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## MEDITERRANEAN ACTION PLAN

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## GUIDELINES

## FOR MONITORING MARINE DUMPING SITES

In cooperation with



IMO

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## **BACKGROUND**

The Joint Meeting of the Scientific and Technical Committee and the Socio-Economic Committee (Athens, 28 May-1 June 1990) requested the secretariat to consider the preparation of guidelines for the monitoring of marine dumping sites.

Further to such request this document was prepared in cooperation with IMO and with the help of a consultant.

### **1. CONTROL OF DISPOSAL AT SEA OPERATIONS**

The overall aim of regional and global conventions and of protocols on waste disposal at sea, is the prevention of pollution of the marine environment. To achieve this control, while recognizing the effectiveness of the sea for certain disposal activities as well as other legitimate uses requires the establishment of environmental management strategies. These strategies are based upon thorough and accurate assessments of the materials proposed for disposal, the ability to predict impacts on the marine environment and upon due recognition of the uncertainties involved in such predictions.

The approach to controlling marine pollution in the legal instruments on waste disposal at sea is, in the first instance, through implementation of a series of Annexes to relevant Protocols. In most of relevant protocols, Annex I to these instruments deals with the most dangerous substances, such as mercury or cadmium, or the organohalogen family of compounds, prohibiting wastes containing these substances unless they occur in trace amounts or are rapidly rendered harmless at sea.

The Annex II deals usually with substances or elements over which there is more general environmental concern. Disposal at sea is restricted where concentrations exceed a critical level (a "significant amount"). The restriction is not a prohibition, but requires early notification by the Consenting Authority and the exercise of "special care" in any subsequent disposal activities when the significant amount is exceeded.

For waste materials passing the scrutiny of the first two Annexes, largely on the basis of chemical content, it is necessary to consider the requirements of Annex III. This Annex outlines General Conditions and Considerations for any application including waste characterization, designation of a disposal site and other considerations such as availability of land-based options (involving re-use or disposal) which may be preferable to sea disposal.

For a number of Conventions, eg. the London Dumping Convention (LDC) and Oslo Convention, Technical guidance has been developed for the interpretation of the Annexes in which terms are defined and guidance is offered on the relevant considerations to be made in a permitting process. The guidance is applicable to any waste material. However, for certain categories of waste, such as dredged material, specific guidance has been elaborated (the Technical Guidance for the interpretation of Annex III of LDC is presented in Annex I to this report.

Proper application of the Annexes will enable a permitting authority to predict the impact of a disposal activity at a designated disposal site and to judge its acceptability.

Establishment of a monitoring programme is a logical consequence of the waste assessment process.

### 1.1. Developments within the London Dumping Convention and the Oslo Convention

The structure of the Annexes of the "Dumping Conventions" has remained virtually constant for almost 15 years, and although review groups have met periodically, the outcome of these discussions has not led to any particularly fundamental change. Changes which have been agreed have dealt with the inclusion of substances in the Annexes and the movement of compounds from one Annex to another.

In 1987, however, a group of experts was established by Contracting Parties to the LDC to review the operational procedures of the Convention, with particular regard to the structure of the Annexes, and any potential ambiguities arising from the application thereof. The Group was asked to recommend any alternative procedures for the classification and assessment of wastes to be dumped at sea which would afford better protection of the environment against the adverse impacts of waste.

The Ad Hoc Group of Experts identified a number of guiding principles for their study namely, that any new structure should:

- i) have as far as possible a scientific foundation to recognize and take account of the uncertainties which may exist in a scientific approach to the assessment of hazard and risk;
- ii) be described in clear, unambiguous terms;
- iii) emphasize waste categories as well as individual contaminants;
- iv) reflect established principles of waste management;
- v) be no less stringent than the existing black/grey list approach to the assessment of wastes intended for disposal at sea.

The product of the Ad Hoc Group of Experts is the New Assessment Procedure (NAP), which is currently in draft form. The NAP contains all of the features of the current Annexes but has ordered the various steps and considerations in a sequence that is consistent with a holistic approach to waste management (the NAP and the guidance for its interpretation are given in Annex II to this report). There are four main features.

Firstly, as in the present Annex I, there is a prohibition category which will include an agreed list of substances or well defined wastes for which prohibition would be absolute; this is stronger than the existing Annex I. Secondly, there is detailed consideration of alternatives to sea disposal including a waste prevention audit, investigation of the possibilities for waste avoidance, through clean(er) technology. In the present Annex structure, such considerations, not enumerated in such detail, are listed under Annex III, and in terms of presentation are given greater prominence in the NAP. The third section deals with waste assessment, by tiered testing to predict the likely impact on the marine environment should sea disposal be considered as the preferred disposal option. Finally there is post-disposal monitoring with feedback into all previous sections of the NAP.

The critical link between the Waste Characterization step and prediction of consequences, and the post-disposal monitoring phase is the Impact Hypothesis. Within the current Annex structure, this step has been "implied". In the NAP technical guidance on the meaning and derivation of an Impact Hypothesis has been given.

The term "Impact Hypothesis" is a summary of predicted impacts on the marine environment by the proposed disposal operation. It is explicitly a statement at the conclusion of the assessment in support of a decision to issue a permit. The Impact Hypothesis should integrate information on waste characterization and the proposed disposal site(s) to provide a concise scientific analysis of the potential effects on man, living resources and other legitimate uses of the sea. It will encompass both temporal and spatial scales of potential effects.

The New Assessment Procedure has received strong support by many Contracting Parties and its operation is now being tested in trial applications by national permitting agencies who will report back to the consultative Meeting before a final decision is taken on its adoption. Some Contracting Parties are more reserved on the acceptability of the scheme since in their view the only means of strengthening the Convention is via a cessation of all waste disposal at sea (with certain exceptions).

The NAP contains outline technical guidance for compliance monitoring since monitoring is an integral part of managing waste disposal activities. The guidance which is reflected in the Monitoring Guidelines set out in Section 2 of this study, describes how clear objectives for monitoring can be set, and how compliance with these objectives can be demonstrated through Hypothesis testing. Hypotheses are designed to answer specific questions regarding the disposal activity rather than simply accumulating data from unstructured measurements at sea. A general statement of a Null Hypothesis is as follows:

Dumping activity X will not cause a particular component of the ocean ecosystem to change by a specified amount in a specific location.

The monitoring approach to test hypotheses is selected in such a way that the collection of unnecessary information is avoided and ensures that all data necessary to answer management questions are available.

Once a monitoring programme is underway, results should be used to modify the sampling and analysis plan as well as providing feedback to the permitting and site selection phases. Decisions might include continuing, modifying or revoking permits, maintaining, changing or withdrawing the site for further use, or terminating monitoring.

## **1.2. Definition of monitoring**

The purpose of monitoring is the protection of inshore and offshore marine waters, their living resources and man from significant or unacceptable consequences of materials and substances discharged or dumped into these waters by man, or arriving in the marine environment via land run-off or the atmosphere. The primary aim of monitoring programmes is to test compliance with an environmental quality standard or hypotheses set as control measures in a disposal operation. A second aim is to provide sufficient information to enable regulations to make sensible decisions about the amounts of contaminants or material which can be discharged in a given area. A third aim is to establish changes in contaminant level or ecosystem variables with time as a consequence of specified activities.

These three aims often provide only simplistic relationships between cause and potential effect and a fourth aim, therefore, is to provide input data for research programmes designed to assess physical, chemical and biological pathways, perhaps via modelling or other predictive tools.

Overall, the aims can be expressed in a general definition of monitoring as follows:

Monitoring is the repeated measurement of a contaminant or an effect (whether direct or indirect) to assess or control exposure to that contaminant, or the effect, to either man or specified elements of the marine resource.

In the particular case of disposal of wastes and other matter at sea the London Dumping Convention adopted a definition of monitoring as follows:

"Monitoring ..... the condition of the seas for the purposes of the convention (as required in Article VI(1)(d)), refers to those measurements performed by Contracting Parties, alone or in collaboration, to demonstrate compliance of their at-sea dumping and incineration practices with the overall intent of the Convention and the requirements of the Annexes".

The definition was incorporated in Resolution LDC.36(12) (see Annex III) designed to encourage Contracting Parties to submit reports of monitoring activities to the Convention Secretariat. For the purpose of this report, the former, more general definition of monitoring will be used.

### **1.3. Guidance from other expert groups**

The guidance established on monitoring within the framework of the London Dumping Convention is essentially general in nature. Since the Convention is global, and incorporates coastal margins of great diversity, in terms of climate, oceanography, use, anthropogenic pressures and pollution, the detail required in formulating "catch-all" guidance would be so great as to render formal guidance of little practical use. However, guidance from international expert groups such as the International Council for the Exploration of the Sea (ICES), the Intergovernmental Oceanographic Commission (IOC) and the IMO/FAO/UNESCO/WMO/WHO/IAEA/UN Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) is kept under review. Moreover, occasional publications in scientific journals and monographs provide an excellent source of reference material. A bibliography of key references and sources is given in Annex VII. In addition to these sources, the exchange of information and experience of Convention fora is a valuable means of refining monitoring strategies.

At the regional level, it is more practicable to draw on the expert groups such as ICES, IOC and GESAMP to formulate guidance packages on monitoring, in some cases specific to particular waste types.

In 1990, the Oslo Commission drafted and adopted a set of monitoring guidelines for sewage sludge and dredged material disposal sites based, in part, on advice from ICES. In its 1988 report, the Advisory Committee on Marine Pollution (ACMP) of ICES reviewed its guidelines on the Philosophy, principles and Strategy of Monitoring (see Annex IV). Following this review, and in view of the trend in phasing out disposal at sea of wastes, other than dredged materials, OSCOM separated the 1980 joint guidelines. The revised guidance for dredged material reflects the ACMP revision and is now proposed as an integral part of the new OSCOM "Guidelines for the Management of Dredged Material Disposal Activities" (this guidance and the "Methods of Monitoring Dumping Grounds for Sewage Sludge" are in Annexes V and VI respectively).

The guidelines proposed for the purpose of the Dumping Protocol of the Barcelona Convention are suitable for any waste type. They also reflect the current ICES advice.

## **2. GUIDELINES PROPOSED FOR THE PURPOSE OF THE DUMPING PROTOCOL OF THE BARCELONA CONVENTION**

### **2.1. Definition**

In the context of assessing and regulating environmental and human health impacts of disposal of materials at sea, monitoring is the repeated measurement of a contaminant or an effect (whether direct or indirect) to assess or control exposure to that contaminant, or the effect, to either man or specified elements of the marine resource.

### **2.2. Objectives**

Monitoring waste disposal operations is generally undertaken for the following reasons:

- i) to establish whether licensing conditions have, as intended, prevented adverse effects on the receiving area as a consequence of dumping;
- ii) to improve the basis on which license applications are assessed by improving knowledge of field effects from large discharges which are not readily estimated by laboratory or literature assessment;
- iii) to provide the necessary evidence to demonstrate within the framework of the Protocol on dumping, that the control measures applied are sufficient to ensure that the dispersive and assimilative abilities of the marine environment are not exceeded causing environmental damage.

The ultimate purposes of monitoring are to control the exposure of the organism of interest to the activity of contaminant in question and to control the effects of the activity on the abiotic environment.

### **2.3. Strategy**

Monitoring operations are expensive for they require considerable resources both at sea and in subsequent working up of samples. In order to approach the monitoring programme in a resource-effective manner, it is essential that the programme should have clearly defined objectives, that the measurements made can meet those objectives, and that the results be reviewed at regular intervals in relation to those objectives. The monitoring scheme should then be continued, reviewed or even terminated, as appropriate.

### **2.4. Impact Hypothesis**

In order to establish the necessary clear objectives for a monitoring programme, it is first necessary to derive an Impact Hypothesis describing predicted effects on the physical, chemical and biological environment.

An impact Hypothesis should integrate information on the characteristics of the disposal site conditions. The aim is to provide a concise scientific analysis of the potential effects on human health, living resources, marine life, amenities and other legitimate uses of the sea. It should encompass both the temporal and spatial scales of potential effects.

The preliminary evaluation should be as comprehensive as possible. The primary areas of potential impact should be identified and are those considered to have the most serious

consequences for human health and the environment. Alterations to the physical environment, risks to human health, devaluation of marine resources and interference with other legitimate uses of the sea are often seen as priorities in this regard.

The expected consequences of disposal could be described in terms of habitats, processes, species, communities and the uses affected. The precise nature of the change, response or interference (effect) predicted could then be described. The target and the effect together could be described (quantified) in sufficient detail so that there would be no doubt as to the parameters to be measured during post-operational monitoring. In the latter context, it might be essential to determine "where" and "when" the impacts can be expected.

In order to develop this hypothesis, it may be necessary to conduct a baseline survey which describes not only the environmental characteristics, but also the variability of the environment. It may also be helpful to develop computer models of the environment, to determine possible effects of disposal. Then, before any programme is drawn up and any measurements are made, the following questions should be addressed:

- i) what exactly should be measured ?
- ii) what is the purpose of monitoring a particular variable, contaminant or biological effect ?
- iii) in what compartments or at which locations can measurements most effectively be made ?
- iv) for how long should the measurements continue to be made to meet the originally defined aim ?
- v) what should be the temporal and spatial scale of measurements made to test the hypothesis ?

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

A major requirement is to develop criteria describing the specific environmental effects of waste disposal that should be prevented outside the designated disposal area.

## **2.5. Monitoring**

The disposal of wastes at sea may have its primary impact at the seabed (in the case of dredged material or solid industrial wastes) or in the water column (in the case of liquid wastes and sewage sludges). Depending upon the waste type, it is often possible to restrict monitoring to one compartment.

Where it is considered that effects will be largely physical, monitoring may be based upon remote methods such as sidescan sonar to identify changes in the character of the seabed and bathymetric techniques (eg echosounding) to identify areas of waste accumulation. Both techniques will require an amount of sediment sampling to establish "ground truth".

Chemical measurements may also serve to prove useful to trace the dispersal of waste and to assess any minor accumulation of material not detected by remote survey methods.



When a contaminated waste is deposited, it may be necessary to measure its chemical components to ensure that unacceptable accumulation of these components does not occur.

Where either physical or chemical effects at the seabed are expected, it will be necessary to examine the benthic community structure in areas where wastes disperse. In the case of chemical effects, it may also be necessary to examine the chemical quality of the biota (including fish).

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.

The spatial extent of sampling will need to take into account the size of the area designated for dumping, any areas of possible short dumping, the mobility of deposited material and water movements which will determine the direction and extent of waste transport. It may be possible to limit sampling within the disposal site itself as effects in this area are accepted and their definition in detail may be unnecessary. However, some sampling should be carried out to aid the identification of the type of effect which may be expected in other areas and for scientific rigour.

The frequency of survey will depend on a number of factors. Where a disposal operation has been going on for several years, it may be possible to establish the effect at a steady state of input and repeated surveys would only be necessary if changes are made to the operation (quantities or type of waste, method of deposit etc...).

If it were decided to monitor the recovery of an area which was no longer used for waste disposal, more frequent measurement might be needed.

The effects of similar wastes (eg dredged materials) upon the marine environment are likely to be similar in many areas. There is therefore little justification for monitoring all sites, particularly those receiving only small quantities of waste. It would be more effective to carry out more detailed investigations at a few carefully chosen sites (eg those subject to large inputs of material) to increase understanding of effects and processes.

Monitoring is most often carried out by the permitting authority or an (research) agency closely associated with it. This is often the most reliable arrangement. In some circumstances, however, it is practicable for the permit holder to conduct a schedule of monitoring to designed by the permitting authority.

## **2.6. Reporting**

The preparation of concise reports of monitoring activities is an essential part of monitoring. Reports should detail the measurements made, the results obtained and how these data relate to the monitoring objectives. The frequency of reporting will depend upon the scale of disposal activities and the intensity of monitoring.

Contracting Parties should inform the Secretariat of their monitoring activities and submit reports when they are available.

ANNEX I

GUIDELINES FOR THE IMPLEMENTATION AND UNIFORM INTERPRETATION  
OF ANNEX III OF THE LONDON DUMPING CONVENTION

ANNEX II

DRAFT NEW ASSESSMENT PROCEDURE (NAP)  
FOR THE LONDON DUMPING CONVENTION

ANNEX III

RESOLUTION LDC.36(12) MONITORING ACTIVITIES  
CARRIED OUT IN ACCORDANCE WITH ARTICLE VI(1)(d)  
OF THE LONDON DUMPING CONVENTION

ANNEX IV

PHILOSOPHY, PRINCIPLES AND STRATEGY OF MONITORING  
OF THE ADVISORY COMMITTEE ON MARINE POLLUTION OF ICES

ANNEX V

DRAFT OSLO COMMISSION GUIDELINES  
FOR THE MANAGEMENT OF DREDGING ACTIVITIES

ANNEX VI

OSLO COMMISSION METHODS OF MONITORING DUMPING GROUNDS  
FOR SEWAGE SLUDGE

ANNEX VII

BIBLIOGRAPHY OF SELECTED REFERENCES RELATED TO  
MONITORING MARINE DISPOSAL SITES

Report of the ICES Advisory Committee on Marine Pollution, Cooperative Research Report No 160, 1988, 123 pages.

[To note in particular Chapter 4 - Monitoring Strategies]

Report of the ICES Advisory Committee on Marine Pollution, Cooperative Research Report No 167, 1989, 172 pages.

[To note in particular Chapter 6 - Monitoring Issues]

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