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REPORT ON MEETING OF EXPERTS ON POLLUTANTS  
FROM LAND-BASED SOURCES  
GENEVA, 19-24 SEPTEMBER 1977

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ON POLLUTANTS FROM LAND-BASED SOURCES  
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## 1. Introduction

1.1 As part of the Mediterranean Action Plan 1/ which was adopted by the Intergovernmental Meeting on the Protection of the Mediterranean Sea, (Barcelona, January/February 1975), the Executive Director initiated a project on "Pollutants from Land-Based Sources in the Mediterranean". This project, which was organized by UNEP, was implemented in close co-operation with the Governments of the region and six specialized United Nations bodies: the Economic Commission for Europe (ECE), the United Nations Industrial Development Organization (UNIDO), the Food and Agriculture Organization (FAO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Health Organization (WHO), and the International Atomic Energy Agency (IAEA).

1.2 A principal objective of the project was to provide the Governments of the region with information on the type and quantity of pollution from major land-based sources and through rivers, and on the present status of waste discharge and water pollution management practices. It also provided for the preparation of an inventory of land-based sources of pollutants being discharged into the Mediterranean. Within the framework of these objectives, the data collected through the project was collated and summarized in a draft report. The report is intended to assist Governments in their negotiations on the draft Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources.

1.3 Subsequently, the Executive Director convened a meeting to review the draft report on the project, and to advise him on the final presentation of the results obtained through the project at the Intergovernmental Review Meeting of Mediterranean coastal States on the Mediterranean Action Plan to be convened in January 1978. Experts from all Mediterranean states were invited to participate in the meeting.

1.4 In addition to reviewing the results obtained through the project on pollutants from land-based sources, the meeting of experts was asked to consider the technical annexes proposed for inclusion in the draft Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources. These annexes, which were first presented to the Athens Intergovernmental Consultation concerning a draft Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources in February 1977, were revised according to the comments made by the Governments of the Mediterranean coastal States and the recommendations made by the WHO/UNEP Workshop on Coastal Water Pollution Control, Athens, 27 June - 1 July 1977 and the WHO Consultations on Radioactivity Releases into the Sea, Monaco, 27-29 July 1977. Further recommendations made by the experts meeting are to be reflected in the proposed technical annexes when they are presented to the second intergovernmental consultation on the draft protocol to be convened by UNEP in Venice from 17 through 21 October 1977.

## 2. Participation

2.1 The meeting of experts was attended by twenty-one Mediterranean experts who participated in their personal capacities, by representatives of the United Nations bodies co-operating in the convening of the meeting and by observers from international organizations. A list of participants is attached as Annex I.

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1/ Annex of the Report of the Intergovernmental Meeting on the Protection of the Mediterranean, Barcelona, 28 January - 4 February 1975, UNEP/WG.2/5.

### 3. Opening of the Meeting (agenda item 1)

3.1 The meeting was opened by Dr. S. Keckes, who welcomed the participants on behalf of Dr. Mostafa K. Tolba, Executive Director of UNEP. Dr. Keckes also thanked the six co-operating United Nations bodies for the contribution that they had made in the preparations for the meeting.

3.2 Dr. Vouk, speaking on behalf of Dr. H. Mahler, Director-General of WHO, welcomed all participants to the meeting. Speaking for the six collaborating United Nations bodies he thanked the participants for their interest in the work being carried out concerning land-based pollutants and noted the essential role played by the Governments of the region in providing the information on which the documentation was based.

3.3 Dr. Keckes continued by thanking the WHO for hosting the meeting. He briefly reviewed the activities of the Mediterranean Action Plan and emphasized the link between the assessment of the sources and state of pollution in the region and the adoption of legal instruments to limit and control the introduction of pollutants into the marine environment. He noted that the project on pollutants from land-based sources had been initiated to assist Governments in their negotiations towards a Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources. Consequently, the meeting was called upon by the Executive Director to advise him not only on the final presentation of the results of the project on pollutants from land-based sources but also on the technical aspects of the protocol as contained in the proposed technical annexes to the protocol. Dr. Keckes stressed that all participants had been invited to the meeting in their personal capacities and that any views expressed were their own and did not represent the views of their Government. The report of the project on pollutants from land-based sources would be submitted to Governments at the Intergovernmental Review Meeting in January 1978 in Monaco. Comment on the technical annexes would be reflected in the proposals submitted to the second intergovernmental consultation concerning a draft protocol for the protection of the Mediterranean Sea against pollution from land-based sources, Venice 17 - 21 October 1977

### 4. Adoption of the Agenda (agenda item 2)

4.1 The provisional agenda as presented in UNEP/WG.13/1 was adopted by the meeting. The agenda is presented in Annex II to this report.

### 5. Review of Project on Pollutants from Land-Based Sources (MED X) (agenda item 3)

5.1 Dr. R. Helmer, Secretary of the meeting, introduced document UNEP/WG.13/3, entitled "Pollutants from Land-Based Sources in the Mediterranean". He explained that the time-schedule for MED X was closely linked to the preparation and negotiation of the draft protocol on land-based pollution, and consequently, in the limited time available, it was only possible to present an overall assessment of:

- (i) relevant pollution sources;
- (ii) the pollution load entering the Mediterranean, and
- (iii) the waste management practices in the various Mediterranean countries.

It was suggested that the meeting may wish to recommend that the countries concerned establish more detailed source inventories as a follow-up to the project. Dr. Helmer outlined some of the difficulties encountered in harmonizing the work and resulting data, but remarked that the success that had been achieved was owed to the co-operation of the Governments of the region and the collaboration of the specialized United Nations bodies. After outlining the content of the report, he invited the participants to comment upon the document chapter by chapter. The main points of the discussion are noted below.

#### Approaches and methods

5.2 During the discussion of the methodology applied to the study of different pollution sources it was emphasized that the results were accurate within the range of one order of magnitude. Taking into account the limited availability of data, an indirect assessment method had to be chosen in most cases and was considered acceptable for the purposes of the report. Adequate bibliographic information on the data and literature sources used was felt necessary and will be added to the report.

5.3 The indirect assessment methods applied to the industrial pollution sources were discussed. The use of employee figures as the basis of computation was questioned due to its large variability. However, it was explained by the consultants involved in the preparation of the report that in each case the best practicable methodology had been applied depending on the data base available in the country.

5.4 The data on metals in wastewaters were found rather scanty in the Mediterranean area; consequently, only a short list of four metals was included in the study. The absence of cadmium estimates was considered a major gap, particularly since this element is included in the list of harmful substances in annex I of the draft protocol on land-based sources.

#### Pollution source inventory

5.5 The presentation of the detailed lists and maps of different pollution source categories were discussed, and a number of corrections were made by the participants during the meeting. It was considered advisable in the light of the ongoing controversy in most countries on the need and siting of new nuclear installations to delete any planned installations from the maps of the MED X report and to include only nuclear installations in operation or under construction at present.

#### Pollution load assessment

5.6 The estimate of total pollution discharges and their sources was considered as the key component of the MED X report. Consequently, the presentation of these results was subject to intensive discussions. Since it was agreed that the summary table provided in the report (table 7) could lead to inaccurate conclusions as to the relative importance of the different source categories, a revision was undertaken. The new version distinguishes between pollution loads originating in the coastal zone and loads carried by rivers, with a subdivision of the latter into man-made pollution loads and natural background fluxes. Keeping in mind the level of uncertainty concerning the pollutant loads carried by rivers as defined in the report (UNEP/WG.13/3), it was decided to present them in Table 7 according to a range of a calculated minimum and maximum for each pollutant.

5.7 The graphic presentation of results in the form of maps was also subject to discussion which led to the acceptance of the pie diagrams showing pollution loads per Mediterranean subregions in tons per annum.

5.8 The original estimate of organochlorine compounds carried by surface run-off into the Mediterranean was considered too low, and a revised assessment was undertaken during the meeting. At present, however, the atmospheric transport of pesticides and the resulting amounts reaching the Mediterranean through this pathway remain an unknown factor. A study to clarify the situation may be initiated in the near future. Also, the importance of microbiological pollution was stressed and a respective amendment will be made to the report.

#### Waste disposal and management

5.9 The present draft, describing through country summaries the practices in this field, was considered appropriate. The importance of a licensing system for individual waste discharges was emphasized particularly in connexion with the forthcoming protocol. Such a system could only be efficient if it is enforced. It was recommended that all new installations be equipped for proper waste disposal and management before the start-up of operations. A number of individual corrections and amendments to the report (UNEP/WG.13/3) were provided by the participants concerning the presentation of country reviews.

#### Conclusions and recommendations

5.10 The draft conclusions of the project as presented in document UNEP/WG.13/3 were considered and amended by the group. A complete set of conclusions and recommendations is attached as Annex III to this report. Highlights of the discussions on this section are recorded below.

5.11 It was recommended that the radioactivity associated with phosphate fertilizers be considered although at present no quantitative estimate of this source is possible. Also, further studies on microbiological pollutants as a major component of domestic sewage discharges were also suggested by the group.

5.12 The recommendations for future activities that were proposed by the agencies participating in project MED X were noted by the meeting, and a number of additional suggestions were made. The preparation of pollution source inventories and inventories on the amount of waste reaching the Mediterranean by each country on a regular basis, which would allow the estimation of the total budget of Mediterranean pollution loads, was regarded as an essential follow-up of project MED X.

5.13 Monitoring programmes were suggested as essential in order to remedy existing data deficiencies. Such monitoring should also cover hazardous substances which are present as trace contaminants only.

5.14 Training activities and technical assistance in connexion with research and also in support of control measures were proposed as crucial for the implementation of pollution reduction programmes. Training of sewage treatment plant operators was specifically identified in this respect.

5.15 It was suggested that the reduction of industrial waste loads could be achieved through the application of best practicable control technology and should be promoted on a larger basis. The view was also expressed that the rational use of fertilizer and pesticides should allow for full efficiency with a minimum of polluting impact on the marine environment.

5.16 Control and Management methods, such as the issuing of individual licences, were endorsed and their wider application and adequate enforcement requested. In addition, environmental impact statements for all new installations resulting in waste discharges to the sea were considered as one useful tool of rational management.

#### Suggestions for international co-operation

5.17 The establishment of more detailed and reliable pollution source inventories and of inventories on the amount of waste reaching the Mediterranean was felt to be an important task for all countries involved. Common methodology is essential to ensure comparability of results. To this end, a refined and simplified version of the guidelines and questionnaires used under project MED X was suggested as a useful starting point. Recognizing the importance of this question, the group thought it would be useful to propose to the next Venice meeting the creation of a new principle requiring states party to the Protocol to establish periodically such inventories.

5.18 A mechanism for the routine collection and compilation of country information was considered necessary, possibly to be arranged in connexion with the forthcoming protocol. Strengthening of the co-operation of national focal points rather than the creation of new international bodies was recommended for this purpose.

5.19 Exchange of information and international co-operation in the field of applied research monitoring and technical assistance were stressed as essential for successful pollution control around the Mediterranean. Adequate training programmes should be established in this respect.

5.20 The development of a model code of practice was emphasized as a useful tool to assure the application of sound technical and administrative solutions to the problem of wastes handling and sea disposal. While such common technical principles would be beneficial to many countries, national legislative solutions would be promoted primarily through the protocol on land-based pollution sources ensuring an adequate treatment by new installations.

5.21 While the monitoring of river discharges could advantageously be conducted under existing international programmes (UNEP/GEMS, European Economic Community), the further investigation of pollution transport by sediments was considered as an urgent research need.

5.22 Atmospheric transport of pollutants such as pesticides and heavy metals is a still undetermined factor in the estimate of pollution loads. An international study on this problem should be initiated as an immediate follow-up of project MED X.

6. Technical Annexes proposed for inclusion in the draft Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources

6.1 Dr. Helmer introduced document UNEP/WG.13/4, entitled "Technical Annexes proposed for inclusion in the draft Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources". As agreed at the Intergovernmental Consultation concerning a draft Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources, Athens, February 1977, the meeting was called upon to review the technical aspects of the proposed protocol and to prepare recommendations for consideration by the second intergovernmental consultation on the draft protocol in Venice, 17 - 21 October 1977. Dr. Helmer explained that since the Athens intergovernmental consultation, the technical annexes had been revised in light of comments made by the Governments of the Mediterranean coastal States and recommendations made by the WHO/UNEP Workshop on Coastal Water Pollution Control, Athens, 27 June - 1 July 1977, and the WHO consultations on Radioactivity Releases into the Sea, Monaco, 27 - 29 July 1977.

6.2 The meeting considered the technical annexes, and the text of the annexes recommended by the meeting for inclusion in the draft protocol is reproduced in Annex IV to this report. The main points raised during the debate on agenda item 4 are noted below.

6.3 Substances should be included in Annex I of the protocol on the basis of one or more of the following criteria: their toxicity; their persistence; and/or their bioaccumulation.

6.4 After a lengthy debate, it was decided that persistent mineral oils and persistent hydrocarbons derived from petroleum origin, in particular used lubricating oils were particularly hazardous and should be included in Annex I. All other crude oils and hydrocarbons derived from petroleum origin should be included in Annex II.

6.5 The desirability of including in Annex I substances which are only suspected for carcinogenic, teratogenic or mutagenic properties was carefully examined. As it was felt that a final decision requires not only technical but also political considerations relating to the desirable safety margin, the words "or suspected" were put between brackets, and it was left to the Venice intergovernmental meeting to decide whether to retain them or not.

6.6 It was generally agreed that radioactive wastes and other radioactive substances should be included in Annex I of the Protocol. However, due to reservations on the part of several experts as to the precise drafting of paragraph A.9 it was decided to leave the paragraph between brackets.

6.7 Although it was recognized that there is no convincing scientific evidence as to the harmfulness of organosilicon substances in the marine environment, it was considered advisable to maintain these compounds in paragraph A.3 of Annex II in light of the precedents found in other international agreements.

6.8 Paragraph A.7 of Annex II which refers to "inorganic compounds of phosphorus and elemental phosphorus" was placed between brackets, since the introduction of these substances into the marine environment was recognized as being hazardous only for some subregional areas of the Mediterranean where eutrophication was a problem.



6.9 The meeting noted the proposal of the Government of Spain which had been submitted to the Secretariat that under Section C of Annex III "Characteristics of discharge site and receiving water" a list of characteristics relating to rivers be included. The group decided that this question should be submitted for consideration to the Venice intergovernmental meeting, since it was related to the interpretation given to Principle 2 of the Protocol.

6.10 The experts suggested that the entire Annex IV be placed in square brackets. It was agreed that the definition of "new installations" would have to be based on legal and political considerations and was outside the scope of the scientific expertise of the meeting. Consequently, the final decision was left to the Venice intergovernmental meeting.

7. Adoption of the Report (agenda item 6)

7.1 The English and French texts of the report of the meeting were adopted on 23 September 1977.

8. Closing of the Meeting

The meeting was closed on 23 September 1977 by the Chairman, who thanked all the participants for the constructive guidance and advice which they had given to UNEP and to the specialized bodies of the United Nations system on the MED X report and the technical annexes.

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AGENDA

1. Opening of the Meeting
2. Adoption of the Agenda
3. Review of Project on Pollutants from Land-Based Sources (MED X)
4. Review of Technical Annexes proposed for inclusion in the draft Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources
5. Other business
6. Adoption of the Report



POLLUTANTS FROM LAND-BASED SOURCES IN THE MEDITERRANEAN  
(PROJECT MED X)

Conclusions and Recommendations

1. The relatively short time period of 1½ years provided for project development and implementation did not allow for an in-depth study of each individual pollution source along the Mediterranean coastline. It was possible, however, to achieve a comprehensive overview as well as a comparative evaluation of major point and non-point sources. Such information was requested by mid-1977 in order to assist in the critical stages of the preparation of the draft protocol on land-based sources.
  2. All the various sectorial studies revealed without exception the limited availability of relevant data in all Mediterranean countries. Particular data deficiencies were encountered for hazardous pollutants such as heavy metals, specific organics and pesticides. Furthermore, the available statistical documents frequently did not provide for a more detailed analysis of data according to industrial activities or geographical allocations.
  3. Collection of the required data in the countries faced various difficulties: data collection and reporting formats vary from one country to another; a large number of different data sources had to be included in each study; certain sectorial data were not readily available; in some cases the required data were not obtained due to confidentiality restrictions which could not be overcome in the short time provided for the project.
  4. In view of the limitations and difficulties encountered, the pollution load assessment for all waste source categories has been, to a great extent, estimated indirectly. It has been worked out taking into consideration demographic statistics, industrial production and employee figures, and agricultural consumption data in addition to the data provided by the questionnaires. Similarly, extrapolations from known sources were made in the case of rivers and of nuclear power stations. Despite the short-comings of such an indirect method of evaluation, the results obtained are homogeneous and fairly complete and cover the entire Mediterranean region. The quality of estimates calculated may be considered accurate within an error range of about one order of magnitude.
- A. Conclusion
5. Compilation and comparison of the sectorial results achieved revealed a number of interesting facts which could assist in the improvement of present pollution control efforts of the countries bordering the Mediterranean Sea.
  6. Domestic sources largely contribute organic matter (BOD or COD), micro-organisms, and nutrients as well as detergents from household uses. Some of the metals are also derived from municipal sewage discharges.
  7. Industrial waste discharges are responsible for considerable amounts of organic matter and suspended solids. Various industrial processes result also in phenol and metal releases while mineral oils are largely introduced from refineries and crude oil terminals.

9. Agricultural run-off is responsible for a considerable portion of the nutrient input into the sea. Suspended solids and pesticide discharges are largely due to soil erosion in the Mediterranean watershed. The airborne load of pesticides could, however, not be included in the study.

10. Major rivers and drains transport an integrated load of domestic, industrial and agricultural pollutants from the entire drainage basin into the sea. Their contribution is therefore very high in suspended solids, nutrients, metals and organic matter. They may also carry most of the pesticide residues from agricultural areas in the Mediterranean watershed.

11. The total discharge of radioactivity into the Mediterranean from nuclear installations is rather low in comparison to the radioactive contaminants in other materials discharged (particularly phosphates) and due to fall-out from earlier weapon tests.

### 12. Recommen dations

1. The present project which is to terminate in 1977 should be considered only as first step towards the required efforts for pollution control in the Mediterranean. Further studies and activities are indispensable. The momentum so far acquired, although significant, will need further stimulus if progress is to be maintained and increased.

2. A number of specific proposals are therefore included here which would strongly help in this task. They are listed according to the type of activity required and include source inventories, monitoring, research, control and management as well as suggestions for international efforts.

#### 1. Source inventories

3. Further analysis of the results of the present project should be undertaken by each interested country. This, complemented by local ad hoc investigations, would assist in planning action required in leading to more efficient control of land-based pollution sources.

4. Based upon detailed country investigations, comprehensive pollution load inventories should be prepared for each regional sea area and the total Mediterranean basin on a regular basis. The relevant protocol may provide the necessary legal basis for this task.

#### 2. Monitoring

5. Routine monitoring of major municipal sewage discharges should be organized in each country. A minimum number of parameters should be agreed upon and their regular sampling and analysis initiated. Similarly, effluents from major industrial complexes should be periodically monitored. Detailed analysis of particularly hazardous substances at critical industrial sources should be carried out. Pollutants listed in Annex I, even if they are present only as trace contaminants, and in Annex II of the protocol are of priority importance in this respect.

16. River water quality monitoring programmes should be established in the developing countries and strengthened in the others. In particular, large and small but heavily polluted rivers should be included in such national programmes which should include monitoring at the tidal limits. Special efforts should be undertaken to initiate the sampling and analysis of suspended sediments for metal and pesticide contents.

17. Individual radionuclides should be monitored in the effluents from nuclear installations as well as in the affected rivers. Also, their distribution from the point of discharge into the Mediterranean Sea should be measured and mapped.

### 3. Research

18. Investigations and pilot studies on existing wastewater treatment and sea outfall systems should be undertaken at several places around the Mediterranean coastline. Such studies should cover municipal sewage as well as hazardous industrial pollutants. Also, these investigations should be extended to the coastal receiving waters in order to assess potentially harmful effects on human health and the marine ecosystem.

19. Further research on the physico-chemical interactions at the solid-liquid interface should be undertaken, particularly in estuaries, in order to allow for a better assessment of pollutants carried by river sediments into the Mediterranean. Such investigations are indispensable for the determination of metal and pesticide loads from river discharges and their subsequent transformation and dispersion in the marine environment.

20. Pilot zone studies in agricultural areas should be conducted in order to obtain improved estimates of sediment yields from erosion and of nutrient and pesticide wash-out rates under different physiographical conditions. Such studies should be combined with river investigations to gain a better insight into the relationship between sediment yield and river transport mechanisms.

21. Training activities and technical assistance should be promoted in order to intensify present research efforts and to support the initiation of new efforts wherever needed.

### 4. Prevention and Control

22. Local and national activities should be stimulated which will assist in the study and application of methods of control of coastal water pollution due to municipal sewage. In this respect, due consideration should be given to alternative treatment and disposal methods such as the reuse on-land for agricultural and low-cost methods of treatment such as waste stabilization ponds exploiting local geographical and climatic advantages. Also, present deficiencies in the operation and maintenance of sewage handling facilities and the training of operators should receive more attention.

23. The application of economically sound treatment methods and processes for various industrial wastewaters should be promoted and the best practicable technology applied. Such methods should aim to reduce pollution at the source and provide for the conservation and possible reuse of substances which are particularly hazardous and consist of valuable material resources.

24. As regards agricultural pollutants, the economic impact of control methods such as fertilizer use and soil loss reduction procedures should be estimated. Also, the restriction and prohibition of persistent organochlorine pesticides should be promoted as an effective instrument for pollution control at the source. As regards irrigation projects, efficient use of fertilizer and pesticides should be ensured through the application in the dissolved form by pipelines.

#### 5. Management

25. In order to ensure efficient water resources management, an appropriate combination of regulatory, technical and economic instruments should be applied so as to provide continuing incentive to control both pollution and marine water quality.

26. The development of appropriate administrative procedures which will succeed in bringing about the necessary co-ordination of efforts for seawater pollution control should be thoroughly studied by the interested countries and an efficient solution applied wherever there are multiple responsibilities resting with a diversity of national, provincial and local services. This should be the minimum step towards the building of the necessary managerial and administrative institutions. Relevant manpower needs and structures require equal attention in this process.

27. Administrative practices such as the issuing of individual licences should be further developed and introduced wherever appropriate. General adoption of a licensing system should be in accordance with the requirements set forth in the protocol on land-based pollution sources. Adequate staffing of the necessary administrative institutions at all levels is essential. Also, the introduction of local charging systems in order to ensure a proper financial basis for effective waste management should be considered. Thus, adequate funds would be provided which can be allocated to water resources development and pollution control measures.

28. The potential environmental impact of new installations around the Mediterranean Sea should be taken into consideration as early as possible in the planning process. Direct and indirect impacts should be assessed as to their short- and long-term consequences in relation to different available alternatives.

#### C. International co-operation

29. In support of the tasks outlined in the above list of recommendations which should lead to an improved control of coastal water quality, a number of activities are suggested. Such action proposals include programmes and projects which are to be undertaken jointly by the countries concerned and in collaboration with the relevant United Nations Agencies as appropriate.

30. The establishment of detailed pollution source inventories and the assessment of waste loads reaching the Mediterranean should be initiated as an important task for all countries involved. The use of common methodology should ensure the comparability of results. To this end, the refinement and simplification of the guidelines and questionnaires used under project MED X is proposed.

31. Common sampling schemes and analytical procedures for the monitoring of municipal and industrial effluents should be prepared and their application promoted. Also, the relevant data handling should be based on uniform methods. Thus, a comparable data base for the assessment of waste loads discharged from major point-sources in the coastal zone of the Mediterranean would be ensured.

32. River monitoring programmes should be initiated and intensified providing for adequate coverage of hazardous substances particularly in the more polluted rivers. Standardized measurement methodology and data handling as well as analytical quality control could be brought about with a minimum of effort by the incorporation of relevant river monitoring stations into the global water quality monitoring network which is presently being established under the UNEP/WHO/UNESCO/WMO Project on Global Water Quality Monitoring (GEMS/WATER).

33. In support of the above suggestions, a network of national services responsible for the monitoring and control of land-based sources should be established which would provide for the necessary mechanism for the routine collection and compilation of country information. Co-ordination should be brought about through strengthening of the co-operation of national focal points.

34. The proportionate contribution of pollutants from air-borne sources and imported due to atmospheric transport phenomena is at present an unknown factor in the pollution of the Mediterranean and should be subject to an evaluation study. Experiences gained elsewhere, e.g. in the Baltic Sea, should be consulted during the formulation of the study.

35. The development of a model code of practice for the discharge of liquid wastes into the Mediterranean coastal waters should be considered as a priority task. Such a guideline on the treatment and disposal of municipal and industrial wastewaters according to technically sound principles and methods was recommended by a recent workshop of Mediterranean experts. 1/

36. As a complementary activity to this practical guideline which will also assist in the implementation of the protocol on land-based pollution sources, internationally comparative studies at existing sea outfall and wastewater treatment systems should be initiated. Development as well as demonstration of recommended practical solutions should result from such studies.

37. National experts of the Mediterranean countries - scientists, engineers, and administrators - should be brought together periodically to exchange views, discuss their common problems and develop appropriate approaches and methods for the control of pollution in the Mediterranean. Such exchange of information and international co-operation in the field of applied research, monitoring, and technical assistance is considered essential and should be supported by adequate training programmes. Relevant activities may be part of the arrangements among the contracting parties of the protocol on land-based sources of pollution.

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1/ Workshop on Coastal Water Pollution Control, Athens, 27 June - 1 July 1977.

ANNEX I

A. The following substances or groups of substances are listed 1/ for the purposes of Principle 4 of the Protocol. They have been selected mainly on the basis of their

- toxicity
- persistence
- bioaccumulation.

1. Organohalogen compounds and substances which may form such compounds in the marine environment. 2/
2. Organophosphorus compounds and substances which may form such compounds in the marine environment. 2/
3. Organotin compounds and substances which may form such compounds in the marine environment. 2/
4. Mercury and mercury compounds.
5. Cadmium and cadmium compounds.
6. Persistent mineral oils and persistent hydrocarbons derived from petroleum origin, in particular used lubricating oils.
7. Persistent synthetic materials which may float, sink or remain in suspension and which may interfere with any legitimate use of the sea.
8. Substances which possess proven [or suspected] carcinogenic, teratogenic or mutagenic properties in or through the marine environment.
- [9. Radioactive wastes and other radioactive matter to be defined by the IAEA.]

B. This Annex applies to all wastes from land-based sources, including municipal and industrial discharges as well as any other point and non-point sources. The present annex does not apply to discharges which contain the substances referred to in section A as trace contaminants only. The discharge of such wastes shall be subject to the provisions of Annexes II and III as appropriate.

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1/ Not in order of priority.

2/ With the exception of those which are biologically harmless or which are rapidly converted into biologically harmless substances.

ANNEX II

A. The following substances, families and groups of substances, or sources of pollution are listed hereunder for the purposes of Principle 5 of the Protocol. The substances, families and groups of substances, or sources of pollution have been selected mainly on the basis of criteria used for Annex I, taking into account the fact that they are generally less noxious or are more readily rendered harmless by natural processes and therefore generally affect more limited coastal areas.

1. The following elements and their compounds:

1. zinc	6. selenium	11. tin	16. vanadium
2. copper	7. arsenic	12. barium	17. cobalt
3. nickel	8. antimony	13. beryllium	18. thalium
4. chromium	9. molybdenum	14. boron	19. tellurium
5. lead	10. titanium	15. uranium	20. silver

2. Biocides and their derivatives not covered in Annex I.

3. Organosilicon compounds and substances which may form such compounds in the marine environment excluding those which are biologically harmless or are rapidly converted into harmless substances.

4. Crude oils and hydrocarbons derived from petroleum origin and mixtures containing any of these other than those listed in Annex I.

5. Cyanides and fluorides.

6. Non-biodegradable detergents and other surface-active substances.

[7. Inorganic compounds of phosphorus and elemental phosphorus.]

8. Pathogenic micro-organisms.

9. Thermal pollution.

10. Radioactive wastes and other radioactive matter, other than those covered in Annex I.

11. Substances which have a deleterious effect on the taste and/or smell of the products for human consumption derived from the aquatic environment, and compounds liable to give rise to such substances in the marine environment.

[12. Substances which have an adverse effect on the oxygen balance.]

B. This Annex applies to all wastes from land-based sources, including municipal and industrial discharges as well as any other point and non-point sources. The present annex does not apply to discharges which contain the substances referred to in section A as trace contaminants only. The discharge of such wastes shall be subject to the provisions of Annex III as appropriate.

C. The control and strict limitation of the discharge of substances referred to in section A should be implemented in accordance with the criteria set out in Annex III.

### ANNEX III

According to principle 5 of the Protocol, the factors to be considered in establishing criteria governing the issue of an authorization for the discharge of wastes containing substances referred to in Annex II include:

#### A. Characteristics and composition of the waste

A general characterization of wastes provides for their classification and assessment of potentially harmful properties:

1. Type and size of waste source (industrial process, etc.).
2. Type of waste (origin, average composition).
3. Form of waste (solid, liquid, sludge, slurry).
4. Total amount (volume, e.g. per year).
5. Discharge pattern (continuous, intermittent, seasonal variations, etc.).
6. Concentrations with respect to major constituents, substances listed in Annex I, substances listed in Annex II, and other substances as appropriate.
7. Physical, chemical and biochemical properties of the waste.

#### B. Characteristics of potentially harmful waste constituents

The potential harmfulness of specific waste constituents requires individual evaluation in the light of actual concentrations and amounts discharged:

1. Persistence (physical, chemical, biological) in the marine environment.
2. Toxicity and other harmful effects.
3. Accumulation in biological materials or sediments.
4. Biochemical transformation rendering harmful compounds.
5. Adverse effects on the oxygen balance.
6. Susceptibility to physical, chemical and biochemical changes and interaction in the aquatic environment with other sea-water constituents which may produce harmful biological or other effects on any of the uses listed in section E below.

#### C. Characteristics of discharge site and receiving water

The local conditions of the water into which the wastes are discharged require consideration with regard to the following:

1. Hydrographic, meteorological, geological and topographical conditions of the coastal area.



2. Location of the waste discharge (outfall, canal, outlet, etc.) and its location in relation to other areas (e.g. amenity areas, spawning, nursery and fishing areas, shellfish grounds), and other discharges.
3. Initial dilution achieved at the point of waste release.
4. Dispersion characteristics (e.g. effects of currents, tides and wind on horizontal transport and vertical mixing).
5. Water characteristics with respect to physical, chemical, biochemical, biological and ecological conditions in the discharge area.
6. Capacity of the receiving water to absorb waste discharges without undue effects.

D. Availability of waste treatment technology

The method of waste treatment and discharge should be selected taking into account the availability and the possible implementation of various treatment, re-use or elimination methods of industrial and domestic wastes and waste waters on land.

E. Potential impairment of sea-water uses

An assessment of the possible impact of waste discharges on the following uses of the sea and the coastal waters is required:

1. Effects on human health through pollution impact on:
  - (a) edible marine organisms;
  - (b) bathing waters;
  - (c) aesthetics.
2. Effects on marine ecosystems, in particular living resources, endangered species and critical habitats.
3. Effects on other legitimate uses of the sea.

ANNEX IV

[A. "New installation" for the purposes of Principle 7 of the Protocol means any industrial, commercial, residential and tourist construction or site,

- (i) for which the building contract is placed or, in the absence of a building contract, the construction or site works are commenced after the expiry of ... year(s) from the entry into force of the Protocol; or
- (ii) which is completed three years or more after that date.

B. Extensions or conversions of existing installations shall be considered as new installations if the resulting increase in the waste discharge exceeds 25 per cent of the previous waste load.]