



United Nations
Environment
Programme



Distr.
RESTRICTED

UNEP/WG.62/4/Rev.1
26 October 1981

Original: ENGLISH



LONG-TERM POLLUTION MONITORING AND RESEARCH PROGRAMME

MED POL - PHASE II

Basic Criteria for the Development of Research Activities

Basic Criteria for the Development of Research Activities ^{1/}

Background

The Long-Term Programme for Pollution Monitoring and Research (MED POL - PHASE II) of the Mediterranean Action Plan (MAP), which was endorsed at the Second Meeting of the Contracting Parties to the Convention for the Protection of the Mediterranean Sea Against Pollution and its related protocols, Cannes, 2-7 March 1981 (UNEP/IG.23/11), defines the research and study topics whose development is required for the successful achievement of the Programme (see Annex I).

These activities will be carried out by Mediterranean research centres and organizations primarily on a direct contractual basis or as a contribution from centres and organizations offered by the Contracting Parties to the Convention for the Protection of the Mediterranean Sea Against Pollution and its related protocols (see Annex I).

In addition, the long-term monitoring of the transport of pollutants to the Mediterranean Sea through the atmosphere (see Annex I) requires research on the strategy and the methods to be followed before its implementation.

Framework of the research activities

The MAP Co-ordinating Unit (MED UNIT), in close collaboration with the Co-operating Agencies (WHO, FAO, IAEA, IOC, WMO and UNESCO), has defined the research activities to be developed and will be responsible for their overall co-ordination.

The Co-operating Agencies, in consultation with the MED UNIT, will be responsible for the day-to-day co-ordination of the relevant activities.

The Research Centres participating in the research activities will be those designated by the National Co-ordinators for MED POL ^{2/} as collaborating MED POL institutions, whether they participate or not in the monitoring components.

^{1/} The Working Group for Scientific and Technical Co-operation (WGSTC) at its first meeting (UNEP/WG.62/7) reviewed the introductory part of this document which was accordingly amended. The text describing activities A through L was prepared by the Co-ordinating Unit for the Mediterranean Action Plan (MED UNIT) in close collaboration with the Co-operating Agencies (FAO, WHO, IOC, Unesco, WMO and IAEA).

^{2/} A list of the National Co-ordinators is attached as Annex II to this document

The research proposals whether they respond to this request or are offered as contributions should be submitted to the MED UNIT through the National Co-ordinators for MED POL. They will have to follow the format outlined in Appendix I.

With regard to the selection of the proposals relevant to the research and study topics of the long-term Mediterranean Monitoring and Research Programme (MED POL - PHASE II), the WGSTC recommended the adoption of a two-fold approach catering for two kinds of activity.

1. Proposals falling within the context of activities B, C and E below will have to be referred for approval to the Working Group for Scientific and Technical Co-operation at its next meeting.
2. Proposals falling within the context of the other activities may be approved by the MED UNIT for a transitional period of one year.

Proposals relevant to activities of category 2 should reach the MED UNIT at the latest by 15 January 1982. Proposals relevant to activities of category 1 should reach the MED UNIT not later than 30 June 1982.

The WGSTC recommended that the costs of the work undertaken for each study should be borne for the main part by the participating institutions.

Assistance will, however, be treated as a priority criterion, in accordance with the Cannes conclusions (see Annex I), as also geographical distribution.

During the transitional period of one year, the MED UNIT will provide all National Co-ordinators for MED POL with a list of studies undertaken, the names of the institutions selected, and the funds granted.

The MED UNIT will also provide the National Co-ordinators for MED POL with details of the agreements between the MED UNIT and the Co-operating Agencies concerning MED POL - PHASE II.

Results

The results of research activities developed as part of MED POL - PHASE II should be, as a general rule, submitted for publication to scientific journals having a widespread circulation and preferably in one of the MAP working languages (English and French).

In addition, it is highly desirable that preliminary findings also be reported and discussed at international workshops, seminars and symposia, especially those having a large Mediterranean audience such as the series of ICSEM/UNEP joint Workshops on Pollution of the Mediterranean Sea.

Administrative and scientific reports should be submitted at the end of the period proposed for the completion of the work or every six months when the work extends beyond this limit.

Activities to be undertaken

Following the research and study topics proposed in the Long-term Programme for Pollution Monitoring and Research in the Mediterranean (MED POL - PHASE II) (see Annex I), twelve research activities, for which research proposals may be submitted, have been defined under Sections A to L below:

ACTIVITY "A"

A.1. Title

Development and testing of sampling and analytical techniques for monitoring of marine pollutants.

A.2. Terms of reference

Development of sampling and analytical techniques for monitoring the sources and levels of pollutants. Testing and harmonization of these methods on the Mediterranean scale and their formulation as reference methods. Substances listed in Dumping and Land-Based Sources Protocol priorities (see Annex I, para. 42(a)).

A.3. Background

During the pilot phase of the Mediterranean Pollution Monitoring and Research Programme (MED POL - PHASE I), sampling and analytical techniques were developed and tested at a large number of Mediterranean Research Centres. Some of these techniques ^{1/} have been formulated as Standard Reference Methods and will soon be proposed for adoption by the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution.

These Standard Reference Methods and other techniques developed during MED POL - PHASE I will be used during the Long-Term Pollution Monitoring and Research Programme (MED POL - PHASE II) by all the collaborating MED POL institutions.

However, in spite of the fact that these techniques are being considered Standard Reference Methods, they should not be considered as a static end result. Development and testing of methods should be a dynamic process continuously subject to adaptation and improvement.

New sampling and analytical techniques covering the needs of the Monitoring Programme will have to be developed on the basis of previous experience, taking into account the technical constraints of such kinds of activity. In addition, the study of the difficulties experienced in the routine use of the presently proposed Standard Reference Methods should complement the development and testing of new ones.

A.4 Objectives

- A.4.1 To select sampling and analytical techniques for monitoring the pollutant inputs at the sources and the levels found in the marine environment of substances listed in Annexes I and II of the Dumping and of the Land-Based Sources Protocols.

A.4.2 To test and harmonize, at the Mediterranean scale, the sampling and analytical techniques developed for their eventual formulation as Standard Reference Methods for the purpose of the Barcelona Convention and related protocols.

A.5 Activities envisaged for the biennium 1981-1983

A.5.1 Development of sampling and analytical techniques to be used in the monitoring of sources and of estuarine, coastal and open-sea areas. Pollutants and matrices included in the MED POL - PHASE II Monitoring Programme should especially be taken into account. (See section A.6 below).

A.5.2 Harmonization, through intercalibration and data quality control exercises, of the already existing reference methods and of those developed in the early stages of implementation of this project.^{2/}

A.5.3 Review of the results obtained through A.5.1 and A.5.2 and technical evaluation of the methods developed before they are proposed as Standard Reference Methods.

A.6. Outputs

Sampling and analytical techniques to be used in the monitoring activities (see document UNEP/WG.62/3/Rev.1) are expected to be tested and developed in accordance with ISO standards.

^{1/} Total coliforms in sea-water by the membrane filtration culture method
Faecal coliforms in sea-water by the membrane filtration culture method
Faecal streptococci in sea-water by the membrane filtration culture method
Faecal coliforms in shellfish (bivalves) by the multiple-test-tube method (MPN)

Total mercury in edible tissue of fish by flameless atomic absorption spectrophotometry after liquid pressure decomposition of the organic material

Total mercury in edible tissue of mussels by flameless atomic absorption spectrophotometry after liquid pressure decomposition of the organic material

^{2/} Priority will be given to the testing of the following techniques developed during MED POL - PHASE I:

- (i) Determination of DDTs in edible tissues of fish
- (ii) Determination of DDTs in edible tissues of shrimps
- (iii) Determination of DDTs in edible parts of mussels

ACTIVITY "B"

B.1. Title

Development of reporting formats required according to the Dumping, Emergency and Land-Based Sources Protocols.

B.2. Terms of reference

Development of reporting formats required according to the Dumping, Emergency and Land-Based Sources Protocols (see Annex I, para. 42(b)).

B.3 Background

The application of the Convention for the Protection of the Mediterranean Sea Against Pollution and its related protocols requires a good assessment of the pollutant load reaching the Mediterranean Sea through the various boundaries.

The quantification of this load cannot be based only on the fractionary data collected through the direct measurement at some of the point sources discharging into the sea. Indirect assessment methods relying on the information obtained by national authorities in compliance with the Dumping and Land-Based Sources protocols should provide adequate load estimates.

The pilot phase of the Mediterranean Pollution Monitoring and Research Programme (MED POL - PHASE I), through pilot project MED POL X, made a preliminary assessment of the amounts of pollutants from land-based sources entering into the Mediterranean Sea. The work was carried out on the basis of information provided by national authorities and was considered as a first estimate, accurate within the range of one order of magnitude (UNEP/WG.18/INF.4).

With the experience gained through MED POL X and other similar activities, WHO developed a method for the rapid assessment of air, water and land pollution sources which was intended to provide an overall picture of the pollutant load reaching the environment at the national or regional level (WHO EFP/81.14).

This method is adequate for "instant" assessment but does not permit the continuous assessment of the pollutant inputs to the marine environment required for the monitoring programme in order to assess the long-term trends of the general pollution situation and the effectiveness of the measures taken to control it.

B.4 Objectives

To develop techniques for the overall assessment of the amounts of pollutants entering the marine environment mainly from land-based sources and through dumping operations. The pollutants assessed should be those listed under Annexes I and II of the Land-Based Sources and Dumping protocols.

B.5 Activities envisaged for the biennium 1981-1983

- B.5.1 Review of presently available knowledge on the information gathering and computation techniques for assessment of overall pollutant load reaching the marine environment.
- B.5.2 Development of techniques for the continuous assessment of the amounts of pollutants entering the Mediterranean Sea from land-based sources.
- B.5.3 Development of techniques for the continuous assessment of the amounts of pollutants entering the Mediterranean Sea through dumping operations.
- B.5.4 Review of the experience gained through B.5.1, B.5.2, and B.5.3, and preparation of standard reporting formats to be adopted by the Contracting Parties to the Barcelona Convention.

B.6 Outputs

- Standard reporting formats for pollutants entering the Mediterranean Sea from land-based sources.
- Standard reporting formats for pollutants entering the Mediterranean Sea through dumping operations.
- Computational techniques for the assessment of overall pollutant loads reaching the Mediterranean Sea through the various sources.

ACTIVITY "C"

C.1. Title

Formulation of the scientific rationale for Mediterranean Environmental Quality Criteria.

C.2. Terms of reference

Formulation of the scientific rationale for the environmental quality criteria to be used in the development of emission standards, standards of use or guidelines for substances listed in annexes I and II of the Land-Based Sources Protocol in accordance with articles 5, 6 and 7 of that Protocol (see Annex I, para. 42(c)).

The terms of reference of activities D and K below should also be taken into account.

C.3. Background

Article 5 of the Protocol for the Protection of the Mediterranean Sea Against Pollution from Land-Based Sources stipulates that:

1. The Parties undertake to eliminate pollution of the Protocol Area from land-based sources by substances listed in annex I to this Protocol.
2. To this end they shall elaborate and implement, jointly or individually, as appropriate, the necessary programmes and measures.
3. These programmes and measures shall include, in particular, common emission standards and standards for use.
4. The standards and the time-tables for the implementation of the programmes and measures aimed at eliminating pollution from land-based sources shall be fixed by the Parties and periodically reviewed, if necessary every two years, for each of the substances listed in annex I, in accordance with the provisions of article 15 of this Protocol.

C.4. Objectives

- C.4.1 To formulate scientific rationales for the environmental quality criteria of substances listed in Annexes I and II of the LBS Protocol. This formulation should concern selected substances, taking into consideration needs, importance, urgency and applicability.

C.4.2 To develop emission standards, standards of use and guidelines for these substances to be proposed for adoption by the Contracting Parties to the Barcelona Convention.

C.5. Activities envisaged for the biennium 1981-1983

C.5.1 Review of existing emission standards and standards of use for selected pollutants of Annexes I and II in the Mediterranean Region and in other comparable areas including appraisal of the applicability of these standards, their results and efficiency, the difficulties encountered and their economic aspects.

C.5.2 Development of proposals for the gradual establishment of emission standards and standards of use of selected substances, taking into consideration needs, urgency, and economic aspects, as well as receiving capacity of the water body.

C.5.3 Review of the results of these activities and preparation of common emission standards and standards of use to be adopted by the Contracting Parties to the Barcelona Convention.

C.6. Outputs

- Emission standards and standards of use for selected pollutants of Annexes I and II of the Land-Based Sources Protocol.

ACTIVITY "D"

D.1. Title

Epidemiological studies related to Environmental Quality Criteria.

D.2. Terms of reference

Epidemiological studies related to the confirmation/revision of the proposed environmental quality criteria for bathing water, shellfish growing waters and edible marine organisms (see Annex I, para. 42(d)).

The terms of reference of activities C and K should also be taken into account.

D.3. Background

The WHO/UNEP Pilot Project on Coastal Water Quality Control in the Mediterranean (MED POL VII), developed within the Mediterranean Pollution Monitoring and Research Programme, had as its main objective the assessment of the potential health hazards connected with the pollution of the coastal waters of the Mediterranean including a scientific study of the epidemiological evidence of health effects resulting from inadequate sanitary conditions in coastal areas. Baseline data on concentrations of various heavy metals in marine organisms also became available as part of the FAO/UNEP (MED POL II) pilot project on Monitoring of Metals particularly Mercury and Cadmium in Marine Organisms.

Environmental Quality Criteria ^{1/} based on the available international experience and the local conditions in the Mediterranean, were developed and are being proposed for approval by the Contracting Parties to the Barcelona Convention. Assessment and, if necessary, adjustment of these criteria require the achievement of epidemiological studies aimed at providing the necessary scientific base for evaluating health effects.

On the other hand, legal limits for body burden of mercury in sea-food varying from one country to another are prone to impede the international exchange of fishery commodities and eventually fishing itself. Reassessment of such standards and of the protection they may provide to fish consumers should be made.

D.4. Objectives

- D.4.1 To ascertain the relationship between dose and response of selected pollutants by developing appropriate epidemiological and toxicological studies.

D.4.2 To assess the adequacy of the existing Mediterranean Environmental Quality Criteria for coastal water related to recreational areas, shellfish growing waters and edible marine organisms.

D.5. Activities envisaged for the biennium 1981-1983

D.5.1 Development of appropriate epidemiological and toxicological studies to provide the necessary data on health effects connected with the marine environmental quality in different areas of the Mediterranean, at different times of the year, and including both non-resident and resident population groups.

D.5.2 Assessment of the adequacy of existing environmental quality criteria for coastal water by using the data provided by the coastal water monitoring in relation to human health, and available information on important determinants influencing this relation (waste water treatment, etc.).

D.5.3 Assessment of the chance of the above-mentioned sea-food consumers exceeding tolerable weekly intakes of heavy metals is recommended by WHO.

D.6. Outputs

- Establishment of the dietary pattern in selected Mediterranean population groups, preferably those with an above-average metal intake.
- Review of the recreational habits of Mediterranean and non-Mediterranean population groups.
- Recommendations for administrative and management control measures.

1/ Environmental Quality Criteria for Recreational Waters, Environmental Quality Criteria for Shellfish Growing Areas, and Environmental Quality Criteria for Mercury in Seafood.

ACTIVITY "E"

E.1. Title

Guidelines and criteria for the application of the Land-Based Sources Protocol.

E.2. Terms of reference

Development of proposals for guidelines and criteria governing the application of the LBS Protocol as requested in article 7 of the Protocol (see Annex I, para. 42(e)).

E.3. Background

Article 7 of the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources binds the Contracting Parties to progressively formulate and adopt, in co-operation with the competent international organizations, common guidelines and, as appropriate, standards or criteria dealing in particular with:

- (a) the length, depth and position of pipelines for coastal outfalls, taking into account, in particular, the methods used for pre-treatment of effluents;
- (b) special requirements for effluents necessitating separate treatment;
- (c) the quality of sea-water used for specific purposes that is necessary for the protection of human health, living resources and ecosystems;
- (d) the control and progressive replacement of products, installations and industrial and other processes causing significant pollution of the marine environment;
- (e) specific requirements concerning the quantities of the substances listed in Annexes I and II discharged, their concentration in effluents and methods of discharging them.

During the pilot phase of the Mediterranean Pollution Monitoring and Research Programme (MED POL - PHASE I), WHO and UNEP prepared a document entitled Principles and Guidelines for the Discharge of Wastes into the Marine Environment, intended to provide guidance for the issuance of permits by national authorities for the discharge of certain types of waste and other matter into the marine environment.

Further studies are nevertheless required in order to provide national authorities with sound technical proposals, well adapted to the Mediterranean environment.

E.4. Objectives

- E.4.1 To review present waste treatment and disposal practices in the Mediterranean region as well as national legal instruments and regulations for waste disposal.
- E.4.2 To assess the technical efficiency and cost-effectiveness of existing submarine outfalls and diffuser systems in the Mediterranean region.
- E.4.3 To develop a code of practice for the design and operation of pipelines for coastal outfalls including pre-treatment of effluents, diffuser systems, etc.
- E.4.4 To categorize effluents requiring special treatment and to recommend alternative products or processes and adjustments to installations aiming at reducing the impact on the marine environment.

E.5. Activities envisaged for the biennium 1981-1983

- E.5.1 Review of existing knowledge on the role of submarine outfalls in the sanitation system, in particular in the Mediterranean Sea.
- E.5.2 Compilation of information on existing legislative measures on submarine outfalls in the Mediterranean Sea.
- E.5.3 Investigation of technical efficiency and cost-effectiveness of selected submarine outfalls and diffuser systems.
- E.5.4 Development of a code of practice for the design of pipelines for coastal outfalls including pre-treatment of effluents.
- E.5.5 Categorization of effluents requiring special treatment and recommended special treatments.

E.6. Outputs

- Critical review of literature and experimental evidence relating to the use of submarine outfalls, with particular reference to Mediterranean conditions.
- Assessment of possible benefits and limits of submarine outfall use in Mediterranean waters.
- Code of practice for the sanitation of coastal areas, with particular reference to submarine outfalls.
- Guidelines for discharge of effluents requiring separate treatment.

- Mediterranean inventory of products, installations and industrial and other processes causing significant pollution of the marine environment, and availability of control measures and progressive replacement methodology.
- Critical review of existing criteria for a priori limitations of quantities of pollutants discharged and practical consequences.

ACTIVITY "F"

F.1. Title

Research on oceanographic processes.

F.2. Terms of reference

Research on oceanographic processes, with particular emphasis on surface circulation and vertical transport. Needed for the understanding of the distribution of pollutants through the Mediterranean and for the development of contingency plans for cases of emergency (see Annex I, para. 42(f)).

F.3 Background

One of the components of the MED POL - PHASE I was the pilot project on Problems on Coastal Transport of Pollutants (MED POL VI). The aim of the pilot project was the investigation of water circulation and stratification in coastal areas and the exchange of water between the coastal and offshore regions, special attention being given to the movement of the surface layer.

The main problems associated with surface circulation arise from the relatively high concentrations that may occur in coastal areas because of the inflow of pollutants from land-based sources and the subsequent transport and dispersion in the coastal region, as well as from the transport into, and along, the coastal region, from open waters, of pollutants that are still in a relatively concentrated form (usually petroleum products).

The use of floating drift-cards or sea-surface drifters was found to be a particularly useful method of observing sea-surface currents, with a low cost/benefit ratio. A thorough computer programme to analyse such data was developed and applied to data from the Ligurian Sea and the Eastern Mediterranean (DRIFTEX).

Although the greatest part of pollutants enters the Sea in the upper layers, winter cooling produces, in some areas of the Mediterranean Sea, strong vertical transport of water that may eventually transfer polluted surface water to greater depths, thus originating a spreading of pollution to the deep Mediterranean waters. The residence time of the deep water being much greater than the average 100 years estimated for the Mediterranean water, vertical transport may turn out to be a mechanism for the long-term rising of overall pollutant levels in the Mediterranean Sea.

The correct analysis of all these factors governing the transport of pollutants in the Mediterranean requires the development of hydrodynamic and mathematical models of the main circulatory processes.

F.4. Objectives

F.4.1 To promote and co-ordinate studies of the oceanographic processes that play a leading role in the surface circulation and vertical transport of water masses.

F.4.2 To assist in the development of various types of models of the aforementioned processes.

F.5 Activities envisaged for the biennium 1981-1983

F.5.1 Analysis of on-going work relevant to the above objectives and harmonization of the various national and international efforts.

F.5.2 Development of additional field measurements as required for the completion of models.

F.6 Outputs

- Models of circulatory processes (horizontal and vertical) adapted to Mediterranean Sea conditions.

ACTIVITY "G"

G.1. Title

Research on the toxicity, persistence, bioaccumulation, carcinogenicity and mutagenicity.

G.2. Terms of reference

Research on toxicity, persistence, bioaccumulation, carcinogenicity and mutagenicity of selected substances listed in annexes I and II of the Land-Based Sources Protocol and the Dumping Protocol (see Annex I, para. 42(g)).

G.3. Background

A variety of methods are used for control of oil pollution at sea, the main one being the application of chemical dispersants. The obvious limitations of other methods indicate that chemical dispersants will remain the principal tool for oil pollution control. The modern generation of dispersants are considerably less harmful to marine life than their predecessors but a considerable amount of work has to be performed to determine their risks to marine life. Tests carried out on a number of dispersants so far have indicated that their acute toxicity to marine life under Mediterranean conditions is appreciably higher than in the more northern seas. Very little work has been performed on the effects of dispersants, and of oil/dispersants mixtures at sub-lethal levels or in the presence of other pollutants. Experimental evidence obtained so far with dispersant/heavy metals combinations shows that effects vary with the particular combination from synergistic to antagonistic. The persistence of dispersants and their possible bioaccumulation as well as possible carcinogenic and mutagenic effects, still remain to be properly studied.

Polychlorinated biphenyls (PCBs) are persistent compounds which can accumulate both in the environment and in biological material. They do not occur naturally in the environment and their levels can be attributed to their wide variety of industrial applications. Results from the monitoring of PCBs in marine organisms during MED POL - PHASE I show that the concentrations vary considerably, often by one or two orders of magnitude, and are, in certain cases, very high. There are also indications that levels in organisms around industrial areas are considerably higher than those from other parts of the Mediterranean. At present our knowledge about the effects of PCBs on Mediterranean marine organisms is very limited. Although some attention was given to studies on the biological effects of PCBs during the MED POL - PHASE I, most of the results reported on effects on marine organisms referred to heavy metals and chlorinated pesticides.

In addition, polychlorinated terpenes which have been applied as insecticides for almost 30 years and are today heavily used, for example in the USA and some European countries, have been shown to be taken up and accumulated in aquatic organisms. Toxic effects of these compounds on marine organisms are of interest because of their long history of use, continuing importance and complex composition. Fish samples from the Baltic and North Sea have been found to be contaminated with polychlorinated terpenes. However not much information is available concerning the presence of polychlorinated terpenes in the Mediterranean waters and organisms, although there is evidence on the application of these insecticides in the agricultural practice of some eastern Mediterranean countries. The commercial products containing polychlorinated terpenes are complex and it has been shown that one of them, the toxaphene (camphechlor) contains more than 170 components. Such multicomponent mixtures are very difficult to analyse and the analyses of environmental samples are furthermore complicated by changes in the original composition due to chemical and metabolic conversions. The relevant studies should provide to the Contracting Parties of the Barcelona Convention necessary information on the eventual hazards to marine life in the Mediterranean.

On the other hand, the members of the marine ecosystem may be exposed to mutagenic activity of both natural and deliberately or accidentally disposed environmental chemicals which cause genotoxic effects. The exposure of germ-line cells to such substances may result in changes in the genetic architecture of marine populations which lead to an increase in the number of genetically defective individuals in future generations. On the other hand, mutations in somatic cells may be the possible cause of cellular and organismic disease, precocious aging, formation of neoplasia and death. Both germ-line and somatic mutational effects may result in extinction of species and disbalance of the ecosystem. At present our knowledge in this field is rather poor. The reason for this may be the fact that the most evident consequence of mutagenic effects, the formation of cancer, appears only in a few marine species and with a very low frequency. Thus, frequency of neoplasia, in contrast to the facts in human populations, so far is not a good criterion for the assessment of the mutagenic risk in marine environment, nor is it the extinction of species, frequently observed as a consequence of pollution. The strategy in the assessment of mutagenic risk should be to look for early signs of mutagenic effects stemming from the observation of correlated activities due to several mutation causing agents, for example the effects on the desoxyribonucleic acid molecule whose damage has two consequences: (a) epigenetic (delay in protein inducibility, reduction in transcriptional and translational fidelity, increase in errors in synthesis, precocious aging in higher animals, death, etc.), and (b) genetic (somatic cell transformation, carcinogenesis, mutation, hereditary instability, selection of mutants, death, etc.).

G.4. Objectives

To determine lethal and sublethal effects of selected pollutants under all possible aspects of their occurrence in the marine environment, including acute and chronic toxicity, persistence, bioaccumulation, carcinogenicity and mutagenicity.

G.5. Activities envisaged for the biennium 1981-1983

G.5.1 Studies on the effects of oil dispersants on marine organisms.

G.5.2 Studies on the effects of PCBs and polychlorinated terpenes on marine organisms and development of proper methods.

G.5.3 Studies on the effects of mutagenic pollutants on marine organisms.

G.6. Outputs

- Review of existing literature on effects of oil dispersants on marine organisms.
- Studies on toxicity of oil dispersants to selected marine organisms in the Mediterranean.
- Review of existing literature on effects of PCBs on marine organisms.
- Studies on the toxicity of PCBs to selected marine organisms in the Mediterranean.
- Studies on the correlation between levels of mutagenic pollutants and DNA strand-breaks in exposed organisms under laboratory conditions.
- Review of existing statistical data on toxaphene production and applications and of present knowledge on levels of water and in biota of the Mediterranean Sea.

ACTIVITY "H"

H.1. Title

Eutrophication and concomittant plankton blooms.

H.2. Terms of reference

Research on eutrophication and concomittant plankton blooms. Needed to assess the feasibility of alleviating the consequences and damage from such recurring blooms (see Annex I, para. 42(h)).

H.3. Background

Scientific sources, particularly results provided by the pilot project MED POL V, indicate that there is quite a number of Mediterranean coastal formations, mainly lagoons and enclosed bays, whose environment is heavily eutrophic, possibly anoxic and eventually even azoic. In all these cases the major causes are increased levels of pollution-borne nutrients and accordingly high production of a number of supertolerant pelagic and benthic algae. Most of the local eutrophic environments could be restored back to almost natural conditions if appropriate pollution control measures are taken.

Furthermore, there are some areas in the Mediterranean Sea, such as the northern Adriatic and the Gulf of Lyon, which receive massive nutrient loads from combined fluvial, agricultural, domestic and industrial sources, inducing large-scale eutrophication in their pelagic environment. Red-tides which appear regularly along the Italian coast of Emilia Romagna and irregular summer phytoplankton blooms appearing all over the northern Adriatic, are examples of the consequences of pollution-induced eutrophication.

Often the complexity of the marine ecosystem, its natural oscillations and a lack of long-term series of observations, hinder an adequate scientific understanding of these processes and a rational planning of eutrophication controlling measures. Therefore, advanced investigations on ecosystem modifications, using relevant outputs of long-term monitoring programme, are certainly needed.

H.4. Objectives

- H.4.1 To investigate the levels, periodicity, and causes of irregular plankton blooms appearing in highly eutrophied areas.

H.4.2 To investigate the quantitative relationships between productivity, biomass and structure of eutrophic communities, and pollution-borne abiotic factors.

H.4.3 To investigate potential toxicity of red-tides and irregular plankton blooms in relation to their taxonomic and biochemical compositions.

H.5. Activities envisaged for the biennium 1981-1983

H.5.1 Studies of large-size eutrophication processes in coastal and open waters of interest.

H.5.2 Studies of the sampling, sample processing and data analysis procedures which might yield appropriate indication of eutrophication.

H.5.3 Preliminary formulation of a rationalized long-term eutrophication monitoring programme.

H.6. Outputs

- Assessment of the present state of significantly eutrophied coastal and open waters of the Mediterranean.
- Results on evolution, state, structure, causes and consequences of large-size eutrophication processes in selected marine areas.
- Proposal for a long-term monitoring programme of eutrophic waters with special attention to irregular plankton blooms.

ACTIVITY "I"

I.1. Title

Pollution-induced ecosystems modifications.

I.2. Terms of reference

Study of ecosystem modifications in areas influenced by pollutants, and in areas where ecosystem modifications are caused by large-scale coastal or inland engineering activity (see Annex I, para. 42(i)).

I.3. Background

During the last ten years we have been faced with a growing general concern, particularly of governmental and professional institutions about outstanding ecosystem changes such as fish and molluscs mass-mortalities, gradual disappearance of sea-grass beds, macro-algae communities and fin-fish populations associated with them, etc., which appear periodically in some Mediterranean areas. Scientific sources and particularly results provided by pilot project MED POL V fully support the hypothesis that these phenomena are the subject of combined effects of increasing pollution loads and fluctuating natural conditions. On the contrary, some large invertebrate species such as sea-urchins (Paracentrotus lividus), mussels (Mytilus galloprovincialis), exotic oysters (Crassostrea gigas) introduced in the Mediterranean, and scyphomedusae (Pelagia noctiluca) among others are enlarging their populations and disturbing some activities such as recreational use of coastal waters, and of course contributing to the development of ecological disequilibria.

I.4. Objectives

Investigation of pollution-induced changes of Mediterranean coastal ecosystems leading to significant modifications of their trophic state and structure and how they can be controlled by environmental protection.

I.5. Activities envisaged for the biennium 1981-1983

- I.5.1 Studies of present ecological conditions in selected zones with existing historical records under the influence of man's activities. Comparison with conditions observed in the past, with indication of the cause/effect relationships between pollution and observed changes.

I.5.2 Study of the sampling, sample processing and data analysis procedures which might yield an appropriate indication of ecosystem changes.

I.5.3 Development of basic criteria for long-term ecological monitoring of pollution.

I.6. Outputs

- Common or comparable methods for assessment of marine ecosystem modifications.
- Analysis of cause-effect relationships which may have influenced the ecosystems modifications.
- Formulation of a rationalized long-term ecological monitoring programme.

ACTIVITY "J"

J.1. Title

Effects of thermal discharges on coastal organisms and ecosystems.

J.2. Terms of reference

Effects of thermal discharges on marine and coastal ecosystems, including the study of associated effects (see Annex I, para. 42(j)).

J.3. Background

Thermal discharges represent for the marine environment disturbing and/or beneficial factors whose importance depends on the characteristics of the receiving environment on one side, and of the incoming discharge on the other.

The expected disturbing effects of thermal discharges should be of the following nature: thermal shock, mechanical shock, action of chlorination and combined action of all above together with other present pollutants. Some beneficial effects on marine organisms, which can be used for aquaculture purposes, may also be expected.

J.4. Objectives

J.4.1 Evaluation of the short-term effects (mortality rate) and of long-term effects (perturbation of the life cycle, such as reproduction, growth, etc.) of the mechanical and thermal shocks and of the combined chlorination on the physiological processes in selected species.

J.4.2 Evaluation of the effects of thermal discharges on marine communities and ecosystems (elimination of species, replacement, etc.)

J.4.3 Investigation of the potentialities of using discharges for breeding and raising selected marine animals.

J.5. Activities envisaged for the biennium 1981-1983

J.5.1 Investigations of plankton distributions before and after circulation through the cooling systems and relationship with environmental parameters.

J.5.2 Investigations of benthic communities within the area influenced by the thermal discharge and comparison with unaffected ones.

J.5.3 Preliminary investigations of physiological effects of thermal and associated chemical discharges on marine organisms, particularly their eggs and larvae.

J.6. Outputs

- Assessment of the effects of thermal discharges under the Mediterranean environmental conditions.
- Studies of consequences of application of chlorine and other biocides, as well as other scaling agents, on the local benthic communities.
- Guidelines for the siting of thermal effluents (power plants, processing industries, etc.) in the Mediterranean region in order to minimize biological effects.

ACTIVITY "K"

K.1. Title

Biogeochemical cycles of specific pollutants.

K.2. Terms of reference

Biogeochemical cycle of specific pollutants, particularly those relevant to human health (mercury, lead, survival of pathogens in the Mediterranean Sea, etc.) (see Annex I, para. 42(k)).

The terms of reference of activities C and D above should also be taken into account.

K.3. Background

The results obtained through the pilot phase of MED POL have clearly indicated the need for more detailed studies on the cycle of selected pollutants which, for some reason or other, are of special relevance to man. For example, it is known that marine organisms, or organisms which depend on marine food (man and other mammals, birds, etc.) studied in some zones of the Mediterranean Sea show higher levels of mercury than individuals of the same species collected in other areas. It has also been shown that certain species of fish from the Red Sea well established in the Eastern Mediterranean concentrate more Hg than their Mediterranean and Atlantic relatives. On the other hand, there is indication that the chemical form in which mercury is present has a bearing on its toxicity and that some elements, particularly selenium, may reduce significantly mercury toxicity.

Another pollutant which is of concern is lead originating in industrial and urban centres. However, systematic studies on the behaviour and ultimate fate of the anthropogenic lead introduced in the sea are badly missing. For example, use of the naturally occurring ^{210}Pb isotope as a tracer may give information on the time scales of the turnover of lead in the sea.

The cycle of pathogens is decisively affected by the survival and multiplication of the organisms in waste water, surface water, and food. Multiplication of pathogens in sea-water, apart from some Vibrio and perhaps Clostridium botulinum does not normally take place. A number of vectors are available for cycling bacteria whose

spread is enhanced by consumption of certain insufficiently cooked sea-food. Direct contact with seawater and beach sand may also contribute to spreading of pathogens responsible for hazards such as infections of skin, wounds, eyes, ears, nose and throat, etc. More precise information regarding all the pathways and transfer rates of the various critical pollutants are badly needed if appropriate measures are to be proposed for their control.

K.4. Objectives

- K.4.1 To understand the fate of selected pollutants introduced in the marine environment in order to assess their impact on the human health, on marine biota and on the marine ecosystem.
- K.4.2 To provide adequate quantitative data on pollutant flows between the ambient and the organisms at various levels within the trophic network, to allow for detailed mass-balance computations.
- K.4.3 To estimate the survival capacity of selected pathogenic organisms and the modalities of them affecting human health.

K.5. Activities envisaged for the biennium 1981-1983

- K.5.1 To assess the major processes controlling the cycles of Hg and its transformation into the more dangerous organic forms, as well as its mass-balance, especially in areas with natural or anthropogenic sources of Hg.
- K.5.2 To assess the major processes controlling the cycles of Pb and its mass balance in the Mediterranean marine environment.
- K.5.3 To assess the cycling of pathogens, including survival, transmission and spread in marine polluted areas, with special reference to the Mediterranean.

K.6. Outputs

- General quantitative model of the behaviour of natural and anthropogenic Hg in the water, suspended matter, sediments and biota of selected areas of the Mediterranean.
- General quantitative model of the behaviour of anthropogenic lead in water, sediments and biota and its mass balance in the Mediterranean region.
- Evaluation of the survival of selected pathogens in the Mediterranean environment, especially related to bathing and to marine food consumption.

ACTIVITY "L"

L.1. Title

Pollutant-transfer processes.

L.2. Terms of reference

Study of pollutant-transfer processes (i) at river/sea and air/sea interfaces, (ii) by sedimentation, and (iii) through the straits linking the Mediterranean with other seas (see Annex I, para. 42(1)).

L.3. Background

There has been a long-standing question whether significant quantities of both natural and anthropogenic substances are transported to the open-sea regions via the atmosphere. This question is important in considering basic geochemical cycles and budgets of a variety of naturally occurring substances as well as in predicting the global impact of anthropogenic materials on the marine geochemical processes. The evidence to date shows that potentially significant quantities of lead and other metals, DDT, PCBs, low-molecular weight petroleum hydrocarbons, etc., are transported to open-sea regions through the atmosphere, either as particles or in the gas phase. Although the atmospheric concentrations of various substances have been determined in the Pacific and Atlantic Oceans, such determinations have scarcely been carried out in the Mediterranean Sea. In addition, the rates of exchange of these substances between the atmosphere and the sea are still largely unknown. Since the Mediterranean Sea is a semi-enclosed sea, the effects of atmospheric transport of pollutants are expected to be higher than in other regions. In addition, the understanding and assessment of the atmospheric transport of pollutants are essential to evaluate the overall pollution situation in the Mediterranean Sea.

The total relative amount of pollutants transported by river water in the dissolved phase compared to that on suspended sediments clearly shows the importance of the latter in any waste load assessment, especially where a high sediment load is present. In addition to natural particulates from various origins, secondary enriched particulates such as pesticides fixed on clay minerals and organic matter eroded and carried by rivers increase the contaminant load. Pollutants from sewage and industrial wastes may be adsorbed on suspended particles or directly discharged in particulate form into receiving waters.

During the pilot phase of the Mediterranean Pollution Monitoring and Research Programme (MED POL - PHASE I), a preliminary review of the role of river sediments in pollutant transfer and of the present knowledge on the quantity and quality of river particulate load discharged into the Mediterranean was carried out as pilot project MED POL IX. The importance of the problem was evident when using the criteria derived from this study for the assessment of the pollutant load reaching the sea from land-based sources (MED POL X).

A substantial fraction of the pollutants in the sea are also found as particles or associated with particulate matter. Vertical transport of these pollutants by sedimentation processes is considered very important for assessing the accumulation of pollutants within the Mediterranean Sea. Data on the water column distribution of various pollutants have been collected in recent years but very few data have been made available on the vertical fluxes of pollutants within the Mediterranean area. Since such data have recently been made available in other seas, such as the Atlantic and Pacific oceans, similar measurements in the Mediterranean should be compared with those in other areas in order to characterize the pollution situation in the Mediterranean Sea. Information on the vertical fluxes of various pollutants is considered useful for projecting a long-term trend of the variations of this pollution situation.

On the other hand, it is well known that great volumes of water are exchanged between the Mediterranean Sea and the adjacent seas, mainly the Atlantic Ocean and the Black Sea. This flow of water is accompanied by a substantial flow of substances in dissolved and particulate matter forms which establish the mass-balance of some of the pollutants. No reasonable attempt was ever made other than for nutrient salts to quantify the flow of such substances and yet it controls, in the long run, the overall levels of some of the more persistent pollutants in the entire Mediterranean Sea.

L.4. Objectives

- L.4.1 To promote and co-ordinate studies of the processes controlling the transfer of pollutants between the river water and the marine water and sediments from the most important rivers of the Mediterranean.
- L.4.2 To investigate the role and importance of the atmospheric transport in the cycle of pollutants, elucidating the transport mechanisms and the flow of pollutants across the air-sea interface.
- L.4.3 To develop sampling and analytical techniques and to establish an operational core network of atmospheric stations to monitor the transport of pollutants into the Mediterranean Sea through the atmosphere.

- L.4.4 To investigate the role and importance of marine sedimentation in the cycle of pollutants, to quantify the flow of pollutants by particulate matter settling through the water column and to assess the long-term trend in the changes of the general pollution situation in the Mediterranean Sea.
- L.4.5 To promote and co-ordinate studies of the flow, through the straits linking the Mediterranean with other seas, of water and of selected substances which may be affected by pollution and their mass balance.
- L.5. Activities envisaged for the biennium 1981-1983
- L.5.1 Assessment of on-going studies of processes controlling the transfer of pollutants between river water and marine water and sediments and development of additional field measurements as required for the completion of presently available models or for their quantitative adjustment.
- L.5.2 Geographical variations of the levels at which selected pollutants are found in studies of the marine aerosol and surface film.
- L.5.3 Feasibility study of a monitoring network and preparation of a detailed long-term programme for the monitoring of the transport of pollutants through the atmosphere.
- L.5.4 Assessment of the vertical fluxes of selected pollutants in particulate matter collected by sediment traps and from bottom sediments and testing of the variability between the various collection techniques used.
- L.5.5 Assessment of on-going studies of the flow through the straits and development of additional field measurements as required for the completion of presently available models or for their quantitative adjustment.
- L.6. Outputs
- Models of the flux of pollutants through the river/sea and air/sea interfaces, through the water column and through the straits.
 - Assessment of the long-term accumulation of pollutants in the entire Mediterranean Sea.
 - Long-term monitoring programme for the transport of pollutants through the atmosphere.

Appendix I

Outline of research proposals to be submitted by research centres
or organizations

(See attached document)

B. Related Work Already Performed or In Progress at Other Institutes/ Travaux s'y rapportant déjà exécutés ou en cours d'exécution dans d'autres Instituts:

C. Related Work Already Performed or in Progress at Institute/ Travaux s'y rapportant déjà exécutés ou en cours d'exécution à l'Institut:

Name/Nom: _____ Academic degrees/Titres universitaires:

Previous scientific experience/Travaux scientifiques antérieurs:

Name/Nom: _____ Academic degrees/Titres universitaires:

Previous scientific experience/Travaux scientifiques antérieurs:

Name/Nom: _____ Academic degrees/Titres universitaires:

Previous scientific experience/Travaux scientifiques antérieurs:

C. Other Staff/Autre personnel:

No./Nombre:	Type of Staff/Catégorie d'employés:

5. SCIENTIFIC BACKGROUND OF THE PROJECT (if space provided below is insufficient, please attach additional sheets)/
CONTEXTE SCIENTIFIQUE DU PROJET (si la place manque ci-dessous, ajouter des feuilles supplémentaires):

A. Significance of Overall Problem/Importance du problème dans son ensemble:

**B. Relationship of These Objectives to Present Knowledge and to Other Similar Projects at Institute or Elsewhere /
Evaluation de ces objectifs sous l'angle des connaissances actuelles et par rapport à d'autres travaux analogues déjà exécutés ou en cours d'exécution à l'Institut ou ailleurs :**

C. Detailed Work Plan for First Year, Including Proposed Methods or Techniques / Plan de travail détaillé pour la première année, avec indication des méthodes ou techniques que l'on se propose d'utiliser :

6. SCIENTIFIC SCOPE OF THE PROJECT (if space provided below is insufficient, please attach additional sheets)/ PORTEE
SCIENTIFIQUE DU PROJET (si la place manque ci-dessous, ajouter des feuilles supplémentaires):

A. Detailed Research Objectives/Exposé détaillé des objectifs de la recherche:

B. Additional Equipment/ Matériel supplémentaire

Item/ Article	Estimated project costs/ Coûts estimatifs du projet
	\$
Sub-Total/ Total partiel :	\$

Is it requested that any of the above items of equipment be purchased by the Agency? / Est-il demandé que certains des articles figurant dans la liste ci-dessus soient achetés par l'Agence?

Yes*/ Oui*

No/ Non

*If "yes" please list the items / *Dans l'affirmative, indiquer quels articles

C. Expendable Supplies/ Fournitures consommables :

Item/ Article	Estimated project costs/ Coûts estimatifs du projet
	\$
Miscellaneous supplies/ Fournitures diverses	
Sub-Total/ Total partiel :	\$

7. PLEASE LIST FACILITIES (buildings, equipment - including type and name of manufacturer, and materials) PRESENTLY AVAILABLE WHICH WOULD BE USED FOR THE PROJECT/ INDIQUEZ LES MOYENS (bâtiments, matériel - en précisant le modèle, et le nom du constructeur - et fournitures) DEJA DISPONIBLES QUI SERVIRAIENT A L'EXECUTION DU PROJET.

8. BUDGET. Estimate for first year of project (please show all amounts in US\$)./ BUDGET. Estimations pour la première année d'exécution du projet (indiquer tous les montants en dollars):

A. Salaries and Wages/ Traitements et salaires

Rate of exchange used/ Taux de change appliqué:
\$1/ 1 dollar =

Project personnel and estimated percentage of total working time to be devoted to project/ Personnel affecté au projet et estimation, en pourcentage, du total des heures de travail qui seront consacrées au projet:		Estimated project costs/ Coûts estimatifs du projet
Personnel/Personnel	Time/ Temps (%)	
		\$
Sub-total/ Total partiel:		\$

9. ALL CASH PAYMENTS ARE MADE BY CHECK, PAYABLE TO THE ORDER OF THE INSTITUTE. THE CURRENCY USED IS EITHER US DOLLARS, OR LOCAL CURRENCY, AT THE OPTION OF THE AGENCY. IF THERE IS ANY REASON WHY PAYMENT IN LOCAL CURRENCY WOULD NOT BE ACCEPTABLE, PLEASE EXPLAIN BELOW / TOUS LES VERSEMENTS SE FONT PAR CHEQUES PAYABLES A L'ORDRE DE L'INSTITUT. LES CHEQUES SONT LIBELLES EN DOLLARS DES ETATS-UNIS OU EN MONNAIE LOCALE, AU CHOIX DE L'AGENCE. SI DES VERSEMENTS EN MONNAIE LOCALE NE SONT PAS ACCEPTABLES, EN DONNER LES RAISONS CI-APRES:

10. IF THE PROJECT IS TO REQUIRE MORE THAN ONE YEAR TO COMPLETE, PLEASE GIVE ESTIMATE OF FUNDS REQUIRED (In US\$) FOR EACH PROJECT YEAR/ SI L'EXECUTION DU PROJET DOIT DURER PLUS D'UNE ANNEE, DONNER UNE ESTIMATION (en dollars) DES FONDS NECESSAIRES POUR CHAQUE ANNEE.

Project Year <i>Année d'exécution</i>	Salaries & Wages <i>Traitements et salaires</i>	Equipment <i>Matériel</i>	Expendable Supplies <i>Fournitures consommables</i>	Travel / Transportation <i>Voyages et transports</i>	Other Costs <i>Autres dépenses</i>	Project Total <i>Total</i>	Requested from the Agency <i>Montant demandé à l'Agence</i>
1st / 1ère	\$	\$	\$	\$	\$	\$	%
2nd / 2ème							%
3rd / 3ème							%
Total/ Total	\$	\$	\$	\$	\$	\$	

11. DOES INSTITUTE HAVE INDEPENDENT LEGAL PERSONALITY? / L'INSTITUT A-T-IL LA PERSONNALITE JURIDIQUE? Yes/Oui No/Non

If not, with whom would contract be made? / Dans la négative, avec qui le contrat sera-t-il passé?

12. ON WHAT DATE IS INSTITUTE PREPARED TO BEGIN PROJECT? / A QUELLE DATE L'INSTITUT SERA-T-IL PRET A ENTREPRENDRE L'EXECUTION DU PROJET?

PRINCIPAL INVESTIGATOR/LE CHERCHEUR RESPONSABLE DU TRAVAIL:	HEAD OF INSTITUTE/LE DIRECTEUR DE L'INSTITUT:
Signature/ Signature	Signature/ Signature
Date/ Date	Date/ Date

D. Travel/transportation (subsidized only in exceptional circumstances. See Instructions)/ Voyages et transports (ne sont subventionnés que dans des cas exceptionnels. Voir Instructions).

Destination and means of travel or transportation/ Destination et mode de voyage ou de transport	Estimated project costs/ Coûts estimatifs du projet
	\$
Sub-Total/ Total partiel:	\$

E. Other Costs (subsidized only in exceptional circumstances. See Instructions)/ Autres dépenses (ne sont subventionnées que dans des cas exceptionnels. Voir Instructions).

Item/ Article	Estimated project costs/ Coûts estimatifs du projet
	\$
Sub-Total/ Total partiel.	\$

F. Total - All Costs (Budget Items A - E)/ Total - Toutes dépenses (rubriques A - E du budget)

Total estimated project cost/ Coût estimatif total du projet

\$

G. Project Financing/ Financement du projet

Please indicate as a percentage/ Indiquer, en pourcentage du total

Amount to be contributed by the Institute/ le montant de la contribution de l'Institut:	%
Amount expected from other (non-Agency) sources/ le montant des fonds attendus de sources autres que l'Agence:	%
Amount requested from the Agency / le montant demandé à l'Agence:	%
	100 %

H. If funds for travel/transportation or other costs (items "D" and "E") have been included in the budget, please indicate for what specific purpose / Si des frais de voyage ou de transport ou d'autres dépenses (rubriques «D» et «E») ont été inscrits au budget, indiquer à quelle fin d'une manière précise:

ANNEX I

The following is the text of Annex V to the report of the second meeting of the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against pollution and its related protocols, Cannes, 2 - 7 March 1981 (UNEP/IG.23/11).

BACKGROUND

1. The pilot phase of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL - PHASE I) was initiated in 1974 and formally approved by the Intergovernmental Meeting on the Protection of the Mediterranean Sea (Barcelona, 28 January - 4 February 1975) as the scientific/technical component of the Mediterranean Action Plan.
2. Initially it consisted of seven pilot projects (MED POL I - VII), which were later expanded by an additional six pilot projects (MED POL VIII - XIII), some of which remain in a conceptual stage only. It was based on the work of 83 national research centres designated by 16 Mediterranean States, and the EEC, as participants in co-operative networks and on the input of eight United Nations organizations (ECE, UNIDO, FAO, UNESCO, IOC of UNESCO, WHO, WMO, IAEA), IUCN and ICSEM. The over-all co-ordination and guidance for MED POL - PHASE I was provided by UNEP, acting as the secretariat of the Mediterranean Action Plan.
3. The general objectives of the MED POL - PHASE I, evolved through a series of expert and intergovernmental meetings, were:

To formulate and carry out a co-ordinated pollution monitoring and research programme taking into account the goals of the Mediterranean Action Plan and the capabilities of the Mediterranean research centres to participate in it;

To assist national research centres in developing their capabilities to participate in the programme;

To analyse the sources, amounts, levels, pathways, trends and effects of pollutants relevant to the Mediterranean Sea;

To provide the scientific/technical information needed by the Governments of the Mediterranean States and the EEC for the negotiation and implementation of the Convention for the Protection of the Mediterranean Sea against Pollution and its related protocols;

To build up consistent time-series of data on the sources, pathways, levels and effects of pollutants in the Mediterranean Sea and thus to contribute to the scientific knowledge of the Mediterranean Sea.

4. The results of, and experience gained through, MED POL - PHASE I are reflected in the documents listed in the appendix to this annex.

5. The Intergovernmental Review Meeting of Mediterranean coastal States and First Meeting of the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution, and its related protocols (Geneva, 5-10 February 1979), having examined the status of MED POL - PHASE I, recommended that during the 1979/1980 biennium a long-term pollution monitoring and research programme should be formulated and the present document is a response to this request.
6. The legal obligations of the Contracting Parties to the:
 - Convention for the Protection of the Mediterranean Sea Against Pollution; adopted at Barcelona, 16 February 1976; entered into force on 12 February 1978;
 - Protocol Concerning Co-operation in Combating Pollution of the Mediterranean Sea by Oil and Other Harmful Substances in Cases of Emergency; adopted at Barcelona, 16 February 1976; entered into force on 12 February 1978;
 - Protocol for the Protection of the Mediterranean Sea Against Pollution from Land-Based Sources; adopted at Athens, 17 May 1980.
7. Based on the recommendations made at various expert and intergovernmental meetings, this draft long-term (10 years) programme for pollution monitoring and research (MED POL - PHASE II) was formulated by the secretariat of the Convention (UNEP) in co-operation with the organizations which supported the MED POL - PHASE I. Subsequently, it was formally approved by the Second Meeting of the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution and its related protocols and the Intergovernmental Review Meeting of Mediterranean coastal States on the Action Plan held at Cannes, 2-7 March 1981.

OBJECTIVES

8. The general long-term objective of MED POL - PHASE II is to further the goals of the Barcelona Convention by assisting the Parties to prevent, abate and combat pollution of the Mediterranean Sea area and to protect and enhance the marine environment of the area. The specific objectives are designed to provide, on a continuous basis, the Parties to the Barcelona Convention and its related protocols with:

Information required for the implementation of the Convention and the protocols;

Indicators and evaluation of the effectiveness of the pollution prevention measures taken under the Convention and the protocols;

Scientific information which may lead to possible revisions and amendments of the relevant provisions of the Convention and the protocols and for the formulation of additional protocols;

Information which could be used in formulating environmentally-sound national, bilateral and multilateral management decisions essential for the continuous socio-economic development of the Mediterranean region on a sustainable basis;

Periodic assessment of the state of pollution of the Mediterranean Sea.

9. These objectives will be achieved through the evaluation of the information on the sources, amounts, levels, trends, pathways and effects of pollutants in the Mediterranean which will be collected, analysed and reported on a systematic basis using commonly agreed methods, and taking into account data available from other sources.

PRINCIPLES

10. The basic principles used in the development of MED POL - PHASE II are listed below:

- (a) Mechanisms which will be used for MED POL - PHASE II related to policy making:

Periodic meetings of Contracting Parties to decide on the programme, approve its budget, review its progress and evaluate its results;

Periodic meetings of the Working Group for Scientific and Technical Co-operation which will consist of national MED POL co-ordinators designated by the relevant national authorities to assist the Contracting Parties in reviewing the progress of the programme and in evaluating the results thereof, and to prepare relevant recommendations for submission, through UNEP as the secretariat of the Convention, to the meetings of the Contracting Parties.

- (b) The monitoring of, and research on, pollutants affecting the Mediterranean marine environment will reflect primarily the immediate and long-term requirements of the Barcelona Convention and its protocols (including those protocols which are in their formative stage) but will also take into account factors needed for the understanding of the relationship between the socio-economic development of the region and the pollution of the Mediterranean Sea.

(c) The strategy of the programme will be such as to provide information on pollution trends within the Mediterranean recognizing that the dynamics of the system are such that pollution in one area can cause detrimental effects in other areas.

(d) For this purpose, monitoring will be organized on several levels:

Monitoring of sources of pollution providing information on the type and amount of pollutants released directly into the environment;

Monitoring of nearshore areas, including estuaries, under the direct influence of pollutants from identifiable primary (outfalls, discharge and coastal dumping points) or secondary (rivers) sources;

Monitoring of offshore areas (reference areas) providing information on the general trends in the level of pollution in the Mediterranean;

Monitoring of the transport of pollutants to the Mediterranean through the atmosphere, providing additional information on the pollution load reaching the Mediterranean Sea.

(e) Studies and research undertaken in the framework of the programme will be directly relevant to the achievement of the objectives of the programme.

(f) PHASE II will be based primarily on the experience and results obtained during PHASE I, but will also take into account the experience gained through other large-scale national, bilateral or multilateral research and monitoring programmes carried out in the Mediterranean and in other regions of the world.

(g) The work will be carried out by national research centres, which will not necessarily have to carry out all the aspects of the programme, in particular those which actively participated in PHASE I, taking into account the need for adequate geographic coverage. These centres will be designated by the relevant national authorities and will be named "collaborating UNEP MED POL centres" after demonstrating their relevant technical competence. Participation of national institutions in the work will be formalized through contracts based on proposals submitted to the Mediterranean Action Plan Co-ordinating Unit in response to requests.

(h) The results of PHASE II will be collated, processed and disseminated by the unit co-ordinating the Mediterranean Action Plan, in co-operation with the relevant specialized organizations

of the United Nations system. The International Computing Centre (ICC) at Geneva will be used for data processing according to agreed standard practices, making full use of existing mechanisms for data exchange.

- (i) Data generated in PHASE II will be comparable, to the largest extent feasible, with those obtained during PHASE I and with those generated through UNEP-sponsored regional seas programmes in other regions, thus contributing to the Global Environment Monitoring System (GEMS), and furthering the concept of integrated monitoring of the environment. The inter-regional comparability of data will be assured through UNEP's Regional Seas Programme Activity Centre.
- (j) The over-all co-ordination of MED POL - PHASE II will be vested in the Mediterranean Action Plan Co-ordinating Unit, acting on behalf of UNEP (the secretariat of the Barcelona Convention).
- (k) The day-to-day co-ordination of the work carried out by national institutions participating in MED POL - PHASE II will be achieved through the relevant international organizations, under the responsibility of the Co-ordinating Unit.
- (l) Mechanisms which will be used, as appropriate, for the analysis of data and their initial evaluation are:

The unit co-ordinating the Mediterranean Action Plan in co-operation with the international organizations;

The Working Group for Scientific and Technical Co-operation;

Experts, selected by the Co-ordinating Unit in consultation with the international organizations. These experts will act in their personal capacity;

Periodic meetings of scientists participating in the programme to discuss the progress made in the projects and the future programme.

- (m) Financial resources for the implementation of PHASE II are:

- (i) Cash from:

Mediterranean Trust Fund;
UNEP's Fund;
Voluntary contributions.

- (ii) Contributions in kind, services and activities related to the Mediterranean Action Plan from:

Collaborating national centres;
Governments of the Mediterranean States and the EEC;
Specialized organizations participating in the programme.

MONITORING

11. Several types of monitoring will be undertaken, all contributing to the fulfilment of the principles contained in paragraph 10.
 - A. Monitoring of sources of pollution to provide information on the type and amount of pollutants reaching the marine environment from coastal sources.
12. The purpose of this monitoring is to establish the pollution load reaching the Mediterranean Sea and to contribute to the understanding of biogeochemical cycles of pollutants relevant to the Mediterranean Sea. It will cover the:
 - (a) Survey of the type and amount of pollutants discharged directly into the coastal waters from land-based (coastal) sources;
 - (b) Survey of the type and amount of pollutants dumped directly into the sea;
 - (c) Survey of the type and amount of pollutants dumped in emergency or released accidentally into the sea;
 - (d) Assessment of the type and amount of selected substances reaching the sea directly through natural (weathering, hydrothermal, etc.) processes from land-based (coastal) or maritime sources.
13. Pollutants to be monitored include:
 - (a) Pollutants listed in annexes I and II of the Land-Based Sources Protocol (paragraph 12 (a)).
 - (b) Pollutants listed in annexes I and II of the Dumping Protocol (paragraph 12(b)).
 - (c) Pollutants referred to in article 8 and article 9 of the Dumping Protocol (paragraph 12(c)).
 - (d) Pollutants referred to in article 8 of the Emergency Protocol (paragraph 12(c)).
 - (e) Substances which may contribute significantly to the over-all level (concentration) of pollutants in the sea (paragraph 12(d)).
14. The monitoring will be based on:
 - (a) Reports to be submitted by the Contracting Parties according to article 7, article 8 and article 9 of the Dumping Protocol.
 - (b) Reports to be submitted by the Contracting Parties according to article 8 and article 9 of the Emergency Protocol.

(c) Reports to be submitted by the Contracting Parties according to article 6 and article 13 of the Land-Based Sources Protocol.

(d) Reports to be submitted by the Contracting Parties on monitoring of sources for substances which may contribute substantially to the over-all level (concentration) of pollutants in the sea (paragraphs 12(d) and 13(c)). Data will be generated by national research centres designated by their Governments to participate in the programme.

B. Monitoring of the coastal waters, including estuaries, within the limits defined by article 1 of the Barcelona Convention and by article 3 of the Land-Based Sources Protocol, under the direct influence of pollutants from identifiable primary (e.g. outfalls, discharge or coastal dumping points) or secondary (rivers and other water courses) sources.

15. The purpose of this monitoring is to establish the effects of measures taken by Contracting Parties under the Land-Based Sources Protocol (article 8(b)).

16. The monitoring will be carried out by governmentally-selected national research centres to monitor areas within their national jurisdiction for the following parameters (indicators) selected on the basis of:

(a) scientific and economic feasibility;

(b) specific needs of the Mediterranean, i.e. relevance to the annexes I and II of the Land-Based Sources Protocol;

(c) identifiable cause-effect relationship.

17. For general monitoring purposes of coastal waters (i.e. not in the heavily polluted areas in the vicinity of point sources) the following priority parameters (indicators) will be taken into account initially:

Total mercury in organisms and sediments;

Cadmium in organisms;

High-molecular weight halogenated hydrocarbons in organisms and Sediments;

Petroleum hydrocarbons in water, sediments and oil residues (tar-balls) on sea-shores;

Faecal coliforms in recreational waters and edible bivalves;

Basic oceanographic and meteorological conditions.

In addition, standard physical and chemical parameters (salinity, oxygen, temperature, etc.) which may contribute to the interpretation of the results, will be monitored.

18. It is envisaged that, after three years, the following additional parameters (indicators) for monitoring of coastal waters will be added to the list:

Cadmium in sediments;

Organic mercury in organisms and sediments;

Total arsenic in organisms;

Selenium in organisms;

Lead in organisms;

Polynuclear aromatic hydrocarbons in organisms;

Additional organics (such as carcinogenic compounds) in organisms;

Radionuclides in organisms;

Faecal coliforms in sediments;

Pathogens in waters, sediments and bivalves;

Ecological parameters, such as productivity and community structure.

19. Taking into account the specificity of estuaries, the parameters (indicators) to be monitored will initially include:

Total mercury in water and suspended matter;

Cadmium in water and suspended matter;

High-molecular weight halogenated hydrocarbons in water and suspended Matter;

Faecal coliforms in water and suspended matter;

Phosphorus in water and suspended matter;

Nitrogen in water and suspended matter;

BOD₅ in water;

COD in water.

20. It is envisaged that, after three years, the following additional parameters (indicators) for monitoring of estuaries will be added to the list:

Total arsenic in water and suspended matter;

Organic mercury in water and suspended matter;

Selenium in water and suspended matter;

Lead in water and suspended matter;

Polynuclear aromatic hydrocarbons in water and suspended matter;

Radionuclides in water and suspended matter;

Oil residues in water and suspended matter;

Pathogens in water;

Phenols in water.

- C. Monitoring of reference areas, as defined by article I of the Convention, which are not under direct influence of pollutants from identifiable primary or secondary sources.

21. The purpose of this monitoring is to provide information on the general trends in the level (concentration) of pollutants in the Mediterranean Sea.

22. The monitoring will be based on the work of governmentally-selected national research centres which will monitor areas falling within their jurisdiction. Monitoring of areas outside of national jurisdiction will be agreed upon jointly by the Governments concerned.

23. The selection of reference areas will take into account the present knowledge of the prevailing conditions and other relevant regional programmes in the Mediterranean Sea.

24. Parameters (indicators) recommended to be monitored in the reference areas are primarily those listed in paragraph 17, with the exception of micro-organisms.

- D. Monitoring of the transport of pollutants to the Mediterranean Sea through the atmosphere.

25. The purpose of this monitoring is to establish the input (flux) of pollutants into the Mediterranean Sea through the atmosphere and thus to provide additional information on the pollution load reaching the Mediterranean Sea.

26. The monitoring will be based on the work of national research centres designated by their Governments.
27. The monitoring areas will include (i) areas directly influenced by identifiable sources of air pollution and (ii) reference areas not directly influenced by identifiable sources of air pollution.
28. Monitoring of areas outside of national jurisdiction, or under shared jurisdiction by two States, will be agreed jointly by the Governments concerned.
29. Parameters (indicators) to be monitored will be selected on the basis of their relevance to annex I and annex II to the Land-Based Sources Protocol and of a feasibility study and research which will be carried out.

E. Sampling and analytical techniques.

30. Sampling and analytical techniques used in the monitoring will be based on mandatory reference methods. Other methods could also be used, including remote sensing, subject to a satisfactory intercomparison.
31. Reference methods developed and tested during MED POL - PHASE I include:
 - (a) Determination of total mercury in edible tissue of fish by flameless atomic absorption spectrophotometry after liquid pressure decomposition of the organic material;
 - (b) Determination of total mercury in edible tissue of mussels by flameless atomic absorption spectrophotometry after liquid pressure decomposition of the organic material;
 - (c) Determination of DDTs in edible tissues of shrimps and fish by gas-liquid chromatography;
 - (d) Determination of DDTs in edible tissue of mussels by gas-liquid chromatography;
 - (e) Determination of total coliforms in sea-water by the membrane filtration culture method;
 - (f) Determination of faecal coliforms in sea-water by the membrane filtration culture method;
 - (g) Determination of faecal streptococci in sea-water by the membrane filtration culture method;
 - (h) Determination of faecal coliforms in shellfish (bivalves) by the multiple-test-tube method (MPN).

32. Additional reference methods will be developed and tested during MED POL - PHASE II (see paragraph 42(a)).

33. Sampling frequency will depend on the purpose of monitoring.

34. All national research centres will participate in the continuing intercalibration of sampling and analytical techniques or in data quality control programmes.

F. Data analysis and dissemination.

35. Data will be subjected to a preliminary quality control and analysis by the national research centres or other organizations collecting them.

36. Depending on their nature, the data will be reported through the national MED POL co-ordinators, (or directly, if so decided by the latter) in an agreed format and according to an agreed schedule, to UNEP's Mediterranean Action Plan-Co-ordinating Unit, or through the Regional Oil Combating Centre or through the the relevant international organizations. On this level, using the computer facilities of the International Computing Center at Geneva, the second analysis of data will be carried out, including the control of their quality, (data validation), and the first integration of data will be achieved on a Mediterranean scale.

37. The Co-ordinating Unit, in consultation with the specialized organizations, may convene groups of experts, either periodically or on an ad hoc basis, to assist in the analysis, integration and interpretation of data, after consideration is given to the possibility of convening meetings of the Working Group for Scientific and Technical Co-operation.

38. Before submitting the data and the reports prepared by UNEP on the basis of these data to the Contracting Parties and other users, they will be reviewed by the Working Group for Scientific and Technical Co-operation.

39. The type of regular reports to be submitted to the Contracting Parties in connection with MED POL - PHASE II are:

- (a) Type and amount of pollutants directly entering the Mediterranean Sea from land-based sources. The report will be based on the analysis and evaluation of data reported according to the provisions contained in paragraph 14 of this document. It will be submitted to the regular (biennial) meetings of the Contracting Parties.

- (b) Quality of the marine environment in the areas monitored under MED POL - PHASE II. The report will consist of:

Collated reports on the quality of the areas monitored according to paragraphs 15-29 of this document, as submitted to the Co-ordinating Unit of the Mediterranean Action Plan from the national MED POL focal points in a commonly agreed format;

Analysis, evaluation and interpretation of the results contained in the reports on the areas monitored according to paragraphs 15-29 of this document.

The report will be submitted to the regular (biennial) meetings of the Contracting Parties.

- (c) Results of selected research and study topics as defined in paragraph 42 of this document.
- (d) Periodically updated report on the state of pollution of the Mediterranean Sea, indicating the major environmental problems, general trends in the pollution of the Mediterranean as well as the environmental problems which may face the Mediterranean basin in the future.

RESEARCH AND STUDY TOPICS

40. Only research and studies directly relevant to the achievement of the objectives of MED POL - PHASE II are envisaged.
41. Research and studies will be carried out by Mediterranean research centres and organizations primarily on a direct contractual basis or as a contribution from centres and organizations offered by the Contracting Parties.
42. Research and study topics included initially in the MED POL - PHASE II (sequence does not imply order of priority):
- (a) Development of sampling and analytical techniques for monitoring the sources and levels of pollutants. Testing and harmonization of these methods at the Mediterranean scale and their formulation as reference methods. Substances listed in Dumping and Land-Based Sources Protocol priorities.
- (b) Development of reporting formats required according to the Dumping, Emergency and Land-Based Sources Protocols.

- (c) Formulation of the scientific rationale for the environmental quality criteria to be used in the development of emission standards, standards of use or guidelines for substances listed in annexes I and II of the Land-Based Sources Protocol in accordance with articles 5, 6 and 7 of that Protocol.
- (d) Epidemiological studies related to the confirmation (or possible revision) of the proposed environmental quality criteria (standards of use) for bathing waters, shellfish-growing waters and edible marine organisms.
- (e) Development of proposals for guidelines and criteria governing the application of the Land-Based Sources Protocol, as requested in article 7 of that Protocol.
- (f) Research on oceanographic processes, with particular emphasis on surface circulation and vertical transport. Needed for the understanding of the distribution of pollutants through the Mediterranean and for the development of contingency plans for cases of emergency.
- (g) Research on the toxicity, persistence, bioaccumulation, carcinogenicity and mutagenicity of selected substances listed in annexes of the Land-Based Sources Protocol and the Dumping Protocol.
- (h) Research on eutrophication and concomittant plankton blooms. Needed to assess the feasibility of alleviating the consequences and damage from such recurring blooms.
- (i) Study of ecosystem modifications in areas influenced by pollutants, and in areas where ecosystem modifications are caused by large-scale coastal or inland engineering activity.
- (j) Effects of thermal discharges on marine and coastal ecosystems, including the study of associated effects.
- (k) Biogeochemical cycle of specific pollutants, particularly those relevant to human health (mercury, lead, survival of pathogens in the Mediterranean Sea, etc.).
- (l) Study of pollutant-transfer processes (i) at river/sea and air/sea interface, (ii) by sedimentation and (iii) through the straits linking the Mediterranean with other seas.

ASSISTANCE COMPONENT

43. In addition to the assistance envisaged through the activities of the Regional Oil Combating Centre, direct assistance in the fields of science, education and technology related to MED POL - PHASE II will be provided as described in the following paragraphs.
44. Individual and collective training will be provided for scientists and technicians in techniques (methods) required for their effective participation in monitoring and research envisaged in the framework of MED POL - PHASE II. This assistance will be in the form of fellowships, experts, workshops, seminars, study tours, grants for attendance at meetings, etc., and will cover training in analytical and sampling techniques, data processing, interpretation of results and various research topics.
45. Training for technicians and administrators will be organized in order to facilitate the application of the Land-Based Sources and the Dumping Protocols. The forms of training will be similar to those mentioned in the preceding paragraph.
46. A quality control programme will be a part of MED POL - PHASE II to ensure the highest degree of quality and of comparability of data. The national research centres participating in monitoring will receive standards and reference substances enabling them to participate in the continuing Mediterranean and global intercalibration exercise. Weaknesses detected through the quality control programme will be corrected through additional training and technical assistance, whenever necessary.
47. The common maintenance services for the sophisticated analytical equipment (atomic absorption spectrophotometers, gas chromatographs, etc.), developed during MED POL - PHASE I, will remain at the disposal of participants in PHASE II thus enabling the equipment used by national research centres to function properly.
48. As required and to the extent possible, standardized material and some equipment will be put at the disposal of national centres participating in MED POL - PHASE II to make it possible for them to participate fully in the monitoring and/or research programme.

CO-ORDINATION

49. The periodic meetings of the Contracting Parties will decide on the programme, approve its budget, review its progress and evaluate its results.
50. The over-all co-ordination of MED POL - PHASE II will be ensured by UNEP through the Co-ordinating Unit for the Mediterranean Action Plan, with the assistance of the international organizations. Such co-ordination shall be achieved as economically as possible.

51. A standing Working Group for Scientific and Technical Co-operation will be established by the Contracting Parties to assist them in their review of the progress of the programme and the evaluation of the results. It will advise UNEP on technical and policy matters related to the programme and prepare recommendations for submission through UNEP, as the secretariat of the Convention, to the meetings of Contracting Parties. The Group will consist of national MED POL co-ordinators designated by the relevant national authorities and will meet at least once a year.
52. The data quality control programme (paragraph 46) and maintenance services (paragraph 47) will be organized and carried out by competent international organizations or selected national institutions, including those carrying out these programmes on a global level, under the over-all guidance of the Mediterranean Action Plan Co-ordinating Unit.
53. In addition to the organizations belonging to the United Nations system, the collaboration with other competent international, regional and intergovernmental organizations in the implementation of MED POL - PHASE II will be actively pursued.

BUDGETARY CONSIDERATIONS

54. The financial resources needed for the work envisaged in the framework of MED POL - PHASE II will come from:
 - (a) Contracting Parties to the Barcelona Convention (cash contributions through the Mediterranean Trust Fund and contributions in kind through participation of their national institutions);
 - (b) UNEP (cash contributions on a project funding basis and contributions in kind through certain services);
 - (c) National institutions participating in the programme (contributions in kind through services, staff time, etc.);
 - (d) International organizations participating in and supporting the programme (contributions in kind through services, staff time, and activities related to the Mediterranean Action Plan);
 - (e) Voluntary contributions.

APPENDIX

List of selected documents relevant to the development
and results of the Co-ordinated Mediterranean
Pollution Monitoring and Research Programme
(MED POL - PHASE I)

Report of the IOC/GFCM/ICEM International Workshop on Marine Pollution in the Mediterranean (Monte Carlo, 9-14 September 1974), UNESCO 1974.

Project on Pollution in the Mediterranean (Msida, 8-13 September 1975) IOC/MPPP/3, UNESCO 1975.

Report of the FAO(GFCM)/UNEP Expert Consultation on the Joint Co-ordinated Project on Pollution in the Mediterranean (Rome, 23 June - 4 July 1975), FAO 1975.

Report of the WHO/UNEP Expert Consultation on Coastal Water Quality Control Programme in the Mediterranean (Geneva, 15-19 December 1975). EHE/76.1, WHO 1976.

Directory of Mediterranean Marine Research Centres. First Edition UNEP 1976.

Manual of Methods in Aquatic Environment Research. Part 2: Guidelines for the Use of Biological Accumulators in Marine Pollution Monitoring. FAO Fisheries Technical Paper No. 150. FAO 1976.

Manual of Methods in Aquatic Environment Research. Part 3: Sampling and Analysis of Biological Material. FAO Fisheries Technical Paper No. 158. FAO 1976.

Guidelines for Health Related Monitoring of Coastal Water Quality. Report of a meeting of WHO/UNEP Joint Group of Experts (Rovinj, Yugoslavia, 23-25 February 1977). WHO 1977.

Health Criteria and Epidemiological Studies Related to Coastal Water Pollution. Report of a meeting of WHO/UNEP Joint Group of Experts (Athens, 1-4 March 1977). WHO 1977.

Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) Summary Report of the Mid-term Review Meeting on IOC/WMO/UNEP and IOC/UNEP Pilot Projects, (Barcelona, 23-27 May 1977). IOC-WMO-UNEP/MED-MRM/3. UNESCO 1977.

Guidelines for the Implementation of Pilot Projects MED I and MED VI. Supplements 1 and 3 to IOC-WMO-UNEP/MED-MRM/3. UNESCO 1977.

Manual for Monitoring Oil and Petroleum Hydrocarbons in Marine Waters and on Beaches. Supplement to manuals and guides No. 7. UNESCO 1977.

Mid-term Review of the Joint WHO/UNEP Co-ordinated Pilot Project on Coastal Water Quality Control in the Mediterranean. Report of the meeting of principal investigators of collaborating laboratories (Rome, 30 May - 1 June 1977). WHO 1977.

Coastal Water Pollution Control. Report of a joint WHO/UNEP Workshop (Athens, 27 June - 1 July 1977). WHO 1977.

Manual of Methods in Aquatic Environment Research. Part 4: Bases for Selected Biological Tests to Evaluate Marine Pollution, FAO Fisheries Technical Paper No. 164. FAO 1977.

Selected Bibliography on Studies and Research Relevant to Pollution in the Mediterranean. FAO Fisheries Technical Paper No. 165. FAO 1977.

Directory of Mediterranean Marine Research Centres. Second Edition, UNEP 1977.

Preliminary Report on the State of Pollution of the Mediterranean Sea. UNEP/IG.11/INF.4. UNEP 1978.

Monitoring of Recreational Coastal Water Quality and Shellfish Culture Areas. Report of a joint WHO/UNEP Seminar (Rome, 4-7 April 1978). WHO 1978.

Coastal Quality Monitoring of Recreational and Shellfish Areas (MED VII). Report of a Workshop convened jointly by WHO and UNEP. (Rome, 17-19 January 1979). WHO 1979.

Pollutants from Land-Based Sources in the Mediterranean. (Report prepared in collaboration with ECE, UNIDO, FAO, UNESCO, WHO, IAEA). UNEP/WG.18/INF.4. UNEP 1979.

Manual of Methods in Aquatic Environment Research. Part 5: Statistical Tests. FAO Fisheries Technical Paper No. 182. FAO 1979.

Principles and Guidelines for Discharge of Wastes into the Marine Environment. WHO 1979.

Data Profiles for Chemicals for the Evaluation of their Hazards to the Environment of the Mediterranean Sea. Vols. I and II. IRPTC/UNEP 1979.

Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL). Programme description, UNEP/IG.14/INF.3. UNEP 1979.

Summary Reports on the Scientific Results of MED POL. Parts I, II and III. UNEP/IG.18/INF.3. UNEP 1980.

- Selected Bibliography on the Pollution of the Mediterranean Sea (prepared in collaboration with FAO, WHO, IOC, WMO, IAEA and UNEP). (In preparation).

Reference Methods for Marine Pollution Studies in the Mediterranean (prepared in collaboration with FAO, WHO, IOC, IAEA and UNEP). (In preparation).

The State of Pollution of the Mediterranean Sea. Pergamon Press/UNEP (in preparation).

ANNEX II

List of National Co-ordinators for MED POL

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