plastics	• OSPAR Guidelines for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (https://www.ospar.org/documents?v=7260). • UNEP/MAP has Ecological Objective 10 related to marine litter and Common Indicator 23 ‘Trends in the amount of litter in the water column including microplastics and on the seafloor. Associated with that Common Indicator is a checklist for collecting data on seafloor marine litter (IMAP CI23). • Recently, Madricardo et al., (2020) have given an overview of the current state-of-the-art methods to address the issue of seafloor macro-litter pollution. The overview includes the following topics: the monitoring of macro-litter on the seafloor, the identification of possible litter accumulation hot spots on the seafloor through numerical models, and seafloor litter management approaches (from removal protocols to recycling processes).

Component	Feature	Examples of the methodologies and techniques
		• Regarding microplastics, the best guidance currently available is that proposed in GESAMP (2019) that has proposed guidelines including: o Designing monitoring and assessment programmes o Monitoring methods for shorelines o Monitoring methods for the sea surface and water column o Monitoring methods for seaflooroMonitoring methods for marine biota o Sampling processing for microplastics o Methods for physical, chemical and biological characterisation of plastic litter
Seabed – Chemistry:	Sediment chemistry – contaminants	Sampling by grab or core (non-contaminating material) then analysis by digestion and Atomic Absorption or Plasma-emission spectroscopy for metals; GCMS or HPLC for organic contaminants; petroleum hydrocarbons by extraction and gravimetry or GCMS. UNEP/MAP has two relevant monitoring guidelines/protocols: • WG. 482/11: Monitoring Guidelines/Protocols for Sampling and Sample Preservation of Sediment for IMAP Common Indicator 17: Heavy and Trace Elements and Organic Contaminant. • WG 482/12: Monitoring Guidelines/Protocols for Sample Preparation and Analysis of Sediment for IMAP Common Indicator 17: Heavy and Trace Elements and Organic Contaminants. • Sediment Profile Imaging can be used with Diffusive Gradient in Thin films (DGT) gels to give information on the profiles on contaminants in the top 20 cm of sediment (Birchenough et al., 2010). Also, there is the possibility of using passive sampler to assess the bioavailability of chemical contaminants in sediment e.g., (Gillmore et al., 2021) and paper LC/SG 41/INF.7 'Laboratory, field, and analytical procedures for using passive sampling in the evaluation of contaminated sediments: user's manual' available through IMO Web Accounts
	Sediment chemistry –organic carbon	Sampling by core or grab to give undisturbed surface sediment then assess Loss-on-ignition (using muffle-furnace), direct measurement of carbon and nitrogen by CHN analyser or wet oxidation technique for carbon. Also, micro-Kjeldahl technique for nitrogen.
	Sediment properties –pH, redox	Platinum electrode measurements at depth in sediment in a grab or on a core sample to give Eh profile and depth of redox profile discontinuity level.
Seabed – Biology:	Biotope	A biotope is an area of uniform environmental conditions providing a living place for a specific assemblage of plants and animals. Techniques for this can include: • Still and video photography using epibenthic sledge towed behind vessel or drop camera; calibrate area observed; record megabenthic organisms and any surface features (pockmarks, burrow entrances). • Use of remote operated vehicle (ROV) from vessel to obtain precise nature of biological features; if necessary, ground-truth using core and grab sampling. • Biotope mapping using combinations of multibeam bathymetry, side scan sonar, sub-bottom profiling and RoxAnn with ground truthing by core and grab analysis.
	Epibenthos	• Still and video photography (as for biotope). • Use of remote operated vehicle (ROV) (as for biotope). • Towed epibenthic sledge, naturalists dredge or scallop dredge from vessel, with onboard analysis. • Seabed towed gear, e.g., Agassiz or beam trawl with onboard analysis of large and common forms but laboratory analysis for more precise identification

Component	Feature	Examples of the methodologies and techniques
	Benthic infauna	UNEP/MAP has a relevant monitoring guidelines/protocol for this issue in UNEP/MED WG.461/21: Update of Monitoring Protocols on Benthic Habitats: Guidelines for monitoring marine benthic habitats in Mediterranean. Techniques for this can include: • Use of grab or core samplers to provide fully quantitative samples; sieving on board and laboratory sorting and identification to give abundance, biomass and species richness per sample. • Sediment profile imaging (SPI) to give photographs, and possible image analysis) of sediment type in relation to presence of organisms – see above
Top Predators:	Fish	UNEP/MED WG.458/4: 'Guidance on monitoring concerning the biodiversity and non-indigenous species' covers cetaceans. Monk seals, sea birds and turtles.
	Seabirds	Aerial and shore photography, visual recording.
	Mammals and Reptiles	Photography, visual recording.

Part II: Sampling and Monitoring Protocols Developed under IMAP

Contaminants in biota

Contracting Parties shall take into consideration the following monitoring and sampling protocols in their monitoring programmes for monitoring and assessment of contaminants in biota as indicated in Part C of these Guidelines. They Protocols are described in detail in the following reports:

a. UNEP/MED WG.482/13. Monitoring Guidelines/Protocols for Sampling and Sample Preservation of Marine Biota for IMAP Common Indicator 17: Heavy and Trace Elements and Organic Contaminants.

b. UNEP/MED WG.482/14. Monitoring Guidelines/Protocols for Sample Preparation and Analysis of Marine Biota for IMAP Common Indicator 17: Heavy and Trace Elements and Organic Contaminants.

c. UNEP/MED WG.482/17. Monitoring Guidelines/Protocols for Sampling and Sample Preservation of Sea Food for IMAP Common Indicator 20: Heavy and Trace Elements and Organic Contaminants.

d. UNEP/MED WG.482/18. Monitoring Guidelines/Protocols for Sample Preparation and Analysis of Sea Food for IMAP Common Indicator 20: Heavy and Trace Elements and Organic Contaminants.

Part III: Innovative Solutions

Novel techniques for Monitoring

A number of novel techniques for marine monitoring have and are becoming available due to new technologies being developed. In particular, the use of autonomous vehicles (drones) either underwater, on the sea surface or in the air are bringing new possibilities for marine monitoring. Powered Autonomous Underwater Vehicles (AUVs) have been in use for some time now that can carry out e.g., surveys of side scan sonar, multibeam bathymetry and sub-bottom profiling. In addition, the use of underwater gliders and autonomous surface vehicles is becoming more common. Canada submitted a useful review of novel drones for marine monitoring to the LC/LP Scientific Groups Meeting in 2019.[6] Also, see Chapters 11-16 on in (NOC, 2020) for details of a variety of such devices.

[6] LC/SG 42/INF.11 available from IMO Wen Accounts